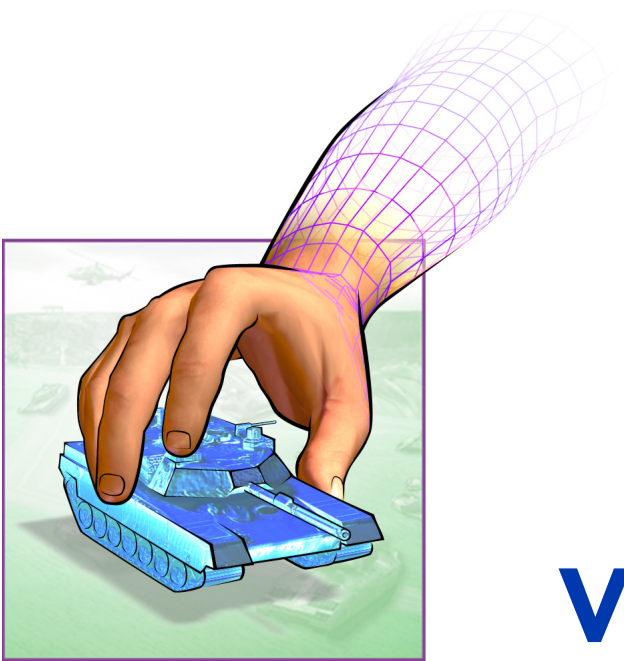
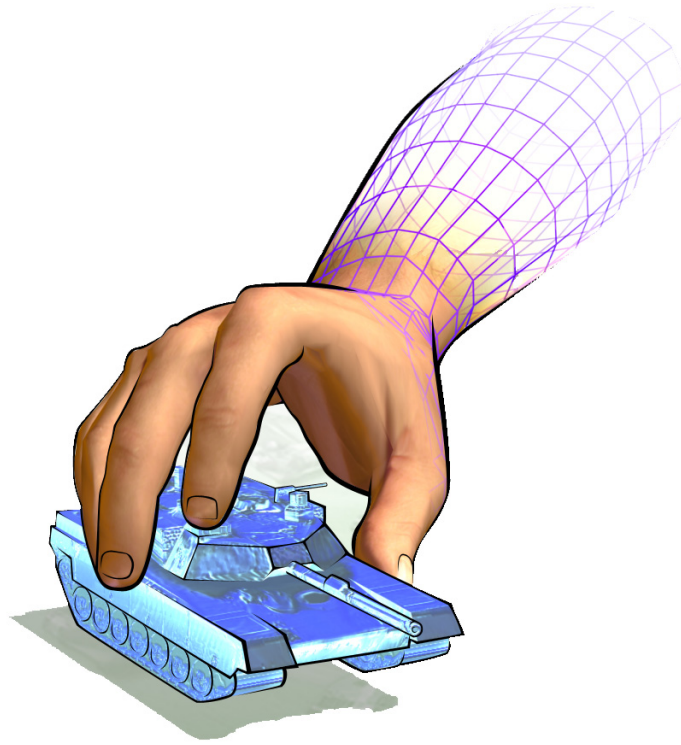




VR-Forces

Users Guide



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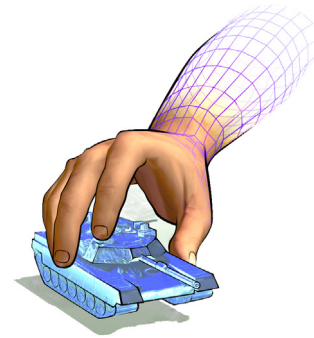
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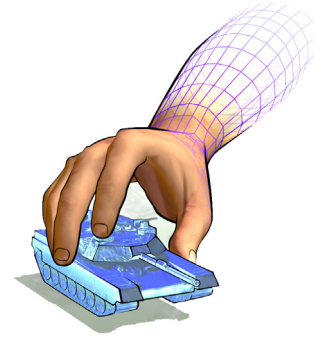
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MÄK Products Glossary

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VR-Forces Quick Reference Card



Preface

This manual is written for persons who will install VR-Forces® or use the VR-Forces application. 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, *Introduction to VR-Forces*, briefly describes VR-Forces and its features.

Chapter 2, *Installing VR-Forces*, explains how to install VR-Forces, set up the FLEXlm license manager, and localize the GUI.

Chapter 3, *VR-Forces Concepts*, provides the conceptual background that will help you quickly master the procedures in this manual.

Chapter 4, *Starting VR-Forces*, describes how to start VR-Forces and load terrain databases, and configure HLA time management. It also describes command line options.

Chapter 5, *Creating and Running Scenarios*, explains how to create and run scenarios, how to create batch scenarios and how to checkpoint scenarios.

Chapter 6, *Navigating and Configuring the Map*, explains how to navigate the VR-Forces window and change display settings.

Chapter 7, *Managing Objects* describes procedures common to entities, control objects, and overlay objects.

Chapter 8, *Creating and Managing Entities*, explains how to create and manipulate entities.

Chapter 9, *Working with Aggregate Entities*, explains how to create and manipulate aggregate entities.

Chapter 10, *Displaying Entity Information*, explains how to configure the various types of entity labels and icons and covers other aspects of entity information.

Chapter 11, *Assigning Tasks*, explains how to assign tasks to entities.

Chapter 12, *Issuing Set Data Requests*, describes how to assign set data requests to entities.

Chapter 13, *Target Detection and Combat Features*, describes spot reports, laser targeting, entity hostility, and how entities take damage.

Chapter 14, *Managing Indirect Artillery*, describes how to set up indirect artillery fire.

Chapter 15, *Writing Plans* explains how to write plans for entities and how to write global plans.

Chapter 16, *Overlays and Graphical Objects* describes the creation and use of control objects, layers, and overlay objects.

Chapter 17, *Using Special Effects* describes how to enable and configure special effects such as trajectory histories, and electromagnetic emissions.

Chapter 18, *Intervisibility*, explains how to use the intervisibility feature to determine line-of-sight between entities.

Chapter 19, *Controlling MÄK 3D Applications* explains how to control the MÄK Stealth from VR-Forces.

Chapter 20, *Terrain Databases and Feature Data* explains how to get information about the loaded database and database features, and how to convert line features to routes.

Appendix A, *Example Scenarios* walks you through the process of creating two of the sample scenarios provided with VR-Forces.

Appendix B, *Customizing the GUI Layout* explains how to manage toolbars and other aspects of the VR-Forces GUI.

MÄK Products Glossary defines terms common to DIS, HLA, and MÄK products.

VR-Forces Quick Reference Card lists command line options, keyboard shortcuts, and navigation and view options.

VR-Forces Documentation

The VR-Forces documentation set is as follows:

- ♦ *VR-Forces Getting Started Guide* is a quick introduction to VR-Forces. It covers the basics of installing VR-Forces, running a scenario, and creating a scenario. It focuses on helping new users avoid common mistakes.
- ♦ *VR-Forces Users 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 Users 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 Developers Guide* explains how to use the VR-Forces APIs. It is distributed in printed format and in PDF format.
- ♦ *VR-Vantage Developers Guide* describes the VR-Vantage API. This is the API used to build the VR-Forces 3D Front End. Developers who want to customize or extend the 3D Front End will need to refer to this manual.
- ♦ *VR-Forces Master Index* combines the indexes from the VR-Forces manuals, including TDB Tool, 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 front-end, 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 VT MÄK line of software products designed to streamline the process of developing and using networked simulated environments. The VT MÄK product line includes the following:

- **VR-Link® Network Toolkit.** VR-Link is an object-oriented library of C++ functions and definitions that implement the High Level Architecture (HLA), 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, RTIsPy®, that allows you to extend the RTI using plug-in modules. It also has a graphical user interface (GUI) for the MÄK RTI rtiexec.
- **VR-Forces®.** VR-Forces is a computer generated forces application and toolkit. It provides an application with a GUI, 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.

- **VR-Vantage™.** VR-Vantage is your 3D visualization solution. It includes two end-user applications, MÄK Stealth and Vantage IG, and the VR-Vantage Toolkit. The Stealth displays a realistic, 3D 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.

Vantage IG is a configurable desktop image generator for out the window (OTW) scenes and remote camera views. It has most of the features of the Stealth, but is optimized for its IG function.

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

- ♦ **MÄK Data Logger.** The Data Logger, also called the Logger, can record HLA and DIS exercises and play them back for after-action review. You can play a recorded file at speeds above or below normal and can quickly jump to areas of interest. The Logger has a GUI and a text interface. The Logger API allows you to extend the Logger using plug-in modules or embed the Logger into your own application. The Logger editing features let you merge, trim, and offset Logger recordings.
- ♦ **MÄK Plan View Display.** The Plan View Display (PVD) provides a 2D, “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
VR-Vantage support:	vrv-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, unlicensed MÄK RTI:	www.mak.com/products/rti.php
Support FAQ:	www.mak.com/support/faq.php

Post

Send postal correspondence to:	VT MÄK 68 Moulton St. Cambridge, MA, USA 02138

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:

<code>Monospaced</code>	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, usually 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 web site is: www.boost.org.

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

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libXML and libICONV

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

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

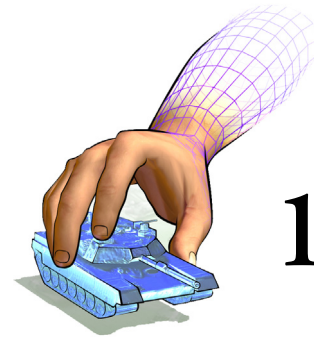
pThreads Library

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/>

EHS, PCRE, and PME

The MÄK RTI links with the EHS, PCRE, and PME libraries. These libraries are distributed under the GNU Lesser General Public License (LGPL). MÄK has made modification to these libraries only to allow them to compile on the supported platforms. For more information about these libraries please see the following web sites:

- ♦ EHS: <http://xaxxon.slackworks.com/ehs/>
- ♦ PCRE: <http://www.pcre.org/>
- ♦ PME: <http://xaxxon.slackworks.com/pme/index.html>



Introduction to VR-Forces

This chapter provides a high-level description of VR-Forces features.

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1.1. Overview

VR-Forces provides both a set of APIs (the VR-Forces toolkit) for creating computer generated forces, or CGF applications, and an implementation of those APIs. VR-Forces is implemented using separate front-end (graphical user interface) and back-end (simulation engine) applications that allow tremendous flexibility for managing your simulation needs. (For information about how this works, please see “[The VR-Forces Program](#),” on page 3-3.) This manual explains how to use the MÄK implementation of VR-Forces.

VR-Forces offers two different graphical user interfaces (GUIs), a 2D, plan view display style GUI, and a 3D GUI. The 2D GUI provides you with insights into a simulated battle by overlaying entities and information onto 2D views of tactical, strategic, and visual databases. The 2D GUI answers typical questions about the placement of forces and how the terrain might affect the engagement more easily than do three-dimensional displays. It is ideally suited for viewing simulations over large areas of open terrain.

The 3D GUI provides three-dimensional, perspective views of the terrain and entity models. It is ideal for scenarios that require situational awareness. It is particularly useful for placing entities with precise location and orientation and for working in terrains in which entities can be at multiple altitudes at a given X, Y coordinate, such as urban terrains.



Much of the information in this manual applies to both the 2D GUI and the 3D GUI, in particular concepts, scenario concepts, plans and planning procedures, and task and set data request procedures. Other details in this manual are specific to the 2D GUI. For simplicity, all procedures in this manual assume use of the 2D GUI. For 3D GUI procedures, please refer to *VR-Forces 3D Front End Users Guide*.

VR-Forces is compatible with both the Distributed Interactive Simulation (DIS) and High Level Architecture (HLA) simulation standards. It supports several database formats. VR-Forces is interoperable with other MÄK products, such as the MÄK Stealth and the MÄK Data Logger.

1.2. Plan View Features of VR-Forces

The VR-Forces display includes the following features:

- ♦ Manipulate the simulation map by zooming and panning
- ♦ Select and track individual entities and groups of entities
- ♦ Turn display features on and off
- ♦ Display a hierarchical, echelon view of entities and an embarkation view
- ♦ Display entity labels that include several types of information
- ♦ Display line-of-sight (intervisibility) for entities.

VR-Forces supports the following database formats:

- ♦ The UTM projection and the Lambert conical conformal projection in CTDB C4B, C7B, and C7L databases
- ♦ OpenFlight UTM and flat earth databases
- ♦ MÄK Terrain Format (GDB)
- ♦ Digital terrain elevation data (DTED) databases
- ♦ Shapefiles
- ♦ Flat earth
- ♦ VMAP
- ♦ DFAD and DFD files.

VR-Forces supports the following coordinate systems:

- ♦ UTM
- ♦ Geocentric
- ♦ MGRS
- ♦ Latitude, longitude
- ♦ Database.

You can overlay raster images, such as CADRG, BMP, and geotiff files on terrain databases.

1.3. The VR-Forces Graphical User Interface

From either graphical user interface, you can:

- ♦ Create and delete entities
- ♦ Create, delete, and edit control objects
- ♦ Assign a sequence of tasks and set data requests to an entity as a plan
- ♦ Assign tasks and set data requests independently of plans
- ♦ Create global plans that run independently of any entity
- ♦ Observe the behavior of entities in response to their environment
- ♦ Create, save, and load scenarios that consist of:
 - Terrain database information
 - An order of battle
 - Graphical objects
 - A plan for each entity in the order of battle

The 2D GUI lets you:

- ♦ Manage hostility relationships
- ♦ Manage spot reports
- ♦ Determine line-of-sight between entities
- ♦ Fire indirect artillery
- ♦ Aggregate and disaggregate, and expand and collapse aggregate entities
- ♦ Create overlays and add graphics to them
- ♦ Control the observer in the VR-Forces 3D Front End and in VR-Vantage.

1.3.1. Entities

Using VR-Forces, you can interactively add individual entities to a simulation and you can aggregate them into higher echelon units. Entities provided include:

- ♦ Ground entities, such as:
 - M1A2 Tank
 - T-80 Tank
 - HMMWV Utility Vehicle
 - BTR-80 APC
 - GAZ-69 Utility Vehicle
 - M2A2 Bradley IFV
 - BMP-2 AFV
 - IEDs

- ♦ Air entities, such as:
 - F-16 Falcon
 - F/A-18 Hornet
 - A-10 Thunderbolt
 - SU-29 Frog
 - VTUAV Cypher
 - MiG-29 Fulcrum
 - AH-64 Apache
- ♦ Surface and subsurface entities, such as:
 - AAVC7A1 Landing craft
 - LCAC
 - Aircraft carrier
 - Guided missile frigate
 - SSBN
- ♦ Life forms, such as:
 - Dismounted infantry
 - Civilian
- ♦ Aggregate entities, such as platoons and companies.

Entity States

You can interactively modify aspects of an entity's state, including:

- ♦ Speed
- ♦ On-board stores such as fuel and ammunition
- ♦ Location
- ♦ Heading.

For more information about changing an entity's state, please see Chapter 12, [*Issuing Set Data Requests*](#).

You can modify entity parameters by editing the object parameter database and other configuration files. For more information, please see *VR-Forces Configuration Guide*.

Physical Modeling

Entities understand how to interact with their environment. They can:

- ♦ Respond appropriately to other entities and objects, for example, avoiding entities, waiting for orders, and so on.
- ♦ Respond to detected targets, for example, deciding which of multiple targets to acquire, which weapon to fire, and what ammunition to use.
- ♦ Follow a route.

Path Planning

If a terrain database has vector data, such as roads, when you task an entity to move to a point or location, you can specify that it try to plan its path to follow any roads that lead to the destination.

Embarkation

Entities can embark on and disembark from other entities, for example, dismounted infantry can embark on a truck, HMMWVs can embark on an LCAC, and fixed-wing aircraft can land on and take off from aircraft carriers.

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To use embarkation in HLA federations, you must use RPR FOM 2.0, draft 17 or later. For information about specifying the correct FOM, please see [“Starting VR-Forces,”](#) on page 4-3 and [“Specifying the RPR FOM Version,”](#) on page 4-26.

1.3.2. Graphical Objects

Using VR-Forces, you can interactively create and name the following kinds of graphical objects as control objects and overlay objects:

- ♦ Points
- ♦ Phase lines
- ♦ Lines
- ♦ Areas
- ♦ Obstacles.

Entities are aware of control objects and can be assigned tasks such as following a route, or moving between points. VR-Forces can also determine if specified entities are in an area and this information can be used as part of mission planning. For more information, please see Chapter 16, *Overlays and Graphical Objects*.

1.3.3. Tactical Graphics Overlays

The VR-Forces 2D GUI supports tactical graphics overlays. Overlays mimic clear plastic overlays that a planner might use to draw graphics on top of a terrain map. You can draw a variety of graphical objects and symbols on the overlays. You can display overlays individually or all together. You can publish overlay objects so that they are visible to other participants in an exercise, or you can restrict them to local visibility.

1.3.4. Entity Tasks

You can assign tasks to entities as part of plans or independently. The tasks supported include:

- ♦ Move to object
- ♦ Patrol along a route
- ♦ Patrol between two objects
- ♦ Follow an entity
- ♦ Fire for effect
- ♦ Take off and land.

Independently assigned tasks override the tasks in a plan, allowing you to respond to the course of a simulation as events transpire, without stopping to edit an entity's plan. For more information, please see [“Assigning Tasks to Entities,”](#) on page 11-3.

1.3.5. Mission Planning

You can create plans for entities that contain tasks, set data requests, and conditional statements. You can save plans and edit them.

Conditional statements specify that tasks will be executed only if a specific condition is true or false. Some of the conditions tested are:

- ♦ Is an entity in a specific area?
- ♦ Is an entity destroyed?
- ♦ Is an entity to the left or right of a phase line?

In addition to conditional statements that are checked only once (**If** statements), VR-Forces supports **When** statements and **While** statements.

Global Plans

Global plans exist independently of any entity. They allow you to assign tasks and set data requests to entities and execute other commands. In essence, they allow you to script the sorts of ad hoc actions that a VR-Forces could take through the GUI. This provides a great amount of flexibility to automatically modify the order of battle and tactical graphics in response to events.

For more information, please see Chapter 15, [Writing Plans](#).

1.3.6. Behaviors

VR-Forces provides several behaviors for entities. Behaviors include:

- ♦ Responding appropriately to other entities and objects, for example, avoiding entities, waiting for orders, and so on.
- ♦ Responding to detected targets, for example, deciding which of multiple targets to acquire, which weapon to fire, and what ammunition to use.
- ♦ Following a route.

Path Planning

If a terrain database has vector data, such as roads, when you task an entity to move to a point or location, you can specify that it try to plan its path to follow any roads that lead to the destination.

1.3.7. Special Effects

VR-Forces includes several features that help you understand the interaction between entities in a simulation and others that add a realistic tone to interactions. These features include:

- ♦ Fire and detonation lines
- ♦ Display of transmitters
- ♦ Display of track histories
- ♦ Display of hazard clouds.

1.3.8. Support for External Communications Servers

You can configure VR-Forces to use an external communications effects server to control the transmission of radio messages between VR-Forces entities. The communications effects server determines which entities are able to communicate with each other, and how long it takes a message to be transmitted from the originator of the message to the receiver of the message.

Any communications effects server that meets the defined interface can be used. Please see *VR-Forces Release Notes* for a list of communications servers known to support the interface. For more information, please see Chapter 9, [*Using VR-Forces with an External Comms Effects Server*](#), in *VR-Forces Configuration Guide*.

1.3.9. Interoperability with the MÄK 3D Visualization Applications

You can set the view mode and manipulate the eyepoint in the VR-Vantage applications from VR-Forces. VR-Vantage can display tactical graphics published by VR-Forces.

1.3.10. Integration with DI-Guy

VR-Forces can specify the animations and appearance characteristics of DI-Guy¹ 3D models in 3D visualization applications such as the VR-Forces 3D Front End and VR-Vantage. You can specify animation and appearance characteristics in an entity's configuration file using the Entity Editor. You can also specify animations and change appearance dynamically during run-time.



You cannot change an entity's character during runtime. The character is assigned based on an entity's entity type as configured in the object parameter database.

For more information, please see [“DI-Guy Animation,”](#) on page 11-14 and [“Set DI-Guy Appearance,”](#) on page 12-9 in this manual and Section 2.8, [“Configuring DI-Guy Integration”](#) and Section 5.4.9, [“Editing a Lifeform's DI-Guy Character, Appearance, and Animation”](#), in *VR-Forces Configuration Guide*.

1.3.11. Batch Mode Operation

Batch mode allows you to run a scenario multiple times or run several different scenarios, without direct action through the graphical user interface. This is useful for running unattended testing or to test the results of a scenario under differing conditions. You can record the results of batch mode simulations using the MÄK Logger, for later review. For more information, please see [“Running VR-Forces in Batch Mode,”](#) on page 5-17.

1. DI-Guy is a product of Boston Dynamics, Inc.

1.4. Helpful Utilities

VR-Forces includes the following utilities for configuring and troubleshooting VR-Forces:

- ♦ The Entity Editor is a graphical user interface that lets you add and remove component systems from entities and specify common parameters. You can create new entities in the editor and can edit the Create menu. You can also create new simulation model sets.
- ♦ The Object Parameter Database (OPD) Editor is a graphical user interface for editing the object parameter database. Using the OPD Editor can speed up editing of the object parameter database and prevent syntactical errors that can occur when you use a text editor to edit parameters.
- ♦ The Scenario Merge tool lets you merge scenarios. This allows development teams to compose portions of a large scenario individually and easily merge them into one combined scenario.
- ♦ The MÄK Terrain Database Tool (TDB Tool) allows you to convert supported terrain databases to GDB format, optimize them for use with VR-Forces, and import vector data. It has a command line interface and a GUI. The GUI version lets you manually add vector features to databases, manipulate graphic overlays, and create multiresolution bitmap files.
- ♦ The vrfMsgDump utility displays the contents of VR-Forces messages discovered on the network.

1.5. The VR-Forces Toolkit

The VR-Forces toolkit lets you develop CGF applications. You can enhance the capabilities of the VR-Forces simulation engine and GUI, or integrate the simulation engine into your own user interface. The toolkit has several APIs. The Simulation API gives you control over:

- ♦ Behaviors
- ♦ Components
- ♦ Entity types
- ♦ Parameters
- ♦ Messages
- ♦ Resources
- ♦ Graphical objects
- ♦ Plans
- ♦ Tasks.

The Remote Control API allows you to control a VR-Forces simulation engine from a remote application, such as a graphical user interface (GUI). The GUI API allows you to modify the *vrfGui* application provided with VR-Forces. The Terrain API lets you manipulate terrain databases.

For a complete discussion of the APIs, please see *VR-Forces Developers Guide*.

1.6. The B-HAVE Module for VR-Forces

The B-HAVE (Brains for Human Activity in Virtual Environments) Module for VR-Forces is a VR-Forces plug-in that extends the movement models for lifeforms and ground platforms, as follows:

- ♦ Full 3D path finding
- ♦ Simplicity of use of basic agents (GoTo)
- ♦ Complexity and realism of behaviors (Hide, Flee, Wander)
- ♦ Complexity and realism of scenarios.

The B-HAVE Module is powered by Kynapse, the world's leading AI technology solution, from Autodesk, Inc. It is based on Kynapse's fundamental concepts of Topological Modeling for Path Finding, and Spatial Reasoning for Advanced Behaviors, all integrated within VR-Forces as advanced planning capabilities.

The B-HAVE Module offers VR-Forces users the ability to:

- ♦ Make entities move autonomously without specifying routes
- ♦ Make entities navigate through complex environments, indoors and outdoors, while avoiding collisions with obstacles and other entities
- ♦ Quickly populate a 3D environment with dozens of entities wandering in buildings, on roads, and on pavement

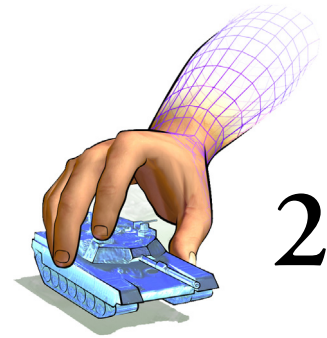
- ♦ Develop complex scenarios in which entities hide from each other and flee from threats.

The B-HAVE Module is a separately licensed product. It is not included with VR-Forces. Please see your MÄK salesperson for details.

1.7. Distributed Simulation Standards Supported

VR-Forces supports the 1.3 and 1516 specifications of the High Level Architecture (HLA) and the Distributed Interactive Simulation (DIS) protocol. VR-Forces has built-in support for the HLA RPR-FOM and can support other FOMs through the FOM Mapping feature. For information about FOM mapping, please see [“Specifying a FOM Mapper,”](#) on page 4-26. Please see *VR-Forces Release Notes* for a list of the versions of DIS supported.

VR-Forces supports time management for HLA exercises.



Installing VR-Forces

This chapter explains how to install VR-Forces on your computer. It also explains how to install other software required for use with VR-Forces.

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2.1. Installing VR-Forces

This section explains how to install VR-Forces on a Windows or a UNIX operating system. You must also install the license manager files. (For details, please see “[Setting Up and Using the FLEXlm License Manager](#),” on page 2-7.) For HLA, you must install an RTI. (For details, please see “[Installing an RTI](#),” on page 2-20.)



To install the VR-Vantage or VR-Forces toolkits, you must enter an installation key. Be sure you have received your key from your MÄK sales person before you start the installation process. If you do not have an installation key, you can install the runtime files. When you receive your installation key you can reinstall and install the toolkit.



The VR-Forces 3D Front End has a separate installer from the standard VR-Forces installer. It adds 3D Front End files to the installed VR-Forces directory. For details, please see *VR-Forces 3D Front End Users Guide*.

2.1.1. Installing VR-Forces on Windows

This section explains how to install VR-Forces from optical media or from a download. Before you install VR-Forces, please read *VR-Forces Release Notes* to see if there are any special instructions for installation.



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

Installing VR-Forces from a CD or DVD

MÄK products are supplied on CDs or DVDs with a common installation interface.

To install VR-Forces:

1. Insert the MÄK Products disc into your optical media drive. If the autorun feature on your computer is enabled, the MÄK PC Products Installation window opens. The PC Products Installation window is similar to [Figure 2-1](#).

If the MÄK PC Products Installation window does not open, open the Windows Explorer. In the root directory for your optical media drive, double-click *makInst.exe*. The MÄK PC Products Installation window opens.

2. In the MÄK PC Products Installation window, click VR-Forces.
3. Follow the instructions of the installation program.

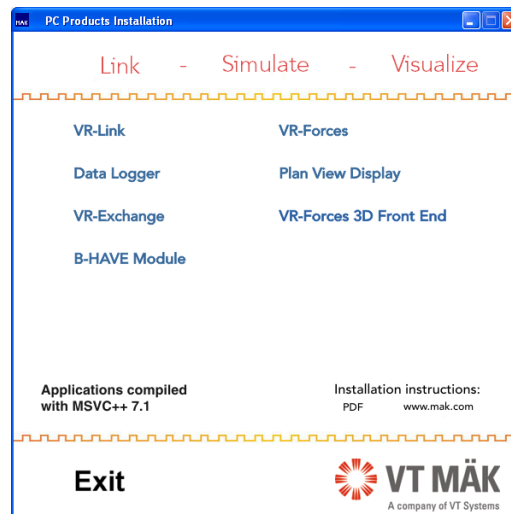


Figure 2-1. MÄK PC Products Installation window

Installing VR-Forces from a Downloaded File

If you downloaded VR-Forces, you received a compressed file. It may be a zip file or an executable file.

To install VR-Forces from a zip file:

1. Copy the zip file to a temporary directory.
 2. Unzip the zip file.
 3. Run *setup.exe*.
 4. Follow the instructions of the installation program.
- To install VR-Forces from an executable file, run the executable.

2.1.2. Installing VR-Forces on a Linux System

This section explains how to install VR-Forces on Linux systems from CD or DVD, or from a download.

Installing VR-Forces from a CD or DVD

To install VR-Forces:

1. Mount the optical drive.
2. Run:

```
./install
```
3. Follow the on-screen instructions. You can install VR-Forces into any directory for which you have write permissions.

Installing VR-Forces from a Downloaded File

If you downloaded VR-Forces, you received a compressed tar file.

To install VR-Forces:

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

```
gtar xzf vrforcesxx-os.tar.gz
```

where `xx-os` is the release, operating system, and other product release coding.



You must use `gtar` (from GNU) not the operating system's default `tar`.

Installing Fonts on Linux Systems

For details about installing TrueType fonts on Linux systems, please read [*./data/symbols/ttf/Readme.txt*](#).

2.2. The VR-Forces Directory Structure

The VR-Forces installation process creates a directory structure like the one shown in [Figure 2-2](#). On PCs, the default installation directory is C:\MAK\vrfx.x. (The VR-Forces 3D Front End adds additional directories. For details, please see *VR-Forces 3D Front End Users Guide*.)

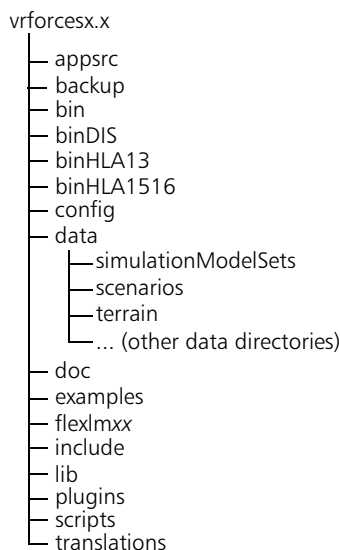


Figure 2-2. Directory structure of VR-Forces files

[Table 2-1](#) describes the contents of the directories installed by VR-Forces.

Table 2-1: Contents of VR-Forces directories (Sheet 1 of 2)

Directory	Directory contents
<i>./appsrc</i>	Source files and project files for API developers.
<i>./backup</i>	This directory contains back-up copies of all the VR-Forces configuration files contained in the <i>./config</i> and <i>./data/simulationModelSets</i> directories. If you make a mistake while editing a file, instead of re-installing VR-Forces, you can start over with a copy of the original file from this directory.
<i>./bin</i>	Protocol-independent executables, such as MÄK Terrain Database Tool and the OPD Editor.
<i>./binDIS</i>	Executables for use with DIS.
<i>./binHLA13</i> and <i>./binHLA1516</i>	Executables for the HLA 1.3 and HLA 1516.
<i>./config</i>	Configuration files. For a description of these files, please see <i>VR-Forces Configuration Guide</i> .

Table 2-1: Contents of VR-Forces directories (Sheet 2 of 2)

Directory	Directory contents
<i>./data</i>	The <i>./data</i> directory has several subdirectories that contain: ♦ Bitmaps and icons ♦ Object parameter database files and probability tables ♦ Terrain databases ♦ Sample scenario files.
<i>./doc</i>	VR-Forces documentation.
<i>./examples</i>	Sample code for toolkit users.
<i>./flexlmxx</i>	Files for the FLEXlm license manager. For complete information see “Setting Up and Using the FLEXlm License Manager,” on page 2-7.
<i>./include</i>	Header files for use by API developers.
<i>./lib</i>	Library files.
<i>./plugins</i>	A directory for storing configuration files that specify which plug-ins to load.
<i>./scripts</i>	Files for the build system supplied with VR-Forces.
<i>./translations</i>	Files and an executable for localizing the GUI.

2.3. Setting Up and Using the FLEXlm License Manager

MÄK products use the FLEXlm license manager. Before you can use a MÄK product, you must obtain a valid license file and configure the license server and client machines. Contact the MÄK sales department for information about special licensing agreements.

2.3.1. The FLEXlm Client-Server Architecture

This section explains the FLEXlm architecture to provide a context for the setup instructions that follow. FLEXlm uses a client-server architecture. The FLEXlm server daemon, *lmgrd*, runs on one computer, known as the license server. This machine services every machine (including possibly itself) on which you want to run a MÄK product. The machines on which the MÄK products are running are called clients. On each client you must specify the server to use to serve licenses to that client.

The license server executes vendor daemons (for MÄK, *maklmgrd*) and uses one or more license files, provided by individual vendors. The license file identifies the products for which you have licenses.

Licenses “float”, so you can install product software on as many computers as you want, but at any given time, you can run only as many instances of a product as you have licensed.



The license key in the license file is tied to the host ID of the server machine. Therefore, if you decide to change the server (or replace the network card), you must get a new license file. If you change the name of the server, you must specify the new server on every client. Depending on how many clients you have, this may not be a trivial process. Keep this in mind when you choose the machine to use as a license server.

Figure 2-3 illustrates the client-server architecture for FLEXlm and MÄK products.

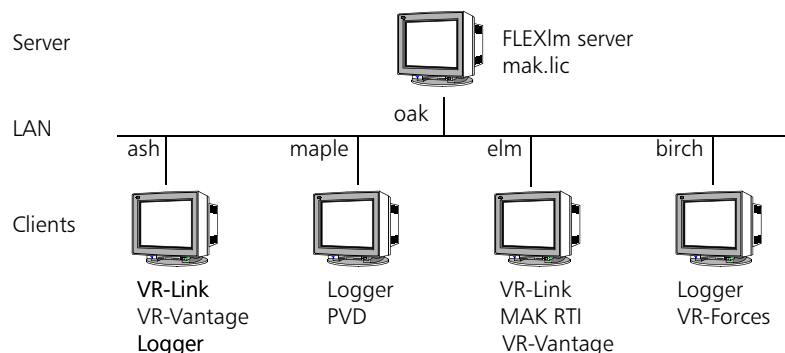


Figure 2-3. FLEXlm example architecture

2.3.2. Installing and Configuring the License Manager

The general procedure for installing and configuring license management is as follows (each step is explained in the rest of this section):

1. Install license manager software.
2. Request a license file.
3. Put the license file in the *flexlm* directory on the license server.
4. Specify the license server on all client machines.

If you have MÄK products installed and you purchase additional licenses or products, you must get a license file for the new products or licenses. For this procedure, please see [“Adding Additional License Files,”](#) on page 2-12.

2.3.3. Installing the License Manager Software

As part of the installation of MÄK products, the FLEXlm software is installed in *./flexlmx.x* (where *x.x* is the FLEXlm version).

1. Install your MÄK products on the machines on which you want to run them.
2. Copy the files in *./flexlmx.x* to the server machine. For Windows, copy the files to *C:\flexlm*. For a Linux computer, a typical location is */usr/local/flexlm*.

2.3.4. Requesting a License File

When you request a license file, you need to know the:

- ♦ Host ID of the license server
- ♦ Name of the license server
- ♦ MÄK invoice number of your purchase
- ♦ Basic contact information for you and your company
- ♦ Platforms for which you have purchased MÄK products
- ♦ Number of licenses for each platform and product.

When you have this information, go to <http://www.mak.com/support/licenses.php> and complete the license key request form. MÄK will e-mail you a license file.

Identifying the Host ID and License Server Name in Windows

To find out the host ID and license server name in Windows:

1. In the *flexlm* directory, run *lmtools.exe*. The LMTOOLS application opens.
2. Select the System Settings tab. The host ID is the string in the Ethernet Address text box. The license server name is the name in the Computer/Hostname text box.

Identifying the Host ID and License Server Name on Linux Computers

To find out your host ID:

1. On the license server, in a command window, change to the *flexlm* directory.
2. Execute *lmhostid*. This program reports a unique number that MAK uses to generate your license activation codes. Write down the number.



The host ID is keyed to the MAC address of your ethernet card, so if you change your network card, you must request a new license file.

- To find out the name of the server machine, at a command prompt, type `hostname`.

2.3.5. Putting the License File in the *flexlm* Directory

When you receive your license file, put it in the *flexlm* directory on the license server. The file should have the extension *.lic*. If it does not, please contact keys@mak.com to clarify why it did not follow this convention.



- ♦ Do not rename the license file.
 - ♦ Do not combine a new license file with an old one. Although this is technically possible, it is often done incorrectly and results in an inability to check out licenses.
 - ♦ If you already have a license file in the *flexlm* directory, do not overwrite the file. For details, please see the instructions in [“Adding Additional License Files,”](#) on page 2-12.
-

2.3.6. Specifying the License Server

The first time you run a MÄK application on a computer, the License Setup dialog box opens (Figure 2-4). It prompts you to enter the hostname of the license server and optionally, a port number.

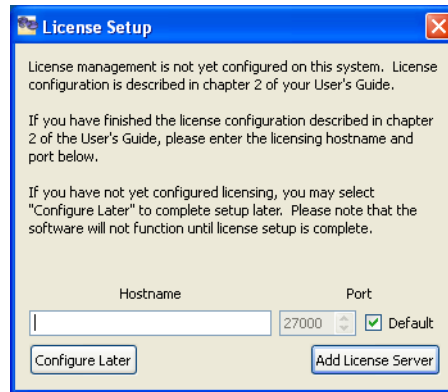


Figure 2-4. License Setup dialog box

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

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

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- ♦ If you are running MÄK products on the license server machine, it is also a client, so you must specify the license server on that machine too.
 - ♦ If you change the license server, the saved configuration will no longer be valid and the License Setup dialog box will open the next time you start a MÄK application.
 - ♦ You can clear the saved license configuration by deleting the cache file. On Windows it is *C:\Documents and Settings\user_name\Application Data\MAK\licenses1.xml*. On UNIX, it is *.mak/licenses1.xml*.
-

The MAKLMGRD_LICENSE_FILE Environment Variable

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



To view a video that illustrates this procedure on Windows, please go to <http://www.mak.com/html/setenvvar.htm>

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

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

Windows

To add the MAKLMGRD_LICENSE_FILE in Windows:

1. Open the System Properties dialog box.

Windows XP:

- a. In Windows XP, on the Start menu, choose My Computer.
- b. In the My Computer window, under System Tasks, click View System Information. The System Properties dialog box opens.

Windows Vista:

- a. In Windows Vista, open the Control Panel and select System and Maintenance.
 - b. Click System.
 - c. Click Advanced System Settings.
 - d. Enter the administrator name and password. The System Properties dialog box opens.
2. Click the Advanced tab.
 3. Click the Environment Variables button. The Environment Variables dialog box opens.
 4. Click the New button. The New System Variable dialog box opens.
 5. In the Variable Name field, enter MAKLMGRD_LICENSE_FILE.
 6. In the Variable Value field, enter `@server_name`, where `server_name` is the name of the license server.

7. Click OK to back out of each dialog box and set the variable.

Linux

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

```
setenv MAKLMGRD_LICENSE_FILE @oak
```

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

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

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

You are ready to run the license server and use your new licenses or MÄK products. For details, please see [“Running the License Server,”](#) on page 2-14.

2.3.7. Adding Additional License Files

If you buy additional MÄK products, or additional licenses for products you already have, you must get an additional license file.

- To request an additional license file, follow the same procedure as for your first license file. For details, please see [“Requesting a License File,”](#) on page 2-8.

To add a new license file to your license server:

1. Put the new file in the *flexlm* directory on the license server, with the other license files. If you already have a license file of the same name, please contact keys@mak.com to find out if you should overwrite the old file or rename the new file.
2. On Windows, if you are running FLEXlm as a service make sure that the Path To The License File value specifies the *flexlm* directory, not a specific file. (For details, please see [“Running FLEXlm as a Service on Windows,”](#) on page 2-15.)
3. Stop the license server daemon and restart it.

You can now use the new products or additional product licenses.

2.3.8. Specifying a Port for the License Server and Daemon

On some systems, specifying a port for the license server, the *maklmgrd* daemon, or both, can resolve connection problems. If you want to run MÄK software through a firewall, you must specify both ports. When used through a firewall, users typically open specific ports for simulation traffic and license verification messages. By specifying both ports, FLEXlm knows which ports have been opened up for use.

You specify a port for the license server by editing the license file and specifying the port during license setup or adding the license server port to the MAKLMGRD_LICENSE_FILE environment variable. To specify a port for the *maklmgrd* daemon, you just have to edit the license file.

To specify a port for the license server:

1. Open the license file in a text editor.
2. Add the port number to the SERVER line as follows:

```
SERVER host_name host_ID port
```

For example:

```
SERVER oak 12345ABCD957 9237
```

3. Add the port number to the MAKLMGRD_LICENSE_FILE environment variable on all computers that use this license server as follows:

```
port@host_name
```

For example:

```
9237@oak
```

To specify a port for the *maklmgrd* daemon:

1. Open the license file in a text editor.
2. Add the port number to the VENDOR line as follows:

```
VENDOR maklmgrd ./maklmgrd port
```

For example:

```
VENDOR maklmgrd ./maklmgrd 2568
```

2.3.9. Running the License Server

The FLEXlm license server daemon must be running on the server machine before you can run your MÄK applications.

- To start the license server daemon, on the server machine only, execute `runLm` from the `./flexlm` directory.



Do not execute more than one instance of `runLm` at a time. If you are not sure whether or not the license server is running, execute `lmstat`.

- To obtain the current status of the server, run `lmstat`.

Shutting Down the License Server

- To force all applications to check in their licenses and shut down the license server daemon, run `lmdown`.

2.3.10. Running FLEXlm as a Service on Windows

You can configure FLEXlm to run as a service on Windows.



To view a video that illustrates this procedure, please go to <http://www.mak.com/html/flexlmservice.htm>

To configure FLEXlm as a service:

1. Install the license management software and obtain a license as described previously in this chapter.
2. Run *C:\flexlm\lmtools.exe*.
3. On the Service/License File tab, select the Configuration Using Services option.
4. Select the Config Services tab.
5. In the Service Name box, enter a name for the service.
6. In the Path To The *lmgrd.exe* File box, enter the fully qualified path of the *lmgrd.exe* file (for example, *C:\flexlm\lmgrd.exe*), or use the Browse button to select the file.
7. In the Path To The License File box:
 - If you have only one license file, enter the fully qualified path of the license file (for example, *C:\flexlm\mak.lic*), or use the Browse button to select the file.
 - If you have multiple license files, enter the directory in which they are located.



If you specify a directory, it must not have a trailing slash. For example, *C:\flexlm*

8. In the Path To The Debug Log File box, enter the fully qualified path of the FLEXlm debug file, or use the Browse button to select a directory. If no debug file currently exists, enter a file name with a *.log* extension.
9. Select the Use Services check box. The Start Server At Power Up check box becomes enabled.
10. Select the Start Server At Power Up check box.
11. Click the Save Service button and click Yes at the prompt.
12. Select the Start/Stop/Reread tab.
13. Click Start Server.

2.3.11. Installing a Dongle License

Some customers are unable to connect to a central license server or require the ability to quickly move licenses from one computer to another without going through the standard license transfer process. These customers may purchase licenses that use dongles. Dongles do not connect to a central license server. You must complete this procedure on each computer for which you want to use a dongle license.

Installing a Dongle License on Windows

1. Download the FlexIdInstaller application from <ftp://ftp2.mak.com/out/FLEXidInstaller.exe>
2. Run *FLEXidInstaller.exe*.
3. On the Select Features panel of the installation wizard, select FLEXid 9.
4. When the installer is finished, if a reboot is required, reboot your computer.
5. Download the HASP installer from:
<ftp://ftp2.mak.com/out/HASPUserSetup.exe>
6. Run *HASPUserSetup.exe* and follow the installation instructions.
7. Insert the license dongle into an appropriate port (USB or Parallel). If you do not know which one you have, ask your IT department for assistance.
8. You will have received a license file from MÄK. Copy the license file to the *flexlm* directory on the computer.



If you do not have a license file, you must request one from MÄK. Please follow the instructions for requesting a license at <http://www.mak.com/support/licenses.php>

9. Set the MAKLMGRD_LICENSE_FILE environment variable to the location of the license file. For example, if the file is called *makDongle.lic* and it is in *C:\flexlm*, set MAKLMGRD_LICENSE_FILE to *C:\flexlm\makDongle.lic*.
10. Start your application. You do not need to run a license server if you are using a dongle.

Installing a Dongle License on Linux

1. Download the flexlmDongleDriver installation from `ftp://ftp2.mak.com/out/HDD_Linux_dinst.tar.gz`
2. Untar the package as follows:

```
tar -zxf HDD_Linux_dinst.tar.gz
```
3. Change directory to *HDD_Linux_dinst*.
4. As the superuser, run *./dinst*. (This is a platform independent Linux installer provided by the makers of FLEXlm.)



After running this, you should be able to plug in the USB dongle and have the device recognized as an Aladdin Hasp device. To verify the installation, run `/sbin/lssusb`. You should see "Aladdin Knowledge Systems HASP v0.06" listed for the plugged in USB dongle.

5. Insert the license dongle into an appropriate port (USB or Parallel). If you do not know which one you have, ask your IT department for assistance.
6. You will have received a license file from MÄK. Copy the license file to the flexlm directory on the computer.



If you do not have a license file, you must request one from MÄK. Please follow the instructions for requesting a license at <http://www.mak.com/support/licenses.php>

7. Set the `MAKLMGRD_LICENSE_FILE` environment variable to the location of the license file. For example if the file is called *makDongle.lic* and it is in */home/makUser/makDongle.lic*, set `MAKLMGRD_LICENSE_FILE` to */home/makUser/makDongle.lic*.
8. Start your application. You do not need to run a license server if you are using a dongle.

Moving a Dongle to a Different Computer

If you want to move the dongle to a different computer, you must install the FLEXid and HASP software and set up the computer as described in the previous sections.

Troubleshooting

If your MÄK application does not run and reports it cannot find a license or some other license-related error, try the following:

- ♦ Verify that the dongle is fully plugged in.
- ♦ Verify that the system can see the dongle, as follows:
 - a. In a console window, change directory to the *flexlm* directory.
 - b. Run the following command:

```
lmhostid.exe -flexid
```

This will return the flexid of the dongle, or specify that the driver is missing. If the driver is missing, install the FLEXid software.

2.3.12. Troubleshooting the FLEXlm License Manager

This section describes some common problems that FLEXlm users face.

Unable to Get a License

If you are unable to get a license for a MÄK application and the FLEXlm log file (*LOG*) indicates that the port is in use, it is possible that you have more than one *lmgrd* or *maklmgrd* processes running. It is also possible that an application that was using a license is thought to have terminated, but is still alive.

To verify and resolve these possibilities:

1. See if more than one *lmgrd* or *maklmgrd* process is running.

On Windows, check the Task Manager. (To open the Task Manager, press **Ctrl+Alt+Delete** and click Task Manager.)

On Linux, enter the following commands:

```
ps -aux | grep lmgrd
ps -aux | grep maklmgrd
```

If more than one instance of either process is running, write down the process ids (PID).



Some Linux systems use `ps -aux`, others `ps -ef` to check processes. Use the command appropriate for your operating system.

2. If there are old processes present that may be using a license, kill them.
On Linux, kill a process with the kill command, for example:

```
kill -9 1385 878
```


where 1385 and 878 are process IDs.
On Windows, select a process in the Task Manager, Processes tab and click End Process.
It is important that you kill all the processes to ensure a clean restart for the license server.
3. On Windows, see if more than one lmgrd or maklmgrd process is running. Check the Task Manager. (To open the Task Manager, press **Ctrl-Alt-Delete** and click Task Manager.)
4. If there are old processes present that may be using a license, kill them. Select a process in the Task Manager, Processes tab and click End Process. It is important that you kill all the processes to ensure a clean restart for the license server.
5. If in step 2 you killed the license server, start it with the runLm command.

Preventing Multiple License Manager Processes

We recommend that you keep the license server running and that you not start and stop it as you run applications. If you prefer to stop the license server when you are not using it, always use lmdown to stop it.

Whenever you start the license manager, first run lmstat to be sure that there is not already a license server process running. Following this practice will ensure that you do not start multiple license servers.

License Manager Cannot Find MÄK License Management Executable

If your license manager gives you an error message indicating that it cannot find the license management executable, try inserting the pathname in the license file as follows:

1. Open the license file (*mak.lic*) in a text editor.
2. Edit the license file to specify the location of the *maklmgrd* executable on the server machine. The file supplied by MÄK represents this location with a dot as shown below:

```
VENDOR maklmgrd .
```

Replace the dot with your absolute path to *maklmgrd*, for example:

```
VENDOR maklmgrd "C:\flexlm\maklmgrd"
```



On Windows, you must enclose the path in quotes.
The drive letter must be uppercase.

The License Manager Reports an Unsupported Product

If you receive an error message indicating an unsupported product, you are trying to use a MÄK product for which you do not have a license or you are trying to run a version of a product that is more recent than the product maintenance expiration date in the license file. Please contact sales@mak.com to purchase a license or update maintenance.

If you are trying to run your application with an RTI other than the MÄK RTI and you get the unsupported product message, it is possible that your application is finding the DLLs for an unlicensed version of the MÄK RTI before it finds the other RTI. To fix this problem do the following:

- Make sure that the other RTI path precedes the MÄK RTI path in your path environment variable.
- Check the directory in which the application is located to be sure that there are no DLLs from the MÄK RTI in that directory.

2.4. Installing an RTI

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



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

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

For the most recent information about the RTI versions supported by MÄK products, please see the release notes for your MÄK application or the Product Versions page on the MÄK web site at: http://www.mak.com/product_version.php.

2.4.1. Installing the MÄK RTI

To install the MÄK RTI, follow the instructions in Chapter 2 of *MÄK RTI Reference Manual*. (If you do not have a printed version of the manual, you can view the PDF versions in *makrtix.x/doc*.)

Configuring Your System to Use the MÄK RTI

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

- ♦ On Linux, use LD_LIBRARY_PATH
- ♦ On Windows, use PATH.

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

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

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

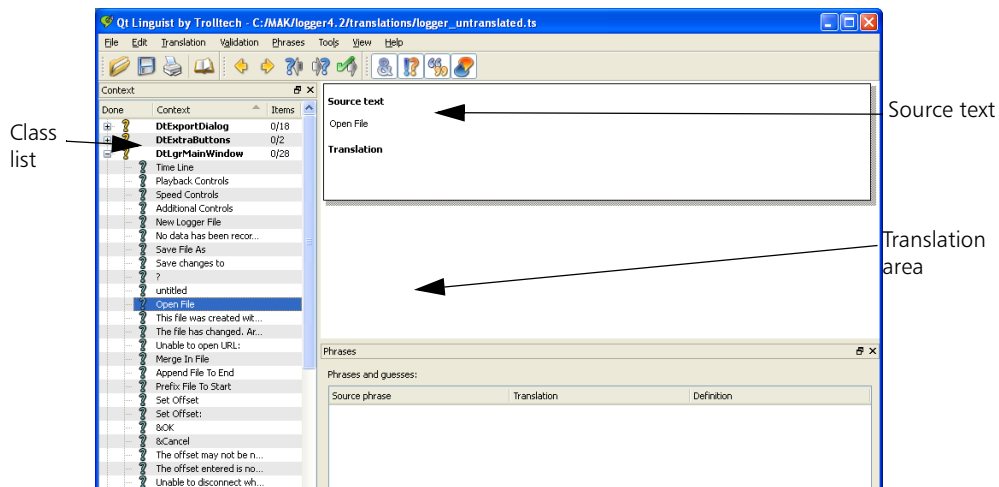
Running Applications with the MÄK RTI

In many cases, you do not need an RTI server, such as the rtiexec, or a central application to use the MÄK RTI, however you can run the rtiexec if you want to. (It is required to use certain features of the MÄK RTI.) Be sure the FLEXlm license server is running, then start the applications, and they should be able to communicate. (For information about the license server, please see “Setting Up and Using the FLEXlm License Manager”.) Please see *MÄK RTI Reference Manual* for information about the rtiexec and changing the networking parameters such as multicast addresses and UDP ports.

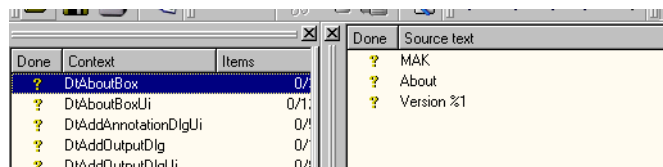
2.5. Localizing the VR-Forces Interface

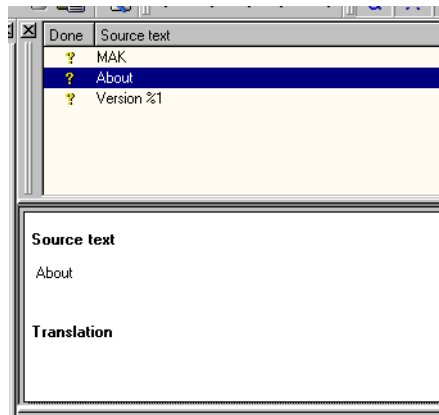
You can localize the VR-Forces interface so that it uses languages other than English. To localize VR-Forces, you edit a resource file using the following procedure:

1. Start the Qt Linguist utility. It is `./translations/linguist.exe`
2. In the Qt Linguist window, choose **File** → **Open**. Select the file `./translations/vrforces_untranslated.ts`. The translation file is opened and a list of classes is displayed on the left side of the window, as illustrated.

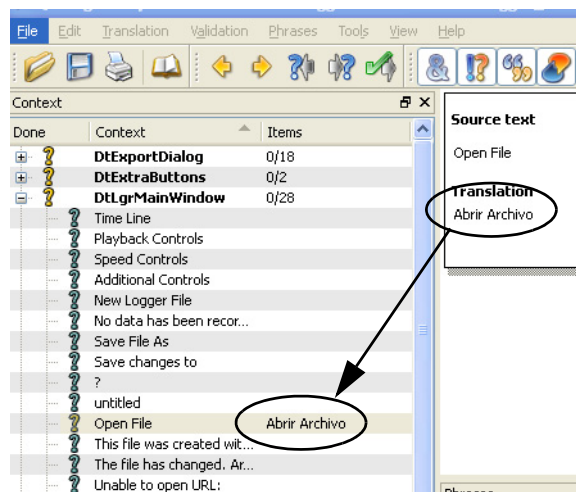


3. To translate text, you select each class in turn and translate the text associated with that class. You do not have to understand anything about what the classes mean, you just have to translate the text. For example, the first class in the list, *DtAboutBox*, contains the text for the About Box.
4. In the Source Text list, select the word "About". The text is displayed in the translation area (the window below the source text list.)
5. Select *DtAboutBox*. The text in the about box is displayed in the Source Text list. The yellow question marks indicate that the text has not been translated yet.





6. Place the cursor in the space below the word “Translation”.
7. Type the translation for the word “About”. As you type, the translation is displayed in the Translation column.



8. When you are done and you are certain of the translation, select the Done and Next button on the toolbar. A green check mark replaces the question mark. When you translate all elements for a class, a green check mark replaces the question mark next to the class name.
9. Repeat this process for each element of source text for each class.
10. Choose **File** → **Release**. A Save As dialog box opens. Change the name in the File Name box from *vrforces_untranslated.qm* to a name that indicates the language to which you have translated the file, using the two-character abbreviation typically used with your language. For example, a Spanish translation would be renamed *vrforces_es.qm*. Save the *.qm* file in the *.translations* directory.
11. Save your translated *.ts* file.

2.5.1. Translating Other Interface Files

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

2.5.2. Applying the Language Files

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

- ♦ Set your computer's environment to the proper language (LANG environment variable).
- ♦ Set the locale to the proper language.
- ♦ Set the **Language** parameter in *vrGui.mtl* to the correct language.
- ♦ Start VR-Forces with the **-G locale** command line option, where *locale* is the two-letter country code for the local language.

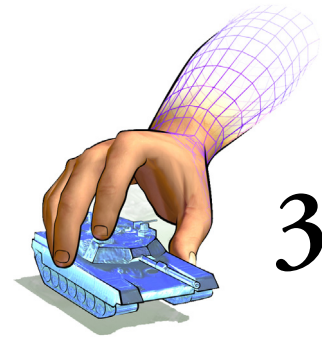
2.5.3. Merging Translation Files

If you localize a version of VR-Forces and upgrade to a newer version, you can merge your localized *.ts* file with the *.ts* file from the new version. Then you only have to translate new or changed text in the new version. You merge translation files with the *translationMerge* utility, which is in the *.bin* directory. The syntax is as follows:

```
translationMerge [-o] [-m] previous.ts current.ts new.ts
```

where:

- ♦ *previous.ts* is the name of the previously localized translation file.
- ♦ *current.ts* is the name of the translation file provided with the current release of VR-Forces.
- ♦ *new.ts* is the name to give to the merged file.
- ♦ **-o** specifies that the merged file removes obsolete messages.
- ♦ **-m** merges modules that have equal text strings.



VR-Forces Concepts

This chapter describes at a conceptual level the components of a VR-Forces simulation and how they work together. Later chapters contain the specific procedures that you use to put VR-Forces to work.

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3.1. The VR-Forces Program

Unlike most computer applications, which have one executable file, VR-Forces has two executable files: a front-end, or graphical user interface (GUI) and a back-end, or simulation engine. The front-end executable is *vrfGui* or *vrf3DGui*. The back-end executable is *vrfSim*.

By separating the simulation engine from the visualization program, VR-Forces allows you to run multiple front-ends, back-ends, or both. If you run multiple GUIs, several VR-Forces users can work together to create and manage scenarios. Using session IDs, you can specify which front-ends control which back-ends. The GUIs also display entities received over the network from other simulations participating in an exercise. You have a limited ability to interact with these remote objects. For more information, please see [“Local Objects and Remote Objects,”](#) on page 3-12 and [“Introduction,”](#) on page 8-2.

If you run multiple simulation engines, the work of simulating entities and graphical objects can be shared by multiple computers, which should improve performance. If you save a scenario, VR-Forces records which objects are simulated by each back-end, so that the configuration can be reproduced the next time you run the scenario.



In this manual, most procedures apply to a user's interaction with the GUI. For the sake of simplicity, unless we are discussing a subject that applies specifically to either the front-end or back-end, we refer to VR-Forces in the sense of the combined interactions of both executables.

3.1.1. Combined Mode

If you do not want to run multiple front-ends or back-ends, you can run VR-Forces in combined mode. In combined mode, you run one front-end and one back-end on the same computer, typically with default startup values. The back-end executable is dependent on the front-end, so that when you exit the front-end, the back-end shuts down also.

3.1.2. Separate Mode

When you run multiple front-ends or back-ends, or start a single front-end and back-end without using combined mode command syntax, you are running VR-Forces in separate mode.

3.2. Working with Multiple Front-ends and Back-ends

Although running multiple front-ends or back-ends, or both, adds to the power and flexibility of VR-Forces, you need to understand how the various executables interact to ensure that your scenarios are created and run smoothly. In this section, we describe:

- How front-ends and back-ends work together
- How back-ends are uniquely identified
- Use of sessions
- How to coordinate multiple front-ends
- How scenarios are loaded and saved when you run multiple back-ends.

3.2.1. How Front-ends and Back-ends Work Together

The VR-Forces front-end is an interface to the simulation engine in the back-end. It communicates with the back-end by sending messages over the network. It displays the state updates and interactions that the back-end generates and sends over the network. [Figure 3-1](#) illustrates loading a scenario and running a simulation.

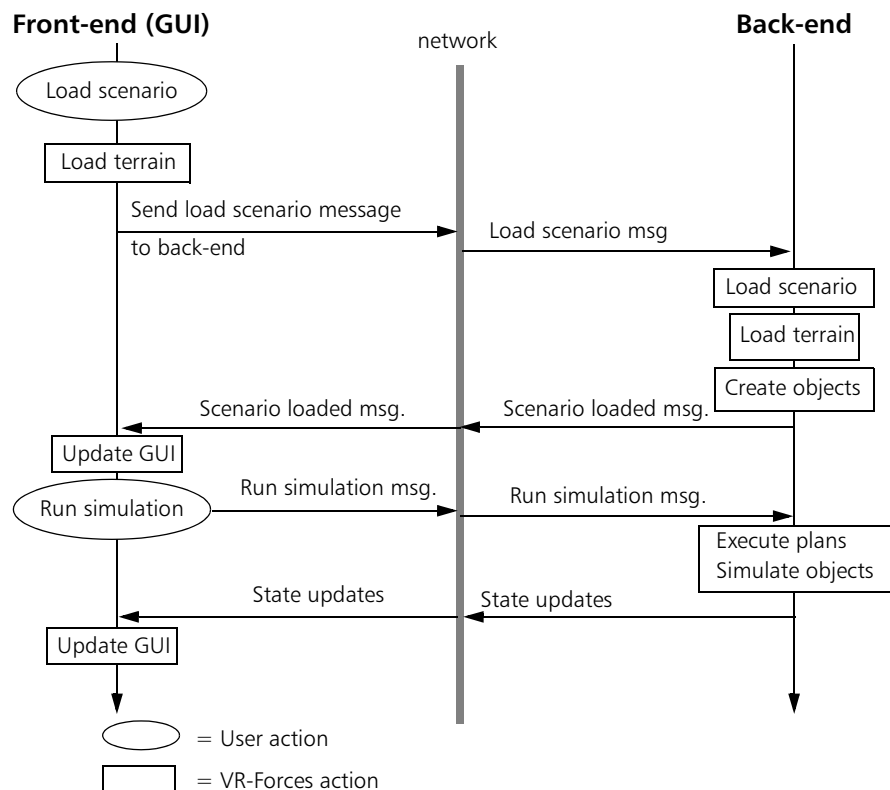


Figure 3-1. Front-end and back-end interaction

3.2.2. How VR-Forces Back-ends are Identified

If you run multiple back-ends, you can specify which back-end you want to use when you create entities and graphical objects. This feature allows you to spread the simulation load across multiple PCs. However, to do this, each back-end must have a unique ID. VR-Forces back-ends are identified by their site ID and application number. Each back-end must have a unique site:application identifier. You assign the site:application identifier when you start an application. It is up to you to make sure that there are no duplicate identifiers. (For details, please see [“Starting VR-Forces,”](#) on page 4-3.)



The site ID and application number concepts are borrowed from DIS. They apply to VR-Forces when it is running in HLA as well.

3.2.3. VR-Forces Sessions

VR-Forces uses sessions to help manage the relationships between front-ends and back-ends. Back-ends are always part of a session. Front-ends can join a session or operate independently of one. When a front-end is joined to a session, it can control the back-ends in that session. When a front-end is not joined to a session, it cannot control back-ends. However, it can open a terrain and view exercises running on its port. In this case it is just a viewer, like MÄK Plan View Display.

Use of sessions helps ensure consistency among front-ends that are controlling a common set of back-ends. The session mechanism ensures that:

- ♦ All front-ends and back-ends in a session run the same scenario and use the same terrain
- ♦ When a front-end joins a session that is running a scenario, it automatically loads the correct terrain for the scenario
- ♦ If any front-end in a session tries to create a scenario or load a scenario, and a scenario is already running, the user is warned that this action will destroy the currently running scenario
- ♦ If any front-end in a session loads a scenario or creates a new scenario, all of the back-ends and other front-ends in that session take the same action.

Sessions provide the following additional benefits:

- ♦ They allow you to specify which front-ends control which back-ends. This feature could be useful, for example, if you want one set of VR-Forces applications to simulate friendly forces and another set to simulate opposing forces. If all applications were in the same session, participants could send orders to the entities in the opposing force. By using separate sessions, this is not possible.

In [Figure 3-2](#), the front-end with session ID 1 can control the back-ends with that same session ID. The front-end with session ID 2, controls the back-end with session ID 2.

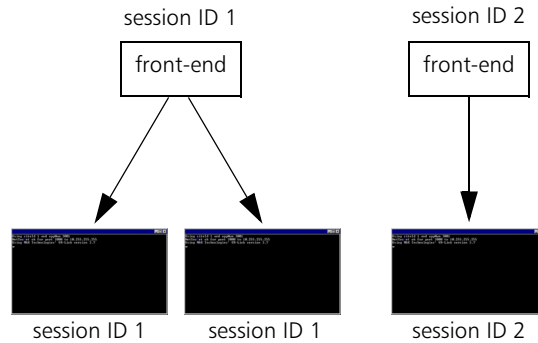


Figure 3-2. Using session ID to control back-ends

- ♦ Sessions allow you to load different terrain databases in different VR-Forces executables that are part of the same exercise. This feature may be helpful if you are participating in an exercise that covers a large geographical area, but only need to observe portions of that total terrain. Loading databases that cover a subset of the total exercise zone could improve the performance of your computer or the resolution of the terrain database.

In [Figure 3-3](#), the two sessions have loaded databases cover different (but overlapping) portions of California, USA. The entire exercise would cover the terrain covered by two databases.

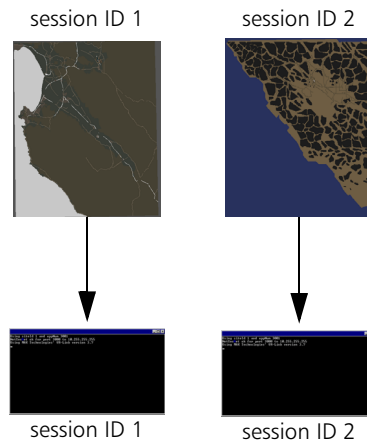


Figure 3-3. Using session IDs to load different terrain databases

If two different sessions use terrain databases that overlap, note the following possible sources of confusion:

- ♦ The front-ends in each session will see entities from the other session that are simulated in the common portions of the terrain. However, the front-end for one session will have no ability to control the entities that are simulated by the other session.
- ♦ If you save the scenario in one of these sessions, it only saves the entities simulated in the session. It does not save the entities from the other session, even though they may be visible in a front-end.
- ♦ If one of the sessions pauses or rewinds, the front-end in the other session will see the entities in the overlapping region pause or return to their origin.

3.2.4. Coordinating Multiple Front-ends

Figure 3-1 shows how a VR-Forces front-end sends messages to a back-end and displays the simulation messages sent out by the back-end. When you run VR-Forces with multiple front-ends, any of them can send control messages to the back-ends and all of them display the state updates. However, you would not want users at different front-ends to send conflicting or overlapping messages. For example, you would not want two different users to try to load the same scenario. Therefore, when you run multiple front-ends, bear the following points in mind:

- ♦ Only one front-end in each session can load a scenario or create a new one (they can all create the objects in the scenario).
- ♦ Any front-end can save a scenario. However, this could lead to multiple, unsynchronized versions of a scenario. It is probably best to reserve saving of scenarios to a specific front-end.
- ♦ Any object that you create in any of the front-ends (except unpublished graphical objects) is visible in the others and can be managed from them.
- ♦ You can close the scenario from any front-end.

VR-Forces provides some help managing multiple front-ends. For example, if one front-end loads a scenario, VR-Forces automatically asks the other front-ends to load the appropriate terrain. And if you close a scenario in one front-end, VR-Forces automatically prompts the other front-ends to close their terrains.

i

Using multiple front-ends is not the same thing as opening multiple VR-Forces windows. (For details, please see “[Using Multiple VR-Forces Windows](#),” on page 4-14.) When you run multiple front-ends, you run an instance of *vrfGui* or *vrf3DGui* for each one. When you open multiple VR-Forces windows, they are all controlled by one *vrfGui* process. (*vrf3DGui* does not support multiple windows.)

3.2.5. Working with Multiple Back-ends

As noted previously, you can distribute simulation of entities and objects among multiple back-ends. When you run multiple back-ends, bear the following points in mind:

- ♦ When you save a scenario created using multiple back-ends, the object map file (please see [“The Object Map File,”](#) on page 3-10) records each object and the site and application ID of the back-end on which it was simulated. When you want to replay that scenario, you should run a set of back-ends with the same site and application IDs. (If you do not, you can remap objects to the back-ends that you are running.)
- ♦ Multiple back-ends must all be started and ready when a scenario is loaded. There is no way for a required back-end to join an exercise after it has started and catch up to the current state of the exercise.
- ♦ If, during an exercise, a back-end drops out of the exercise, there is no good way for it to rejoin the exercise. If you load the scenario being run, it will be at the beginning, not at the point that the rest of the participants had reached.
- ♦ If you want a back-end to join an exercise after it has started, you must explicitly load the terrain database (`-T` option), object parameter database (`-M` option), and scenario parameters being used in the exercise using command-line options. The back-end will not receive any order of battle data, but it can be used to create new entities and graphical objects going forward in the simulation.
- ♦ When you save a scenario that uses multiple back-ends, the final scenario files are composed of information generated by each back-end and sent to the front-end, where it is combined. Therefore, if any of the back-ends has dropped out of the exercise or is otherwise unavailable, the scenario data will be incomplete.

Remapping Back-ends

The previous section lists the issues you should consider when creating, saving, and loading scenarios that use multiple back-ends. If you choose to run a scenario that requires multiple back-ends and some of the back-ends are not available, VR-Forces lets you remap objects from the missing back-ends to the available back-ends. You can remap back-ends automatically or manually.

If a scenario is missing its object map (`.omp`) file, you can remap the objects and create a new object map file. By default, in combined mode all the entities are remapped to the combined mode back-end. By default, in separate mode the remapping dialog box lists the missing back-end as “UNKNOWN”.

To configure remapping of back-ends, set the remapping parameters in *vrGui.mtl*.

You might also want to manually remap back-ends to load balance a scenario. For more information, please see [“Load Balancing a Scenario,”](#) on page 5-9.

3.3. Scenarios

Whenever you use VR-Forces, you work in the context of a scenario. A scenario consists of everything that needs to be specified to run a VR-Forces simulation. Each scenario has a scenario file (*.scn*) and the following supporting files:

- ♦ An order of battle file (*.oob*)
- ♦ A plan file (*.pln*)
- ♦ A global plan file (*.gpl*)
- ♦ An object map file (*.omp*)
- ♦ An overlay file (*.ovl*)
- ♦ A terrain database for the front-end and back-end
- ♦ A selection groups file (*.sgr*)
- ♦ A hostility relationships file (*.hst*).

3.3.1. The Scenario File

The scenario file specifies the pathnames of a terrain database file, a simulation model set, and the other files required for a scenario. It specifies the following simulation-wide parameters:

- ♦ Time multiplier (for faster or slower than real-time operation)
- ♦ Random number seed (for repeatability)
- ♦ Frame advance mode
- ♦ Frame time interval
- ♦ Automatic reorganization
- ♦ Simulation time
- ♦ Exercise start time.

3.3.2. Terrain Databases

Each scenario is associated with a terrain database. A terrain database provides three-dimensional information about a geographic area and provides the environment within which simulated entities function. With the information in a terrain database, VR-Forces can calculate height, intervisibility, and other three-dimensional information.

A terrain database does not have to be stored in the same directory as a scenario. It is referenced by the scenario. This lets you use a terrain database, which can be quite large, in more than one scenario, without needing to make multiple copies of it. For more information about terrain databases, please see [“Terrain Databases,”](#) on page 3-28 and Chapter 20, *Terrain Databases and Feature Data*.

3.3.3. The Order of Battle File

The order of battle is a description of the local objects in a simulation. When you create a scenario, you populate it with entities. When you save or checkpoint a scenario, VR-Forces saves a record of each entity, including its state information and geographic location, to the order of battle file. The next time you run the scenario, it starts with all the entities in their saved location and state.

The order of battle file also describes the environmental objects and published graphical objects that have been defined for the scenario. Graphical objects identify locations and areas in the terrain. You can place a basic set of objects on the map. You can place many more types of objects on overlays. For more information, please see [“Graphical Objects,”](#) on page 3-24 and Chapter 16, *Overlays and Graphical Objects*.

3.3.4. The Plan Files

The plan file (*.pln*) saves the plans for the entities in a scenario. Plans are not saved separately for each entity; they are all in one file. Global plans are saved in a separate file (*.gph*). For conceptual information about plans, please see [“Plans,”](#) on page 3-27.

3.3.5. The Object Map File

When you start VR-Forces with multiple back-ends, you can specify which back-ends simulate the various objects you create. The object map file records the back-ends on which objects are simulated. The next time you open the scenario, VR-Forces looks for the back-ends specified in the object map file. If any of the specified back-ends is not available, the front-end asks you if you want to remap objects to the back-ends that are present. You can run the simulation without remapping. However, the behavior of a simulation that is missing entities or objects is unpredictable.

If you forget the names of the back-ends you need for a scenario, you can view the object map file in a text editor and determine the site and application numbers for the back-ends you need to run.

3.3.6. The Overlay File

The overlay file (*.ovl*) stores:

- ♦ Unpublished overlay objects
- ♦ The ordered position of overlay layers
- ♦ The ordered position of the overlay objects, both published and unpublished.

3.3.7. The Selection Groups File

The selection groups file (*.sgr*) stores the details of selection groups, if you have created any. For details about selection groups, please see [“Creating and Using Selection Groups,”](#) on page 7-9.

3.3.8. The Hostility Relationships File

VR-Forces lets you configure hostility relationships. That is, for any force you can specify which forces it is hostile to. By default Friendly and Opposing forces are hostile to each other. If you change the hostility relationships, they are saved in the hostility relationships file (*.hst*).

3.3.9. The Batch Mode File

A batch mode file contains the information that VR-Forces needs to run scenarios in batch mode. Batch mode offers the following options:

- ♦ Run a particular scenario multiple times.
- ♦ Run a series of different scenarios (batches), each of which can be run multiple times.
- ♦ Run from the command line using one back-end. If a scenario was created using multiple back-ends, you cannot run it in batch mode using this method.
- ♦ Run from the VR-Forces front-end using one or more back-ends.
- ♦ Generate Logger Control messages to have the MÄK Logger record each simulation.

For each batch (one scenario run one or more times) within the batch file, you can:

- ♦ Specify the length of time the simulation is to run (in real time or simulation time)
- ♦ Specify the object parameter database to use
- ♦ Specify that the random number seed used be the value specified in the scenario file, a value specified in the batch file, or be computer generated.

A batch file has the file extension *.bsn*.

For more information, please see [“Running VR-Forces in Batch Mode,”](#) on page 5-17.

3.4. Objects

All entities, environmental objects, control objects, and graphical objects are objects. The procedures for selecting, viewing, and organizing objects are fairly similar. However since their purposes and use are quite different, for the most part we discuss entities and graphical objects separately.

3.4.1. The Object Parameter Database

VR-Forces creates objects based on parameter specifications in the object parameter database. In the object parameter database, objects are identified by an 8-digit enumeration based on the DIS Enumeration Document (*Enumeration and Bit Encoded Values for Use with Protocols for DIS Applications*). (The DIS enumerations have also been incorporated into the HLA RPR FOM.) In this manual, when we refer to entity or force type enumerations, we are referring to this set of enumerations. For information about the object parameter database and how to edit it, please see *VR-Forces Configuration Guide*.

3.4.2. Local Objects and Remote Objects

From the point of view of a particular VR-Forces back-end, a local object is any object that is simulated in that back-end. In that same back-end, a remote object is an object that is received over the network from an external application, such as another VR-Forces simulation back-end, or a non-VR-Forces simulation. A given VR-Forces application participating in a networked exercise may know about a mixture of local and remote objects.

There are two categories of remote objects: objects simulated by VR-Forces applications, and objects simulated by applications other than VR-Forces. When VR-Forces learns about a non-VR-Forces remote object, it knows only what is transmitted in the standard DIS or HLA message. By contrast, VR-Forces remote objects share additional state information over the network, including a string name, an echelon ID (if the entity is organized), and a string label.



Since the VR-Forces GUI allows you to manage objects regardless of which back-end is simulating them, in the interest of simplicity, in this chapter and throughout the rest of this manual, we will refer to entities or objects simulated by a VR-Forces back-end, whether local or remote, simply as entities or objects and we will refer to entities simulated by applications other than VR-Forces as remote entities or objects.

You cannot control remote objects from VR-Forces. However, you can attach VR-Forces components such as sensors and radios to remote objects and you can write plans that use these components. For more information, please see [“Writing Plans for Remote Entities,”](#) on page 15-28, and [“Configuring VR-Forces Components on Remote Entities,”](#) on page 8-29, in *VR-Forces Configuration Guide*.

3.5. Entities

The players in a simulation are called entities. There are two broad classes of entities: single entities, such as a tank or a submarine, and aggregate entities, such as a platoon or a company. Since aggregates are entities, they have most of the characteristics of single entities as described in the following sections. Characteristics that are particular to aggregates are described in [“Aggregate Entities,”](#) on page 3-20.

Entities can act in and respond to their environment. They execute tasks and they have behaviors. Each entity is part of a force-level organizational unit and many may be members of subordinate organizational units.

The VR-Forces application comes with a set of entity models that you can instantiate in a simulation. Application developers can create additional entities with the VR-Forces toolkit. You can also create new entity types in the Entity Editor. For information about creating new entities, please see *VR-Forces Configuration Guide*.

3.5.1. How Entities are Identified

VR-Forces identifies entities by name, echelon ID, object ID, and label. [Table 3-1](#) summarizes the characteristics of each type of identifier.

Table 3-1: Entity identifiers

Identifier	Characteristics
Name	♦ Must be unique ♦ Persists from exercise to exercise ♦ Set by user ♦ Limits on the length of the character string.
Echelon ID	♦ Must be unique ♦ Persists from exercise to exercise ♦ Managed by VR-Forces. Manipulable by user by organizing entities into aggregates.
Object ID	♦ Unique ♦ Does not persist from exercise to exercise ♦ No user control.
Label	♦ Does not have to be unique ♦ Persists from exercise to exercise ♦ Controlled by user ♦ No limit on character length.

Entity Names

A name is a text string that, by default, consists of the entity category, as defined in the object parameter database, and an integer that in combination with the category, makes the name unique. For example, if you create a new scenario and add two M1A2 tanks and two Apache helicopters, the default names are M1A2 1, M1A2 2, USA ϵ RW 1, and USA ϵ RW 2. You can edit an entity name to make it meaningful to you.

Entity names have the following restrictions on their length:

- ♦ Entities – 11 characters
- ♦ Aggregates – 10 characters in HLA exercises, 32 characters in DIS.



If you are using a character set that requires multiple ASCII characters to represent a visible character, entity and aggregate names will need to be correspondingly shorter.

Echelon IDs

An echelon ID is a text string that identifies the entity's place in the force hierarchy. For example, the hypothetical entities in the previous section would be part of Blue force, or Force 1. The echelon ID for M1A2 1 would be 1 M1A2, 1 Force. The syntax of echelon IDs and the details of entity organization are described in [“How Entities are Organized,”](#) on page 3-15. You cannot edit an entity's echelon ID. The echelon ID changes if you change the force hierarchy by adding, removing, or editing aggregate units.

Object IDs

Each entity has a unique object ID (global object designator). The global object designator is equivalent to the HLA object name in HLA, and the DIS entity identifier in DIS. The object ID is used to identify the entity internally and for network communications.

Entity Labels

An entity label is a text string that you can use to identify entities without the restrictions of uniqueness or character length that affect the other identifiers. For example, if Company A and Company C each have a 1st Platoon, you could not give both of them the name 1st Platoon, because names must be unique. However, you could give each of them the label 1st Platoon.

3.5.2. How Entities are Organized

All entities simulated by VR-Forces exist in the context of a hierarchy. At the top-most level, entities are grouped according to force ID (friendly, opposing, neutral, and so on). At lower levels, entities are grouped according to military organization, in which an entity has a designation in the hierarchy, such as 2nd Platoon, B Company. At each echelon level in the organization, an entity has a single superior entity. Aggregate entities contain one or more subordinate entities. The hierarchy's lowest level contains an individual entity.

Each entity has an echelon ID in the following format:

```
designator [category] [echelon], designator [category] [echelon], ...,  
force_number Force
```

where:

designator is a number or letter that differentiates the entity from other members of the echelon, such as 1 (M1A1), 2 (M1A2), and so on.

category is an optional descriptor for the entity, such as M1A2.

echelon is an optional descriptor for the organizational unit, such as "Platoon".

force_number is the force the entity belongs to, based on the force type enumerations. The force is the highest level in the hierarchy.

When you create a new entity, it exists only within the default force. Therefore its echelon ID would be similar to:

```
1 M1A2, 1 Force
```

If an entity becomes part of an aggregate, the aggregate information becomes part of the echelon ID, and the designator may change, for example:

```
2 M1A2, 2 Plt, 1 Force
```

The M1A2 from the first example is still an M1A2, but it has a new echelon designator: number two in 2 Plt. It is still in Force 1.

How Echelon IDs are Assigned

The category and echelon labels that make up an echelon ID, such as “M1A2”, “Plt”, and so on, are specified in the VR-Forces object parameter database and are associated with object-types. When you create an entity or aggregate of a certain type, the echelon ID category and echelon name associated with that type are assigned to the entity. You cannot change the labels interactively. Although you can change the labels by editing the object parameter database, please note the cautions associated with doing so. For information about changing echelon ID labels, please see Section 7.6, “[Changing the Echelon ID Category and Echelon ID Level](#)” in *VR-Forces Configuration Guide*.

Designators are assigned by VR-Forces. You have no direct control over them. When you create new entities, they are assigned designators sequentially, starting with one (1). If you aggregate a group of entities, the aggregate leader is assigned the designator 1, and the other entities in the aggregate are assigned successive designator numbers.

3.5.3. How Entities Communicate

VR-Forces includes a default communication model called simple-radio-comm-model. Using this simple communication model, radio messages always reach their intended destination (as long as the destination is on a reachable network), and messages are all passed instantly. The simple radio communication model has one parameter, which determines how the radio networks are set up. There are three connection-modes available:

- ♦ **aggregate** mode specifies that each aggregate has its own radio network. Messages sent from an entity can reach any entity that is in the same organization, at the same level (the entity’s peers in the organization), and can also reach the entity’s direct superior. All other entities are outside the network, and are unable to receive messages sent by the entity.
- ♦ **force** mode specifies that there is a radio network for each force in VR-Forces. Messages sent from an entity can reach any other entity of the same force.
- ♦ **all** mode specifies that all entities in VR-Forces are part of one large radio network. In this case, any entity can receive messages sent by any other entity.

For details about configuring radios, please see *VR-Forces Configuration Guide*.

External Communication Model

VR-Forces includes an external communication model that can communicate with an external communication effects server over the network to determine how to deliver radio messages. For details, please see Chapter 9, [Using VR-Forces with an External Comms Effects Server](#), in *VR-Forces Configuration Guide*.

Custom Communication Models

You can create new communication models and install them in VR-Forces. This is useful if you want to define your own connectivity model, or write your own algorithms for determining if radio messages get delivered. For details, please see Section 9.5.1, “[Creating Custom Communication Models](#)” in *VR-Forces Developers Guide*.

3.5.4. VR-Forces Uses a Component Architecture

VR-Forces entities use a component architecture similar to that used in many robotics applications. There are three basic types of components supported: sensors, controllers, and actuators. Components communicate with each other through data ports and port groups, which may provide data as simple as a single number (such as a throttle value) or more complex data such as a list of entities that have been detected. The port groups make it possible to multiplex and prioritize multiple data sources to a single data recipient. For example, the automotive actuator of ground vehicles can receive inputs from a collision-avoidance controller, move-to-point controller, and follow-route controller, but it does not want inputs from all of those controllers at once.

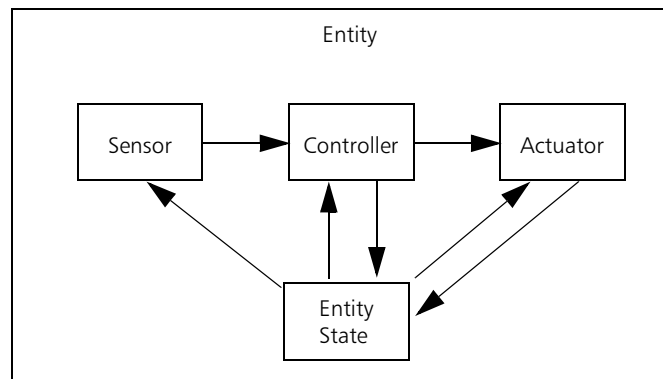


Figure 3-4. Entity component architecture

The component architecture supports any number of sensors, controllers, and actuators in a simulated entity. Components are specified in the object parameter database by using component descriptors. Component descriptors indicate the type of component that should be created. They can also provide parameter information to a component.

VR-Forces Configuration Guide discusses components in detail.

Sensors

Sensor components provide models of the simulated environment, which are used by controller components to make decisions and perform tasks. The simplest sensor might provide (simulated) ground truth, while more sophisticated ones could use complex models for sensing electromagnetic emissions, RADAR, or a cognitive model to simulate a soldier or crew member's perception of the simulated world. Sensor components can get information from:

- ♦ The virtual network
- ♦ From a terrain database
- ♦ By monitoring the state of the entity model
- ♦ Many other potential sources.

The use of sensors is optional.

Controllers

Controller components typically provide control inputs to actuator components (although this is not required). Controllers can use information provided by sensors to perform their functions, but this is not a requirement either. For example, the controller that implements the various forms of the Wait task neither requires sensor information, nor provides control inputs to any actuators.

Actuators

Actuator components:

- ♦ Provide the physical model of the entity being simulated
- ♦ Change the entity's state
- ♦ Interact with other simulated objects (such as by sending messages).

Actuators can use control inputs provided by controller components as parameters to its model each simulation frame. Actuators may:

- ♦ Send messages on the radio system
- ♦ Generate events on the virtual network, such as detonations
- ♦ Modify the state of the entity simulated: position, velocity, damage, and so on.

Actuators can also use data directly from a sensor, when modelled or filtered data is preferred over simulated ground truth for a model that does not require a controller.

3.5.5. Entity Behaviors and Tasks

A behavior is something that an entity knows how to do on its own. Behaviors describe how an entity reacts to a specific condition or situation or how it performs a task. A task is something that you tell an entity to do. An entity does not innately know that it should move to a point. However, if you task an entity to move to a point, it knows how to locate the point and how to move to it.

Behaviors can override task assignments. For example, if an entity is moving along a route and detects another entity in its path, the collision-avoidance behavior overrides the movement task until the entity successfully avoids the obstacle and can return to moving along the route.

VR-Forces creates models of the expected behavior of the entities we supply. These models simulate the behaviors you would expect from live participants and objects functioning in the real world. You can change the parameters for the behavior models. With the VR-Forces toolkit, you can change the models themselves and add additional models. For more information, please see *VR-Forces Developers Guide*.

To learn about changing behavior parameters, please see Chapter 8, [Configuring Object Behaviors](#), in *VR-Forces Configuration Guide*.

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No semi-automated forces (SAF) system, such as VR-Forces, can completely emulate the behavior of any complex entity. The behaviors provided by VR-Forces handle the lower level activities necessary to complete a task, and allow you to focus on the higher level activities involved in assigning tasks and preparing plans.

3.6. Aggregate Entities

The aggregate entities in VR-Forces are multi-resolution models. Their components enable them to be simulated in either of two states:

- Disaggregated: Subordinates are separately simulated and published entities ([Figure 3-5](#)). Aggregates in this state can be tasked and given plans, but usually pass responsibility for execution to their subordinates.
- Aggregated: Subordinates are not simulated separately. Tasks and plans are executed by the aggregate.

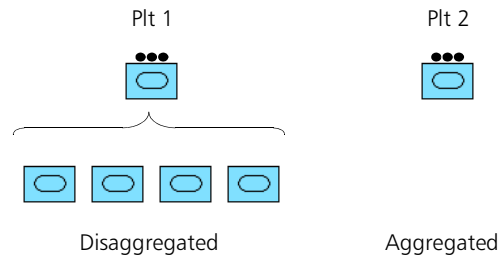


Figure 3-5. Disaggregated and aggregated entities

An aggregate entity can support either of these states. At any given time, one subset of components and systems is enabled, and the other is disabled. At runtime, you can switch dynamically between these states.

You can configure VR-Forces so that aggregate state is determined automatically according to a set of rules, or to have aggregate state controlled manually.

The choice of whether or not to simulate aggregates in the aggregated or disaggregated state depends on your goals for the simulation. For example, if you need to support large numbers of entities, and do not want or need to simulate individual entity behavior, then you may want to simulate some or all of your aggregates in the aggregated state. Conversely, if you need to simulate the detailed behavior of subordinates, then you will want to simulate aggregates in the disaggregated state.



An aggregate in the aggregated state only simulates movement behavior. It does not model combat behavior. Simulate aggregates in the disaggregated state if you want them to model attrition. However, an aggregate in the aggregated state does keep track of its current resource and attrition state. If an aggregate later transitions to a disaggregated state, this state information is preserved.

For more details about the differences between the two aggregate models, please see [“Introduction to Aggregates,”](#) on page 9-2.

3.6.1. How Aggregates Are Organized

The organization within a disaggregated aggregate is based on the echelon ID of each member entity. For example, in [Table 3-2](#) four unique entities (identified by name) are assigned designators in 2 Plt.

Table 3-2: Example of names and echelon IDs

Name	Echelon ID
Tank 1	1 M1A2, 2 Plt, 1 Force
Tank 2	2 M1A2, 2 Plt, 1 Force
Tank 3	3 M1A2, 2 Plt, 1 Force
Tank 4	4 M1A2, 2 Plt, 1 Force

Assignment of echelon IDs is handled automatically by VR-Forces when you create an aggregate.

Reorganizing Aggregates

Reorganization is the reassignment of echelon IDs to the members of an aggregate unit when a member entity gets destroyed. If reorganization is enabled, when a member of an aggregate unit gets destroyed, the destroyed entity is assigned the highest numerical ID in the unit, and the surviving members' echelon IDs are moved down numerically by one. For example, assume a platoon as shown in the leftmost table in [Figure 3-6](#). If 2 M1A2 (currently the entity named Tank 2) gets destroyed, reorganization would result in the new echelon ID assignments illustrated in the rightmost table. The former 3 M1A2 is now 2 M1A2, former 4 M1A2 is now 3 M1A2, and the former 2 M1A2, is now 4 M1A2. Their echelon IDs have changed. Their names and object IDs have not.

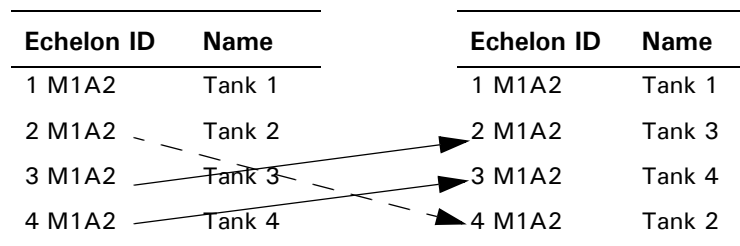


Figure 3-6. Reorganization of Platoon 2

You can configure VR-Forces to reorganize aggregates automatically, or you can reorganize manually. Manual reorganization does not require you to reassign each designator; you simply order the aggregate to reorganize with the Set Reorganize command.

3.6.2. How Aggregates Move

When an aggregated entity receives a movement command, VR-Forces calculates the path it must follow. Then it moves to the location similarly to any individual entity. The entity icon is placed at the center of the bounding box of the area that would be encompassed by the aggregate if it was disaggregated.

When a disaggregated entity receives a movement command, VR-Forces calculates the path the aggregate leader must follow for movement. Then it calculates parallel paths (taking into account the formation) for each individual member of the aggregate. The individual entities are then responsible for following these paths until the aggregate completes the movement task.

Closing Formation

VR-Forces can close up holes in formations that are created when an aggregate member is removed from a formation. When an aggregate is ordered to form up, it assigns formation positions to each of its member entities. Each position in the formation has an internal ID. If at some point one or more of the aggregate's members are destroyed, removed, or independently tasked, the aggregate reassigns the formation IDs for its list of member entities. Member entities which are gone, destroyed, or independently tasked, are given the least significant formation IDs. The active entities are moved up in the formation to fill the vacancies. Assignment to a different formation position has no effect on echelon designator.

The process of closing formation is internal to an aggregate. Formation position is not reported as part of entity information. The only way to determine an entity's formation position is to observe the formation as the aggregate moves.

Closing formation is an inherent feature of aggregates in the VR-Forces application. You do not need to do anything to put it into effect and you cannot turn it off.

Closing Formation Versus Reorganization

Closing the formation of the entities in an aggregate unit is not the same thing as reorganization. Reorganization changes the echelon designators of its members. Closing formation does not change the echelon designators of aggregate members, or the tasks an entity is assigned. It only affects the relative positioning of members within a formation.

3.6.3. How Aggregates Carry Out Tasks

Like other entities, each aggregate has a plan and you can assign independent tasks to aggregates (plans and tasks are discussed later in this chapter). When a disaggregated aggregate is given a task, it sends radio messages to its subordinates directing them to carry out their role in the task, for example, getting into formation and moving to a waypoint.

If an aggregate is in the aggregated state, it does not send task messages to subordinates. However, if while carrying out its task the entity disaggregates, it sends appropriate task messages to its subordinates to continue with the task execution. For example, suppose an aggregate is moving to a point and its path to the point passes through a disaggregation area. When it enters the disaggregation area, it would disaggregate, calculate routes for its subordinates, and send them Move Along Route tasks. When the aggregate exits the disaggregation area, it aggregates again and the tasks for its subordinates are abandoned.

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Disaggregation areas are special control objects. If automatic aggregation and disaggregation is enabled, when an aggregate enters a disaggregation area, it automatically disaggregates. When it leaves the area it aggregates. For more information, please see [“Using Disaggregation Areas,”](#) on page 9-10.

The precise way in which an aggregate sends out messages to its subordinates is part of the modeling of the aggregate that is built into the VR-Forces application.

3.7. Graphical Objects

VR-Forces has the following set of control objects, which it creates on the terrain map (rather than on overlays):

- ♦ Waypoint – a specific X, Y, Z coordinate.
- ♦ Phase line – infinitely long line defined by two points.
- ♦ Route – a sequence of points in three-dimensional space.
- ♦ Area – a polygonal area. Areas are considered to have volume, so that air and subsurface entities can interact with them.
- ♦ Obstacle – a polygonal area on the map. Obstacles are considered to have volume, so that air and subsurface entities can interact with them.

You can also draw various kinds of points, lines, areas, entity symbols, and text on overlays. These graphics can represent objects such as locations on the terrain, supply routes, minefields, and so on.

You can publish graphical objects (the default behavior), in which case they are visible to other VR-Forces applications (and to other MÄK applications, such as the Stealth or Plan View Display), or you can choose not to publish them, in which case they are visible only in the front-end that creates them. (For details, please see Chapter 16, *Overlays and Graphical Objects*.)

Graphical objects have names, which, like entity names, must be unique. New objects are assigned default names in the format `Point 1`, `Point 2`, `Route 1`, `Route 2`, and so on. You can specify an alternative name when you create the object. A graphical object's name can be up to 255 characters long.

Entities are aware of points, lines, and areas and can respond to them. For example, an entity can follow a route, or move to a point.

The following sections provide more information about the basic graphical object types.

3.7.1. Points

A point identifies an X, Y, Z coordinate in the terrain. You can command an entity to travel to a point and to travel back and forth between points. Waypoints are displayed using the waypoint symbol (Figure 3-7). The bottom of the symbol points to the location of the waypoint. You can place several different kinds of points on overlays.

A point can have an altitude value. This allows you to send aircraft to waypoints or have them patrol between points.

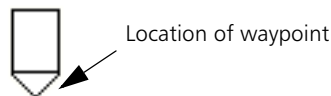


Figure 3-7. Waypoint symbol

3.7.2. Phase Lines

A phase line is defined by two points, but is considered to extend indefinitely in either direction and have infinite height. A phase line is used to test the location of an entity, for example: Is entity A to the left of phase line B? The left side of the line is determined relative to the direction in which the line is drawn. A phase line's label is placed at the beginning of the line. Therefore, you can always determine which side of a line is the left side. Figure 3-8 illustrates two phase lines. The arrows are placed to the left of the line and indicate the direction of the line.



Entities cannot move along phase lines, so do not create a phase line if you want a two point route.



Figure 3-8. Phase line direction

3.7.3. Lines

A line is a sequence of points in three-dimensional space. Like phase lines, lines have a direction. A line's name is displayed at its beginning. You can also display an arrow showing the line's direction. (For details, please see [“Displaying a Route's Direction Arrow,”](#) on page 16-18.)

Entities can move along lines from one end to the other, and can patrol back and forth along them.



Do not create a two-point line if you want a phase line. VR-Forces cannot determine whether an entity is to the left or right of a line.

3.7.4. Areas

An area defines a polygon. An area is used to test the location of an entity, for example: Is entity A in area B?

3.7.5. Obstacles

Obstacles represent areas of the terrain that would cause an entity problems, such as a ditch or minefield. If a ground entity encounters an obstacle in its path, it tries to drive around the obstacle. Obstacle avoidance applies only to obstacle objects. It does not apply to overlay objects, such as minefields, ditches, and so on.

3.8. Tasks

VR-Forces entities can execute a variety of movement and tactical tasks. These tasks can be assigned in plans or through the Task menu. Tasks assigned outside of a plan are called independent tasks.

Some tasks are mutually exclusive with other tasks, for example, an entity cannot execute two different movement tasks at the same time. Other tasks, such as Send Text Message, can run concurrently with movement tasks. When you task an entity, if the new task is mutually exclusive with the current task, the entity immediately stops the current task and begins the new one. If the new task is not mutually exclusive with the current task, the entity executes the new task and continues with the previous task. For information about how to configure mutually exclusive tasks, please see Section 8.8, [“Configuring Task Execution Rules”](#), in *VR-Forces Configuration Guide*.

If an entity has a plan, when you give it an independent task, it abandons the rest of the plan.

Independent tasks are useful for assigning tasks to entities without the need to edit a plan. You can assign them interactively, so simulation participants can respond immediately to events in a simulation by assigning new tasks to an entity as they might have to do in the field. Tasks are described in detail in Chapter 11, [Assigning Tasks](#).

3.9. Plans

VR-Forces has two kinds of plans, global plans and entity plans. A plan can assign tasks and set data requests to an entity. Plans can also contain commands that create or delete entities and objects. The commands in a plan can be conditional, that is, they will be executed only if a condition is satisfied.

Global plans are created and executed independent of any particular entity. Commands sent to entities from a global plan affect an entity as if it received an independent task through the GUI Task and Set menus: they interrupt the current task, if any, and cause the entity to abandon its plan, if it has one.

An entity plan is a set of statements that order an entity to complete a sequence of tasks, change its state, or both. The entity carries out the tasks in order unless it is interrupted by an independent task or global command. When you open a scenario, it is in pause mode (unless you start it with the `-1` command line option). When you start the simulation, the plans start executing.

An entity owns its plan. Changing its name, echelon relationship, or force does not change its plan.

If an entity does not have a plan, it does not mean that the entity will have nothing to do. An entity may be assigned tasks by its superior in the Force hierarchy. It can also be assigned tasks interactively from the GUI. If you want an entity to take planned actions independently of those assigned by its superior, you need to add statements to its plan.

You can view an entity's plan at any time in the Plan window. The task that an entity is currently executing is highlighted. A simple plan might look like the following:

```
Move-To Waypoint:"red point"  
Wait-Duration Seconds-ToWait:900  
Move-To Waypoint:"white point"  
Set Engagement-Rules="Fire-at-will"
```



You can edit plans while a simulation is running. However, when you change an entity plan during a simulation, the entity starts executing the plan from the beginning, which may cause its activities to be out of synchronization with the other entities in the simulation.

Plans are discussed in detail in Chapter 15, *Writing Plans*.

3.10. Set Data Requests

Set data requests affect the state or behavior of an entity. They take effect immediately. Assignment of a set data request does not affect the task that an entity is executing. By contrast, if you assign an entity a task, it stops its current task and begins the new task. You can send set data requests from a plan or from the GUI. The various set data requests are described in detail in Chapter 12, *Issuing Set Data Requests*.

3.11. Terrain Databases

Each simulation takes place within the extents of a terrain database. A terrain database provides three-dimensional information about a geographic area and provides the environment within which simulated entities function. With the information in a terrain database, VR-Forces can calculate height, intervisibility, and other three-dimensional information.

VR-Forces can load several database formats from the native files. However, the preferred way to load a database is through a MÄK Terrain Descriptor (MTD) file. An MTD file is a descriptive file created by the MÄK Terrain Database Tool (TDB Tool).

The MÄK Terrain Database Tool is a utility included with VR-Forces. It allows you to customize the parameters used to convert terrain databases to GDB format. It also allows you to add vector data to databases and to edit the resulting GDB terrains. The TDB Tool creates MTD files for each database it creates. You can associate raster images with databases and the MTD file records this information. When you create a scenario, you specify an MTD file and all the required information to load the database is available to VR-Forces.

When VR-Forces loads a non-GDB database, it converts it into MÄK Terrain Format (GDB) using default conversion parameters. You can then save the database in GDB format to speed up loading the next time you open the database. However, a database loaded using default conversion parameters might not be optimized for use with VR-Forces and you cannot load raster maps or import vector data as you can in the TDB Tool.

The 2D GUI typically displays the same GDB terrain as is loaded by the back-end. The 3D Front End can display GDB terrains, but they lack the texture details expected in a 3D view. Therefore, you will typically load a 3D terrain in the 3D Front End that corresponds to the GDB terrain that the back-end loads.

3.11.1. Using Large Terrain Databases

Most of the databases provided with VR-Forces use a UTM (Universal Transverse Mercator) projected coordinate system. The UTM system divides the earth into 60 vertical slices or UTM zones. Each zone is 6-degrees of longitude wide (about 600km at the equator). UTM databases are well-suited to the two-dimensional view provided by the front-end. However, their accuracy decreases as you move away from the origin, so they are not well-suited for exercises that need to simulate over areas greater than one UTM zone.

To support large play areas, simulations can use geocentric coordinates. In the geocentric coordinate system, the origin is at the center of the earth. The positive X-axis passes through the prime meridian at the equator; the positive Y-axis passes through 90 degrees east longitude at the equator; and the positive Z-axis passes through the North Pole. The equivalent large-area database for use in a two-dimensional display is a geodetic database.

VR-Forces provides the following database support in the front-end and back-end:

- ♦ The 2D front-end can load databases in UTM or geodetic coordinates. If you try to load a geocentric database in the front-end, it is converted to geodetic for display purposes.
- ♦ The back-end can load databases in UTM or geocentric coordinates. If you try to load a geodetic database in the back-end, it is converted to geocentric for simulation purposes.

For more information about terrain databases, please see Chapter 20, [Terrain Databases and Feature Data](#) and *MÄK Terrain Database Tool Users Guide*.

3.12. Intervisibility (Line-of-Sight)

You can display intervisibility (line-of-sight) between points, within areas, and between a point and all entities in a defined area. Intervisibility displays can be transient or permanent. Permanent intervisibility displays are objects. You can resize them and move them around the map. Intervisibility objects can be tied to a particular entity.

You can display a terrain profile and range and heading data for point-to-point intervisibility lines.

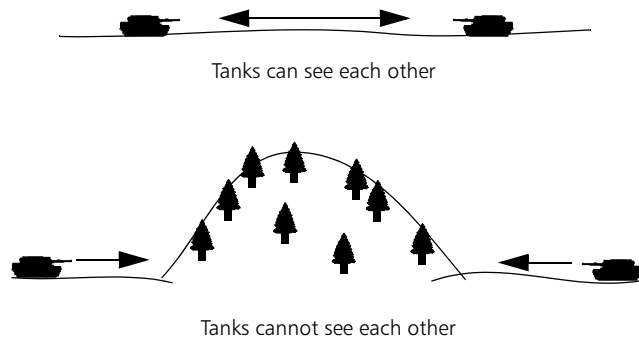


Figure 3-9. Intervisibility

You can configure parameters for intervisibility objects, such as the height above the terrain from which intervisibility is calculated. You can also change the colors used to display intervisibility. For procedures, please see Chapter 18, [Intervisibility](#).

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- ♦ By default, intervisibility between entities is calculated from the center of their bounding volumes. The VR-Forces target detection sensor uses an offset, which is often above the center of the entity. Unless you change the Origin LOS Elevation value in the Intervisibility Options dialog box to use the same offset as the target detection sensor, you might notice entities shooting at targets for which they do not appear to have line-of-sight.
 - ♦ Linear and areal features do not block line-of-sight. Only point features block LOS.
-

3.13. Representing and Managing Time in VR-Forces

VR-Forces employs the concepts of simulation time and exercise time. In HLA federations, it may be affected by federation time. Finally, these concepts also have a relationship to wall-clock, or real time. The following sections discuss how these concepts interrelate.

3.13.1. Simulation Time and Exercise Time

VR-Forces maintains an exercise clock. The clock keeps track of current elapsed simulation time and simulated exercise time. Elapsed simulation time is the amount of time that has passed since the simulation started, and is expressed in days, hours, minutes, and seconds in the format 00:00:00:00. Simulated exercise time is the simulated time of day, and is expressed in days, hours, minutes, and seconds in the format 00:00:00:00.

You can set the starting simulation time and exercise time for new scenarios. Application developers can manipulate simulation time using VR-Forces. Unless a local developer tells you otherwise, simulation time starts at 00:00:00:00. Exercise time starts at 01:00:00:00.

As illustrated in [Figure 3-10](#), elapsed simulation time starts at 00:00:00:00 and represents the total amount of time since the simulation began. Simulated exercise time starts on the first day at some specified time of the 24 hour clock and continues to represent the day of the exercise and 24-hour time.



When you use the days, hours, minutes, seconds format for exercise time, days start at one, not zero. Zero seconds exercise time is 01:00:00:00.

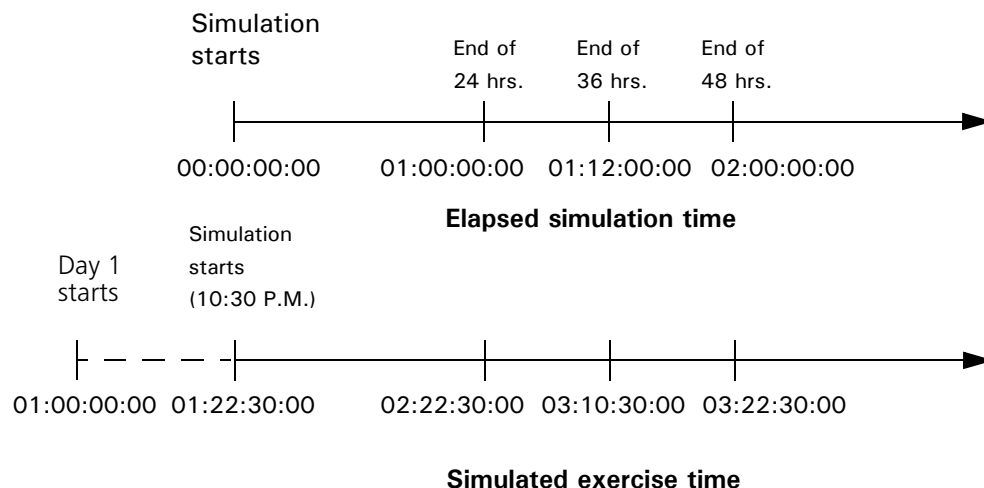


Figure 3-10. Elapsed simulation time compared to exercise time

3.13.2. Exercise Clock Modes

The exercise clock supports the following modes:

- ♦ Variable-Frame Run-To-Complete mode advances simulation time by the amount of time passed since the last time the exercise clock was ticked. This mode is typical for distributed, interactive simulations. It does not provide repeatable results. Do not use this mode in time-managed HLA federations.
- ♦ Fixed-Frame Best-Effort mode advances simulation time by a fixed amount each frame, even if a frame takes longer than the fixed amount to compute. If the simulation takes less than the fixed frame time to compute, it waits until the frame time has elapsed before starting another.

This mode is suitable for viewing or interactive use if your hardware can handle the frame rate. It is suitable for distributed use only in time-managed HLA federations.

- ♦ Fixed-Frame Run-To-Complete mode advances simulation time by a fixed amount each frame, even if a frame takes longer than the fixed amount to compute, just as in Fixed-Frame Best-Effort mode. However, if the simulation takes less than the fixed frame time to compute, it does not wait for the remainder of the frame time to elapse before starting the next frame.

This mode is most useful for situations where you want a simulation to run with internal consistency and high fidelity, and want it to run to completion, but do not need to observe the simulation. So, for example, you might run a simulation overnight and view the results the following day. Fixed-Frame Run-To-Complete mode is not suited for interactive use. It is suitable for distributed use only in time-managed HLA federations.



If you want to change the default clock mode, you must use the correct syntax. For information about how to set the exercise clock mode, please see Chapter 3, *Scenario Files* in *VR-Forces Configuration Guide*.

Repeatability

Repeatability is the ability to get the same results from a simulation each time you run it. Simulations that are run interactively or across a network are not repeatable, because you cannot guarantee consistent behavior by participants or the network.

For repeatable results:

- ♦ Use either Fixed-Frame Best-Effort mode or Fixed-Frame Run-To-Complete mode
- ♦ Run with just one back-end
- ♦ Do not interact with the scenario while it is running
- ♦ Use the same random number generator seed for each iteration of the simulation
- ♦ Configure sensors with the `tick-period-uses-real-time` parameter set to `False`. For more information about this parameter, please see Section 5.4.5, “[Ticking Components](#)”, in *VR-Forces Developers Guide*.

Running a Simulation Faster or Slower than Real Time

VR-Forces supports simulation at rates faster or slower than real-time by applying a multiplier to the tick time.

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- ♦ Do not run your simulation at faster or slower than real-time if you are interacting with other real-time simulations.
 - ♦ Running a simulation faster than real-time can cause performance of entity models to degrade.
-

3.13.3. Using HLA Time Management

In HLA, use of time management allows the rate at which a federate proceeds to be controlled by another federate. Federates being controlled by other federates are said to be constrained. Federates that control other federates are time regulating. A federate can be both time regulating and constrained. It can also be unconstrained.

The main reasons why you might want to enable time management for VR-Forces are to run VR-Forces as part of a wider federation that is using time management or to synchronize multiple VR-Forces back-ends. Without time management, multiple back-ends can stay synchronized only if they all are able to maintain the same frame rate. However, if they cannot do so, they will no longer have a shared concept of simulation time and will become unsynchronized. By using time management services, multiple back-ends can be configured to run in lock-step with respect to simulation time, ensuring that events will always happen in the same order.

For details about enabling time management, please see [“Configuring Time Management for HLA Exercises,”](#) on page 4-9.

VR-Forces Simulation Time Versus Federation Time

Time management synchronizes federates to federation time. Federation time is the common model of time for the federation as whole. It is the time used in time stamp ordered messages (TSO), exchanged by time-managed federates. During the lifetime of a federation, federation time always increases. (There is no notion of rewinding back to an earlier time as with VR-Forces simulation time.)

VR-Forces simulation time is not the same as HLA federation time. It is the elapsed time within a scenario (the time displayed in the simulation clock in the GUI). When you first start a simulation, federation time and simulation time may be similar. However, if you rewind a time-managed simulation, the discrepancy between the two time streams will increase. This should not have any effect on running and rewinding scenarios. As long as all the back-ends start from the same simulation state when you begin a simulation, they will be correctly synchronized (against federation time) as the simulation progresses.

Using Time Management in the GUI

Use of time management in the GUI is independent of time management in the back-end. Enabling Time Constrained mode in the GUI can produce smoother entity movement when the back-end is time-managed. This is because the GUI will perform dead-reckoning with respect to federation time instead of wall-clock time.

When you enable time management for the GUI, you can specify a simulation time scale. (For details, please see [“Enabling Time Management for the GUI,”](#) on page 4-10.) This setting allows the GUI to influence how fast simulation time advances for the federation as a whole. Setting this parameter to 1 indicates you would like to advance simulation time at the same rate as wall-clock time (that is, run the simulation in real-time). You can also use this parameter to slow down the advancement of simulation time, to allow examination of events in a given time interval in more detail.

When you adjust the simulation time scale parameter in the GUI, it can be helpful to open the Frame Rate Monitor to observe the simulation time scale ratios for the back-end(s). The ratio of simulation time to wall-clock time is displayed for each back-end in the frame rate monitor. In [Figure 3-11](#), back-end 1:3001 is running at a rate of approximately 3 times faster than real time.

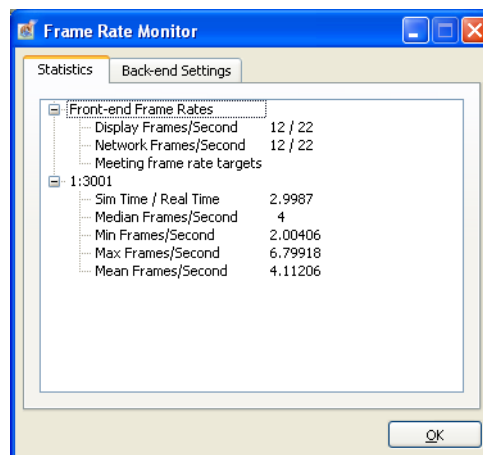
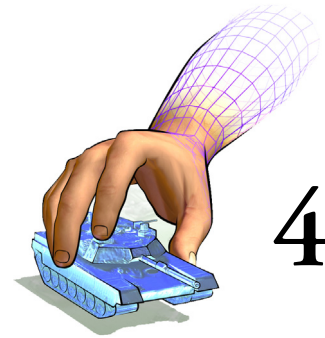


Figure 3-11. Frame Rate Monitor

3.14. Interactions

VR-Forces displays interactions, such as detonations, that it receives in interaction messages or PDUs. You cannot select or otherwise manipulate them. You can only view them.



Starting VR-Forces

This chapter explains how to start and stop VR-Forces and load terrain databases.

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4.1. Starting VR-Forces

You can run VR-Forces in combined mode, or by starting individual front-ends and back-ends. Each front-end and back-end must have a unique site:application identifier. Please see [“The VR-Forces Program,”](#) on page 3-3 for conceptual information about combined mode and VR-Forces applications.

By default, all front-ends and back-ends start with session ID 1. Front-ends automatically try to join a session. If no back-ends are running when a front-end starts, it does not join a session. However, if at a later time a back-end with the same session ID starts, the front-end will automatically join the session.

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If you run VR-Forces for HLA, be sure that you have installed an RTI and configured your system to use it. For details, please see [“Installing an RTI,”](#) on page 2-20.

For convenience you can create batch files or scripts to start VR-Forces. Please see [“Command Line Options,”](#) on page 4-15 for a list of command line options.

4.1.1. Starting VR-Forces from the VR-Forces Launcher

As noted previously, you can run VR-Forces in combined mode or in separate mode. You can run the 2D GUI or the 3D GUI. For any of these combinations, you can run in DIS, HLA 1.3, or HLA 1516. And for either HLA specification, you can run using one of several different versions of the RPR FOM. With all these different possible startup configurations, particularly for HLA, it can be confusing to keep track of the options for starting VR-Forces. The VR-Forces Launcher simplifies the process of specifying the simulation standard to use when starting VR-Forces.

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The VR-Forces Launcher uses default values for the site ID and application number. If you want to run multiple front-ends, back-ends, or both, you must start the additional executables from the command-line using unique siteID:application number combinations. For details, please see [“Starting Independent VR-Forces Executables \(Separate Mode\),”](#) on page 4-5.

To start the VR-Forces Launcher:

1. On Windows, on the Start menu, choose **Programs** → **MAK Technologies** → **VR-Forces *x.x*** → **VR-Forces *configuration***, where *x.x* is the release number, and *configuration* is:
 - GUI only (2D or 3D)
 - Simulation Engine (back-end) only
 - GUI + Simulation Engine (combined mode).

If this is the first time that you are running VR-Forces, or if you have not previously selected a default startup connection, the Simulation Connections Configuration dialog box opens (Figure 4-1).

On Linux, in a console window, enter the following command to start in combined mode:

```
vrfLauncher --app vrfGui -z vrfSim
```

To start in separate mode, use one of the following commands:

```
vrfLauncher --app vrfGui  
vrfLauncher --app vrfSim
```

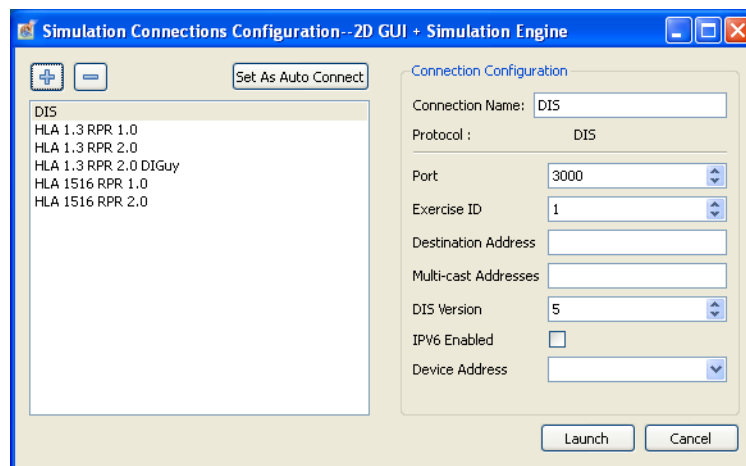


Figure 4-1. Simulation Connections Configuration dialog box

2. In the Simulation Connections Configuration dialog box, select a connection configuration. (Optionally, create a new configuration. For details, please see [“Configuring Simulation Connections,”](#) on page 4-29.)
3. Click Launch. The VR-Forces executables you selected on the Start menu start.

4.1.2. Starting VR-Forces in Combined Mode from the Command Line

For a list of command-line options, please see [“Command Line Options,”](#) on page 4-15

To start VR-Forces in combined mode on Windows or Linux from the command line:

1. Open a console window.
2. Change to the `./bin` directory for the protocol you are using.
3. Enter the following command:

```
vrfGui options -z vrfSim
```

The VR-Forces window opens and a console window for the back-end opens.

Overriding the Default Site ID and Application Number in Combined Mode

In combined mode, you can override the default site ID and application numbers with the `-s` and `-a` command-line options for the front-end and the `-t` and `-p` command line options, for example:

```
vrfGui -s 2 -a 3004 -t 2 -p 3005 -z vrfSim
```

4.1.3. Starting Independent VR-Forces Executables (Separate Mode)

To run VR-Forces in separate mode:

1. Open a console window.
2. Change to the `bin` directory for the protocol you are using.
3. Enter a command for each VR-Forces executable you want to run. Specify a unique site:application identifier for each executable, for example:

```
vrfSim -s 1 -a 3001  
vrfSim -s 2 -a 3001  
vrfGui -s 1 -a 3000
```

A VR-Forces window opens for each front-end you start and a console window opens for each back-end. For an example of running multiple front and back-ends, please see [“VR-Forces Startup Tutorial,”](#) on page 4-6.

4.1.4. Specifying a Session ID

- To assign a session ID, use the `-i` command line option.

```
vrfGui -s 1 -a 3000 -i 25  
vrfSim -s 2 -a 3002 -i 25
```

The default session ID is 1. You cannot change the session ID during runtime.

4.1.5. VR-Forces Startup Tutorial

This section is a brief example of how to run multiple front and back-ends on multiple computers. Examples are provided for DIS and HLA. For both protocols, assume the configuration in (Figure 4-2). This configuration has two front-ends and three back-ends. Each is on a different computer. Assume that they are all running in the same session.

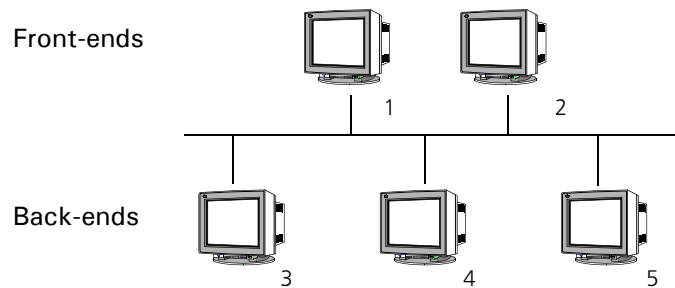


Figure 4-2. VR-Forces multicomputer configuration

DIS Configuration

In a DIS exercise, you typically specify a port so that the exercise traffic is isolated from other network traffic. Each front-end and back-end must have a unique site:application ID.

Run VR-Forces on each PC using the following commands:

- ♦ PC 1:
`vrfGui -s 1 -a 3000 -P 1234`
- ♦ PC 2:
`vrfGui -s 1 -a 3001 -P 1234`
- ♦ PC 3:
`vrfSim -s 1 -a 3002 -P 1234`
- ♦ PC 4:
`vrfSim -s 1 -a 3003 -P 1234`
- ♦ PC 5:
`vrfSim -s 1 -a 3004 -P 1234`

HLA Configuration

In an HLA exercise, you could simply specify the site:application ID and use default values to specify the HLA configuration parameters. Specification of the site:application ID is identical to that in DIS. For this example, we will specify a FOM Mapper other than the default (RPR FOM 1).

Run VR-Forces on each PC using the following commands:

- ♦ PC 1:

```
vrfGui -s 1 -a 3000 -x VR-Link20017-1  
--rprFomVersion 2.0017 -F VR-Link20017-1.fed
```
- ♦ PC 2:

```
vrfGui -s 1 -a 3001 -x VR-Link20017-1  
--rprFomVersion 2.0017 -F VR-Link20017-1.fed
```
- ♦ PC 3:

```
vrfSim -s 1 -a 3002 -x VR-Link20017-1  
--rprFomVersion 2.0017 -F VR-Link20017-1.fed
```
- ♦ PC 4:

```
vrfSim -s 1 -a 3003 -x VR-Link20017-1  
--rprFomVersion 2.0017 -F VR-Link20017-1.fed
```
- ♦ PC 5:

```
vrfSim -s 1 -a 3004 -x VR-Link20017-1  
--rprFomVersion 2.0017 -F VR-Link20017-1.fed
```

4.2. Managing a Front-end's Session Connection

A front-end can be joined to a session or not joined. When a front-end is not joined to a session, it cannot create, load, or manage a scenario. It can only load a terrain and function as a 2D viewer. You can tell a front-end's session status by the availability of Join Session and Resign Session commands on the File menu.

When you start a front-end it automatically tries to join a session. If there is no session running, it will poll the network until one becomes available and then automatically join it. Once a front-end is joined to a session, you can manually resign and rejoin it.

If you just have one front-end running, when you open and close a scenario, the front-end opens and closes the terrain database for the scenario, as you would expect. If you have two or more front-ends loaded, the front-end from which you load a scenario automatically loads the terrain. However, all other front-ends prompt you to load the terrain. (The front-end knows which terrain to load, it is just asking permission to do so.) Similarly, when you close a scenario, the front-end from which you close the scenario automatically closes the terrain. All other front-ends ask permission to close the terrain. In either of these cases, you do not have to accept the default behavior. You can load an alternative terrain when a scenario opens and you can keep the terrain loaded when a scenario closes.



If do not load the terrain specified by the scenario, it is possible that visual and simulation terrains will not be synchronized.

4.2.1. Joining a Session

When you join a session, all menu commands related to scenario management are enabled. If a scenario is loaded in the session, the terrain is closed.

To join a session:

1. Choose **File** → **Join Session**. The Join Session dialog box opens (Figure 4-3). If a scenario is running, its details are listed.

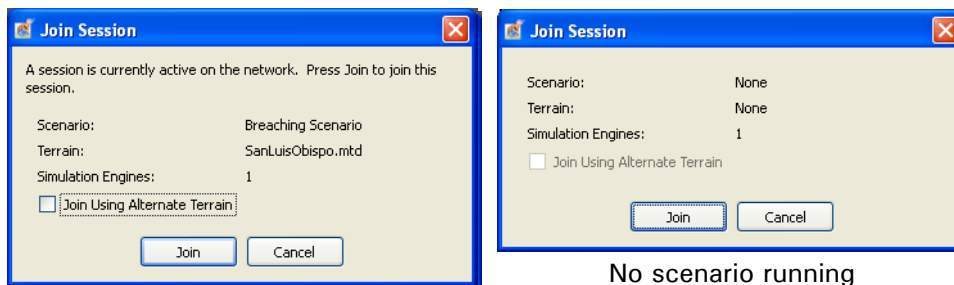


Figure 4-3. Join Session dialog box

2. If a scenario is running, optionally, specify that you want to load an alternate terrain:
 - a. Select the Join Using Alternate Terrain check box.
 - b. Click Join. An Open Database dialog box opens.
 - c. Select the terrain that you want to load.
 - d. Click Open. The terrain is loaded and the front-end joins the session.



If you join a session using an alternate terrain, the front-end (visual) and back-end (simulation) terrains might not be synchronized.

3. Click Join. The front-end joins the session. If a scenario is running, the front-end automatically loads the correct terrain.

4.2.2. Resigning from a Session

When you resign from a session, all menu commands related to scenario management are disabled. If you have a scenario loaded, the terrain is closed.

- To resign from a session, choose **File** → **Resign From Session**.

4.2.3. Configuring Session Messages and Join at Startup

You can configure the display of session-related messages and whether or not the front-end tries to join a session automatically at startup.

To configure sessions:

1. Choose **Options** → **Session Options**. The Session Options dialog box opens (Figure 4-4).

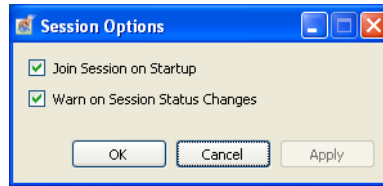


Figure 4-4. Session Options dialog box

2. Select the options that you want to enable.
3. Click OK.

4.3. Configuring Time Management for HLA Exercises

To use time management services in an HLA exercise, you must properly configure an RTI, enable time management in the VR-Forces back-ends, and optionally, enable time management in the GUI.

Time management is enabled at the application level, not the scenario level. Scenarios created without use of time management work in time-managed mode. No time management-specific information is saved as part of a scenario.

If you enable time management in the back-end, then whenever you create or load a scenario that specifies a fixed-frame mode (that is, the **frame-mode** parameter in the scenario file is set to either fixed-frame best effort or fixed-frame-run-to-complete), the back-end will become a regulating and constrained federate. It will remain in this state until the scenario is closed.

A time-managed back-end advances simulation time at a rate that is a function of the frame-mode specified in the scenario it is executing. If the **frame-mode** is fixed-frame, then it tries to advance simulation time at a rate approximating real time. However, if the back-end has a heavy simulation load, or another time-constrained federate is advancing at a relatively slower rate, the back-end may not achieve this rate. If the **frame-mode** is fixed-frame-run-to-complete, the back-end tries to advance simulation time as fast as possible, independent of wall-clock time.

For conceptual information about time management, please see [“Using HLA Time Management,”](#) on page 3-34.

4.3.1. RTI Requirements for Time Management

To use time management in VR-Forces, your RTI must be properly configured to support this service. If you are using the MÄK RTI, set the `RTI_useRtiExec` and `RTI_timeMgmt` parameters to 1. When you start the federation, you must run the `rtiexec`.

If you are using another RTI, please consult its documentation for configuration instructions.

4.3.2. Enabling Time Management for the Back-end

To enable time management in the back-end, use one of the following methods:

- Set `runInTimeManagementMode` to 1 in `vrfsim.mtl`.
- Start the back-end with the `--timeManagement` command-line option. For example, to start the back-end in time management mode using the sample FED file configured for use with time management and the federation name VR-LinkTM:

```
vrfsim -s 1 -a 3001 --timeManagement -F VR-LinkTM.fed  
-x VR-LinkTM
```



- The back-end will only run in time management mode (time regulating and constrained) while it has a scenario loaded.
 - If a scenario is configured with `frame-mode` set to variable-frame, the back-end will not become time regulating or constrained. It will print a warning to the console and run without time management enabled.
-

4.3.3. Enabling Time Management for the GUI

The VR-Forces GUI can run as a time-regulating federate, a time constrained federate, or both. You can specify the lookahead value and a ratio for simulation time. The simulation time scale is a ratio of simulation time to real time. It controls the rate of simulation time advancement (an upper bound on how fast the GUI will attempt to advance simulation time).

If Time Constrained mode is enabled, you can set the Simulation Time Scale parameter. Simulation Time Scale is the ratio of simulation (federation) time to wall-clock time. It represents an upper bound or target rate at which simulation time should advance with respect to wall-clock time. However, the GUI is not guaranteed to achieve this rate. Other time managed federates (including the VR-Forces back-end) may prevent the GUI from achieving this desired rate. Slower time-managed federates will slow the advancement of simulation time for all federates.

If Time Regulating mode is enabled, you can set the Lookahead value. The Lookahead establishes a lower bound on the time stamps that can be sent in time stamp ordered (TSO) messages by a time-regulating federate. Please consult your RTI documentation for more information.

You can configure time management for the GUI in *vrGui.mtl* or using the Time Management dialog box.

To configure time management for the GUI in the *vrGui.mtl* configuration file, set the following parameters:

- ♦ To enable Time Constrained mode, set `runInTimeConstrainedMode` to 1.
- ♦ To enable Time Regulating mode, set `runInTimeRegulatingMode` to 1.
- ♦ To specify a simulation time scale, set `simTimeScale` to a real number greater than zero.
- ♦ To set the lookahead value, in seconds, set `lookahead` to a real number greater than or equal to zero. Please consult your RTI documentation for more information.

To configure time management in the GUI:

1. Choose **Options** → **Time Management**. The Time Management dialog box opens (Figure 4-5).

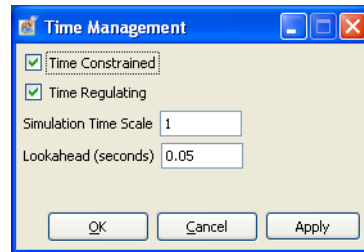


Figure 4-5. Time Management dialog box

2. To set VR-Forces as a time constrained federate, select the Time Constrained check box. The Simulation Time Scale box becomes enabled.
3. If you selected Time Constrained, to specify a simulation time scale, type a value in the Simulation Time Scale box.
4. To set VR-Forces as a time regulating federate, select the Time Regulating check box. The Lookahead box becomes enabled.
5. If you selected Time Regulating, to specify a lookahead value, type a value, in seconds, in the Lookahead box.
6. Click OK.

4.4. Opening a Terrain Database

If you are using multiple front-ends, when you load or create a scenario, the front-end on which you issue the command loads the correct terrain database. The other front-ends prompt you to load the terrain. However, you can choose to load a different terrain. Also, if you want to use the front-end as a viewer, you can manually load a terrain database. For a brief description of the databases supplied with VR-Forces, please see [“Terrain Databases Provided with VR-Forces,”](#) on page 20-13.



It is possible to open a terrain without having a scenario loaded. In such cases you cannot create any type of VR-Forces object. To create and manipulate entities and objects, you must load or create a scenario.

To open a terrain database:

1. In the VR-Forces window, choose **File → Open Terrain**. The Open Terrain dialog box opens.
2. Select the MTD file that defines the database you want to use, or select a terrain database.
3. Click Open. The database is displayed in the VR-Forces window ([Figure 4-6](#)).

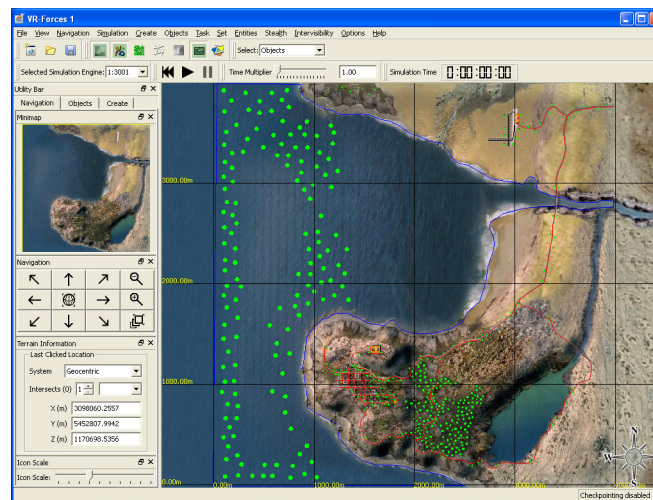


Figure 4-6. VR-Forces window with a database loaded



- ♦ If you load a terrain database while one is currently loaded, VR-Forces closes the current database and then opens the new one.
 - ♦ VR-Forces keeps a list of the terrains you open.
 - To quickly open a recently used terrain, choose **File** → **Recent Terrains** → *terrain_name*.
-

4.4.1. Loading a Terrain Database at Startup

- To load a terrain database when you start VR-Forces, use the `-T` command line option.

```
vrfSim -s 1 -a 3001 -T "../data/terrain/myDatabase.mtd"
```

4.4.2. Saving a Terrain Database in GDB Format

If you load a non-GDB terrain database in VR-Forces, it gets converted to GDB format. You can save the database as a GDB terrain for quicker loading in the future.



When you save a terrain database as GDB through the GUI, you cannot take advantage of the performance and memory optimization options that are available with the TDB Tool. You also cannot add raster images to the display. Therefore, you may want to convert all databases using the TDB Tool and load them from the resulting MTD files.

To save a database in the GDB format from the VR-Forces GUI:

1. Choose **File** → **Save Terrain As GDB**. The Save Database dialog box opens.
2. Type a name for the database.
3. Click Save.

4.4.3. Closing a Terrain Database

- To close a terrain database, choose **File** → **Close Terrain**. If the database you opened was not in GDB format, you are prompted to save it as GDB.

4.5. Using Multiple VR-Forces Windows

You can open multiple VR-Forces windows. This allows you to view various parts of an exercise at the same time or view the same portion of an exercise using different display settings. Each window is identified by an ID number in the title bar, for example VR-Forces 1, VR-Forces 2, and so on.



Opening multiple windows is not the same thing as running multiple front-ends. Multiple windows are all part of the same `vrfGui` instance and are all on the same computer. Multiple front-ends are separate instances of `vrfGui` and are usually run on separate computers.

- To open a VR-Forces window, choose **File** → **Window** → **New**.
- To close a VR-Forces window, choose **File** → **Window** → **Close** from the menu for that window.



If only one VR-Forces window is open, choosing **File** → **Window** → **Close** exits VR-Forces.

4.6. Saving VR-Forces Settings

When you close VR-Forces, it saves the following application and display settings to `./config/vrfGuiSettings.mtl`:

- ♦ Toolbar positions
- ♦ Terrain view settings
- ♦ Display settings
- ♦ Intervisibility settings
- ♦ The icon scale
- ♦ Window position.

If you do not want to save settings, start VR-Forces with the `-D` command line option. If you want to specify a different settings file, start VR-Forces with the `-d` command line option.

You can restore the application settings to their default values.

- To restore settings to their default values, delete `./config/vrfGuiSettings.mtl`.

4.7. Exiting VR-Forces

When you exit VR-Forces, all GUI windows close. In combined mode, the application terminates. If you are not running in combined mode, you must also close all simulation engines.

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

4.8. Command Line Options

VR-Forces has command line options for *vrGui* and *vrSim*.



- ♦ Some options are specific to *vrSim* or *vrGui*. If an argument is specific to *vrSim*, it only works in separate mode, unless it is specifically described as being for combined mode. Please see the argument descriptions for details.
 - ♦ Most of the command-line options for *vrGui* do not apply to the 3D Front End. For more information, please see *VR-Forces 3D Front End Users Guide*.
-

Command Line Options for vrfGui

```
vrfGui [(-a | --appnumber) application_number
(-A | --destAddrString) destination_address
--addTranslationFile
--appIdRange lower-upper
(-B | --batchScenarioFileName) batch_file
(-d | --defaultSettingsFile) settings_file
(-D | --doNotUseSettingsFile)
--defaultConfigFile configuration_file
--disVersion version
(-f | --fomMapperLib) FOM_mapper_library
(-F | --fedFileName) FED_file_name
--fomMapperInitData data
(-g | --useGlobalMiniMap)
(-G | --language) language_code
(-h | --help)
(-H | --hostAddressString) ethernet_address
(-i | --sessionId) session_ID
--ignoreAdvisories
(-l | --addConfigFile) filename1 ... filename
(-L | --scenarioFileName) file_name
--loadPlugin plugin_file
--logDirectory directory
(-m | --defaultSymbolMapFile) symbolmap_file
(-M | --addsymbolMapFile) file_name
--mcastTtl ttl
(-n | --notifyLevel) notification_level
(-N | --federateName) federate_name
--noPluginDirectory
(-o | --defaultOverlayMenu) file_name
--outputLogFile
(-p | --backendAppNum) appnum
(-P | --disPort) port
--pluginFile
(-R | --scriptFile) script_file
--recvBufferSize size
--rprFomRevision revision
--rprFomVersion version_number
(-s | --siteId) site_id
(-S | --multicastAddresses) multicast_address
--sendBufferSize size
--simulationModelSet
--suppressSelfReflect
(-t | --backendSiteId) site_ID
(-T | --terrainDatabase) terrain_database
--tickManagingEnabled
--useAsyncIO
--useIpv6
(-v | --version) version
```

```
(-x | --exerciseId | --execName) {exercise_ID |  
    execution_name}  
(-z | --backendApplicationName) [back-end]  
(-Z | --combinedMode) ]  
(-- | --ignore_rest) ]]
```

Command Line Options for vrfSim

```
vrfSim [(-a | --appnumber) application_number
      (-A | --destAddrString) destination_address
      --appIdRange lower-upper
      (-B | --batchScenarioFileName) batch_file
      (-c | --frontEndPID) PID
      (-d | --settingsFile) file_name
      --daemon
      --deviceAddress address
      --diGuyAnimationsFile file_name
      --diGuyCharacerDataFile file_name
      --disVersion version
      (-f | --fomMapperLib) FOM_mapper_library
      (-F | --fedFileName) FED_file_name
      --fomMapperInitData data
      (-h | --help)
      (-i | --sessionId) session_ID
      --ignoreAdvisories
      (-L | --scenarioFileName) "scenario_pathname"
      --loadPlugin plugin_file
      --logFrameRateStatistics
      --mcastTtl ttl
      (-n | --notifyLevel) notification_level
      (-N | --federateName) federate_name
      --noPluginDirectory
      --outputLogFile file_name
      (-P | --disPort) port
      (-q | --doNotUseConsole)
      (-r | --startInRunMode)
      --recvBufferSize size
      --rprFomRevision revision
      --rprFomVersion version_number
      (-s | --siteId) site_id
      (-S | --multicastAddresses) multicast_address
      --suppressSelfReflect
      --sendBufferSize size
      --simulationModelSet sms
      (-T | --terrainDatabase) terrain_database
      --targetFrameRate rate
      --timeManagement
      --useAsyncIO
      --useIpv6
      (-v | --version) version
      (-x | --exerciseId | --execName) {exercise_ID |
      execution_name}
      (-- | --ignore_rest)]]
```

Protocol-Independent Arguments:

The following arguments are protocol-independent:

(**-a** | **--appNumber**) *application_number* specifies the application number. For details, please see [“Specifying the Site ID and Application Number,”](#) on page 4-23.

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

--appIdRange 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.) For more information, please see [“Running in Batch Mode from the Command Line,”](#) on page 5-21.

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

(**-d** | **--settingsFile**) *settings_file* specifies a configuration file to load instead of *vrfSimSettings.xml*. (*vrfSim* only)

-D specifies that VR-Forces should not load or save a settings file.

--daemon starts that back-end as a daemon process (Linux only). If you start *vrfSim* as a daemon, it does not try to read characters from the console. It forks a background process at startup. It will exit cleanly if it receives a SITGTERM, SIGQUIT, or SIGINT signal.

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

--diGuyAnimationsFile file_name specifies an additional configuration file for DI-Guy animations. (*vrfSim* only)

--diGuyCharacerDataFile file_name specifies an additional configuration file for DI-Guy character data. (*vrfSim* only)

-g runs VR-Forces with a global Minimap. For details, please see [“Using the Minimap with Multiple Windows,”](#) on page 6-11. (*vrfGui* only)

-G language_code specifies the language used for the GUI text. (*vrfGui* only) Please see [“Specifying the Language to Use in the GUI,”](#) on page 4-24.

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

-H 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. (*vrfGui* only)

-i session_ID specifies a session ID. For details, please see [“Specifying a Session ID,”](#) on page 4-5.

-l filename specifies a configuration file to load. For details, please see Chapter 2, [VR-Forces Configuration Files](#), in *VR-Forces Configuration Guide*. (*vrfGui* only)

`-L "scenario_pathname"` loads the specified scenario. The pathname can be absolute or relative from the `.bin` directory. Mutually exclusive with the `-T` option. For details, please see [“Loading a Scenario from the Command Line,”](#) on page 5-9.

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

`--logDirectory directory` specifies the directory in which log files should be written. (*vrfGui* only)

`--logFrameRateStatistics` specifies that the back-end should log frame rate statistics. (*vrfSim* only)

`-m filename` specifies a symbol map file to load. (*vrfGui* only)

`(-M | --addsymbolMapFile) file_name` specifies a symbol map file to load. (*vrfGui* only)

`(-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. For details, please see [“Setting the Notification Level,”](#) on page 4-24.

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

`(-o | --defaultOverlayMenu) filename` specifies the file that defines the menus for creating overlay objects.

`-p application_number` specifies the application number for the back-end in combined mode. Use `-p` to override the default application number. For details, please see [“Overriding the Default Site ID and Application Number in Combined Mode,”](#) on page 4-5. (*vrfGui* only)

`--physicalWorldFile file` specifies a physical world configuration file to load. (*vrfSim* only)

`--pluginFile file` specifies the configuration file that lists which plug-ins to load. (*vrfGui* only)

`-q` specifies that all *vrfSim* output go to the log file rather than the console (quiet mode). If you are using a high level of notification, sending output to the console can degrade performance. Running in quiet mode prevents this degradation of performance. This command only applies to back-ends running on Windows. To create a log file on Linux, redirect the output of *vrfSim*, for example:

```
vrfSim > mylog.txt
```

For more details about log files, please see [“The VR-Forces Log Files,”](#) on page 4-32.

`-r` starts the back-end in run mode. If you start the back-end without specifying a scenario (with `-L`) or a terrain database (with `-T`), the back-end starts in pause mode.

`-R script_file` specifies a script file to load at startup. For details, please see [“Running a Script at Startup,”](#) on page 4-23. (*vrfGui* only)

- `-s site_ID` specifies the site ID. This option applies only to the front-end in combined mode. It applies to *vrfGui* and *vrfSim* in separate mode. For details, please see [“Specifying the Site ID and Application Number,”](#) on page 4-23.
- `--simulationModelSet` specifies the simulation model set. It must be declared separately for front-end and back-end even in combined mode.
- `-t site_ID` specifies the site ID for the back-end in combined mode only. Use `-t` to override the default site ID. For details, please see [“Overriding the Default Site ID and Application Number in Combined Mode,”](#) on page 4-5. (*vrfGui* only)
- `-T terrain_database` specifies a terrain database to load in the back-end. Mutually exclusive with the `-L` option. This option is valid with both *vrfSim* and *vrfGui*. For details, please see [“Working with Multiple Back-ends,”](#) on page 3-8 and [“Loading a Terrain Database at Startup,”](#) on page 4-13.
- `--targetFrameRate rate` specifies the frame rate above which *vrfSim* will yield CPU time to other processes. (*vrfSim* only)
- `--tickManagingEnabled` enables network tick management. This option has the same effect as setting `tickManagingEnabled` to 1 in *vrfGui.mtl*. For details, please see Section 1.4.3, [“The Heavy Network Traffic Level”](#) in *VR-Forces Configuration Guide*. (*vrfGui* only)
- `-z [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 *vrfGui.mtl* configuration file. The back-end pathname may be relative or absolute. For details, please see [“Starting VR-Forces in Combined Mode from the Command Line,”](#) on page 4-5. (*vrfGui* only)
- `-Z` 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. Please see [“Specifying a FOM Mapper,”](#) on page 4-26.

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

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

--ignoreAdvisories specifies that the front-end or back-end will ignore HLA advisory messages.

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

--rprFomRevision *revision* specifies the revision of RPR FOM 2, draft 17, for example, RPR FOM 2, draft 17, revision 2.

--rprFomVersion *version_number* specifies the version of the RPR FOM that you are using, for example, RPR FOM 2, draft 17.

--timeManagement enables time management for the back-end. (*vrSim* only)

(-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.

--deviceAddress *address* specifies the device to use to connect to the network. For use if you have multiple ethernet cards on a computer.

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

--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.

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

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

--suppressSelfReflect represses self reflection of the DIS exercise connection.

--useAsyncIO specifies use of asynchronous I/O. For details, please see [“Using Asynchronous I/O,”](#) on page 4-28.

--useIpv6 specifies that the DIS exercise connection use IPV6.

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

4.8.1. Running a Script at Startup

The `-R` option lets you specify a script file to run at startup. The script only affects the instance of VR-Forces that you are starting. It is a text file that can include the commands listed in this section and commands that have been developed locally using the GUI API remote control classes.

The supported commands are:

- (`opendatabase database_name`) – Opens and displays the specified database. (Equivalent to **File** → **Open Terrain**.)
- (`loadoverlay overlay_file`) – Loads an overlay file. (Equivalent to **File** → **Overlays** → **Load**.)
- (`setlocalextent (list x y z) (list x y z)`) – Sets the map extents (in local coordinates) to the specified Northeast and Southwest coordinates. (Equivalent to zooming into a particular area.)

4.8.2. Protocol Independent Command Line Options

This section describes in greater detail the command line options that you can use with both DIS and HLA.

Specifying the Site ID and Application Number

Each VR-Forces front-end and back-end must have a unique site ID:application number pair. To specify the site ID, use the `-s` option. To specify the application number, use the `-a` option, for example:

```
vrfSim -s 2 -a 3005
```

The default application number for `vrfGui` is 3000; for `vrfSim` it is 3001.

If you are running in combined mode, use `-s` and `-a` to override the default site ID and application number for the front end. Use `-p` and `-t` to override the default site ID and application number for the back-end, for example:

```
start vrfGui -s 2 -a 4321 -t 2 -p 3009 -z vrfSim
```



If you record a VR-Forces simulation with the MÄK Logger and you want to view the Logger file in VR-Forces, when you view the Logger file, you must run VR-Forces with an application number that is different from the one you used when you recorded the simulation.

Specifying the Default Simulation Model Set

Every scenario must specify a simulation model set. The default simulation model set is *default.sms*. To specify a different default simulation model at startup, use the `--simulationModelSet` option. You must specify the SMS separately for the front-end and back-end, even if you are running in combined mode, for example:

```
vrfGui --simulationModelSet mydefault.sms -z "vrfSim  
--simulationModelSet mydefault.sms"
```

Specifying the Language to Use in the GUI

VR-Forces decides which translation files to use based on the language setting for your computer. However, you can override the language setting with the `-G` command line option, for example, the following command sets the language to German:

```
vrfGui -s 1 -a 3000 -G de
```

If you use this command line option, you must have a file named *vrf_language_code* (for example, *vrf_de*) in the *.translations* directory. For more information, please see [“Localizing the VR-Forces Interface,”](#) on page 2-22.



You cannot specify a language file for messages sent from the back-end.

Setting the Notification Level

You can control the types of messages sent to the console (and log file on a PC) by specifying a notification level.

➤ To specify a notification level, use the `-n` option, for example:

```
vrfSim -s 1 -a 3001 -n 1
```

The notification levels you can specify are:

- ♦ 0 – Only fatal messages are printed.
- ♦ 1 – Warning messages and fatal messages are printed.
- ♦ 2 – Some diagnostic information is printed with warnings and fatal messages.
- ♦ 3 – Verbose information is printed.
- ♦ 4 – Debug information is printed.

The default notification level is 2.



The Linux version of VR-Forces does not have a log file. Informational messages are sent to the window from which you start VR-Forces. To capture informational messages, redirect output to a file.

Loading Plug-ins

You can load plug-ins from the command line or by specifying them in a *plugins.mtl* configuration file.

To load a plug-in from the command line, use the `--loadPlugin` command line option, for example:

```
vrfGui -s 1 -a 3000 --loadPlugin pluginA --loadPlugin  
pluginB
```



Do not specify the extension of the plug-in (for example, *.dll*). If the extension is included, the plug-in will not load.

VR-Forces can display a list of the plug-ins that are loaded. For details, please see [“Viewing a List of Loaded Plug-ins,”](#) on page 4-33.

For information about *plugins.mtl*, please see Chapter 2, *VR-Forces Configuration Files*, in *VR-Forces Configuration Guide*.

4.8.3. Command Line Options for HLA Federations

VR-Forces listens to whatever port is specified in the RID file. For information about the RID file, consult your RTI documentation.

Specifying the Federation Execution

By default, VR-Forces uses the *VR-Link.fed* file and the VR-Link federation execution.

- To specify the HLA federation execution name, use the `-x` option, for example:

```
vrfSim -s 1 -a 3001 -x vrlink
```



If you are using the MÄK RTI and are running multiple, concurrent federation executions, you must run the `rtiexec`. In other words, you cannot use the MÄK RTI in lightweight mode if you are running multiple federations. Please see the MÄK RTI documentation for details about how to configure it to use the `rtiexec`.

Specifying the Federate Name

You can specify the federate name to use for VR-Forces.

- To specify the HLA federate name, use the `-N` option, for example:

```
vrfSim -s 1 -a 3001 -N vrforces
```

Specifying the FED File

In combined mode, specifying `-F` in the command line or in *vrfGui.mtl* (**fedfile**) also applies to the back-end. If you are running a back-end independently and want to specify a FED file name, you must use `-F`.

- To specify a FED file at startup, use the `-F` option or set the **fedFile** parameter in *vrfGui.mtl*.

Specifying the RPR FOM Version

VR-Forces has built-in support for the RPR FOM. The default version is 1.0.

You can specify a different RPR FOM version (0.5, 0.7, 0.8, 2.0006, 2.0014, or 2.0017). If you specify a different FOM version, you must also specify the correct FED file (with `-F`).

```
vrfSim -s 1 -a 3001 --rprFomVersion 2.0017  
-F VR-Link20017-1.fed
```



Please see *VR-Forces Release Notes* for a list of the RPR FOM versions supported by your version of VR-Forces.

Specifying a FOM Mapper

VR-Forces supports alternative FOMs through the VR-Link FOM Mapper. You can specify which FOM Mapper to use with the `-f` command line option:

```
vrfSim -s 1 -a 3001 -f myFomMapper
```

Specifying the RPR FOM Revision

RPR FOM revision 2 for version 2.0017 fixes an encoding and decoding size issue with object ID lists to match RPR FOM 2 draft 17. To specify the RPR FOM revision, use the `--rprFomRevision revision` command-line option, for example:

```
vrfSim -s 1 -a 3001 --rprFomVersion 2.0017  
-F VR-Link20017-1.fed --rprFomRevision 2
```

Specifying FOM Mapper Initialization Data

Some FOM Mappers require initialization data. If you specify a FOM Mapper that requires such data, specify the data with the `--fomMapperInitData` option:

```
vrfSim -s 1 -a 3001 -f myFomMapper --fomMapperInitData ABC
```

The string “ABC” is passed to the FOM Mapper creation function in the shared library as an initialization parameter.

Specifying a FED File That is Appropriate for the FOM Mapper



The `-f` option only tells the application which FOM Mapper to use. It does not ensure that you are using the right FED file for the FOM Mapper. Make sure that you are using a FED file that is consistent with the FOM Mapper you have chosen.

By default VR-Forces uses a FED file called *VR-Link.fed*, but you can specify an alternate FED file using the `-F` option.

The following example instructs the application to use the RPR FOM 2.0, version 17 FOM mapping code, in the federation execution VR-Link20017, with the *VR-Link20017-1.fed* file:

```
vrfSim -s 1 -a 3001 --rprFomVersion 2.0017 -x VR-Link20017
-F VR-Link20017-1.fed
```

Enabling Time Management

You can enable time management for the back-end from the command line, as follows:

```
vrfSim -s 1 -a 3001 --timeManagement -F VR-LinkTM.fed -x
VR-LinkTM
```

4.8.4. Command Line Options for DIS Exercises

This section describes command line options that apply only to using VR-Forces with DIS exercises.

Specifying the Port Number

By default, VR-Forces listens to port 3000.

- To change the port that VR-Forces listens to, use the `-P` option, for example:

```
vrfSim -s 1 -a 3001 -P 3500
```

Specifying Point-to-Point or Multicast Operation

You can specify that VR-Forces run in point-to-point mode or multicast.

- To specify point-to-point, use the `-A` option, for example:

```
vrfSim -s 1 -a 3001 -A 123.123.12.1
```

- To specify multicast, use the `-S` option, for example:

```
vrfSim -s 1 -a 3001 -S 233.233.22.3
```

You can specify more than one multicast address, as follows:

```
vrfSim -s 1 -a 3001 -S address -S address ...
```



The default is broadcast mode.

Specifying the Multicast Time-to-Live

The multicast time-to-live specifies the number of routers that a message can pass through when PDUs are sent to multicast addresses.

- To specify the multicast time-to-live value, use the `--mcastTtl` option, for example:

```
vrfSim -s 1 -a 3001 -S address -S address --mcastTtl 3
```

Using Asynchronous I/O

If you want to use asynchronous I/O for DIS exercises, start VR-Forces with the `--useAsyncIO` option. Using asynchronous I/O can help prevent dropped packets and the resulting loss of information. There is no comparable command line option for HLA. To use asynchronous I/O in HLA, you set a RID file parameter.

Specifying the Exercise ID

- To set the VR-Forces exercise ID, use the `-x` option, for example:

```
vrfSim -s 1 -a 3001 -x 6
```

Specifying the DIS Version

- To specify the DIS version, use the `--disVersion` command line options, for example:

```
vrfSim -s 1 -a 3001 --disVersion 6
```

where:

- ♦ 4 = 2.0.4
- ♦ 5 = IEEE 1278.1
- ♦ 6 = 2.1.4 (IEEE 1278.1a).

4.9. Configuring Simulation Connections

A simulation connection specifies the connection parameters for a DIS or HLA simulation connection. VR-Forces comes with the following connection configurations:

- ♦ DIS (port 3000)
- ♦ HLA 1.3 RPR FOM 1.0
- ♦ HLA 1.3 RPR FOM 2.0, draft 17
- ♦ HLA 1.3 RPR FOM 2.0, draft 17, with support for DI-Guy
- ♦ HLA 1516 RPR FOM 1.0
- ♦ HLA 1516 RPR FOM 2.0, draft 17

You can add your own connection configurations using, for example a different DIS port or your own FOM Mapper.

4.9.1. Opening the Simulation Connections Configuration Dialog Box

Simulation connection configurations are maintained in the Simulation Connections Configuration dialog box. This dialog box opens automatically when you start VR-Forces, unless you choose a configuration as the default connection for auto connection. If Auto Connect is enabled and you want to change the connection, you can open the dialog box from the Tools menu.

- To open the Simulation Connections Configuration dialog box, on the Windows Start menu, choose **Programs** → **MAK Technologies** → **VR-Forces x.x** → **Tools** → **Configure Connections**.

4.9.2. Adding a Simulation Connection

To add a simulation connection:

1. If the Simulation Connections Configuration dialog box (Figure 4-7) does not open automatically when you start VR-Forces, choose **Programs** → **MAK Technologies** → **VR-Forces x.x** → **Tools** → **Configure Connections**.

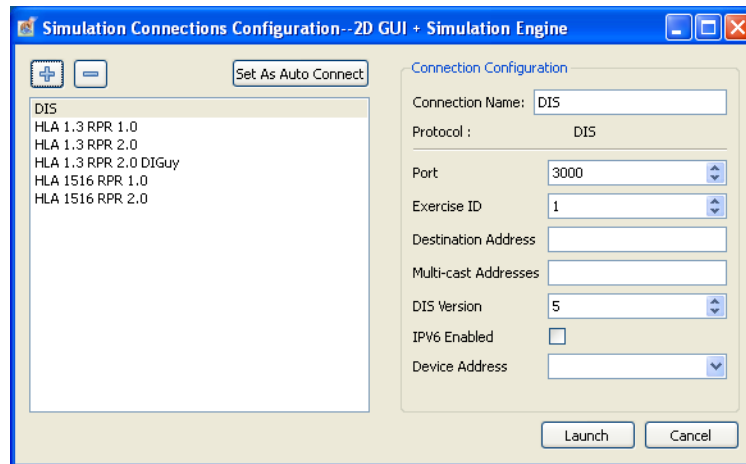


Figure 4-7. Simulation Connections Configuration dialog box

2. Click the Plus (+) button. The Create Connection dialog box opens (Figure 4-8).

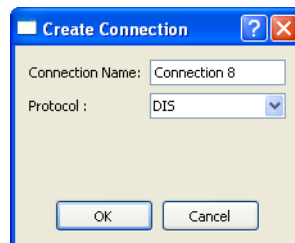


Figure 4-8. Create Connection dialog box

3. In the Connection Name box, type a name for the connection.
4. Select a protocol from the Protocol list.
5. Click OK.
6. The connection is added to the list in the Simulation Connections Configuration dialog box.
7. Select the new connection in the list.
8. Edit the parameters in the Connection Configuration group box as desired.

4.9.3. Editing a Simulation Connection

To edit a simulation connection:

1. If the Simulation Connections Configuration dialog box (Figure 4-7) does not open automatically when you start VR-Forces, choose **Programs** → **MAK Technologies** → **VR-Forces x.x** → **Tools** → **Configure Connections**.
2. In the list of connections, select the connection that you want to edit.
3. Edit the parameters in the Connection Configuration group box as desired.

4.9.4. Deleting a Simulation Connection

To delete a simulation connection:

1. If the Simulation Connections Configuration dialog box (Figure 4-7) does not open automatically when you start VR-Forces, choose **Programs** → **MAK Technologies** → **VR-Forces x.x** → **Tools** → **Configure Connections**.
2. In the list of connections, select the connection that you want to delete.
3. Click the Minus (–) button. A confirmation prompt opens.
4. Click Yes.

4.9.5. Configuring Auto Connect

If you know that you will usually or always want to use the same simulation connection, you can set up Auto Connect and you will not have to select a connection every time you start VR-Forces.

To configure Auto Connect:

1. If the Simulation Connections Configuration dialog box (Figure 4-7) does not open automatically when you start VR-Forces, choose **Programs** → **MAK Technologies** → **VR-Forces x.x** → **Tools** → **Configure Connections**.
2. In the list of connections, select the connection that you want to use every time you start VR-Forces.
3. Click Set as Auto Connect. A star is displayed next to the selected connection.

Disabling Auto Connect

To disable Auto Connect:

1. Choose **Programs** → **MAK Technologies** → **VR-Forces *x.x*** → **Tools** → **Configure Connections**. The Simulation Connections Configuration dialog box opens (Figure 4-7).
2. In the list of connections, select the connection that is configured for auto connect.
3. Click Set as Auto Connect. Auto connect is disabled and the star is removed from next to the connection.

4.10. The VR-Forces Log Files

On Windows, VR-Forces creates two log files, *vrfSim.log* and *vrfGui.log*. Both log files are written to the directory from which you run VR-Forces.

On Linux, in combined mode, VR-Forces automatically creates a log file, *vrfSim.log* for back-end output. Front-end output is sent to the console. If you want to view back-end output, open a second console window, and do `tail -f vrfSim.log`. If you want to send front-end output to log files, or if you are running in separate mode and want to create a log file for either the front-end or back-end, you need to redirect your output to a file, for example:

```
vrfGui > vrfGui.log
```

4.11. Viewing a List of Loaded Plug-ins

You can view a list of the plug-ins that are loaded when you start up VR-Forces. Plug-ins may include a description that you can also view.

To view the details of loaded plug-ins:

1. Choose **Help** → **Plugins**. The Plugins dialog box opens ([Figure 4-9](#)).

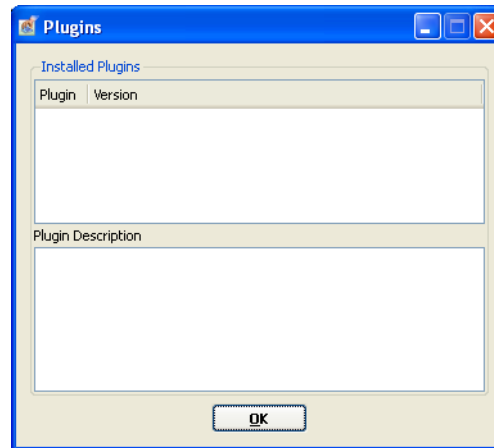
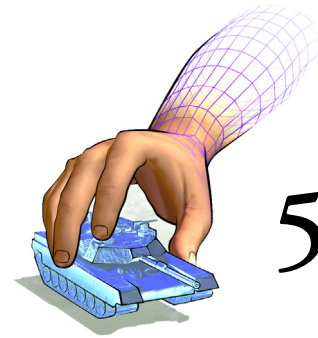


Figure 4-9. Plugins dialog box

2. To view details about a plug-in, select it in the list.



Creating and Running Scenarios

This chapter explains how to create, load, run, and save scenarios.

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5.1. Creating a Scenario

When VR-Forces starts, the map area is blank. To use VR-Forces to simulate entities, you must load a scenario or create a new one.



If you are using multiple front-ends in the same session, when one of them creates a scenario, the terrains in all other front-ends are closed (unless the terrain is the same as that for the new scenario) and the terrain for the new scenario is loaded.

To create a scenario:

1. Choose **File** → **New Scenario**, or click the New Scenario button on the File toolbar. The Select Simulation Database dialog box opens (Figure 5-1). By default, it opens in `./data/terrain`, the directory that contains the terrain databases shipped with VR-Forces. For a brief description of the databases supplied with VR-Forces, please see “[Terrain Databases Provided with VR-Forces](#),” on page 20-13.

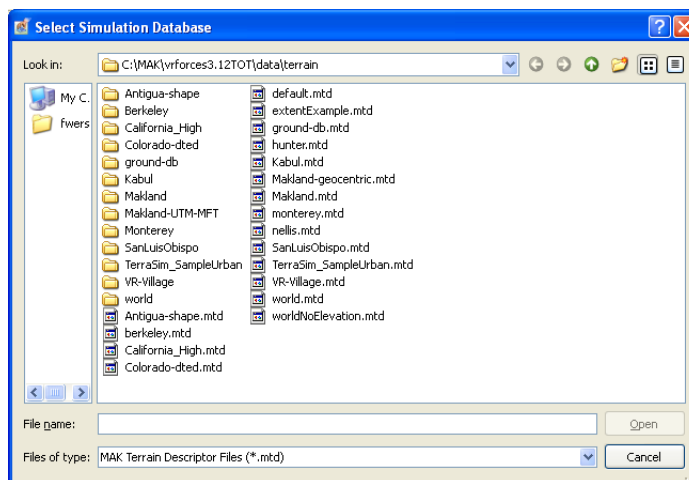


Figure 5-1. Select Simulation Database dialog box

2. In the file list, select a terrain database or an MTD file. (MTD is the preferred file type.) A database must be a geodetic, flat earth, or UTM database. By default, this terrain is used for both the front-end and back-end. For details, please see “[Using Large Terrain Databases](#),” on page 3-29. For details about MTD files, please see *MAK Terrain Database Tool Users Guide*.

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Remember, if you load a geocentric database in the front-end, it is automatically converted to geodetic. If you load a geodetic database into the back-end, it is converted to geocentric. You can save scenario loading time by converting databases to the proper coordinate system as GDB files before you load them.

3. Click Open. The New Scenario dialog box opens (Figure 5-2).

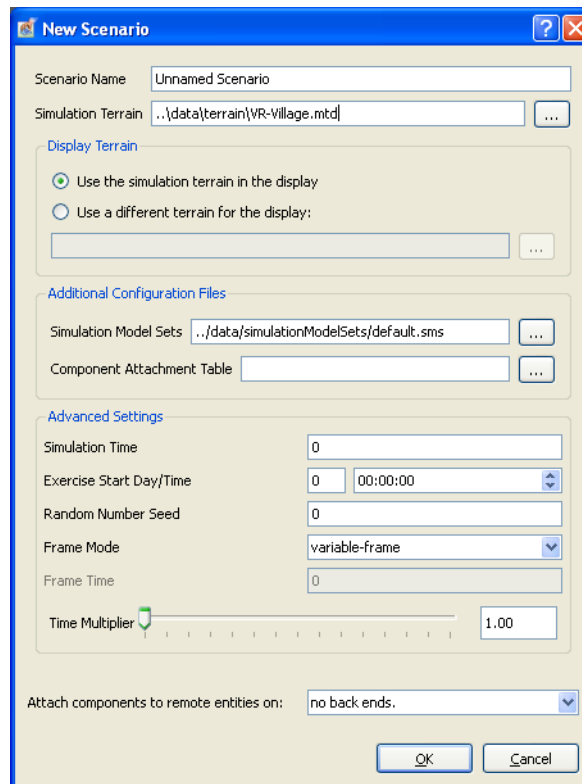


Figure 5-2. New Scenario dialog box

4. Optionally, set scenario parameters (overriding the default settings). Table 5-1 describes the parameters you can set.



If you are creating a scenario in the VR-Forces 3D Front End, you might need to specify a different terrain for the front-end. Please read the description of the Display Terrain parameter in [Table 5-1](#).

Table 5-1: Scenario parameters

Parameter	Description
Scenario Name	Specifies the name of the scenario. This is the name used to identify the scenario when you join a session. If you do not specify a name, the scenario file name is used.
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 Sets	Specify simulation model sets. A scenario must specify at least one simulation model set. For more information, please see “Specifying Multiple Simulation Model Sets,” on page 5-6. Default: <i>default.sms</i> .
Component Attachment Table	If you plan to attach components to remote entities, specify the component attachment table that you want to use. For details about configuring components for attachment to remote entities, please see “Configuring VR-Forces Components on Remote Entities,” on page 8-29, in <i>VR-Forces Configuration Guide</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.

Table 5-1: Scenario parameters

Parameter	Description
Time Multiplier	Specify a time multiplier for the scenario. For HLA time-managed federations, this parameter is ignored. Default: 1.0 (real-time).
Attach Components to Remote Entities On	Specifies whether or not to attach components to remote entities, and if so, the back-ends on which to manage the components that are being attached to remote entities. Unlike other scenario parameters, you can change this value when you load a scenario. For details about configuring components for attachment to remote entities, please see “Configuring VR-Forces Components on Remote Entities,” on page 8-29, in <i>VR-Forces Configuration Guide</i> .
 This value is not saved in the scenario file. To attach components in future runs of the scenario, you must specify the appropriate setting each time you load the scenario.	

For more information about these parameters, please see:

- [“Simulation Time and Exercise Time,”](#) on page 3-31
- [“Exercise Clock Modes,”](#) on page 3-32
- Section 3.2.1, [“Scenario Parameters”](#) in *VR-Forces Configuration Guide*.

6. Click OK.

The map displays the terrain database that you chose. The Minimap displays a thumbnail version of the database ([Figure 5-3](#)).

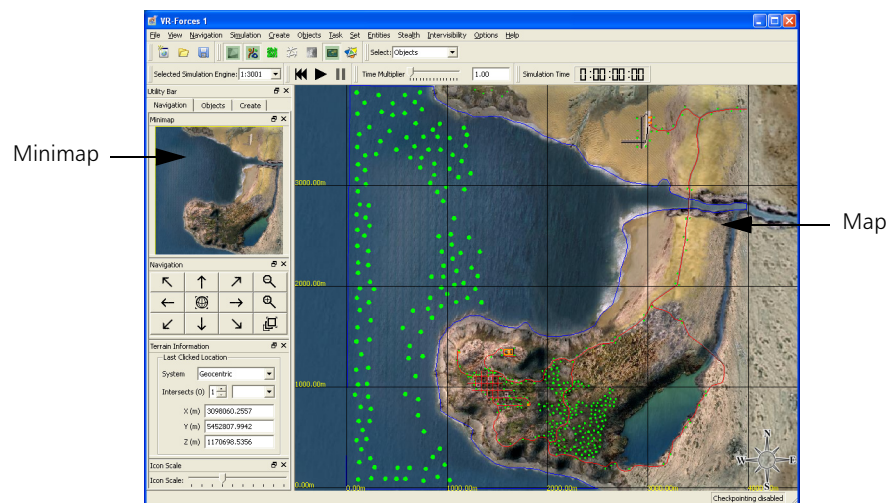


Figure 5-3. VR-Forces window

7. Add the entities and graphical objects that you need for your simulation. For information about adding entities, please see [“Creating Entities,”](#) on page 8-3. For information about adding graphical objects, please see Chapter 16, [Overlays and Graphical Objects](#). For details about manipulating the map view, please see Chapter 6, [Navigating and Configuring the Map](#).
8. Save the scenario. For details about saving scenarios, please see [“Saving a Scenario,”](#) on page 5-12.

5.1.1. Specifying Multiple Simulation Model Sets

You can specify more than one simulation model set for a scenario. One strategy for extending VR-Forces is to use the default SMS for the majority of objects and to create a separate SMS for customized entities. As you upgrade to newer versions of VR-Forces, you can more easily migrate your customized SMS to the new version because your changes have not been integrated into the default SMS.

To specify multiple simulation model sets for a scenario:

1. In the New Scenario dialog box, click the Browse button on the Simulation Model Set line. The Simulation Model Set Files dialog box opens. It lists the SMS files to be loaded for this scenario.

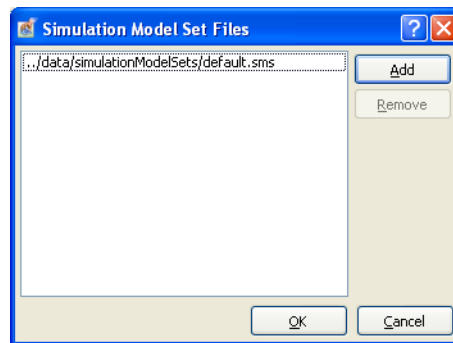


Figure 5-4. Simulation Model Set Files dialog box

2. In the The Simulation Model Set Files dialog box, click Add. A blank line is added to the window.
3. Click the browse button next to the blank line. The Choose File dialog box opens.
4. Select a simulation model set and click Open. The SMS is added to the text box.
5. Click OK.
6. Complete the New Scenario dialog box.

5.1.2. Merging Scenarios

VR-Forces users often assign scenario development to multiple persons or teams. Then they merge the separately-developed scenarios into a master scenario. Merging scenarios by hand can be a difficult task due to the requirement to reconcile entity and object names, plans, and other scenario elements that could be duplicated, particularly if objects are named using the default conventions. VR-Forces includes an offline tool, Scenario Merge, for merging scenarios. For details, please see Chapter 4, [Merging Scenarios](#), in *VR-Forces Configuration Guide*.

5.2. Loading a Scenario

After you have created and saved a scenario, you can load it and run it on any platform supported by the version of VR-Forces in which you created it. Most scenarios are forward compatible. Please see *VR-Forces Release Notes* for compatibility issues.

If you want to load a scenario that you created in the 2D GUI into the 3D Front End, you might have to edit the scenario file to use the correct terrain database in the front-end. If you created the scenario using a terrain whose MTD file has an entry for the 3DViewMetafileRecord, you can open the scenario in either GUI without editing the scenario. However, if the MTD file does not specify a 3D terrain in addition to a 2D terrain, you must edit the **Gui-Terrain-Database** parameter in the scenario file to specify the correct terrain for the GUI. For more information, please see Chapter 3, [Scenario Files](#), in *VR-Forces Configuration Guide*.



If you are running multiple front-ends in the same session, when you load a scenario, any terrains that are open on other front-ends are closed and the terrain for the newly loaded scenario is opened.

To load a scenario:

1. Choose **File** → **Load Scenario** or click the Open button on the File toolbar. The Load Scenario dialog box opens (Figure 5-5).

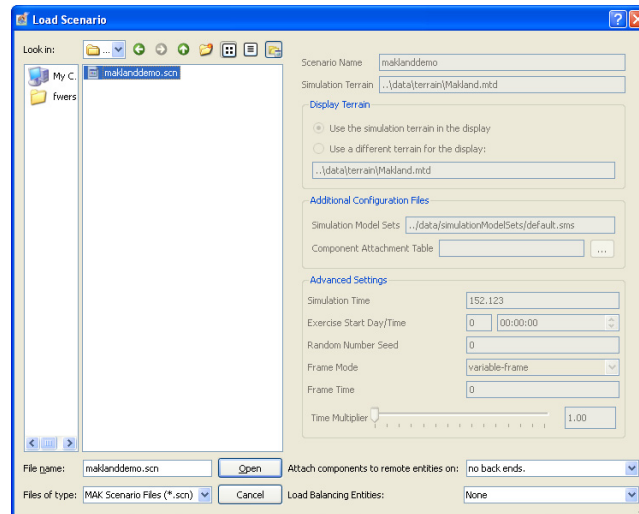


Figure 5-5. Load Scenario dialog box

2. Select a scenario to load. Scenarios are files with the suffix *.scn*. Sample scenarios are located in the *../data/scenarios* directory. (Batch scenarios, described in “Running VR-Forces in Batch Mode,” on page 5-17, have the suffix *.bsn*.)
3. Optionally, specify whether or not to allow management of components on remote entities by selecting an option in the Attach Components to Remote Entities On drop-down list. For details about configuring components on remote entities, please see “Configuring VR-Forces Components on Remote Entities,” on page 8-29, in *VR-Forces Configuration Guide*.
4. Optionally select a load balancing option.
5. Click Open.

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- ♦ When you load a scenario that uses multiple back-ends, if any of the required back-ends are not running, VR-Forces prompts you to remap the objects in the scenario. The Remap Missing Back-ends dialog box lists the unavailable back-ends and the available back-ends. You can specify which back-ends to map objects to or you can select “map all to” and map all objects to one back-end. For more information, please see “Remapping Back-ends,” on page 3-8.
- ♦ VR-Forces keeps a list of the scenarios you open.
 - To quickly open a recently used scenario, choose **File** → **Recent Scenarios** → *scenario_name*.

5.2.1. Loading a Scenario from the Command Line

If you start VR-Forces from the command line, you can specify a scenario to load. Use the `-L` option, for example:

```
vrfGui -L "../data/scenarios/myScenario.scn" -z vrfSim
```

5.2.2. Load Balancing a Scenario

After you create a scenario, you may decide that you want to spread simulation of objects across more back-ends than you used to create it. You would typically increase the number of back-ends to improve performance. The process of spreading the simulation work across multiple simulation engines is called load balancing. VR-Forces supports even distribution (done automatically by VR-Forces) and manual load balancing.

To load-balance a scenario:

1. Choose **File** → **Load Scenario**. The Load Scenario dialog box opens.
2. In the Load Scenario dialog box, select an option from the Load Balancing Entities list (Figure 5-6).

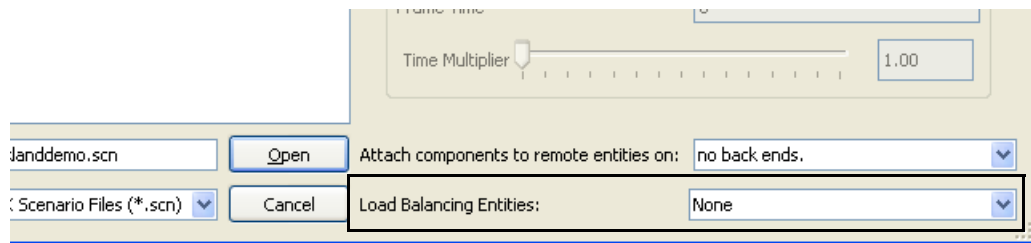


Figure 5-6. Load Balancing list

If you select Even Distribution, VR-Forces automatically distributes objects across the available back-ends. If you choose Manual load balancing, the Object Mapping dialog box opens (Figure 5-7).

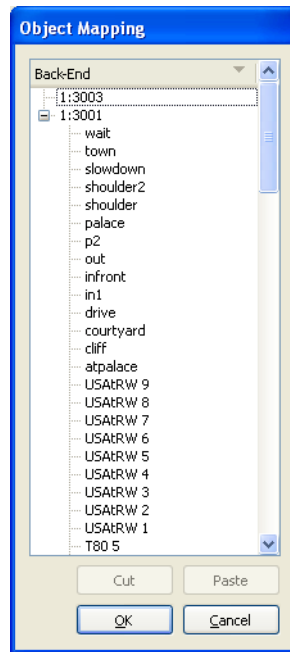


Figure 5-7. Object Mapping dialog box

3. In the Object Mapping dialog box, expand the list for the back-end from which you want to distribute objects.
4. Redistribute objects by dragging them from a source back-end to a target back-end, or by cutting them from the source back-end and pasting them onto the target back-end. You can view the new distribution of objects, as shown in [Figure 5-8](#), by expanding the list for the target back-end.

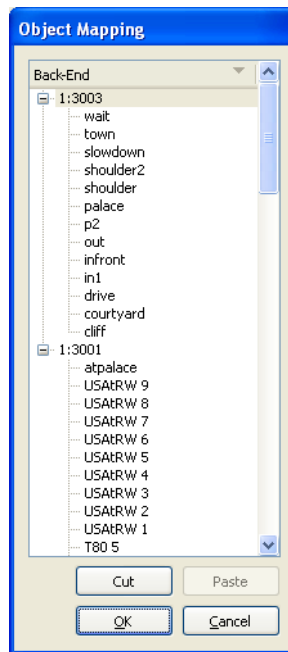


Figure 5-8. Object Mapping dialog box after load balancing

5. Click OK. The scenario loads. If you open the information dialog box for an object, the title bar displays the back-end on which it is simulated.
6. To preserve the new object mappings, save the scenario. When you save the scenario, you are prompted to save the original mappings. Click No to save the new load balanced mappings.

5.2.3. Sample Scenarios

VR-Forces includes several sample scenarios. Appendix A, [Example Scenarios](#) has the step-by-step process for creating the breaching scenario and the embarkexample scenario.

5.3. Saving a Scenario

The first time you save a scenario, VR-Forces saves the path of the terrain database and other scenario configuration data to a scenario file. This information usually does not change between runs of a scenario. Every time you save a scenario, VR-Forces saves the order of battle, the plans, and object mapping information to individual files that have the same name as the scenario, but with file extensions that identify the information in the file (*.oob*, *.pln*, *.gpl*, *.ovl*, *.sgr*, *.hst*, and *.omp*).



- If you want to keep the initial state of a scenario (simulation time = 0 and no simulation has taken place), so that you can repeatedly run a simulation from the beginning, save the scenario when you have finished creating it, but before you run it. Then, do not save the scenario again under the same name (unless you specifically want to change the original state of the scenario).
- If you load an alternate terrain in a front-end when it joins a session, the alternate terrain is not saved as part of the scenario.

When you save a scenario, whether during the course of setting it up or during a simulation, all state information gets saved. Essentially, every save is a checkpoint. Therefore, when you run a saved simulation, all entities will resume whatever they were doing when the scenario was saved.

If you save a scenario after it has started (whether it is paused or running), it is not saved to the original scenario file. It is saved to a checkpoint that is named using the convention *scenario_name_at_time_time.scn*. This ensures that you cannot inadvertently overwrite the original scenario file. To overwrite the original scenario, you must use Save Scenario As. For more information about checkpoints, please see “[Saving Checkpoints](#),” on page 5-14.

To save a new scenario:

1. Choose **File** → **Save Scenario** or click the Save button on the file toolbar. The Save Scenario dialog box opens.
2. Select the directory in which you want to save the scenario.
3. Give the scenario a name.
4. Click Save. All scenario files are saved with the new name.



If you save a remapped scenario, you are prompted to save the scenario with the original mappings or with the remappings.

5.3.1. Saving an Existing Scenario

In most computer applications, when you save an existing file, the current version of the file simply overwrites the previously saved version. However, when VR-Forces saves a scenario, the save action depends on the status of the scenario. VR-Forces tracks the simulation time of the scenario. When you save a scenario:

- ♦ If a version of the scenario exists with the current simulation time, VR-Forces displays a message indicating that a version of the scenario at that simulation time exists and asks if you want to overwrite it.
- ♦ If there is no version with the current simulation time, VR-Forces creates a new checkpoint at the current simulation time, using the checkpoint naming convention.

This behavior ensures that if you change a scenario after you have started a simulation, you will never inadvertently overwrite the original version or another checkpoint.

➤ To save a previously saved scenario, choose **File** → **Save Scenario**.

5.3.2. Saving a Scenario to a New Name

To save a scenario to a new name:

1. Choose **File** → **Save Scenario As**. The Save Scenario dialog box opens.
2. Select the directory in which you want to save the scenario.
3. Give the scenario a name.
4. Click Save. The scenario is saved to the new name.

5.3.3. Saving Scenarios with Relative or Absolute Pathnames

The scenario file records the pathnames of the other files used by the scenario. It can save the pathnames as absolute or relative paths. By default, all newly saved scenarios are saved with paths relative to the *.bin* directory. You can change the default behavior by editing the `makePathsRelative` parameter in *vrfGui.mtl*.

If VR-Forces is set to save scenarios using relative paths and you save a scenario that was previously saved using absolute paths, the pathname for the terrain database keeps an absolute path. To change the terrain database path to a relative path, you must edit the scenario file. Thereafter, the relative path will be preserved.

5.3.4. Saving Checkpoints

You may want to save snapshots of a simulation at various points in its life for after-action-review or to use as the starting point of a new exercise. You might also want to stop an exercise and resume it at some later point, with all entities remembering their tasks and state information. You can do this by saving a checkpoint.

You can save a checkpoint at any time by saving the scenario. Checkpoints are saved to the same directory. You can also configure VR-Forces to save checkpoints at regular intervals. If periodic checkpointing is enabled, the Status bar displays the time until the next checkpoint.

When you run a checkpointed scenario, entities resume the tasks that they were executing at the time the checkpoint was saved. If detonations were scheduled or if missiles were in flight, they resume their former state.

Saving an Individual Checkpoint

Whenever you save a scenario, it creates a checkpoint.

- To save an individual checkpoint, choose **File** → **Save Scenario**.

Scheduling Periodic Checkpoints

You can configure VR-Forces to save checkpoints at regular intervals. You can specify that the intervals be calculated in real time or simulation time. Saving checkpoints in simulation time may be useful if you are running a scenario at a rate greater or lesser than real time.

To schedule checkpoints:

1. Choose **File** → **Checkpoint** → **Schedule Periodic Checkpointing**. The Periodic Checkpointing dialog box opens (Figure 5-9).

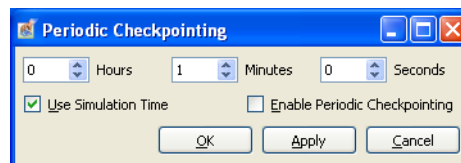


Figure 5-9. Periodic Checkpointing dialog box

2. Enter the time interval between checkpoints, in hours, minutes, and seconds.
3. Select the Enable Periodic Checkpointing check box.
4. To save checkpoints based on simulation time, check the Use Simulation Time check box. To use real time intervals, clear the check box.
5. Click OK.

Disabling Periodic Checkpointing

To disable periodic checkpointing:

1. Choose **File** → **Checkpoint** → **Schedule Periodic Checkpointing**. The Periodic Checkpointing dialog box opens.
2. Clear the Enable Periodic Checkpointing check box.
3. Click OK.

5.4. Starting a Simulation

If you want to use VR-Forces like a plan view display to observe a remote simulation, you can start it, open a terrain database, and wait for it to pick up messages from the network. However, you will probably use VR-Forces to run simulations that have locally simulated entities.

5.4.1. Starting or Resuming a Paused Simulation

When you load a scenario, it opens in the paused state unless you start with the `-L` and `-r` back-end command line options.

- To begin or resume execution of a paused scenario, choose **Simulation** → **Run Simulation**, or click the Run icon on the Simulation Control toolbar (Figure 5-10).



Always save a new scenario before you run it for the first time. If you do not save it, you will not be able to return to the starting point. Rewinding a scenario that has not been saved deletes all unsaved objects.

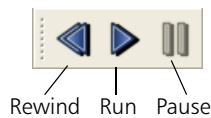


Figure 5-10. Simulation Control toolbar

5.4.2. Changing the Simulation Speed

You can vary the speed of a simulation so that it runs at speeds faster or slower than real-time.

If you are running VR-Forces with time management, the Time Multiplier toolbar is disabled.



If you increase the speed at which a scenario runs, the frame rate is reduced and performance of models may degrade.

- To change the speed of a simulation, drag the indicator on the Time Multiplier toolbar ([Figure 5-11](#)), or type a value in the text box.



Figure 5-11. Time Multiplier toolbar

5.4.3. Pausing a Simulation

When you pause a simulation, local entities stop executing plans and tasks. Display of remote entity activity continues as it is received over the network.

- To pause a simulation, choose **Simulation** → **Pause Simulation**, or click the Pause button on the Simulation Control toolbar ([Figure 5-10](#)).

5.4.4. Rewinding a Scenario

If you are running a scenario or have completed a scenario and want to start it over again, you can rewind it. Rewinding a scenario returns it to its last saved state.



If you are working on a new scenario and have not saved it, rewind deletes all your work and returns the scenario to its original, blank state.



If you save checkpoints while a scenario is running, when you rewind, the scenario rewinds to the most recent checkpoint, not to the original scenario. To return to a version of the scenario other than the most recent checkpoint, you must load that version.

- To rewind a scenario, choose **Simulation** → **Rewind Simulation**, or click the Rewind button on the Simulation Control toolbar (Figure 5-10).

If you do not pause a scenario before you rewind it, it starts playing again immediately. You can configure VR-Forces to automatically pause when you rewind a scenario.

- To specify that VR-Forces pause when you rewind, choose **Options** → **Rewind Pauses Back-End**, or press **k**.

5.4.5. Closing a Scenario

You can close a scenario without exiting VR-Forces.

- To close a scenario, choose **File** → **Close Scenario**.

5.5. Running VR-Forces in Batch Mode

Batch mode allows you to run one or more scenarios multiple times, without direct action through the graphical user interface. A scenario run in batch mode runs with the parameters in the scenario file, except that you can override the random number seed in the scenario file.

Batch mode is “read only.” You cannot save a scenario, create entities or objects, pause the scenario, or otherwise change it, while a batch is running. However, you can view the Objects List Panel, Plan windows, and open informational dialog boxes. You can close a scenario that is running in batch mode and resume control of VR-Forces.

5.5.1. Creating a Batch File

To run VR-Forces in batch mode, you create a batch file (.bsn). VR-Forces supplies a sample batch file. Use it as a model for creating your own batch files.

To create a batch file:

1. Create scenarios as you would any scenario. (For details, please see [“Creating a Scenario,”](#) on page 5-2.)
2. In a text editor, open the sample batch file provided with VR-Forces.
3. Save the batch file under a new name, with the file extension .bsn.
4. Replace the sample values with your own, as described in [“Editing a Batch File,”](#) on page 5-18.
5. Save the new batch file.

5.5.2. Editing a Batch File

A batch file is written in MÄK Technologies Lisp format (MTL). (For information about the MTL format, please see Section 2.1, [“MÄK Technologies Lisp \(MTL\) Files”](#), in *VR-Forces Configuration Guide*.) A batch file starts with parameters that affect the entire batch. Then it has a batch list, which contains one or more batches. Each batch specifies a scenario, the number of times it is to be run, and other parameters. [Table 5-2](#) describes the parameters.

The following is an example of a batch file:

```
(scenario-batch
  (use-logger-control True)
  (logger-files-path "..\logger_tapes") ;; path is relative to Logger
  executable.
  (batch-list
    (batch
      (number-of-runs 2)
      (random-number-seed 4)
      (scenario-filename "..\data\scenarios\breach\breaching.scn")
      (parameter-filename
        "..\data\simulationModelSets\default\vrfsim.opd")
      (simulation-run-duration 0 : 0 : 0 : 30.000000) ;; simulation time
    )
    (batch
      (number-of-runs 3)
      (scenario-filename
        "..\data\scenarios\apache\apache_groundDB.scn")
      (parameter-filename
        "..\data\simulationModelSets\default\vrfsim.opd")
      (run-duration 0 : 0 : 0 : 20.000000) ;; real time
    )
  )
)
```


Table 5-2: Batch file parameters (Sheet 1 of 2)

Parameter	Description
Scenario-batch parameters	
use-logger-control	Specifies whether or not to generate Logger Control messages. Options: ♦ False – Do not generate messages. ♦ True – Generate messages to create Logger files for each run of each batch.
logger-files-path	If user-logger-control is True, specifies the directory in which to store Logger files. The path can be absolute or relative to the Logger executable.
Batch-list parameters	
number-of-runs	Specifies how many times to run the scenario in this batch run entry.
random-number-seed	This parameter is optional. If it is specified, it overrides the random number seed in the scenario file. It specifies a random number seed as follows: ♦ -1 – use a value generated by the computer. Values are different for each run of this batch. ♦ Any non-negative integer – use the number specified for each run of the batch.
scenario-filename	Specifies the scenario to be run in this batch run entry. The scenario can be specified as an absolute path or a path relative to the directory in which the executable is located.
parameter-filename	This parameter is optional. If it is specified, it overrides the object parameter database specified by the scenario and specifies the object parameter database file to use.
simulation-run-duration	Specifies the duration in simulation time that the simulation will run. It is mutually exclusive with run-duration. If both are specified, VR-Forces uses simulation-run-duration.
	 Specify hours, minutes, and days as integers, for example 15. Specify seconds as real numbers, for example, 15.0.

Table 5-2: Batch file parameters (Sheet 2 of 2)

Parameter	Description
run-duration	Specifies the duration in real time that the simulation will run. For example, if a scenario has a time scale set to 2 (twice real time), and a run-duration of 10 minutes, 20 minutes of simulation time will elapse before the batch stops running this scenario. It is mutually exclusive with <code>simulation-run-duration</code> .
	! Specify hours, minutes, and days as integers, for example 15. Specify seconds as real numbers, for example, 15.0.

5.5.3. Running VR-Forces in Batch Mode

To run VR-Forces in batch mode:

1. Start VR-Forces. If any of the scenarios you plan to run in batch mode require multiple back-ends, start the back-ends with the required site and application IDs.
2. If you are going to generate Logger control messages, start the MÄK Logger.
3. Choose **File** → **Batch File** → **Open**. The Load Batch File dialog box opens.
4. Select the batch file you want to run.
5. Click Open.

VR-Forces begins running the first scenario in the batch file. When VR-Forces finishes running the batch file, it closes the final scenario.



- ♦ When VR-Forces runs a batch file, if it cannot load a scenario specified in the file, it skips the scenario and goes to the next batch entry in the file.
- ♦ Automatic remapping is always enabled for batch mode. If you are running VR-Forces in combined mode, objects are remapped to the back-end specified by the `backendSiteId` and `backendAppNum` parameters (default: 1:3001). If you are running in separate mode, objects are remapped to the back-end specified by the `batchModeRemapSiteId` and `batchModeRemapAppNum` parameters. For details about these parameters, please see Chapter 2, *VR-Forces Configuration Files*, in *VR-Forces Configuration Guide*.

Running in Batch Mode from the Command Line

If your scenarios only need one back-end, you can run a batch file from the command line.

- To run a batch from the command line, use the `-B` parameter, with the back-end in separate mode.

```
vrfSim -B "../data/scenarios/batchfile.bsn"
```

The scenario begins to run automatically.

5.5.4. Recording Batch Scenarios

You can generate Logger Control messages and save scenario output to a Logger file. You must start the Logger before you run the batch scenario.

If you generate Logger Control messages, each simulation is saved individually by the Logger, with a filename in the format:

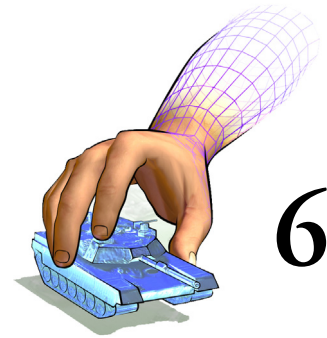
```
<batch_scenario_name>_<scenario_run_number>_<random_number_seed>.lgr
```

You can specify the directory in which you want the Logger file to be saved.

5.6. Recording VR-Forces Simulations with the MÄK Logger

You can use the MÄK Logger to record VR-Forces simulations and then play them back for review. If you want to view a Logger file in VR-Forces (as opposed to some other MÄK viewer, such as the MÄK Plan View Display or MÄK Stealth), note the following considerations:

- ♦ When you view the Logger file, you must run VR-Forces with an application number that is different from the one you used when you recorded the simulation. If you use the same application number, VR-Forces may crash.
- ♦ Do not load the original scenario in VR-Forces while you view the recording. Just load the terrain database that the simulation requires.
- ♦ If you are using HLA 1516, do not record a simulation and then immediately play it back. Exit the applications and start a new federation. Trying to play back the file in the federation from which it was recorded can result in name reservation conflicts and applications may crash.



Navigating and Configuring the Map

This chapter explains how to navigate and manipulate a VR-Forces window.



The procedures in this chapter assume that you know how to conduct common GUI activities, such as dragging an object.

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6.1. The VR-Forces Window

VR-Forces shows all the simulated entities and interactions on a terrain database or raster map. You can have multiple VR-Forces windows open for a given instance of the front-end, but they all show the same terrain database. Each VR-Forces window has a map and the following toolbars:

- ♦ Menu toolbar: Menus for accessing VR-Forces commands.
- ♦ Simulation control toolbars:
 - Simulation Control toolbar: allows you to start, pause, and rewind a scenario
 - Simulation Selection toolbar: displays site and application numbers of multiple back-ends, if present
 - Simulation Time toolbar: displays the elapsed simulation time
 - Time Multiplier toolbar: allows you to control the speed at which the simulation runs.
- ♦ Selection Mode toolbar: lets you specify the selection mode.
- ♦ Utility toolbar: a docking location and organizer for toolbars. It has three tabs. The Navigation tab has the following toolbars:
 - Icon Scale toolbar: allows you to change the size of entity icons and labels
 - Terrain Information toolbar: provides coordinate information for the last selected entity or ground point
 - Minimap: Thumbnail view of the database and entities that you can use to focus the map
 - Navigation toolbar: allows you to pan and zoom the display.

The Objects tab has the following toolbars:

- Objects List Panel: provides five views of the objects in the simulation
- Object Count toolbar: provides summary statistics for the objects in the simulation.

The Create tab holds the Entity Palette, which lets you select entities and objects to create on the map.

- ♦ Status bar: displays hints for selected options.
- ♦ Icon toolbars have icons for frequently used menu commands.

The following toolbars are not displayed by default. You can access them through the View menu:

- ♦ Minimap Color toolbar: displays the color of the rectangle in the minimap and allows you to change the color
- ♦ Overlay toolbar: added automatically when you create an overlay, it has tabs for each overlay
- ♦ Stealth Navigation toolbar: lets you control the position and orientation of MÄK Stealths and other VR-Vantage applications from VR-Forces if a Stealth is publishing its location.

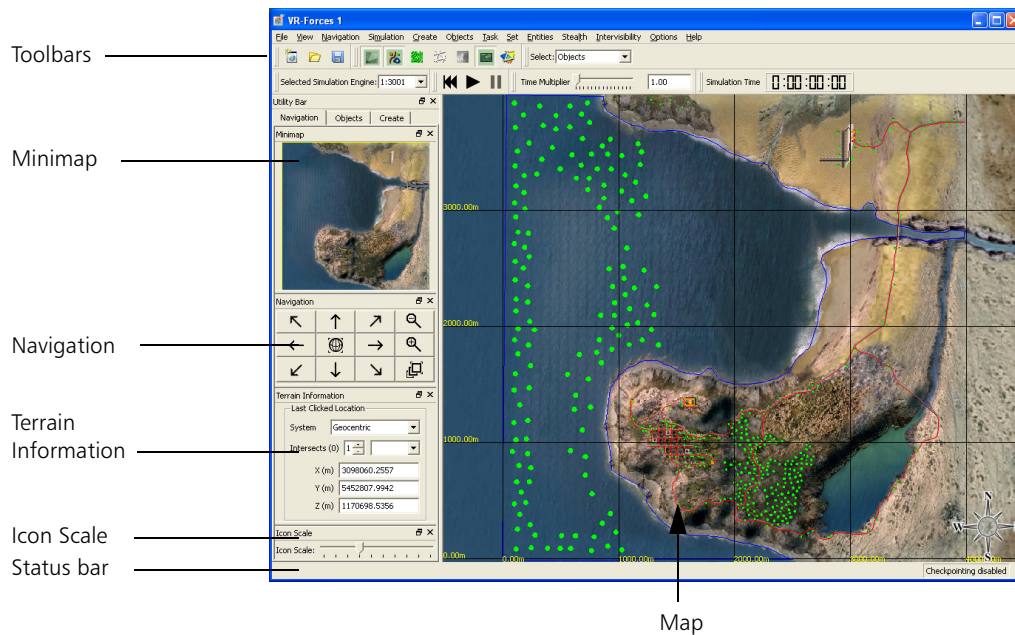


Figure 6-1. VR-Forces window and toolbars

You can undock toolbars and display them anywhere on your desktop. You can hide any toolbar that you do not want to be visible. You can also customize the icon-based toolbars and add new ones for any menu command that is not currently on a toolbar. For details, please see Appendix B, *Customizing the GUI Layout*.

6.1.1. Using Context Sensitive Menus

The VR-Forces window has context sensitive menus (also called popup or right-click menus) that are displayed when you right-click or middle-click entities or the terrain.



You can configure how VR-Forces handles context sensitivity for the Task and Set menus. For details, please see the `availableTaskSetRetrievalScheme` parameter in Table 2-1 in *VR-Forces Configuration Guide*.

6.1.2. Full Screen View

You can display the map so that it covers the entire screen of your monitor. In full screen mode, no toolbars are displayed. You can zoom in and out using the mouse wheel and can pan the map using the keyboard.

- To view the map full screen, choose **View → Show Full Screen**.
- To exit full screen mode, press the **Ctrl+Enter** keys.

6.1.3. Printing the Map View

You can send the map view to a printer. It prints the current view, not the entire database.

To print the map view:

1. Choose **File → Print → Map View**. A Print dialog box opens.
2. Specify the proper orientation for printing (portrait or landscape) based on the aspect ratio of the map view.
3. Click Print.

Printing the Objects in the Map View

You can print out the objects displayed in the map view. The terrain is not printed.

To print the objects in the map view:

1. Choose **File → Print → Objects**. A Print dialog box opens.
2. Specify the proper orientation for printing (portrait or landscape) based on the aspect ratio of the map view.
3. Click Print.

6.1.4. Saving an Image of the Map to a File

You can save an image of the map view to a file. The current view is saved, not the entire database.

To save an image of the map view:

1. Choose **File → Print → Map View to File**. The Save Map Area dialog box opens.
2. Navigate to the directory in which you want to save the file.
3. In the File Name text box, type a name for the image.
4. In the Output Format list, select the format to which you want to save the image.
5. Click Save.

6.2. Navigating the Map

You can change your view (the extents of the database visible in the window) of the map by panning, zooming in and out, or selecting a specific area in the Minimap.

6.2.1. Panning the Map

You can pan the map in eight compass directions. In the Terrain View Options dialog box, you can set the increment by which the map is panned. For details, please see [“Setting Panning Increments,”](#) on page 6-7.

To pan the map, use one of the following methods:

- Click on the appropriate pan button in the Navigation toolbar.
- On the Navigation menu, choose the Pan command for the direction in which you want to pan the map.
- On your keyboard’s keypad (Num Lock must be on), press the number keys that correspond to the compass points of the Navigation toolbar ([Figure 6-2](#)).

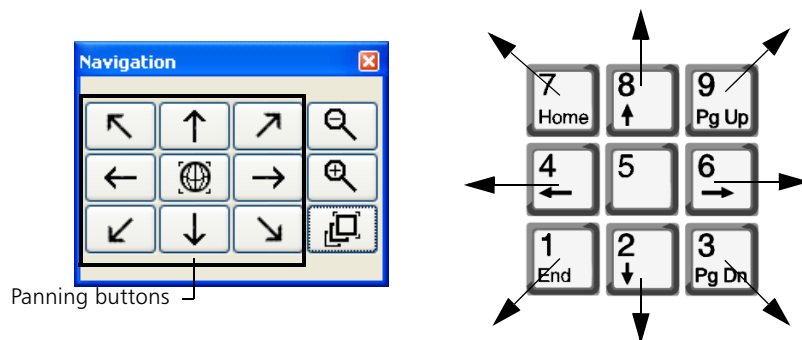


Figure 6-2. Panning with the Navigation toolbar and the keyboard

- Hold down the active mouse button and drag the mouse to the edge of the map in the direction that you want to pan. The map pans as long as you hold down the button.

Setting Panning Increments

Panning is specified as a percentage of the map. The default increment for panning the map is 20% (1/5 of the window).

To change the pan increment:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Navigation tab (Figure 6-3).

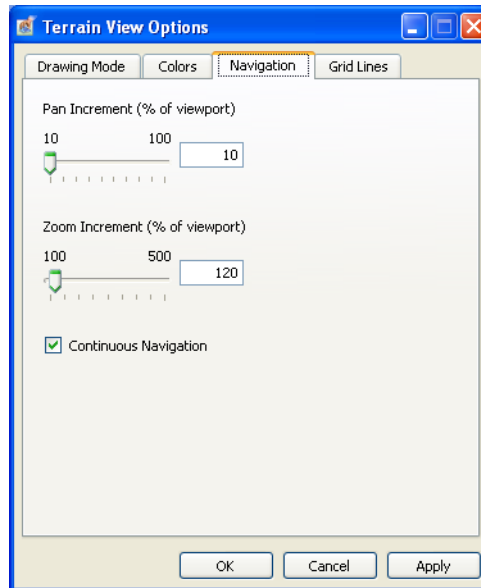


Figure 6-3. Terrain View Options dialog box, Navigation tab

3. Change the increment by moving the Pan Increment slider or entering a value in the text box.
4. Click OK.

6.2.2. Zooming the Map

You can zoom in and out on the map to vary the level of detail that you see.

To zoom the map, use one of the following methods:

- Click the Zoom In or Zoom Out buttons on the Navigation toolbar (Figure 6-4).

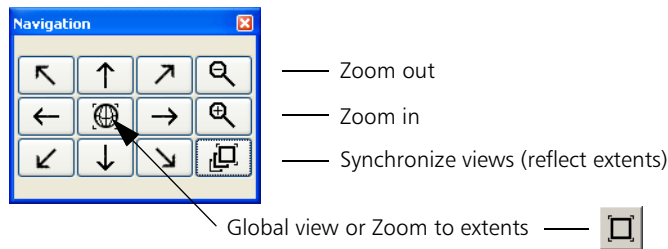


Figure 6-4. Zoom buttons

- To show the entire database, click the Global View button on the Navigation toolbar. If the Zoom to Extents button is displayed, click the terrain to show the Global View button.
- In the Navigation menu, choose the Zoom command for the direction you want to zoom.
- On your keyboard, press + (plus key) to zoom in; press – (minus key) to zoom out.
- Rotate the scroll wheel on the mouse forward to zoom in, backward to zoom out.



When you use the mouse wheel to zoom in or out, it zooms one increment for each click of the wheel.

The map zooms in or out around the center point of the map.

In the Terrain View Options dialog box, you can set the increment by which the map is zoomed. For details, please see “[Setting Zoom Increments](#),” on page 6-9.

Zooming in on an Area of a Map

- To zoom in on a specific area, hold down the **Shift** key and drag a bounding outline around the area on the map to zoom in on.

Zooming to Extents

You can select an object or objects and zoom the map to the extents of those objects. If no objects are selected, Zoom to Extents acts as Reset to Global View.

To zoom the map to the extents of the selected objects, use one of the following methods:

- ♦ Choose **Navigation** → **Zoom to Extents**.
- ♦ Press **5**.
- ♦ Click the Zoom to Extents button in the Navigation toolbar ([Figure 6-4](#)).

Setting Zoom Increments

The zoom increment is specified as a percentage of the screen. The default increment for zooming the display is 200, which increases or decreases magnification by two times the image size.

To change the zoom increment:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Navigation tab ([Figure 6-3](#)).
3. Change the increment by moving the Zoom Increment slider.
4. Click OK.

6.2.3. Enabling and Disabling Continuous Panning and Zooming

By default, when you press a navigation control on the Navigation toolbar, VR-Forces keeps panning or zooming while you press the control. You can enable and disable this feature.



The keyboard controls for panning and zooming always support continuous navigation.

To enable or disable continuous navigation:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Navigation tab ([Figure 6-3](#)).
3. To enable continuous navigation, select the Continuous Navigation check box. To disable continuous navigation, clear the check box.

6.2.4. Centering the Map View on an Object

You can focus on an object by centering the map on the object or by zooming to the extents of the object. (For details, please see “[Zooming to Extents](#),” on page 6-9.) If you use one of these methods to focus on an entity and the entity subsequently moves, the map view stays static and the entity may move out of the view. To follow an entity as it moves, track it. (For details, please see “[Tracking Entities](#),” on page 8-8.)

You can center only individual objects, not multiple objects.

To center an object on the map:

1. Select an object.
2. Choose **Navigation** → **Center Selection**.

6.2.5. Using the Minimap to Change the View

The Minimap shows a thumbnail version of the database, including where entities are located. It shows you the portion of the database that is currently displayed in the window, and it allows you to select a portion of the database to view.

As you resize the VR-Forces window, the rectangle in the Minimap adjusts to match the aspect ratio of the map.

- To select a portion of the map to view, draw a rectangle in the minimap that defines the area you want to view ([Figure 6-5](#)).



Figure 6-5. Viewing area rectangle in the Minimap

- To change the region being viewed without changing the size of the view, in the Minimap, click the center point of the area you want to view.



If you try to change the view with the Minimap and the view does not change, check to be sure you are not tracking an entity.

6.2.6. Using the Minimap with Multiple Windows

You can open multiple VR-Forces windows from an instance of the front-end. (This is not the same thing as running multiple front-ends. There is only one front-end executable running.) If you display multiple VR-Forces windows, the behavior of the Minimap varies as follows:

- If you start VR-Forces with the `-g` command-line option, it opens a global minimap, which is independent of the VR-Forces window (you cannot dock it). As you open additional VR-Forces windows, the Minimap displays a viewing area rectangle for each window.
- If you start VR-Forces without the `-g` option, each VR-Forces window has its own Minimap, which affects only its associated map.

Regardless of the type of Minimap, if you have multiple windows open, you can make it easier to associate the view area rectangles with VR-Forces windows by changing the color of the rectangle for each window. For more information, please see [“Changing the Color of the Minimap Rectangle,”](#) on page 6-12.

Using Multiple Independent Minimaps

If you are not using a global Minimap, each VR-Forces window you open has its own Minimap. You can undock the Minimaps. When you select a Minimap, its associated VR-Forces window becomes active.

Using a Global Minimap

In a global Minimap, the viewing area rectangle for the active window is solid. The other rectangles are dashed lines (Figure 6-6).

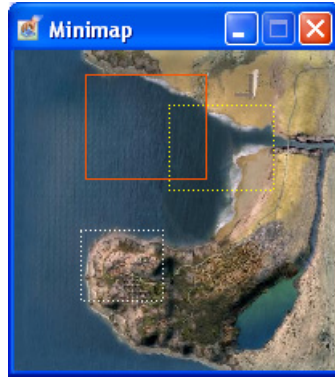


Figure 6-6. Minimap for multiple VR-Forces windows

- To specify use of a global minimap, start VR-Forces with the `-g` command line option.
- To change the active rectangle in a global Minimap window, select a different VR-Forces window, or right-click in the Minimap window until the desired rectangle is active.

6.2.7. Changing the Color of the Minimap Rectangle

To change the color of the Minimap rectangle:

1. Choose **Options** → **Minimap Color**. A color picker dialog box is displayed.
2. Select the color you want to use for the rectangle.
3. Click OK.

6.2.8. Resizing the VR-Forces Window

In addition to zooming and panning the canvas, you can resize the VR-Forces window to change your view of the exercise. If a window is showing the entire database and you resize the window, it may not show the entire database, depending on how the proportions of the resized window compare to the proportions of the database.

6.3. Controlling the View of Other Exercise Participants

You can synchronize (mirror the extents of) the map view of other players in an exercise to the view in your window. VR-Forces view control messages affect MÄK Plan View Display and VR-Forces applications that are listening to the same port. Views are sent in world coordinates, so they are applicable to different types of databases.

- To send a view control message, choose **Navigation → Reflect Extents**, or on the Navigation toolbar, click the Synchronize button (Figure 6-4).

6.3.1. Enabling and Disabling Continuous View Control Messages

When you click the Synchronize button, as described in the previous section, VR-Forces sends one view control message. You can enable continuous sending of view control messages, in which case all changes in the map extents are sent to other applications.

To enable continuous sending of view control messages, use one of the following procedures:

- ♦ Choose **Options → Always Mirror Extents**.
- ♦ Do the following:
 - a. Click and hold down the Synchronize button on the Navigation toolbar. The Lock Button dialog box opens.
 - b. Optionally, select Do Not Ask Again.
 - c. Click Yes.
- ♦ If you have previously selected Do Not Ask Again in the Lock Button dialog box, click the Synchronize button and hold it down for about a second. Then release the mouse button.
- To disable continuous view control messages, click the Synchronize button in the Navigation toolbar, or choose **Options → Always Mirror Extents**.

6.3.2. Enabling or Disabling Receipt of View Control Messages

If you disable the view control option in an application, it does not respond to view control messages, but can still send them. If you have multiple windows open from the same application, turning off view control for one turns it off for all of them.

- To enable or disable response to view control messages, choose **Options → View Control**.

6.4. Changing Display Settings

You can change settings that control which information gets displayed in a VR-Forces window and how the information is displayed. You change settings in the Display Options dialog box and the Terrain View Options dialog box. When you close VR-Forces, the settings get saved to the *vrGuiSettings.mtl* file. For details, please see “[Saving VR-Forces Settings](#),” on page 4-14.

6.4.1. Specifying the Coordinate System for the Terrain Information Toolbar

The Terrain Information toolbar ([Figure 6-7](#)) displays the location of the selected terrain point or entity in one of the following coordinate systems:

- ♦ Geocentric
- ♦ UTM
- ♦ Latitude and longitude
- ♦ MGRS
- ♦ Database.

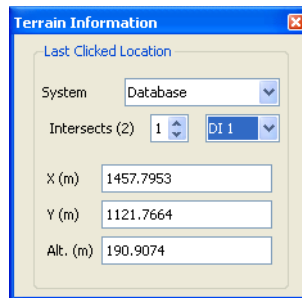


Figure 6-7. The Terrain Information toolbar

- To specify the coordinate system used in the Terrain Information toolbar, select an option from the System list.

6.4.2. Specifying the Drawing Mode

The drawing mode determines how a database is displayed. You can turn the following modes on and off:

- ♦ Polygons
- ♦ Features
- ♦ Wireframe
- ♦ Raster maps
- ♦ Terrain shading
- ♦ Contour lines.

To turn display of a drawing mode on or off:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Drawing Mode tab (Figure 6-8).

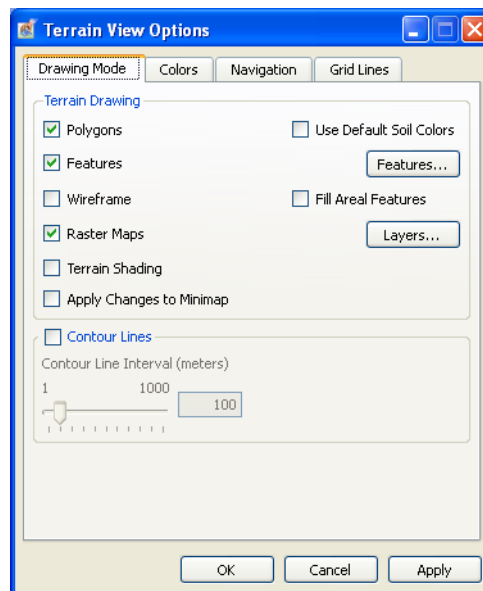


Figure 6-8. Terrain View Options dialog box, Drawing Mode tab

3. Select or clear the check box for the item you want to display or not display.
4. To apply the current changes to the Minimap, select Apply Changes to Minimap.
5. Click OK.

Using the Drawing Options Toolbar



Figure 6-9. Drawing Options toolbar

The Drawing Options toolbar (Figure 6-9) has the following buttons:

- ♦ Enable/Disable Polygon Drawing (1)
 - ♦ Enable/Disable Feature Drawing (2)
 - ♦ Enable/Disable Contour Line Drawing (3)
 - ♦ Enable/Disable Wire Frame Drawing (4)
 - ♦ Enable/Disable Terrain Shading (5)
 - ♦ Enable/Disable Raster Maps (6)
 - ♦ Enable/Disable Polygon Coloring Using Soil Type (7).
- To change the drawing mode using the Drawing Options toolbar, click the icon for the drawing mode that you want to display or hide.

Drawing Modes

This section illustrates the effect of displaying or hiding different drawing modes.

Polygons

Polygons describe the terrain.



Figure 6-10. Polygons on and off

Features

The Features check box turns the feature nodes in the terrain database on or off, if the database has them.

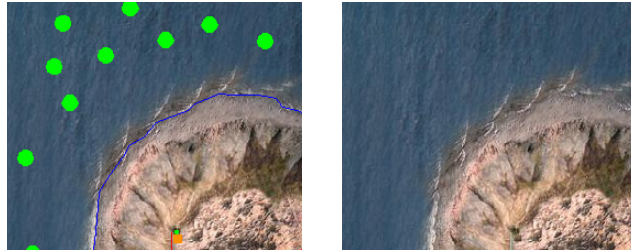


Figure 6-11. Features on and off

Wireframe

Wireframe mode shows the outline of the polygons.

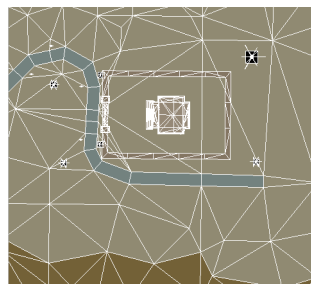


Figure 6-12. Wireframe on

Raster Maps

When raster maps are enabled, the bitmap picture of the map is displayed, if one is configured in the MTD file.

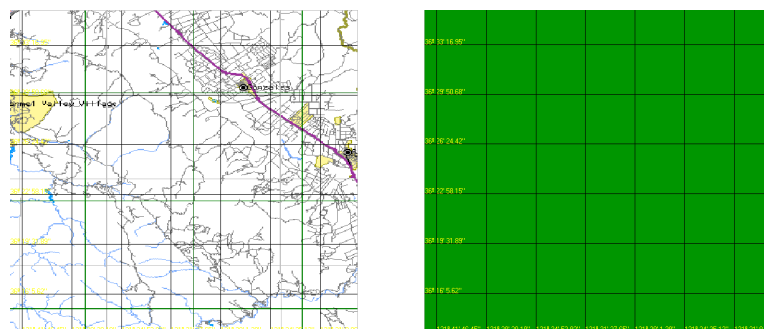


Figure 6-13. Papermap on and off

Terrain Shading

Terrain shading shows the contours of the terrain by varying the color according to height. Polygons must be displayed to display terrain shading.

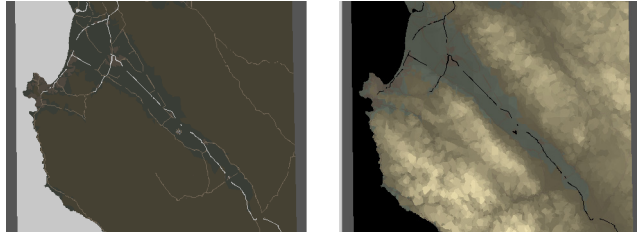


Figure 6-14. Terrain shading off and on

Contour Lines

Contour lines show changes in the height of the terrain. The interval between contour lines is determined by the Contour Line Interval slider.

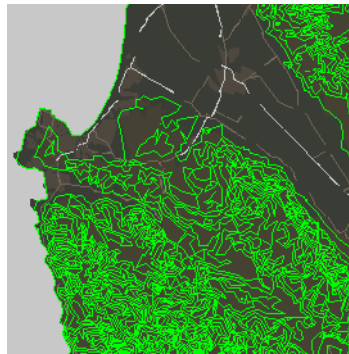


Figure 6-15. Contour lines

6.4.3. Specifying the Display of Raster Map Layers

If you are displaying raster maps and there is more than one layer, you can specify which layers to display. You can also specify the order in which layers are drawn. For example, the *Makland.mtd* terrain has four layers (Figure 6-17). Figure 6-16 illustrates the difference in the display between having the Makland Raster Image layer on top (the default), and having the Makland Map Image layer on top.

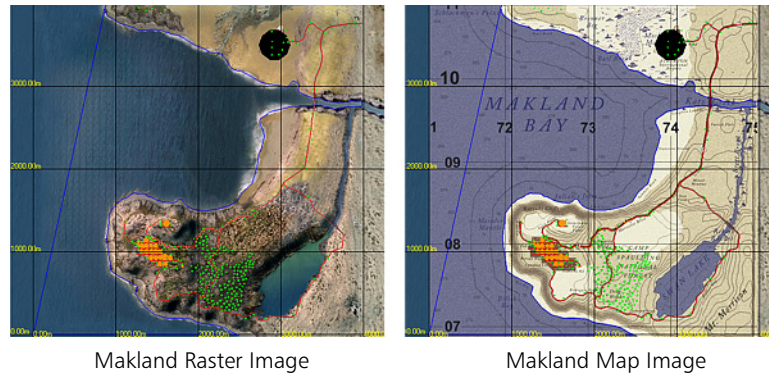


Figure 6-16. Effect of changing layer order

To display or hide raster map layers:

1. Choose **Options** → **Raster Map Layers**. The Raster Map Layers dialog box opens (Figure 6-17). It lists each of the layers in the MTD file.

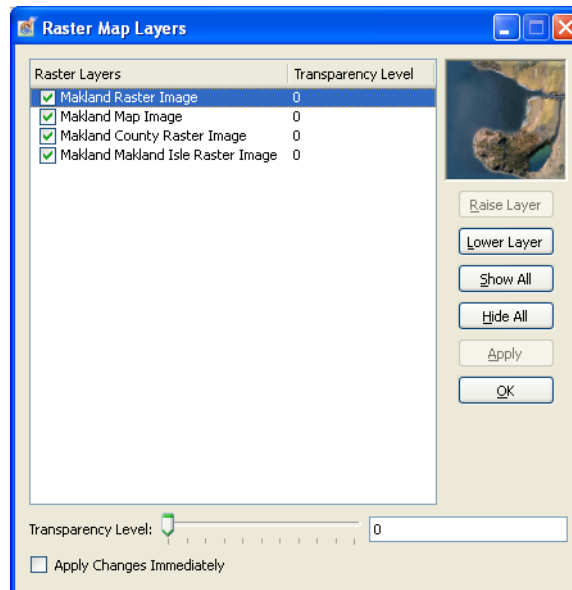


Figure 6-17. Raster Map Layers dialog box

2. To hide or display a particular layer, select or clear the check box next to the layer's name in the list.
 - To hide all layers, click the Hide All button.
 - To show all layers, click the Show All button.
3. To change the order in which layers are drawn, select a layer and click the Raise Layer or Lower Layer button.

4. To have changes take effect immediately, select the Apply Changes Immediately check box.
5. If you are not applying changes immediately, click Apply or OK.

6.4.4. Specifying the Transparency of Raster Map Layers

You can specify a degree of transparency for a raster map layer when you load raster map files, including multiresolution papermaps. This feature allows you to see the polygon data underlying the map. [Figure 6-18](#) illustrates the *Berkeley.mtd* terrain at three levels of transparency. (Feature data is enabled in all three pictures.)



Use of transparency can degrade performance.

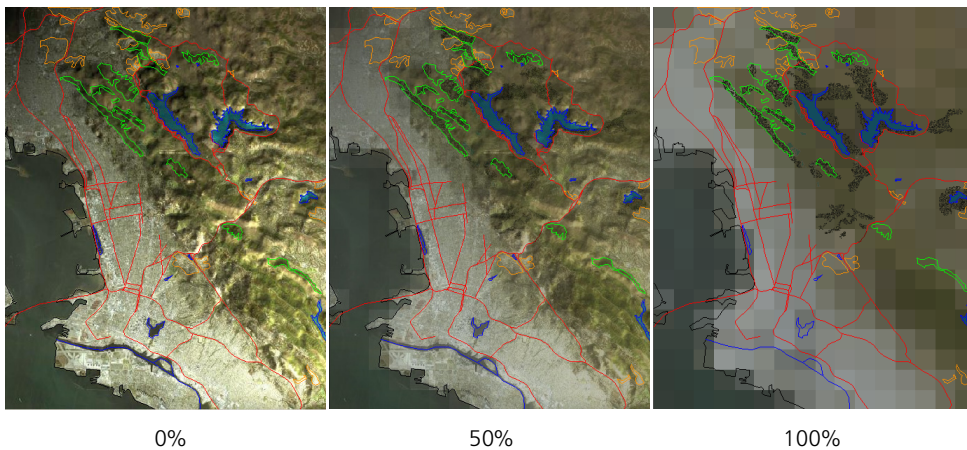


Figure 6-18. Setting transparency levels

To specify transparency of map layers:

1. Choose **Options** → **Raster Map Layers**. The Raster Map Layers dialog box opens ([Figure 6-17](#)).
2. Select the layer whose transparency you want to change.
3. Click the value in the Transparency Level column of the layer that you want to edit. The value becomes highlighted to indicate that it is editable.
4. Type a transparency value between 0 (opaque) and 100 (fully transparent).
5. Press **Enter**.



As an alternative to steps 3 through 5, you can adjust transparency using the Transparency Level slider (at the bottom of the dialog box).

6. Click Apply or OK.

6.4.5. Specifying the Display of Features

If you are displaying a database that has feature data, you can specify which features to display.

To display or hide feature data:

1. Choose **Options** → **Terrain Features**. The Terrain Features dialog box opens (Figure 6-19).

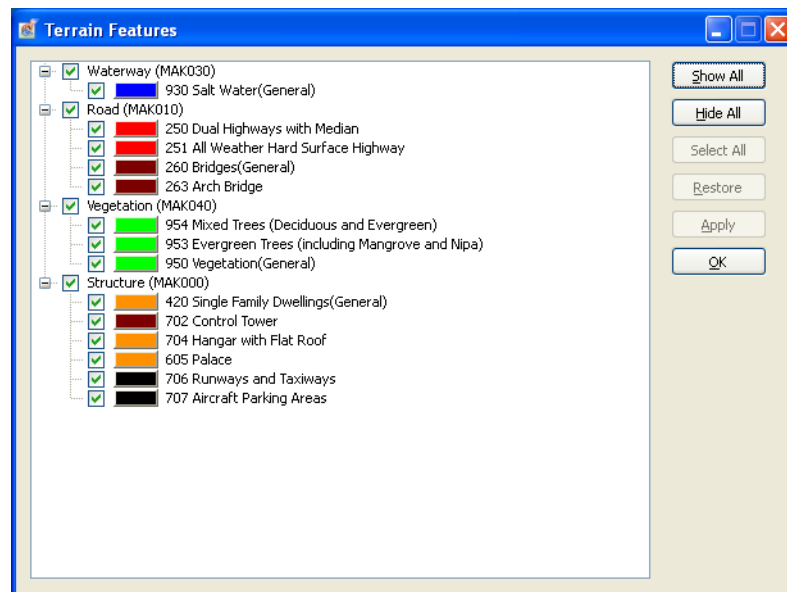


Figure 6-19. Terrain Features dialog box

2. To hide or display a particular feature, select or clear the check box next to the feature's name in the list.
 - To select all features, click the Show All button.
 - To unselect all features, click the Hide All button.
3. Click Apply or OK.

6.4.6. Using the Default Soil Colors

By default, terrain polygons are displayed using the color that was assigned to them when the database was imported to GDB. These hard-coded colors do not necessarily correspond to the soil type and polygons with the same soil type may have different hard-coded colors. You can specify that VR-Forces display polygons with the color associated with the soil type.

To display polygons with the color associated with their soil type:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens (Figure 6-8).
2. On the Drawing Mode tab, if the Polygons check box is cleared, select it.
3. Select the Use Default Soil Colors check box. (To display polygons with their hard-coded color, clear the Use Default Soil Colors check box.)
4. Click OK.

6.4.7. Specifying the Spacing of Contour Lines

To change the spacing of contour lines:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Drawing Mode tab (Figure 6-8).
3. Change the interval by moving the Contour Line Interval slider.
4. Click OK.

6.4.8. Specifying the Display of Grid Lines

You can toggle the display of grid lines on and off. You can also specify the spacing between grid lines.

To specify the display of grid lines:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Grid Lines tab (Figure 6-20).
3. Select or clear the Grid Lines check box.
4. Click OK.

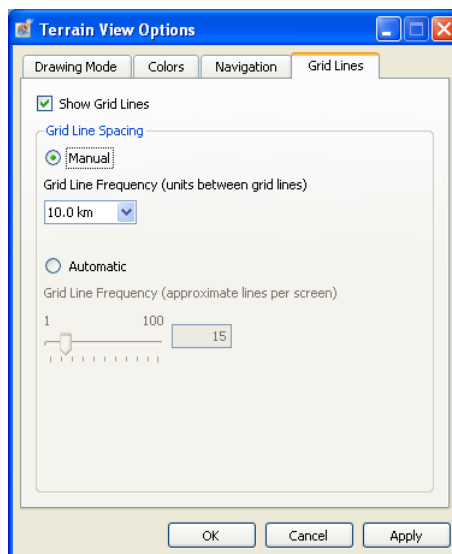


Figure 6-20. Terrain View Options dialog box, Grid Lines tab

Changing the Grid Line Spacing

VR-Forces maintains the distance between grid lines at powers of 10 of the current measurement unit, for example, every 10 meters, every 100 meters, and so on. (For information about measurement units, please see [“Changing Measurement Units,”](#) on page 6-27.) You can change the grid line spacing using manual mode or automatic mode. In either case, the number of grid lines in the display varies depending on the extent of the database that is displayed in the window.

In manual mode, you select the power of 10 to use for grid line spacing.

In automatic mode, you choose the number of grid lines you want to display along the longest dimension of the map. VR-Forces chooses the power of 10 that lets it display a number of grid lines that is as close to the amount specified as possible.

To change the spacing of grid lines:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Grid Lines tab ([Figure 6-20](#)).
3. If grid lines are not enabled, select the Grid Lines check box.
4. Specify automatic grid lines spacing as follows:
 - a. Select the Automatic option button.
 - b. Change the frequency by moving the Grid Line Frequency slider.

Specify manual grid lines spacing as follows:

- a. Select the Manual option button.
 - b. Select a frequency from the list.
5. Click OK.

6.4.9. Changing Terrain-Related Colors

You can change the colors assigned to:

- ♦ Contour lines
- ♦ Background
- ♦ Wireframe
- ♦ Grid lines
- ♦ Grid line labels.

To change a color setting:

1. Choose **Options** → **Terrain View**. The Terrain View Options dialog box opens.
2. Select the Colors tab (Figure 6-21).
3. Click the color button to the left of the option that you want to change. The Select Color dialog box opens. This is a color picker for your windowing system.
4. Select one of the existing colors or click Define Custom Colors to select any RGB value.
5. Click OK.
6. Click OK in the Terrain View Options dialog box.

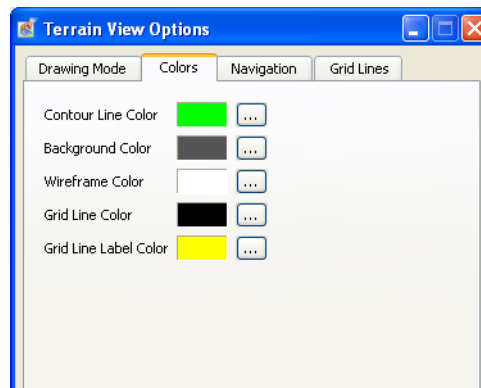


Figure 6-21. Terrain View Options dialog box, Colors tab

6.4.10. Configuring the Zoom Selection Box

You can configure the color and line thickness of the box that is drawn when you zoom in on the terrain by drawing a zoom selection box (Figure 6-22).



Figure 6-22. Zoom selection box

To change the color of the zoom selection box:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Colors tab.
3. Click the Browse button next to the Zoom Selection label. A color picker opens.
4. Select a color or create a custom color and click OK to exit the color picker.
5. Optionally, move the slider to change thickness of the Zoom Selection box.
6. Click OK or Apply.

6.4.11. Changing Measurement Units

You can specify the units used to display coordinate and distance measurements. Display units are configured by measurement type. This means that you can use different measurement units for different types of data. You can also specify the number of decimal places for measurement values. When you change a measurement display unit, the changes take effect immediately. They are saved and applied the next time you run VR-Forces.

The types of data and the display objects that they affect are as follows:

- ♦ Distance: Applies to task and set dialog boxes, terrain information, intervisibility lines, entity information, symbol information, and grid lines.



If you open a geodetic terrain, distance only applies to range information. Grid lines for geodetic databases take their precision from the Lat/Lon DMS coordinate system selection.

- ♦ Altitude: Applies to task and set dialog boxes, terrain information, intervisibility lines, entity information, symbol information, and grid lines.
- ♦ Velocity (Speed): Applies to task and set dialog boxes, entity information, and symbol information.
- ♦ Acceleration: Applies to entity and symbol information.
- ♦ Rotational Velocity: Applies to symbol information.
- ♦ Orientation (Heading): Applies to task and set dialog boxes, entity information, and symbol information.

To specify measurement units:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the General tab (Figure 6-23).
3. In the Display Units group box, select a measurement unit for each category from the drop-down list.
4. Type a precision for each measurement unit in the corresponding box in the Decimal Places column.

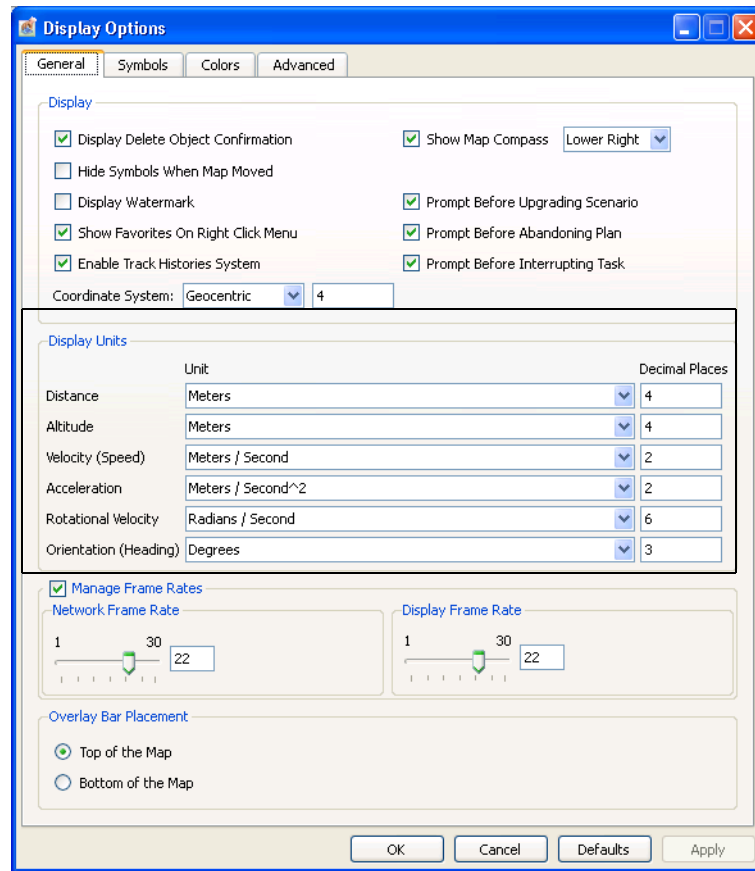


Figure 6-23. Display Options dialog box, General tab

5. Click OK.

6.4.12. Specifying the Coordinate System for Dialog Boxes

Some dialog boxes require you to enter the coordinates of a point on the map. You can specify which coordinate system these dialog boxes should use.



If you select the UTM coordinate system, grid lines are displayed using UTM coordinates. Otherwise, grid lines are drawn using the coordinate system of the terrain database.

To specify the coordinate system used in dialog boxes:

1. Choose **Options** → **Display**. The Display Options dialog box opens ([Figure 6-23](#)).
2. On the General tab, in the Display group box, select an option from the Coordinate System list.
3. Type a value for the number of decimal places to use in coordinate values in the box next to the Coordinate System list.
4. Click Apply or OK.

6.4.13. Displaying the Compass

Depending on the location of a terrain database, a heading of 0 degrees might not align with true North. To help identify discrepancies between an entity's heading and the compass directions, you can display a compass on the map.

To display a compass on the map:

1. Choose **Options** → **Display**. The Display Options dialog box opens ([Figure 6-23](#)).
2. On the General tab, in the Display group box, select Show Map Compass.
3. Select a location for the compass from the drop-down list.
4. Click Apply or OK.

6.4.14. Displaying a Watermark

You can display a semi-transparent watermark on the map, for example a company logo.

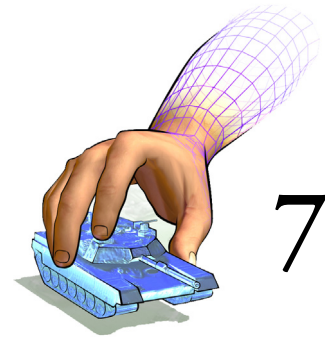
To display a watermark:

1. Choose **Options** → **Display**. The Display Options dialog box opens ([Figure 6-23](#)).
2. On the General tab, in the Display group box, select the Display Watermark checkbox.
3. Click Apply or OK.

Configuring the Display of Watermarks

To configure the watermark that is displayed and its location, edit the following parameters in *vrfGui.mtl*:

- ♦ **enableLogoOverlay** enables (1) or disables (0) display of a watermark.
- ♦ **overlayLogoFile** specifies a raster image to use as a watermark.
- ♦ **overlayLogoPosition** specifies the location of the watermark as a number from 1 through 9, where each number represents a location on the screen equivalent to its location on the numeric keypad on a typical computer keyboard.
- ♦ **overlayLogoScaleFactor** specifies the amount to scale the raster image. Default: 1.0 (no scaling).
- ♦ **overlayLogoPositionX** and **overlayLogoPositionY** specify the location of the watermark in pixels. These parameters override **overlayLogoPosition**.



Managing Objects

This chapter describes procedures and features that are common to entities, control objects, and overlay objects.

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7.1. The Objects List Panel

There is a great deal of similarity in how you select, move, and view the different types of objects. You can manage them on the map, to some extent from the keyboard, and in the Objects List Panel, which is the central repository of object information.

The Objects List Panel, on the Objects tab of the Utility toolbar, has the following views:

- ♦ Entity list: displays entities in the simulation (Figure 7-1)
- ♦ Environmentals list: lists control objects and overlay objects (Figure 7-1)
- ♦ Echelon view: displays the entity hierarchy (Figure 7-1)
- ♦ Embarkation view: displays the embarkation relationships of entities (Figure 7-2)
- ♦ Selection groups: allows you to manage object selection groups (Figure 7-2).

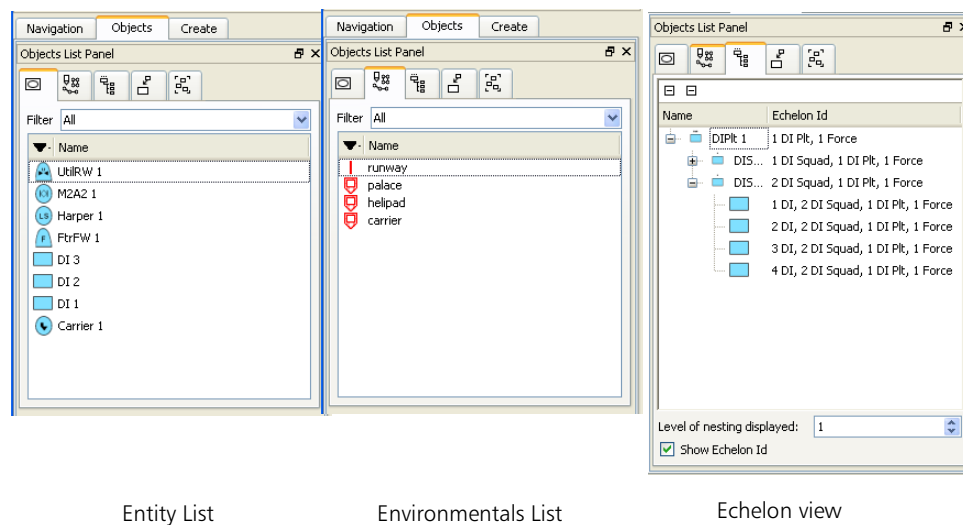


Figure 7-1. Objects List Panel

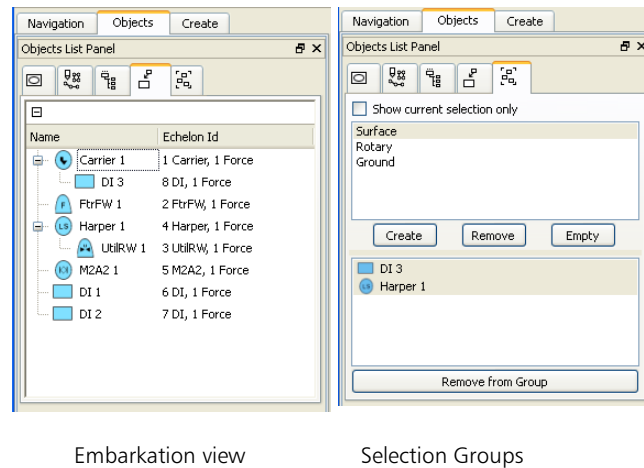


Figure 7-2. Objects List Panel

7.2. Selecting Objects

You can select objects from the Objects List Panel or directly on the map. When you select an object, its border color changes to white.



To select entities, you must be in Select Objects mode. For details, please see the next section.

7.2.1. Choosing the Selection Mode

Selection modes constrain which types of objects you can select. This can be useful if you want to select objects by dragging a bounding outline on the map, but only want to select objects of a certain type within the area of the selection box. VR-Forces has the following selection modes:

- Objects – lets you select all object types
- Features – lets you select terrain features, if present
- Entities – only entities can be selected
- Aggregates – only aggregate entities can be selected
- Control Objects – only control objects can be selected
- Overlay Objects – only overlay objects can be selected.



You cannot select features by dragging a bounding box around them.

- To set the selection mode, choose **Objects** → **Select** → *object_type*, or on the Selection Mode toolbar (Figure 7-3), select a mode from the list.



Figure 7-3. Selection Mode toolbar

7.2.2. Selecting Objects on the Map and Overlays

To select objects on the map or on an overlay, use any of the following mouse actions:

Mouse Action	Result
Click the object.	Selects an object.
Ctrl -click the object.	Selects multiple objects one at a time.
Draw a bounding outline around the objects you want to select.	Selects multiple objects.
Right-click the object.	If no objects are selected, right-clicking selects an object and displays the popup menu. If one or more objects are selected, right-clicking a selected object maintains the selection and displays the popup menu. Right-clicking an unselected object changes the selection to the object you right-clicked.

When you select an object on the map, the views on the Objects List Panel add a gray highlight to the entry for the object to indicate that it is selected.

7.2.3. Selecting Objects in the Objects List Panel

The Objects List Panel has several views of the objects in a scenario.

To select an object in the Objects List Panel:

1. Select a view in the Objects List Panel.

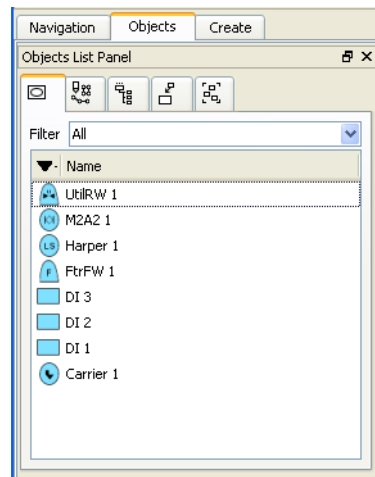


Figure 7-4. Objects List Panel - Entity List view

2. Locate the object you want to select. You can filter the list to make it easier to find particular objects. (For details, please see [“Filtering the Object Lists,”](#) on page 7-7.) Disaggregate and expand aggregates if necessary.
3. Click the entry for the object. The selected object is highlighted in the Objects List Panel view and on the map.
4. Optionally, select multiple objects, as follows:
 - **Shift**-click to select a contiguous range of entities
 - **Ctrl**-click to select multiple non-contiguous entities.

Iterating through the Object Lists

You can select objects in an object view sequentially from menu commands and from the keyboard. VR-Forces iterates through the current view of the list. If you change the filters in effect, the list of objects through which you can iterate changes.

To iterate through the entity view, do one of the following:

- ♦ Choose **Navigation** → **Next Entity** or press . (period).
- ♦ Choose **Navigation** → **Previous Entity** or press , (comma).

To iterate through the environmental object list, do one of the following:

- ♦ Choose **Navigation** → **Next Environmental** or press >.
- ♦ Choose **Navigation** → **Previous Environmental** or press <.

Filtering the Object Lists

You can filter the display in the Entities List and the Environmental List.

- To filter the display of objects, select a category to view from the list at the top of the toolbar ([Figure 7-4](#)).

7.2.4. Unselecting Objects

To unselect objects on the map or on an overlay, choose one of the options in [Table 7-1](#).

Table 7-1: Unselecting objects on the map

Action	Result
Click on the map away from the selected object or objects.	Unselects all objects.
Click a selected object.	If multiple objects were selected, deselects all except the object you clicked.
Ctrl -click a selected object.	Unselects the object. If multiple objects were selected, does not unselect other objects.

To unselect objects on the Objects List Panel, choose one of the options in [Table 7-2](#).

Table 7-2: Unselecting objects in the Objects List Panel

Action	Result
If one object is selected.	Ctrl -click the object.
If a group of objects is selected:	
Ctrl -click an object.	Unselects the object without affecting other selections.
Click an object.	Selects the clicked object and unselects all other objects.

7.3. Hiding and Displaying Objects by Category

You can hide or display objects based on the following categories:

- ♦ Aggregate formation routes
- ♦ Control objects
- ♦ Destroyed objects
- ♦ Embarkation routes
- ♦ Friendly objects
- ♦ Intervisibility objects
- ♦ Landing routes
- ♦ Neutral objects
- ♦ Opposing objects
- ♦ Overlay objects
- ♦ Path planning routes
- ♦ Tactical smoke
- ♦ Stealth icon.

To display or hide objects by category:

1. Choose **Objects** → **View Objects** → *category*, where *category* is one of the listed object types.
2. Select the check box to display an object type. Clear the check box to hide it.

7.3.1. Hiding and Displaying Objects by Overlay

You can hide and display the objects on individual overlays. An open eye icon indicates the overlay is visible. A closed eye indicates the objects are hidden.

- To hide and display overlay objects by overlay, on the Overlay toolbar or in the Overlay Manager, click the Eye icon (Figure 7-5) for the layer whose objects you want to show or hide.



Figure 7-5. Overlay toolbar

7.4. Creating and Using Selection Groups

Selection groups are named subsets of the objects in an exercise. Their purpose is to allow you to quickly select specific objects without needing to locate them on the map or in the Objects List Panel and select them individually. Using selection groups can be helpful if you want to quickly select a group of objects that do not fit neatly into the default filter options on the other object tabs, for example a mix of friendly and opposing forces and graphical objects. The group definitions are saved and loaded as part of the scenario.

An object can be in multiple selection groups.

7.4.1. Creating a Selection Group

To create a selection group:

1. Select the objects that you want to group together.
2. On the Objects List Panel, select the Selection Group view (Figure 7-6).

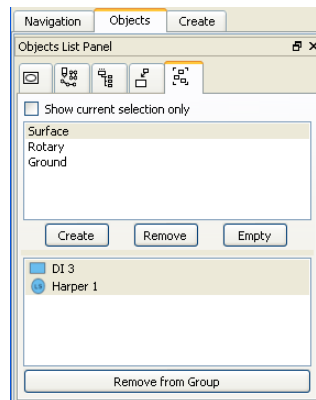


Figure 7-6. Objects List Panel - Selection Group view

3. On the Selection Groups view, click Create, or choose **Objects** → **Selection Groups** → **Create Selection Group**. The New Selection Group dialog box opens.
4. Type a name for the selection group.
5. Click OK. The group is added to the group list.

7.4.2. Selecting a Selection Group

To select a selection group, use one of the following methods:

- ♦ In the Selection Groups window, click the group that you want to select.
- ♦ Choose **Objects** → **Selection Groups** → **Select** → *selection_group_name*.

7.4.3. Adding Objects to a Selection Group

You can add objects to a group and remove objects from a group.

To add objects to a selection group:

1. Select the objects you want to add to a group.
2. Choose **Objects** → **Selection Groups** → **Add To** → *group_name*, where *group_name* is one of the groups listed on the pull right menu. You can also drag the objects onto the group name in the Selection Groups list.

7.4.4. Removing Objects from Selection Groups

You can remove objects from a specific selection group and you can remove an object from all selection groups.

To remove an object from a selection group:

1. In the Objects List Panel, select the group from which you want to remove an object.
2. On the map or in the group members list, select the object that you want to remove from the selection group.
3. In the Objects List Panel, click Remove From Group. The object is removed from the selected group.



If you select an object on the map, but its selection group is not selected in the Objects List Panel, clicking Remove From Group has no effect.

To remove an object from all selection groups:

1. Select the object.
2. Choose **Objects** → **Selection Groups** → **Remove from All Selection Groups**. The object is removed from all selection groups in which it is a member.

7.4.5. Emptying a Selection Group

Emptying a selection group removes all the members of the group, but leaves the group in the selection group list so that you can add objects to it at a later point.

To empty a selection group:

1. In the Objects List Panel, select the group you want to empty.
2. Click Empty.

7.4.6. Deleting a Selection Group

Deleting a selection group does not delete the objects from the scenario.

To delete a selection group:

1. In the Objects List Panel, select the group you want to remove.
2. Click Remove.

7.5. Moving Objects

You can move an object in the following ways:

- ♦ Drag the object from one point on the map to another
- ♦ Drag an entity from the Echelon View to a new location
- ♦ Move an object from one layer to another
- ♦ Set the location of an entity.

Dragging an entity from the Echelon View can be convenient if you want to move an entity from a location that is currently not visible in the map to a visible portion of the map.



You can only move objects simulated by VR-Forces.

For information about setting the location of an entity, please see [“Set Location,”](#) on page 12-18.

7.5.1. Dragging an Object to a New Location

To drag an object from one point on the map to another:

1. Place the cursor over the object you want to move.
2. Press and hold the left mouse button.
3. While holding the mouse button, drag the object to a new location.
4. Release the mouse button.



- ♦ You can drag multiple objects of different types.
 - ♦ You can drag objects from one VR-Forces window to another.
-

7.5.2. Dragging an Entity to a New Location from the Objects List Panel

You can drag an entity from the Echelon View or the Embarkation View to a new location on the map. This can be convenient if you want to move an entity from a location that is currently not visible in the map to a visible portion of the map.

To move an entity by dragging it from the Objects List Panel to a point on the map:

1. In the Echelon View or Embarkation View, select the entity that you want to move.
2. Drag it to the location on the map where you want to place it.



You can move multiple entities with this method. They maintain their spatial relationship.

7.5.3. Canceling a Drag-and-Drop Move

- To cancel a move made by dragging an object, press **Escape** while you are still holding down the left mouse button.

7.5.4. Undoing or Redoing an Object Move

The Undo and Redo options apply to moving objects.

- To undo an object move, choose **Objects** → **Undo** (or **Redo**).

7.6. Copying and Pasting Objects

You can copy objects and paste the copies elsewhere in a scenario or even in another scenario. The Paste Special option allows you to specify which entity characteristics you paste.

VR-Forces copies the following data about an object:

- ♦ Environmental objects:
 - Original name
 - Label
 - Force
 - Color
 - Appearance (line width, fill style, and so on)
- ♦ Entities:
 - Original name
 - Label
 - Force
 - Heading
 - Appearance (lights, landing gear, and so on)
 - Rules of engagement
 - Plan
- ♦ Aggregate entities copy the same information as individual entities plus the list of subordinates.

VR-Forces does not copy:

- ♦ The current task.
- ♦ State information, except as noted previously.
- ♦ Load balancing status. All objects get pasted into the currently selected back-end.
- ♦ Embarkation structures. If, for example, you copy an aircraft carrier that has planes embarked, only the carrier is copied, not the embarked entities.



The copy/paste process is resource intensive. It is primarily for use during scenario development. Use during a simulation could affect performance.

7.6.1. Copying Objects

To copy objects:

1. Select the objects you want to copy.
2. Choose **Objects** → **Copy**.

7.6.2. Pasting Objects

A simple paste pastes all of the attributes of an object that get copied. It pastes objects as follows:

- ♦ Local (non-published) objects get pasted into the front-end. They do not get published.
- ♦ Overlay objects are placed on the currently selected overlay. If you copied objects that were on different overlays, that differentiation is not preserved.
- ♦ Entities are placed on the map. If copied entities were on layers, that information is not preserved.
- ♦ Copied objects maintain the state at the time that they were copied. Therefore, if you paste objects some time after they were initially copied, the copies do not reflect any changes that may have taken place to the original entities. For example, if an entity was copied and then deleted, the copied version of the entity is still pasted.
- ♦ Embarkation structures are not copied, only the parent entity.



Pasting entity plans may have unexpected consequences, because their object references do not change when you copy them. For example, suppose the plan for Entity A refers to Waypoint 1. You copy Entity A and Waypoint 1 and paste them as Entity B and Waypoint 2. If you copy the plan, Entity B's plan will still refer to Waypoint 1. If you expected it to refer to Waypoint 2, you will not see the behavior you expected. You can choose not to paste plans. For details, please see [“Pasting Specific Entity Characteristics,”](#) on page 7-15.

To paste the objects in the copy buffer.

1. Choose **Objects** → **Paste**. The objects in the save buffer are displayed on screen. They float as you move the cursor to show you where they will be placed when you paste them.
2. Click on the map where you want the objects to be pasted. They are pasted in the relative positions in which they were copied.
3. Optionally, continue pasting additional copies if desired.
4. Right-click to exit paste mode.

7.6.3. Pasting Specific Entity Characteristics

When you paste entities, you can specify which of the following entity characteristics you want to paste with the entity:

- ♦ Plans.
- ♦ Appearance.
- ♦ Heading.
- ♦ Rules of engagement.
- ♦ Entity name. (If you are pasting an entity in its original scenario, you must paste with a new name. However if you are copying it to another scenario, you might want to keep the same name.)

To use Paste Special:

1. Choose **Objects** → **Paste Special**. The Paste Special dialog box opens.



Figure 7-7. Paste Special dialog box

2. By default, all options are selected. Clear the check boxes for the options you do not want to paste. If you are pasting entities into the scenario from which they were copied, you must paste with new names. Clearing that option will cause the paste to fail.
3. Click OK. The objects in the save buffer are displayed on screen. They float as you move the cursor to show you where they will be placed when you paste them.
4. Click on the map where you want the objects to be pasted. They are pasted in the relative positions in which they were copied.
5. Optionally, continue pasting additional copies if desired.
6. Right-click to exit paste mode.

7.7. Displaying Information About an Object

You can display information about individual objects, including entities, aggregates, environmental objects, and Stealths (Figure 7-8 and Figure 7-9). You cannot edit this information.

You can display a limited amount of object information in the entity list and the environmental list. (For details, please see “Displaying Object Information in the Objects List Panel,” on page 7-18.)

To display an object information dialog box, use one of the following methods:

- ♦ Select an object and choose **Objects** → **Information**.
- ♦ Double-click an object on the map, or in the Objects List Panel.

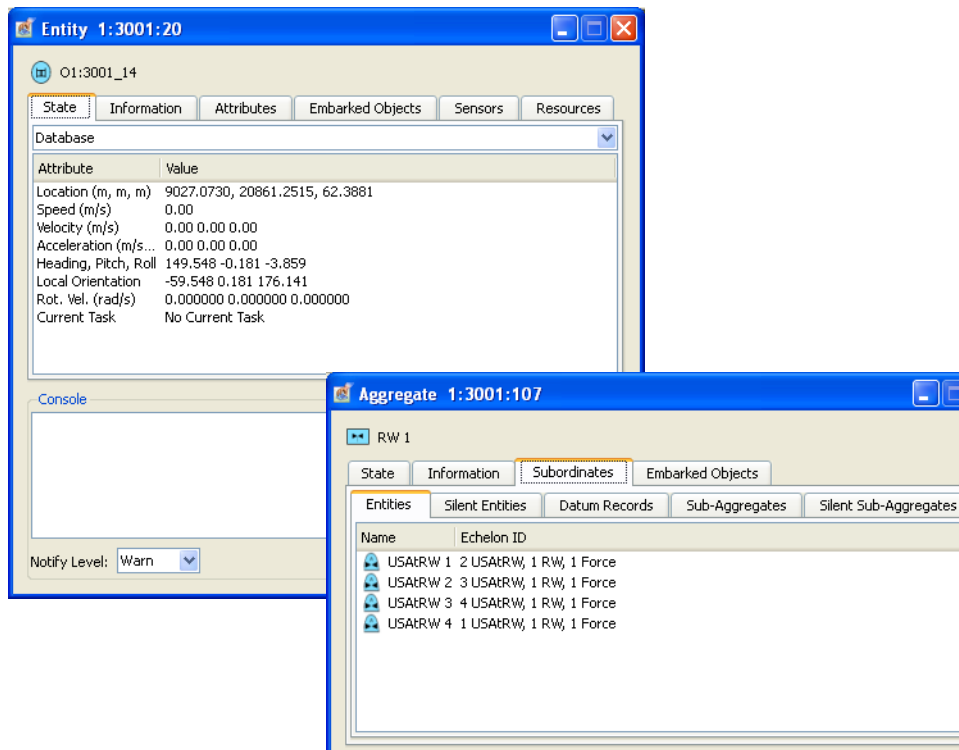
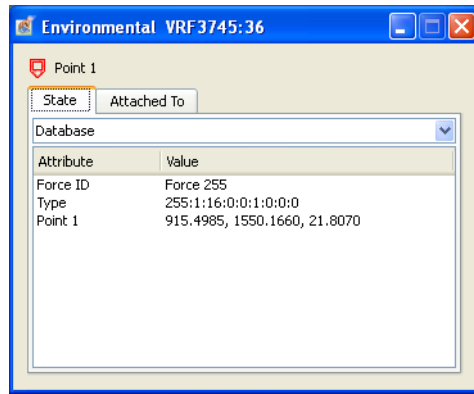


Figure 7-8. Entity and aggregate information dialog boxes

Environmental Object Information dialog box



Stealth Information dialog box

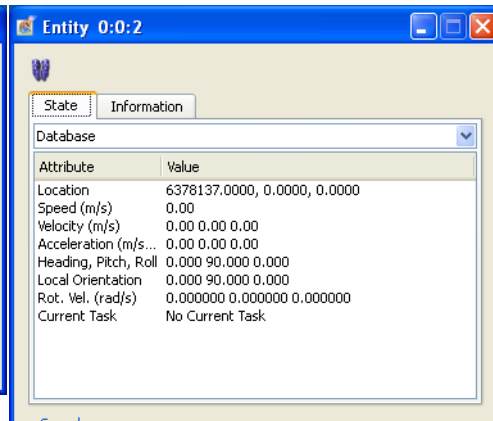


Figure 7-9. Information dialog boxes

7.7.1. Displaying Object Information in the Objects List Panel

You can display or hide several columns of object information in the Entities list and Environmentals list. In the Entities view, you can display:

- Name
- Entity type
- Entity ID
- Location
- Speed
- Velocity.

In the Environmentals list, you can display:

- Name
- Entity type
- Entity ID.

To display or hide a column of object information:

1. In the Entities list or Environmentals list, click the downward pointing arrow in the first column. A list of information types is displayed ([Figure 7-10](#)).

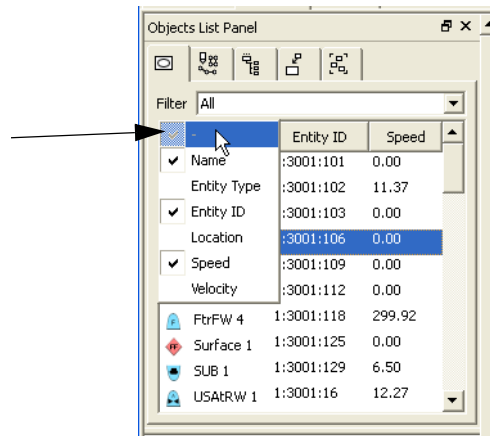


Figure 7-10. Object information options

2. Click the information type that you want to display or hide. The appropriate column is added to or removed from the list window.

7.8. Assigning Objects to Overlays

Entities and control objects always get placed on the map when you create them. However, you can assign them to overlays. The principal benefits to assigning objects to overlays are the ability to hide them by hiding the overlay, and to prevent them from being edited, by locking the overlay. For details about hiding and locking overlays, please see Chapter 16, [Overlays and Graphical Objects](#).

You can move objects between overlays just as you would overlay objects. For details, please see [“Moving an Object to a Different Overlay,”](#) on page 16-24.

To assign an object to an overlay:

1. Select the object you want to assign to an overlay.
2. Choose **Objects** → **Overlay Assignment** → **Add To** → *overlay*, where *overlay* is the name of an existing overlay.

7.8.1. Assigning an Object to a New Overlay

If you have not yet created any overlays, you can create one and assign an object to it in one procedure.

To create a new overlay and assign an object to it:

1. Select the object you want to assign to the new overlay.
2. Choose **Objects** → **Overlay Assignment** → **New Overlay**. The New Overlay dialog box opens.
3. Type a name for the new overlay.
4. Click OK. The new overlay is created and the object is assigned to it.

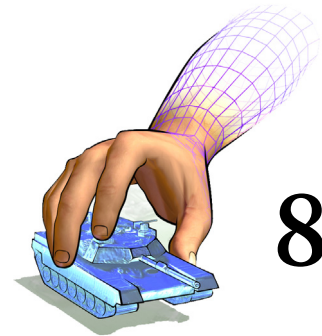
7.8.2. Removing an Object from an Overlay

To remove an entity or control object assignment from an overlay:

1. Select the objects you want to remove from their overlays.
2. Choose **Objects** → **Overlay Assignment** → **Remove from Overlay**. The objects are removed from their layers.

7.9. Creating Cultural Features

Cultural features are objects that you can add to a scenario to simulate human artifacts such as buildings, bridges, and so on. They are listed as a category on the Create menu and the Entity Palette. You add them to a scenario the same way you would add an entity. For details, please see [“Creating Entities,”](#) on page 8-3.



Creating and Managing Entities

This chapter explains how to create and manipulate entities. For information about working with aggregate entities, please see Chapter 9, *Working with Aggregate Entities*. For information about managing entity information, please see Chapter 10, *Displaying Entity Information*. For information about entity hostility relationships, target detection, and target acquisition, please see Chapter 13, *Target Detection and Combat Features*. For information about assigning tasks and set data requests to entities, please see Chapter 11, *Assigning Tasks* and Chapter 12, *Issuing Set Data Requests*.

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8.1. Introduction

In “[Local Objects and Remote Objects](#),” on page 3-12, we described the difference between local entities and remote entities. The following procedures in this chapter apply only to local entities:

- ♦ Creating and deleting entities
- ♦ Setting entity parameters
- ♦ Creating, deleting, and manipulating aggregates
- ♦ Displaying echelon data for an entity
- ♦ Using spot reports
- ♦ Entity embarkation
- ♦ Displaying resource status.

The following procedures in this chapter apply to all entities:

- ♦ Selecting and deselecting entities
- ♦ Tracking entities
- ♦ Displaying entity information
- ♦ Displaying entity labels, except echelon information and resources.

8.2. Creating Entities

Although most of the information about entities that is described in this chapter applies to aggregate entities also, the procedure for creating aggregate entities is different from that of creating individual entities. Creating entities in the 3D Front End is somewhat different than the 2D GUI. Please see *VR-Forces 3D Front End Users Guide* for details. To learn how to create an aggregate, please see “[Creating Aggregates](#),” on page 9-4.



You can also create entities by copying existing entities. For details, please see “[Copying and Pasting Objects](#),” on page 7-13.

To create a new entity:

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.
2. Choose **Create** → *Entity_category* → *ForceType* → *Entity_type*, where:
 - *Entity_category* is a category of entity, such as Ground or Lifeform
 - *ForceType* is Friendly, Opposing, or Neutral
 - *Entity_type* is a specific type within the category, such as M1A2 or T80.
3. If you want to specify an altitude for the entity as you create it, follow the procedure in “[Specifying an Altitude for a New Entity](#),” on page 8-6. Otherwise, click on the map where you want to place the entity. You can continue clicking to create multiple instances of the selected entity type.
4. Right-click to exit create mode.

The force ID of the entity is set to the type specified in the simulation model set.



The Create menu is configurable (please see Section 5.10, “[Editing the Create Menu](#)” in *VR-Forces Configuration Guide*). If you change the menu configuration, the menu paths described in this chapter may not be accurate.

8.2.1. Using the Entity Palette to Create Entities

The Entity Palette is an alternative to the Create menu for creating entities. It offers a point and click interface and a favorites list for your most frequently created entity types.

To create an entity from the Entity Palette:

1. On the Utility toolbar, select the Create tab (Figure 8-1).



Figure 8-1. Entity Palette

2. In the Categories drop-down list, select the category of entity you want to create, for example, Ground, Surface, or Aggregate. The entity list updates to show the entities of this type and the currently selected force that are available to create.
3. In the Force drop-down list, select the force for the entities that you want to create. The entity list updates to show the entities for this force and the selected category that are available to create.
4. Optionally, select the Show Entity Type check box to add entity type enumerations to the names in the list.
5. Click the entity that you want to create.

6. If you want to specify an altitude for the entity as you create it, follow the procedure in [“Specifying an Altitude for a New Entity,”](#) on page 8-6. Otherwise, click on the map where you want to place the entity. You can continue clicking to create multiple instances of the selected entity type.
7. To exit create entity mode, right-click.

Creating a Favorites List for Entity Creation

If you frequently create certain types of entities, you can avoid the necessity to repeatedly filter the Entity Palette list by creating entities from the Favorites tab. The Favorites list shows all specified entities without regard to category or force. You create entities from the list the same way you would create an entity from the Objects tab.

Favorites get saved to *./config/vrfGuiSettings.mtl*. Therefore, if you delete the settings file or start VR-Forces without it, the favorites will not be available.

To add an entity to the Favorites list:

1. Filter the Entity Palette, Objects tab to show an entity that you want to add to the Favorites list.
2. Right-click the entity and choose Add to Favorites. The entity is added to the Favorites list.

8.2.2. Default Placement of New Entities

By default, ground, lifeform, rotary-wing, and fixed-wing entities get placed on the ground. Surface and subsurface entities are created at sea level.

Ground-based entities are placed at the highest possible terrain intersection at the location. If a terrain supports buildings with multiple levels, the entity is placed at the highest level. Once the entity begins moving, if the next calculated location resides in-between two levels of terrain, and if the entity is configured to respect terrain intersections when moving, and there is no terrain blocking its movement, the entity places itself at the closest elevation to the desired location.

8.2.3. Specifying an Altitude for a New Entity

By default, land-based entities are placed on the ground (as described in “[Default Placement of New Entities](#),” on page 8-5). However you may want an entity to be placed at an altitude other than the default location. For example, you might want a lifeform to be placed inside a building, or a helicopter to start the scenario already in the air. You have two options for setting the altitude of a new entity. You can use the Set Altitude set data request to set the altitude after you create the entity, or you can set the altitude as part of the creation process.

To set an entity’s altitude as part of the creation process:

1. Select the entity type to be created on the Create menu or on the Entity Palette.
2. **Ctrl**-click the location where you want to create the entity. The Altitude and Heading dialog box opens ([Figure 8-2](#)).



The cursor remains in create mode while you fill out the dialog box.

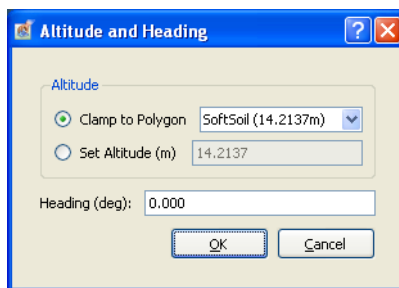


Figure 8-2. Altitude and Heading dialog box

4. To set the altitude, choose one of the following options:
 - To place the entity on a polygon, choose Clamp to Polygon and select a polygon from the list. This option is most useful when you are placing the entity on a portion of the database that has multiple levels, such as a building.
 - To set the altitude to a specific height, choose Set Altitude Manually and type the altitude, in meters. This option is best to place an entity in the air.
5. To set the heading, type a heading in the Heading box.
6. Click OK. The cursor is still in create mode, so you can continue to create entities of this type.

8.2.4. Editing an Entity's Name

When you create an entity, VR-Forces gives it a name based on its category in the object parameter database. You can change the name to something more meaningful. For example, VR-Forces might name a platoon `P1t 1`. You could change it to something like `1st P1t`, or `1/A/4-37`. You can also give an entity a label. For more information about naming entities, please see [“How Entities are Identified,”](#) on page 3-13.



Changing an entity's name can invalidate plan statements that refer to it. For details, please see [“Name Changes Can Invalidate Plan Statements,”](#) on page 15-31.

To edit an entity's name:

1. Select the entity.
2. Choose **Objects** → **Edit**. The Edit Entity dialog box opens ([Figure 8-3](#)).

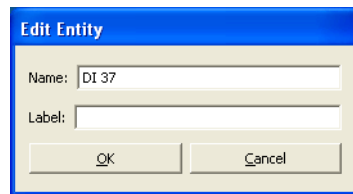


Figure 8-3. Edit Entity dialog box

3. Type a name for the entity in the Name text box.
4. Optionally, type a label for the entity in the Label text box.
5. Click OK.



Entity names have the following restrictions on their length:

- ♦ Entities – 11 characters
- ♦ Aggregates – 10 characters in HLA exercises, 32 characters in DIS.

If you are using a character set that requires multiple ASCII characters to represent a visible character, entity and aggregate names will need to be correspondingly shorter.

8.2.5. Entity Resources

When you create an entity, it has a full complement of resources, as defined in the object parameter database. You do not have to assign resources to an entity when you create it. However, if you want an entity to start a simulation with less than a full set of resources, you could use Set Resource set data requests to set its resources at some amount less than 100%.

8.2.6. Deleting Entities

To delete an entity:

1. Select the entity you want to delete.
2. Choose **Objects** → **Delete** or press the **Delete** key.



- ♦ If you delete an aggregate entity, all its subordinates also get deleted.
 - ♦ If you delete an entity that has an intervisibility object pinned to it, the intervisibility object also gets deleted. For details, please see “[Deleting Intervisibility Objects](#),” on page 18-16.
-

8.3. Tracking Entities

When you track an entity, VR-Forces follows the entity, keeping it roughly centered in the window, panning if necessary. You can also track an entity’s progress along a line.

8.3.1. Tracking Entities on the Map

To track an entity:

1. Select the entity you want to track.
2. Choose **Navigation** → **Track Selection**.

Stopping Tracking

- To stop tracking entities, choose **Navigation** → **Clear Tracking**.

8.3.2. Tracking Entities Along a Line

You can view entities within a specified distance of a line in its Terrain Profile window (Figure 8-4).

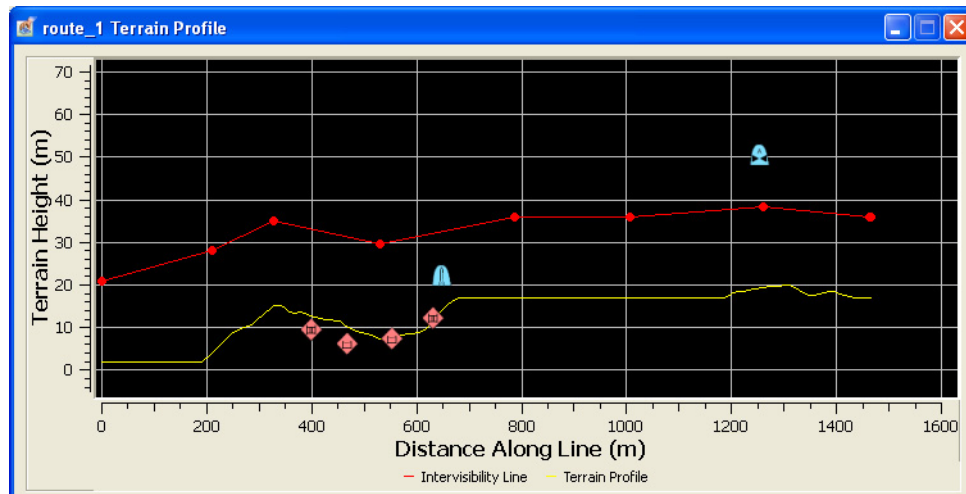


Figure 8-4. Tracking entities on a line

To track entities along a line:

1. Select the line along which you want to track entities.
2. Choose **Objects** → **Show Terrain Profile**. A Terrain Profile window opens.
3. Click More. The window expands.
4. Select Track Entities That Are Within.
5. Click Apply. As entities move within the specified distance of the line, icons are displayed at the entity location.

Specifying the Distance from a Line for Entity Tracking

To specify the distance from a line within which entities are tracked:

1. Select the line along which you want to track entities.
2. Choose **Objects** → **Show Terrain Profile**. A Terrain Profile window opens.
3. Click More. The window expands.
4. Specify a value in the Track Entities That Are Within [] Of This Line text box.
5. Click Apply.

8.4. Embarking and Disembarking Entities

Embarkation places entities into or onto other entities, for example, dismounted infantry in a truck, trucks on an LCAC, or aircraft on an aircraft carrier. While embarked, the entities travel with the entity on which they are embarked. By default, embarked entities are not visible on the map. “[Displaying and Hiding Embarked Entities](#),” on page 8-14, explains how to make embarked entities visible.



If you are using HLA and want to use the embarkation feature, you must use RPR FOM 2, draft 17. In Windows, VR-Forces includes entries in the Simulation Connectison Configuration dialog box that start VR-Forces using the correct FED file and FOM Mapper for RPR FOM 1.0, and RPR FOM 2, draft 17.

You can attach control objects to entities so that embarked entities can use them to move about on the parent entity. For example, an aircraft could taxi towards a waypoint on the flight deck of an aircraft carrier. You attach objects to entities when you create them, as described in “[Attaching an Object to an Entity](#),” on page 16-15.

VR-Forces displays information about embarked entities in the following ways:

- The embarkation status of entities is displayed in the Embarkation tab of the Objects List Panel ([Figure 8-5](#)).

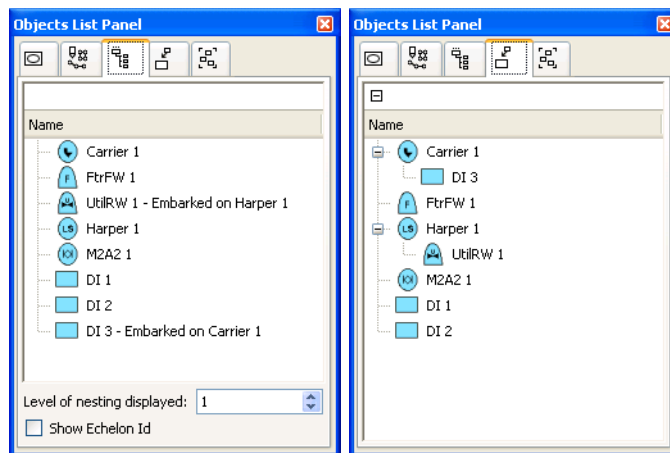


Figure 8-5. Echelon view and Embarkation view

- Objects have a label that shows the number of objects that are currently embarked on it. Display of the label is managed from the Symbols tab of the Display Options dialog box.
- The State tab on the Entity Information dialog box lets you show the entity’s location on the parent. (For details, please see “[Displaying an Embarked Entity’s Location on its Parent](#),” on page 8-14).

You can embark and disembark entities instantly (described in this section), or you can have them simulate embarkation and disembarkation using the Embark and Disembark tasks, described in Chapter 11, *Assigning Tasks*.

When you embark an entity using the Embark task, the entity can embark only on entities that are configured to accept that type of entity. For example, LCACs are configured to accept several types of ground vehicles. You cannot give a DI an Embark task to embark on an LCAC. However, when you use the immediate embark method to embark an entity, you can use preconfigured slots (spaces) for entities or specify an override. When you specify an override you can embark an entity on any other entity at the coordinates you enter. However, it is your responsibility to know what the proper coordinates are.

8.4.1. Embarking and Disembarking Entities Instantly

You can embark and disembark entities instantly using commands on the Entities menu, using set data requests, or in the Embarkation View. Using set data requests lets you embed immediate embarkation in plans. This may be particularly useful in a global plan, in which you may want to quickly create and embark entities without paying attention to the realism of the action. For details about using set data requests for embarkation, please see Chapter 12, *Issuing Set Data Requests*.

Embarking Entities Instantly Using the Embark On Command

The Embark On command lets you embark entities using preconfigured embarkation spaces or using specific coordinates. If the embarkation spaces on the parent entity are full, VR-Forces sends a message to the back-end console and the entity is not embarked. To embark entities instantly from a plan, use the Set Embarked set data request.

To embark an entity instantly using the Embark On command:

1. Select the entity that you want to embark.
2. Choose **Entities** → **Embark On**. The Embark On dialog box opens.

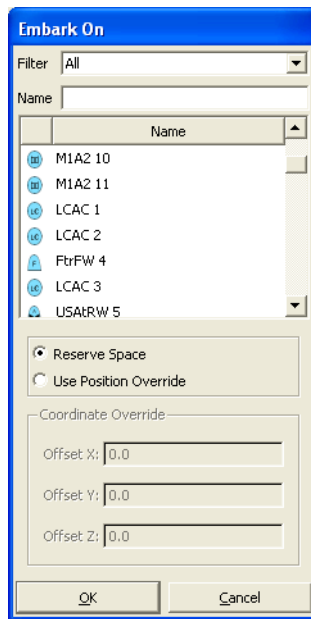


Figure 8-6. Embark On dialog box

3. Optionally, filter the list of potential parent entities.
4. Select the parent entity.
5. To embark in a configured space, select the Reserve Space option. To specify an embarkation point, select Use Position Override.
6. If you chose the Use Position Override option, specify the X, Y, and Z values, in body coordinates, for the embarkation point.
7. Click OK.

Embarking Entities in the Embarkation View

To embark an object in the Embarkation View:

1. On the Objects List Panel, select the Embarkation view.
2. Drag the entity you want to embark onto the parent entity.

8.4.2. Disembarking Entities Using the Disembark Command

Like the Embark On command, the Disembark command is typically used as part of scenario development. To simulate disembarkation, you would use the Disembark task. To provide instant disembarkation in a plan, you would use the Set Disembarked set data request.

To disembark an entity instantly:

1. Select the entity that you want to disembark. If embarked entities are hidden, make them visible first. (For details, please see [“Displaying and Hiding Embarked Entities,”](#) on page 8-14.)
2. Choose **Entities** → **Disembark**. If the entity was embarked using the default embarkation point, it is disembarked next to the former parent entity. If the entity was embarked using a position override, it is disembarked in the same location as the former parent.

To disembark an entity in the Embarkation View:

1. Open the Embarkation View.
2. Drag the entity you want to disembark off of the parent entity to the force level.

Disembarking All Entities

To disembark all entities from a parent entity:

1. Select the parent entity.
2. Choose **Entities** → **Disembark All**. All the entities are disembarked to locations spread out around the parent entity.

8.4.3. Displaying and Hiding Embarked Entities

Normally, embarked entities are not visible. You can toggle the display of embarked entities on and off. When embarked entities are displayed, they may not be easily visible, because they are placed in the same location as the parent entity.

To display or hide embarked entities:

1. Select the parent entity.
2. Choose **Objects** → **Display Embarked Objects**.

8.4.4. Displaying an Embarked Entity's Location on its Parent

The Entity Information dialog box normally displays an entity's location in the world. If an entity is embarked, it can also display the entity's location on the parent.

To display an embarked entity's location on its parent:

1. Select the entity whose location you want to view.
2. Choose **Objects** → **Information**. The Entity Information dialog box opens.
3. In the filter list on the State tab, select Parent. The location on the parent is displayed (Figure 8-7).

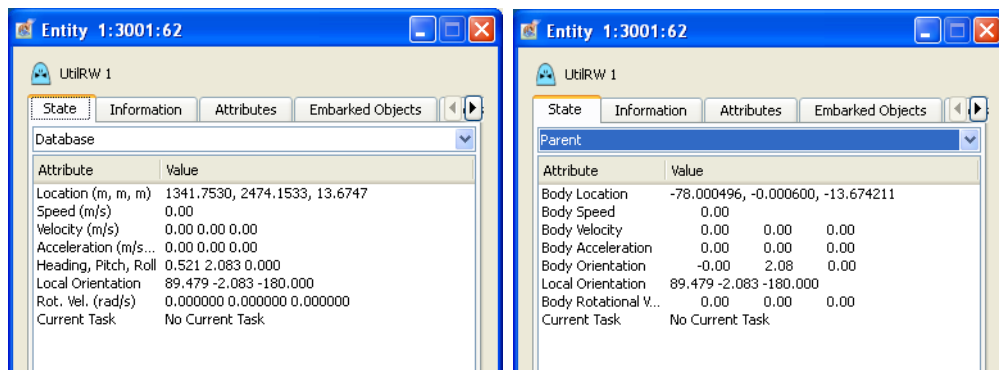


Figure 8-7. Embarked entity location in world and on parent

8.5. Collision, Obstacle, and Feature Avoidance

Many entity behaviors are built into their models. Collision and obstacle avoidance are among these behaviors. By default, entities avoid other entities and obstacle objects placed on the map (those created from the Create Obstacle menu option). If, while carrying out a task, a ground, lifeform, or rotary-wing entity detects that it is on course to collide with another entity or an obstacle, it alters its route to avoid the collision. Then it returns to its task.

When an entity avoids an obstacle, it does not necessarily follow the outline of the obstacle, it avoids the obstacle's bounding volume, which is conceptually the smallest rectangle that bounds all of the points in the obstacle.

Ground entities can also avoid features, such as buildings and plants. By default, entities avoid other entities, buildings, water, and vegetation. (LCACs do not avoid vegetation by default.)

Collision avoidance has the following qualifications:

- ♦ To specify that ground entities should not move through the terrain (for example, through a wall or through a hill), set the **check-terrain-collisions** parameter in the automotive actuator component (powertrain) to True. For performance reasons, it defaults to False, so that entities that do not care about terrain collisions do not perform the check.
- ♦ If an entity is tasked to move to a point that is inside an obstruction, or very close to one, it might never reach the point, but it will continue to try to reach the point as long as the task is in effect. This behavior also applies to entities following routes that have vertices inside an obstruction.
- ♦ If a terrain has geometric features as well as point vector features, the feature avoidance may not work because the points are placed on the terrain on “top” of the existing geometry, which means they are on top of the geometric feature.
- ♦ Path following and obstacle avoidance may not work well together. Entities moving along a road may seek to avoid obstacles, such as trees or light posts, that are placed close to the road, even though they would not hit the obstacles as long as they stay on the road. To prevent this problem from occurring, the ground collision avoidance controller has been given a lower priority than the Move To Path controller. (For information about component priority, please see Section 7.2.2, “[Configuring the Priority of Components](#)”, in *VR-Forces Configuration Guide*.)
- ♦ Do not place entities inside obstacles. Their behavior will be unpredictable.
- ♦ Although you can assign a force to an obstacle when you create it, it has no effect on entity behavior. Entities avoid all obstacles.

You can configure the objects that an entity will avoid by editing its entry in the object parameter database. For details about configuring obstacle avoidance, please see Section 8.10, “[Configuring Obstruction Avoidance](#)”, in *VR-Forces Configuration Guide*.



The B-HAVE Module for VR-Forces, an extra-cost plug-in for VR-Forces provides improved collision avoidance using advanced AI techniques.

8.6. Entity Movement and Soil Type

In VR-Forces, the movement of entities is affected by the surfaces on which they are moving. The speed of movement over a given surface (as a percentage of ordered speed) is configured in the **soil-list** block in an entity's object parameter database entry.

You can determine the soil type for a polygon by clicking it and looking at the Information toolbar. (For details, please see [“Displaying Information about a Point,”](#) on page 20-3.)



As you observe an entity moving on the map, you might expect that the terrain coloring would help you understand why an entity might not move as quickly as you expect. However, the colors used to represent terrain may or may not reflect the surface types assigned to polygons. You can force the terrain color to more accurately reflect the surface type. (For details, please see [“Using the Default Soil Colors,”](#) on page 6-22.)

[Table 8-1](#) lists the soil types supported for terrain databases and how they map to the roughness types that can configured in the **soil-list** block for VR-Forces entities.

Table 8-1: Soil type/roughness type mappings

Soil type	Roughness type
ocean	deep-water
deepLake	deep-water
shallowLake	shallow-water
deepRiver	deep-water
shallowRiver	shallow-water
shallowPond	shallow-water
shallowStream	shallow-water
dryGround	hard-packed
pavedRoad	paved-road
gravelRoad	gravel
dirtRoad	gravel
asphalt	hard-packed
USRailroad	hard-packed

Table 8-1: Soil type/roughness type mappings

Soil type	Roughness type
softSoil	sand
swamp	muck
mud	muck
forest	hard-packed
grass	hard-packed
cultivatedFields	hard-packed
orchards	hard-packed
rock	rocks
boulder	rocks
sand	sand
building	hard-packed
tree	hard-packed

8.7. Using a Joystick to Control Entities

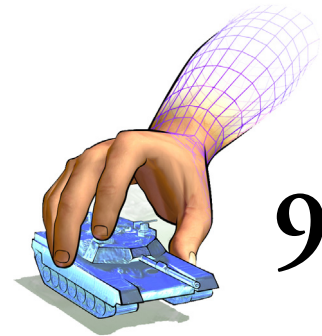
VR-Forces supports use of joysticks to control ground, fixed-wing, and rotary-wing entities. The default joystick parameters are specified in the file `./config/joyParam.dat`. You can override the default values for specific entities by specifying parameters in the object parameter database.



The joystick must be connected to the computer on which the entity is being simulated.

To enable or disable joystick use:

1. Select the entity for which you want to enable or disable joysticks.
2. Choose **Entities** → **Enable Joystick** or **Disable Joystick**.



Working with Aggregate Entities

This chapter explains how to create and manage aggregate entities.

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9.1. Introduction to Aggregates

It is important to understand the differences between an aggregated aggregate entity and a disaggregated aggregate. The types of aggregates are introduced in [“Aggregate Entities,”](#) on page 3-20. This section provides additional details about how aggregates function in the two different aggregation states.

9.1.1. How Aggregate State is Shown in the GUI

Aggregates publish their current aggregate state using the DIS/RPR FOM aggregate state enumeration. The current value for this parameter is displayed on the State tab in an aggregate’s information dialog box. It can be accessed in the aggregate’s *DtVrfAggregateStateRepository* member.

Aggregated State

When an aggregate is in the aggregated state, its subordinates do not exist as distinct entities. It does not have any subordinates shown in the Echelon View or on the Subordinates tab of its information dialog box. It does not display ghosted icons for subordinates. You cannot expand or collapse it.

Disaggregated State

When an aggregate is in the disaggregated state, its subordinates are simulated as distinct entities. (However, it is possible to have a disaggregated aggregate with no subordinates.) Subordinates are displayed under the aggregate in the Echelon View and are listed on the Subordinates tab of its information dialog box. You can expand or collapse the aggregate view.

9.1.2. Changing the Aggregation State at Runtime

Aggregates can change their aggregation state at runtime. All state information maintained by the aggregate (for example, the current task it is executing, plan state, current resource levels) is maintained across the transition between aggregated and disaggregated states. This section describes how aggregates handle transitions for the most important activities.

Movement

All movement tasks can be executed in either aggregated or disaggregated state. Aggregates can transition between states at any time, without interrupting movement tasks. For example, say an aggregate in the disaggregated state, is executing a move-to-location task. While it is executing the task, you issue a Set Aggregate State set data request, indicating it should switch to the aggregated state. The aggregate transitions into the aggregated state (subordinates are deleted, and the state associated with them is mapped and stored internally in the aggregate), and continues moving toward its destination. Similarly, making a transition in the opposite direction while executing a movement task, does not interrupt the execution of that task.

Aggregates preserve their formation across aggregate state transitions.

Combat

Only disaggregated aggregates can engage in combat. However, an aggregate remembers any loss of resources or subordinates while it is aggregated. If a subordinate is destroyed while the aggregate is disaggregated, it will not be created again if the aggregate aggregates and then disaggregates again.

Resources

Resources are tracked and restored across state transitions. However, if a subordinate is destroyed while in the disaggregated state, then all of its resources are lost. They are not redistributed to other subordinates.

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When you restore an aggregate that is in the aggregated state (using Set Restore), the original configuration of the aggregate is recreated. If you restore an aggregate that is in the disaggregated state, then only those subordinates still present in the simulation are restored. Any destroyed subordinates that were previously removed from the simulation as result of a disaggregate-->aggregate-->disaggregate transition are be restored. To fully recover all subordinates, restore the aggregate while in the aggregated state.

9.1.3. Triggering Aggregate State Transitions

Aggregate state transitions can be initiated manually or automatically:

Manually: You can send a Set Aggregate State set data request or use Aggregate and Disaggregate commands on the Entities menu. This immediately forces the aggregate to change state. As a set data request, state changes can be included in plans.

Automatically: In the Aggregate Options dialog box you can configure automatic aggregation and disaggregation. In automatic mode, aggregates automatically aggregate or disaggregate according to the following rules:

- ♦ If the aggregate is within “disaggregation range” of a hostile entity or aggregate, the aggregate is in the disaggregated state. Disaggregation range is the range around an entity or aggregate in which you want to force any nearby aggregated entities to disaggregate so you can detect or engage them. This range is configurable for every type of entity and aggregate in the Entity Editor.
- ♦ If the aggregate’s formation footprint (projection of its bounding extent in a topographic plane) overlaps a disaggregation area, the aggregate is in the disaggregated state. (A disaggregation area is a specific type of control object.)
- ♦ If neither of the above conditions is in effect, the aggregate is in the aggregated state.

9.2. Creating Aggregates

You can create an aggregate by selecting existing entities (which can be individual entities or aggregate entities) and combining them to form an aggregate entity, or by placing a preconfigured aggregate from the Create menu.

When you create an aggregate, it is created as a subordinate to the force level. You cannot create aggregates that are subordinates of an existing aggregate. Once you create an aggregate, you can subordinate it to another aggregate. (For details, please see [“Adding Entities to an Aggregate,”](#) on page 9-8).

By default, aggregates are created in a disaggregated state. However, you can change this behavior. For details, please see [“Configuring the Aggregate Creation State,”](#) on page 9-7.

9.2.1. Creating an Aggregate by Combining Existing Entities

When you create an aggregate by combining entities, you can specify the order of subordinates in the aggregate. This determines which subordinate is considered the aggregate leader and affects the assignment of echelon IDs. You cannot change the subordinate order after you create the aggregate.



When you create an aggregate entity, the members of the aggregate get new echelon IDs to reflect the new entity hierarchy.

To create an aggregate by combining existing entities:

1. Select the entities that you want to become part of an aggregate.
2. Choose **Entities** → **Aggregate As**. The Aggregate As dialog box opens (Figure 9-2).

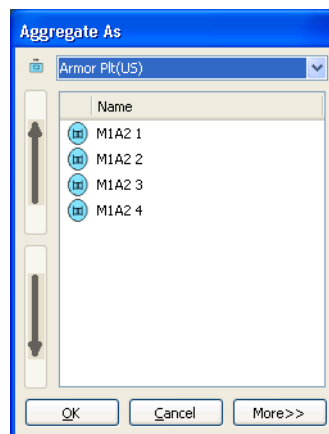


Figure 9-1. Aggregate As dialog box

3. Select an aggregate type from the list.
4. Optionally, customize the entity type enumeration for the aggregate, as follows:
 - a. Click More. The dialog box expands to show the entity type enumeration for the aggregate type selected.

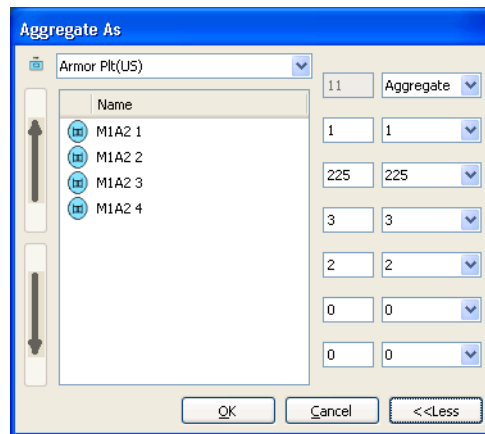


Figure 9-2. Aggregate As dialog box

- b. Edit the enumeration by typing values in the boxes in the left column, or selecting values from the lists in the right column.



If an edit to the enumeration results in an entity type that does not match the aggregate type selected in the list, the list entry does not change. However, the aggregate will be created with the entity type specified by the custom enumeration.

6. Optionally, change the order of subordinates, as follows:
 - a. Select the subordinate whose order you want to change.
 - b. Click the up or down arrow to move it to a new position in the list of subordinates.
7. Click OK.

By default, the aggregate is created in a disaggregated, collapsed format. The icons for individual members are hidden. You can change the default aggregation state. For details, please see [“Configuring the Aggregate Creation State,”](#) on page 9-7.

9.2.2. Creating a Preconfigured Aggregate

VR-Forces includes preconfigured aggregates at several hierarchical levels. You can configure these entities and add additional aggregates in the Entity Editor. (For details, please see Section 5.5, “[Editing Aggregates](#)”, in *VR-Forces Configuration Guide*.)

- To create a preconfigured aggregate, choose **Create** → **Aggregate** → *ForceType* → *aggregate*, where *ForceType* is Friendly or Opposing, and *aggregate* is one of the options on the sub-menu.



You can add additional preconfigured aggregates to the Create menu the same way you would add other entities to it. For details, please see Section 7.5.1, “[Adding an Aggregate to the Object Parameters Database](#)” in *VR-Forces Configuration Guide*.

9.2.3. Configuring the Aggregate Creation State

To configure the aggregation state used when aggregates are created:

1. Choose **Options** → **Aggregates**. The Aggregate Options dialog box opens ([Figure 9-3](#)).

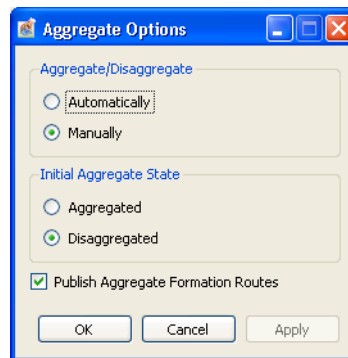


Figure 9-3. Aggregate Options dialog box

2. In the Initial Aggregate State group box, select the creation option that you want.
3. Click OK.

9.3. Selecting an Aggregate

- To select an aggregate, select its icon on the map, or select it one of the views on the Objects List Panel.

9.4. Adding Entities to an Aggregate

- To add an entity to an aggregate, in the Echelon View, select the entity you want to add and drag it onto the aggregate as illustrated in [Figure 9-4](#).

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You can add entities to an aggregate only if it is in the disaggregated state.

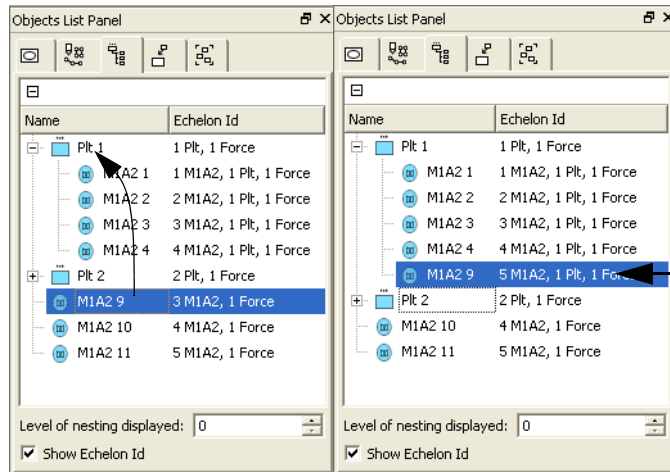


Figure 9-4. Adding an entity to an aggregate

9.5. Removing an Entity from an Aggregate

- To remove an entity from an aggregate, in the Echelon View, drag the entity from the aggregate to the force level in the window, as illustrated in [Figure 9-5](#), or into another aggregate.



You can remove entities from an aggregate only if it is in the disaggregated state.

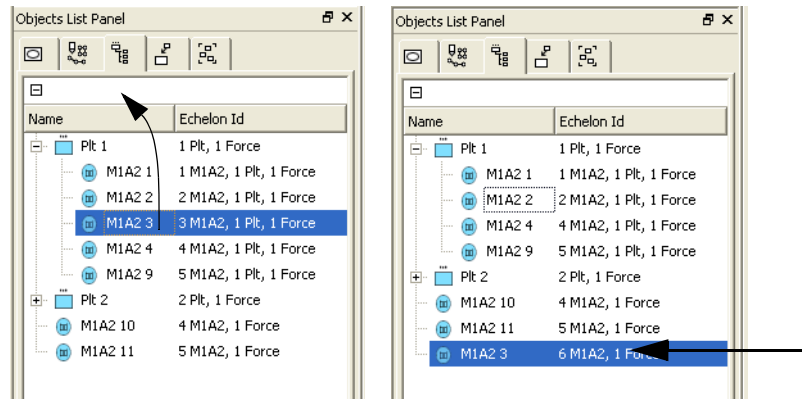


Figure 9-5. Removing an entity from an aggregate

9.6. Changing the Aggregation State of an Aggregate Entity

You can aggregate and disaggregate aggregates manually and automatically.

9.6.1. Aggregating and Disaggregating Entities Manually

- To aggregate a disaggregated entity, choose **Entities** → **Aggregate**.



You can also change an aggregate's state with the Set Aggregate State set data request (which also means that you can change state from within a plan).

- To disaggregate an aggregated entity, choose **Entities** → **Disaggregate**.

9.6.2. Configuring Automatic Aggregation and Disaggregation

When automatic aggregation and disaggregation is enabled, aggregated entities automatically disaggregate when they enter a disaggregation area or when they encounter opposing forces.

To configure automatic aggregation and disaggregation:

1. Choose **Options** → **Aggregates**. The Aggregate Options dialog box opens (Figure 9-3).
2. In the Aggregate/Disaggregate group box, select Automatically or Manually.
3. Click OK.

9.6.3. Using Disaggregation Areas

When an aggregated entity that has automatic aggregation and disaggregation enabled enters a disaggregation area, it disaggregates. When it leaves the area, it aggregates again. A disaggregation area is an overlay object. You create one just like any other overlay object, as described in Chapter 16, *Overlays and Graphical Objects*. The menu path for disaggregation areas is **Create** → **Disaggregation Area**.

9.7. Expanding and Collapsing Aggregates

You can display disaggregated aggregates in expanded or collapsed mode. When an aggregate is collapsed, it is displayed as one icon. When an aggregate is expanded, all the members of the aggregate are visible as individual entities and the aggregate icon is hidden.



An aggregate's icon does not indicate whether it is aggregated or disaggregated. However you can easily infer its state from the Entities menu or the Echelon View. The aggregate commands on the Entities menu are context sensitive. If you select an aggregate and the Disaggregate command is available, then the aggregate is in the aggregated state. Similarly, if you view an aggregate in the Echelon View, if it is aggregated, you cannot expand it in the tree. If it is disaggregated, you can expand it to see its subordinates.

To expand an aggregate:

1. Select the aggregate you want to expand.
2. Choose **Entities** → **Expand Aggregate**.

To collapse an aggregate:

1. Select any member of the aggregate.
2. Choose **Entities** → **Collapse Aggregate**.

9.7.1. Expanding and Collapsing Aggregates in the Echelon View

You can expand and collapse aggregates in the Echelon View on the Objects List Panel, which also expands or collapses them on the map.

- To expand an aggregate in the Echelon View, click the plus sign next to its icon.
- To collapse an aggregate in the Echelon View, click the minus sign next to its icon.

9.7.2. Expanding and Collapsing the Echelon View by Level of Aggregation

In addition to expanding and collapsing the order of battle on a node-by-node basis, as in typical hierarchical view windows, the Echelon View enables you to view entities by the level of aggregation.

Individual entities are directly subordinate to the force they belong to. If an entity becomes part of an aggregate, the aggregate is subordinate to the force and the individual entity is one level further away. Seen another way, you can say that the force is the parent and all other entities in that force are children, grandchildren, and so on.

The Echelon View displays the entities in columns that are equivalent to their relationship to the force – the first column is children, the second column is grandchildren, and so on.

At the top of each column in the Echelon View is a plus (+) or minus (-) icon that works like the icons within the hierarchical display. A plus indicates that at least one entity in that column is an aggregate entity and that none of the aggregates in the column are expanded. A minus indicates that at least one aggregate at that level is expanded. Clicking a minus sign collapses all aggregate entities in the column. Clicking a plus sign expands all aggregates in the column.

- To change the hierarchical level view in the Echelon View, click the level controls in the horizontal band across the top of the window.

Figure 9-6 illustrates an Echelon View with several levels of aggregates, some of which are collapsed and some of which are expanded.

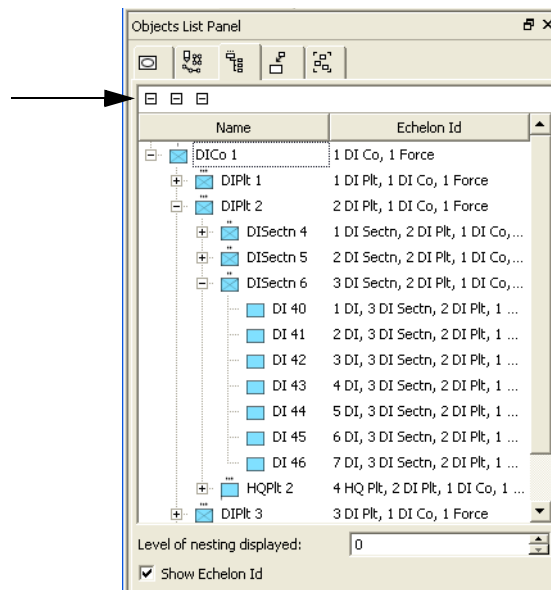


Figure 9-6. Echelon View

9.7.3. Displaying Ghosted Icons for Collapsed Aggregates

If you want to select aggregates from the map, you need to collapse them so that you can select the aggregate icon. However, when you do this, you can no longer see where individual subordinate entities are located and if subordinates are destroyed, you cannot see which ones are destroyed and which are functional. You can enjoy most of the benefits of expanded and collapsed aggregates at the same time if you display subordinates as ghosted icons.

When you display ghosted aggregates, the aggregate icon is displayed normally, and the subordinate members are displayed using semi-transparent icons. [Figure 9-7](#) illustrates the display for the order of battle illustrated in [Figure 9-6](#), for each possible level of ghosting. You cannot select ghosted icons or otherwise interact with them.

To display ghosted icons:

1. On the Objects List Panel, select the Echelon View.
2. Collapse and expand aggregates as desired.
3. In the Echelon View, in the Level of Nesting Displayed box, select the level of nesting for which you want to view ghost icons. Ghost icons are displayed only for collapsed aggregates.

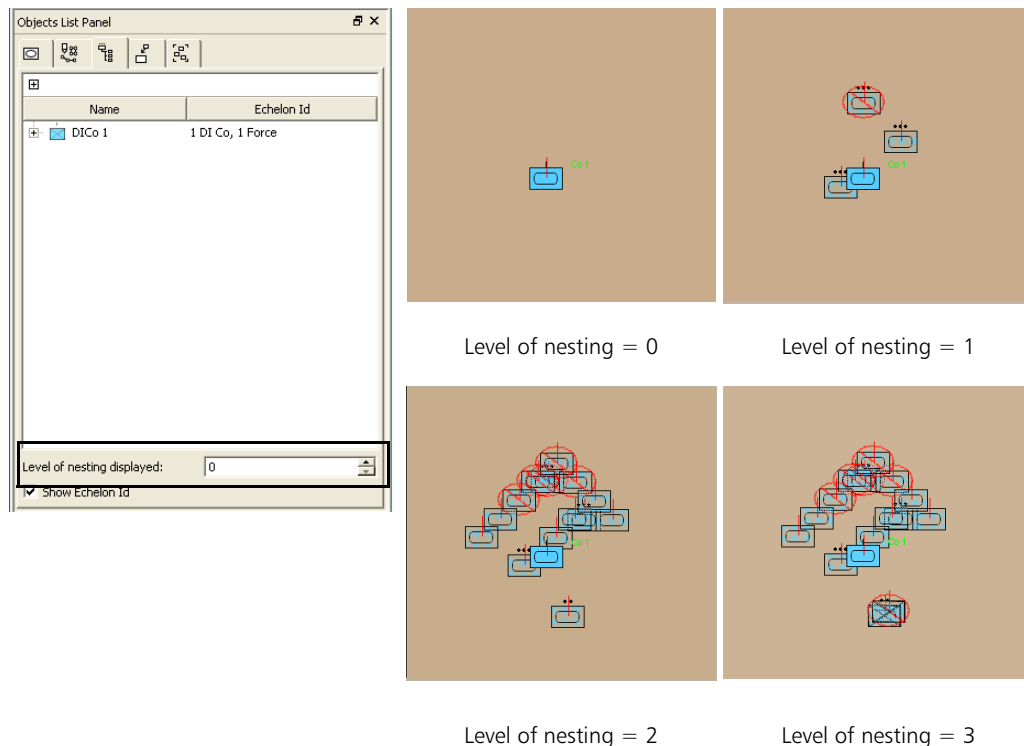


Figure 9-7. Ghosted icons

9.8. Writing Plans for Aggregates

- To write a plan for an aggregate, follow the procedures for writing a plan for an entity in Chapter 15, [Writing Plans](#).

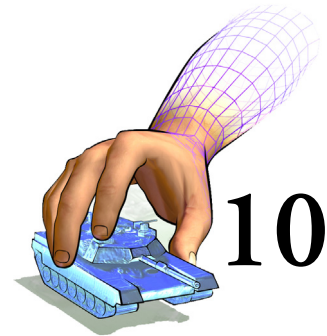
9.9. Deleting an Aggregate



If you delete an aggregate, all its member entities get deleted.

To delete an aggregate:

1. Select the aggregate.
2. Choose **Objects** → **Delete**.



Displaying Entity Information

This chapter explains how to display information about entities.

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10.1. Displaying Entity Labels

VR-Forces displays information about an entity in on-screen labels. Most labels are displayed in text to the right of the entity (Figure 10-1). The default color is green, but it is configurable. (For details, please see “[Changing Terrain-Related Colors](#),” on page 6-25.) Some information is displayed graphically. The graphics are illustrated in Figure 10-2. For a description of each entity label, please see the tooltip associated with each option on the Display Options dialog box, Symbols tab.

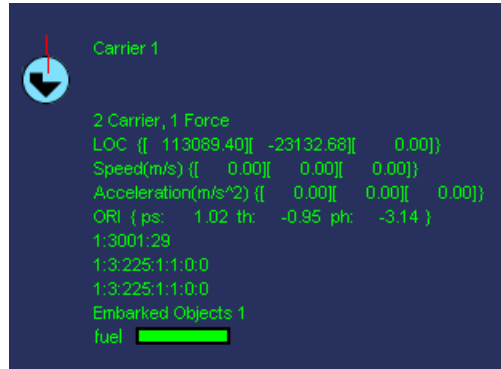


Figure 10-1. Entity labels

By default, the label displays the heading indicator, movement indicator, and name. You can display the following additional information:

- ♦ Name
- ♦ Echelon ID
- ♦ Label
- ♦ Overlay
- ♦ Location
- ♦ Velocity
- ♦ Acceleration
- ♦ Heading
- ♦ Object ID
- ♦ Entity Type
- ♦ Entity Guise
- ♦ Bounding box
- ♦ Fire and detonation lines
- ♦ Track history
- ♦ Emitter beam
- ♦ Sensor contacts
- ♦ Object console warning
- ♦ Route direction
- ♦ Transmitters
- ♦ Range Rings
- ♦ Embarked objects.
- ♦ Resource display.

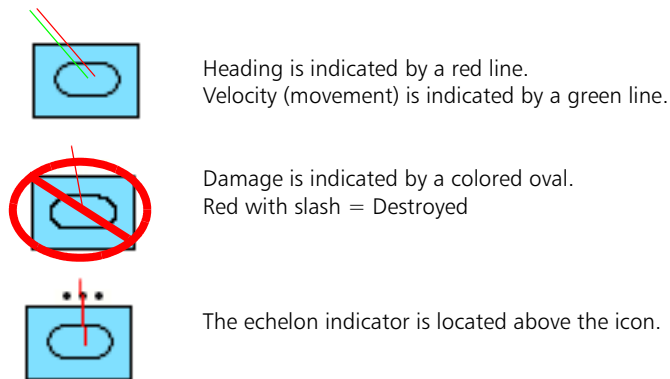


Figure 10-2. Entity graphics

Echelon indicators are illustrated in [Figure 10-3](#).

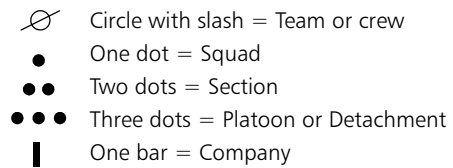


Figure 10-3. Unit echelon indicators

10.1.1. Turning Entity Labels On and Off

The settings on the Symbols tab of the Display Options dialog box enable and disable labels globally. You can enable the following on a per-object basis:

- ♦ Resources
- ♦ Range rings
- ♦ Embarked objects
- ♦ Main symbol
- ♦ Sensor contacts.

To enable or disable labels globally:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).

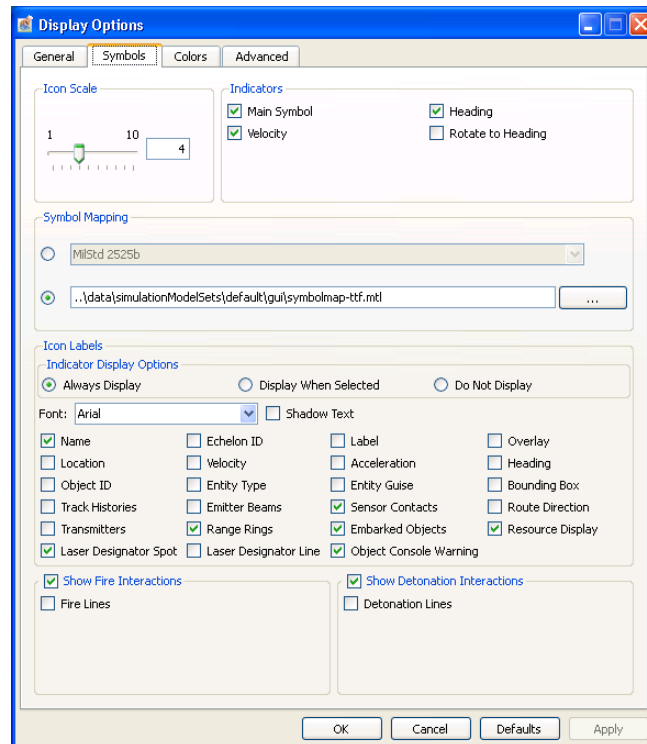


Figure 10-4. Display Options dialog box, Symbols tab

3. In the Icon Labels group box, select the labels that you want to display. Clear the check boxes for labels that you do not want to display.
4. Click OK.

To enable or disable labels for individual entities:

1. Select the entity.
2. Choose **Objects** → **Display option**, where *option* is Resources, Range Rings, Main Symbol, Sensor Contacts, or Embarked Objects.

10.1.2. Changing the Readability of Labels

You have several options for changing the readability of labels, including changing their size, changing their color, and adding a drop shadow.

Changing the Size of Labels

You can change the size of entity label text (and entity icons). Smaller text reduces screen clutter. Larger text improves readability.

- To change the size of label text, adjust the slider in the Icon Scale toolbar (Figure 10-5) or the Display Options dialog box, Symbols tab.



Figure 10-5. Icon Scale toolbar

Figure 10-6 illustrates resized icons and labels.

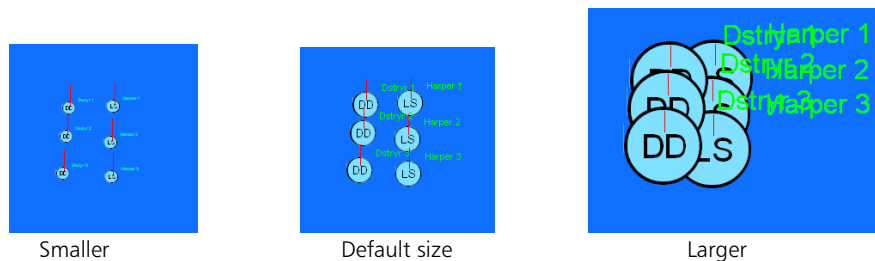


Figure 10-6. Resizing icons and labels

Displaying a Drop Shadow for Labels

An entity label color that is easy to read on light colored terrain may be hard to read on dark-colored terrain. You can compensate for these differences by displaying labels in a light color and adding a drop shadow.

To display a drop shadow for text:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. In the Icon Labels group box, select the Shadow Text check box.

4. Click OK.

Changing the Color of Entity Labels

To change the color of entity labels:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Colors tab (Figure 10-7).

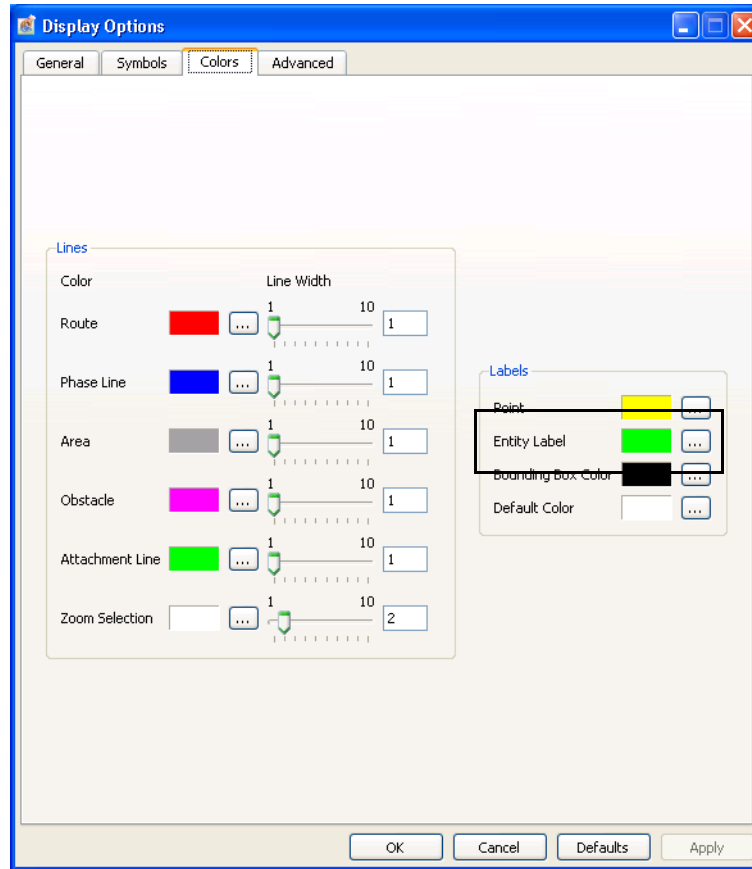


Figure 10-7. Display Options dialog box, Colors tab

3. Click the Entity Label color button. A color picker opens.
4. In the color picker, choose a color or define a custom color, then click OK to close the color picker.
5. Click Apply or OK.

10.1.3. Hiding the Heading and Velocity Indicators

To display or hide the heading and velocity indicators:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. In the Indicators group box, select the Heading and Velocity check boxes to display the indicators. Clear the check boxes to hide the indicators.
4. Click Apply or OK.

10.1.4. Displaying an Entity's Bounding Box

The entity bounding box shows the extents of the entity's bounding volume, as defined in *./config/boundingVolume.mtl*. This is the bounding volume used for intervisibility testing.

To display an entity's bounding box:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. To display the bounding box, in the Icon Labels group box, select Bounding Box. To hide the bounding box, clear the check box.

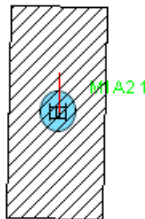


Figure 10-8. Entity bounding box

4. Click Apply or OK.



You may need to zoom in on the entities to see their bounding boxes.

10.1.5. Displaying Entity Range (Threat) Rings

You can display an entity's threat range – the area within which its armaments are effective. The threat range is displayed as a circle, with a line indicating the armament and its direction of fire. If an entity's armament is an articulated part, such as a tank's turret, the direction of fire swings with the part (Figure 10-9).



Figure 10-9. Range ring for articulated part

You enable or disable display of range rings globally. You display range rings on a per-entity basis. You can configure the number of rings, their transparency, and the display of range labels.



On small databases, an entity's range ring may extend beyond the edge of the terrain display.

Enabling and Disabling the Display of Range Rings

You can enable or disable the display of range rings in the Display Options dialog box or the Range Ring Options dialog box.

To enable or disable the display of range rings in the Display Options dialog box:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. In the Icon Labels group box, select or clear the Range Rings check box.
4. Click OK.

To enable or disable the display of range rings in the Range Ring Options dialog box:

1. Choose **Options** → **Range Rings**. The Range Ring Options dialog box opens (Figure 10-10).
2. Select or clear the Enable Range Rings check box.

3. Click OK.

Displaying Range Rings for an Entity

To display or hide range rings for an entity:

1. Enable the display of range rings, as described in the previous section.
2. Select an entity.
3. Choose **Objects** → **Display Range Rings**.

Configuring the Display of Range Rings

To configure the display of range rings:

1. Choose **Options** → **Range Rings**. The Range Ring Options dialog box opens (Figure 10-10).

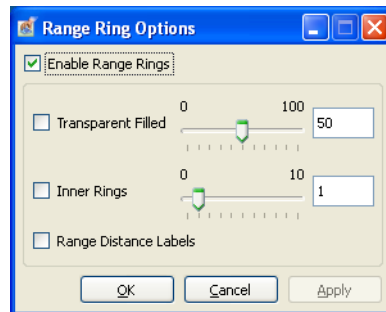


Figure 10-10. Range Ring Options dialog box

2. To fill range rings, select Transparent Filled. Adjust the slider to control the degree of transparency, from 0 (opaque) to 100 (fully transparent).



Use of transparency can degrade performance.

3. To set the number of rings, select the Inner Rings check box and specify the number of rings using the slider or in the text box.
4. To display range labels for each ring, select the Range Distance Labels check box.
5. Click OK or Apply. Settings apply to all range rings in the display.

10.2. Displaying Entity Resources

VR-Forces tracks the amount of resources that an entity has. You can view the status of resources in the Entity Information dialog box and as an entity label.

10.2.1. Viewing Numerical Resource Data

The Entity Information dialog box lists the entity's current amount of resources, its starting amount, and the percentage remaining (Figure 10-11).

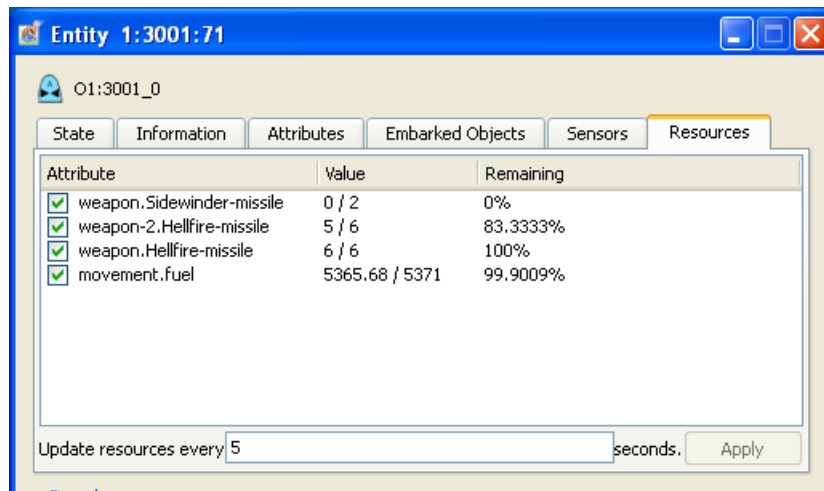


Figure 10-11. Entity resources

- To view entity resource status, on the Entity Information dialog box, select the Resources tab.

10.2.2. Displaying Resource Status

You can display bar graphs as part of an entity's label that show the approximate status of resources. The status is represented by the length of the bar and the color (Figure 10-12), as follows:

- ♦ Green = 40 - 100% of the resource is available
- ♦ Yellow = 10 - 40% of the resource is available
- ♦ Red = Less than 10% of the resource is available
- ♦ Black rectangle = the resource is fully depleted.

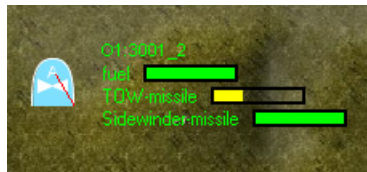


Figure 10-12. Entity resource labels

To display entity resource bar graphs:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab.
3. Select the Resource Display check box and click Apply.
4. Select the entities for which you want to display resource status.
5. Choose **Objects** → **Display Resources**. The bar graphs are displayed.



The Resource Display setting displays or hides status bars globally. It must be checked to see any status bars. However, actual display of the status bars is entity-specific. You must enable resource display for each entity that you want to view.

Configuring the Display of Resource Status Bars

You can specify the frequency at which resource data is updated. You can also specify which resources are displayed in the resource label. These settings only affect the display of bar graphs. Regardless of these settings, VR-Forces continues to monitor resources and update resource status in the Entity Information dialog box.

To configure the display of resources:

1. Double-click the entity whose display you want to configure. The Entity Information dialog box opens ([Figure 10-11](#)).
2. Select the Resources tab. The window lists all resources that the entity has. By default, all resources are checked, which means that there is a bar graph displayed for each of them.
3. To remove the graph for a resource from the entity's label, clear the check box for that resource.
4. To change the frequency with which resources are updated for this entity, type a value in the Update Resources Every [] Seconds text box.
5. Click Apply.

10.3. Configuring Entity Console Messages

The Object Console of the Entity Information dialog box displays messages sent from the simulation engine, from an entity's plan, and from other entities. You can set the notification level that controls the display of these messages. You can save them to a log file, and you can clear the display.

10.3.1. Setting the Notification Level for Console Messages

Console messages for an entity are displayed only if they match or exceed the notification level set for that entity. The entity notification level is set individually for each entity. You can set the notification level in the Entity Information dialog box, with the Set Notify Level set data request, or with the `objectConsoleNotifyLevel` parameter in *vrfSim.mtl*. (For the set data request procedure, please see “Set Notify Level,” on page 12-19.)

To set the notification level for an entity’s console in the Entity Information dialog box:

1. Select the entity.
2. Choose **Objects** → **Information**. The Entity Information dialog box opens. The console is the panel at the bottom of the dialog box (Figure 10-13).

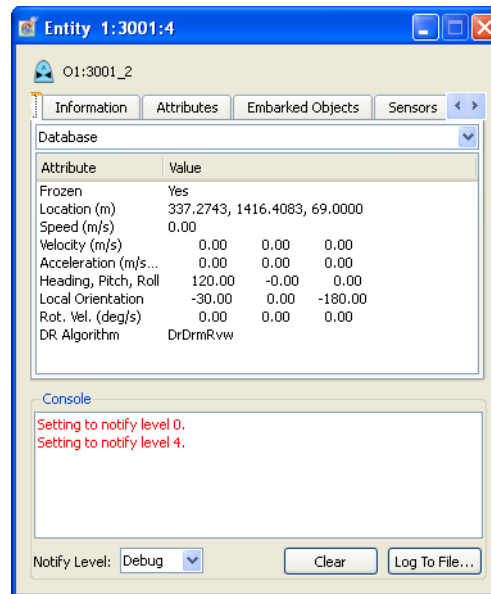


Figure 10-13. Entity Information dialog box, Object Console tab

3. In the Console group box, select a notification level from the Notify Level list.

10.3.2. Logging Console Messages to a File

You can save the messages that are sent to the entity console to a log file. Messages are saved only for the current run of the simulation.

To log entity console messages to a file:

1. Select the entity.
2. Choose **Objects** → **Information**. The Entity Information dialog box opens (Figure 10-13).
3. In the Console group box, click Log to File. A save dialog box opens.
4. Type a name for the log file.
5. Click OK.

10.3.3. Displaying Object Console Warning Icons

By default, when an entity receives a message in its console, it displays a warning icon next to the main entity icon. This lets you know that it has received a message. When you open the Entity Information dialog box, the icon is removed. You can disable the display of this icon.

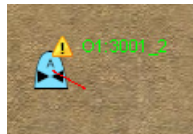


Figure 10-14. Object console warning icon

To enable or disable the object console warning icon:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. In the Icon Labels group box, select or clear the Object Console Warning check box.
4. Click OK.

10.3.4. Clearing the Object Console

- To clear the messages from the object console, in the Console group box, click Clear.

10.4. Entity Icons

VR-Forces can display entity icons based on raster (BMP) files, unicode True-Type (UTTf) fonts, or TrueType fonts. The *symbolmap-utf.mtl* and *symbolmap-utf.mtl* files display MILSTD-2525B object icons (Figure 10-15). The *symbolmap-images.mtl* and *symbolmap-images-perspective.mtl* files have entity images that look like the entities they represent and include animation (Figure 10-16).

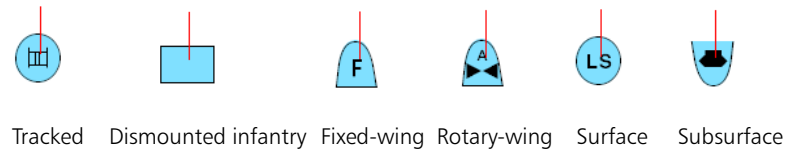


Figure 10-15. MILSTD-2525B icons



Figure 10-16. Animated icon images

The color and shape code for entity icons is:

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

Symbols have a black border except as follows:

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

Symbols that represent aggregate entities have aggregate identifiers above the symbol. These identifiers are described in “[Displaying Entity Labels](#),” on page 10-2.

10.4.1. Changing the Symbol Files Used for Entity Icons

You can load a symbol map file from the GUI if you want to change the symbols used for entities.

If you need to add icons that are not provided with VR-Forces, you can add them using whichever of the supported file types you prefer or have available.

To load a symbol map file:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab.
3. In the Symbol Mapping group box (Figure 10-17), select the first option button and select a type of symbol from the drop-down list, or select the second option button and choose the symbol map file that you want to use.

i

The options in the drop-down list correspond to the symbol mapping files provided with VR-Forces. Therefore, if you have not added your own symbol mapping files, there is no benefit to selecting the actual file over selecting from the list.

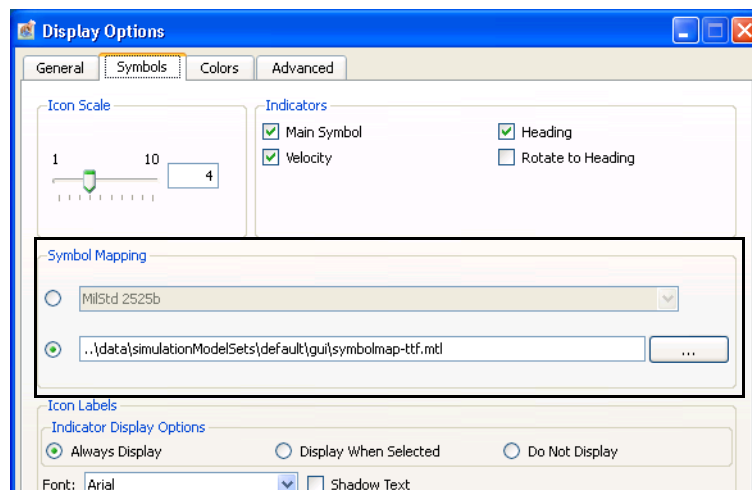


Figure 10-17. Display Options, Symbols tab, Symbol Mapping group box

4. Click OK. The new symbol mapping is applied.

10.4.2. Changing the Size of Entity Icons

You can change the size of entity icons to reduce screen clutter or improve visibility. [Figure 10-6](#) compares the default size of icons and labels with resized symbols.

- To change the size of icons, adjust the slider in the Icon Scale toolbar or on the Display Options dialog box, Symbols tab.

10.4.3. Orienting Entity Icons to Match their Heading

You can rotate entity icons so that their orientation on the map matches their heading.

To orient entity icons to match their heading:

1. Choose **Options** → **Display** and select the Symbols tab ([Figure 10-17](#)).
2. In the Indicators group box, select Rotate to Heading.

10.4.4. Displaying Entities as Dots

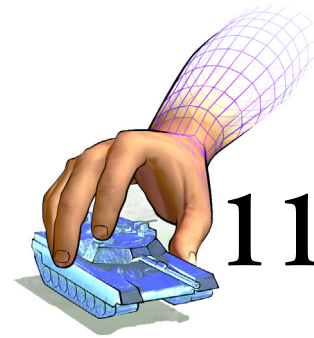
You can override the entity symbol mapping and display entities as dots. This option can speed up performance. You can resize the dots with the Icon Scale.

To display entities as dots:

1. Choose **Options** → **Display** and select the Symbols tab ([Figure 10-17](#)).
2. In the Indicators group box, clear the Main Symbol check box.
3. Click Apply or OK. All entity icons are converted to dots.

To display entity icons as dots on a per-entity basis or for a group of entities:

1. Select the entities.
2. Choose **Objects** → **Display Main Symbol**.



Assigning Tasks

This chapter explains how to assign tasks to entities.

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Assigning Tasks

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11.1. Assigning Tasks to Entities

You can assign tasks to an entity as part of its plan, as part of a global plan, and independently of any plan. For conceptual information about tasks, please see [“Tasks,”](#) on page 3-26. For information about how to add a task to a plan, please see [“Adding an Entity Task or Set Data Request to a Plan,”](#) on page 15-17. For the procedures for assigning tasks, please see [“Task Procedures,”](#) on page 11-12.

You cannot assign tasks to non-VR-Forces entities. However, you can use a remote entity as a parameter in a task, for example, following a remote entity, or targeting a remote entity. For more information, please see [“Using Non-VR-Forces Entities in Plans,”](#) on page 15-33.

11.1.1. Concurrent Task Execution

Some tasks can execute at the same time. Some are mutually exclusive. If you assign an entity a task that is mutually exclusive with its current task, the current task is abandoned. If you assign a task that is not mutually exclusive with the current task, an entity executes the new task and then continues with the previous task.

All movement tasks are mutually exclusive. Entities can execute the various Send tasks while they are executing movement tasks. For information about how to configure mutually exclusive tasks, please see Section 8.8, [“Configuring Task Execution Rules”](#), in *VR-Forces Configuration Guide*.

11.1.2. Overriding Tasks and Plans

By default, when an entity is executing a task and you issue an independent task to that entity, VR-Forces displays a prompt that tells you the current task and asks you to confirm that you want to replace it. If the entity is executing a task that is part of a plan, the prompt asks you to verify that you want to replace the entire plan with the new task. If you have assigned the independent task to multiple entities, VR-Forces displays a prompt for each entity.

To enable or disable the task override prompt:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the General tab.
3. To specify the behavior for interrupting tasks, select or clear the Prompt Before Interrupting Task check box.
4. To specify the behavior for interrupting plans, select or clear the Prompt Before Abandoning Plan check box.



Clearing the check boxes in steps 3 and 4 means that you will be prompted for the action to take when you assign an independent task to an entity that is already executing a task.

5. Click OK.

11.1.3. Escaping the Task Assignment Process

You can escape the task assignment process at any point before you complete it.

- To escape the task assignment process, in the task dialog box, click Cancel.

11.1.4. Specifying Parameters for Tasks

VR-Forces lets you specify task parameters in dialog boxes or by selecting them on the map. Many tasks require you to select an object or entity. When you choose a task that requires selection of an object, the cursor changes to select mode.



You must be in Object Selection mode to select objects. For details, please see [“Choosing the Selection Mode,”](#) on page 7-4.

If you select the appropriate object, the selection is reflected in the task dialog box.

If you prefer, you can specify all parameters in the task dialog box. Depending on the zoom level of the map and the number of entities and graphical objects you have created, it may be easier to select an object from a list than to select it from a densely packed group of icons.

11.1.5. Determining the Current Task

The Entity Information dialog box for an entity lists its current task on the State tab. If an entity is executing a task as part of its plan, you can also see which task it is executing by opening its Plan window.

11.1.6. Filtering the Object Selection Lists

If a task requires you to select objects, you can filter the object selection list (Figure 11-1) to make it easier to find the particular objects you need to select. If you are selecting entities, for example in a Follow Entity task, you can display all entities, individual entities only, or aggregate entities only. Within the latter two groups, you can display friendly or opposing entities. In a Move To task, you can filter for waypoints, overlay point objects, friendly entities, or opposing entities.

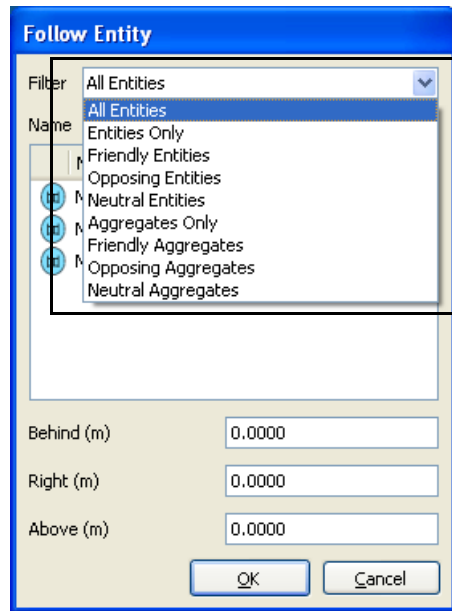


Figure 11-1. Entity filter list

- To filter an entity list, in a task or set data request dialog box, choose the filter type from the list.

11.1.7. Skipping a Task

You can instruct an entity to skip the task it is executing. If the entity is executing a plan, it moves to the next task in its plan. If there are no further tasks, the entity waits for further orders.

- To order an entity to skip a task, choose **Entities** → **Skip Task**.



Skip task does not apply to members of an aggregate that are executing tasks assigned to them by the aggregate leader.

11.2. Assigning Tasks to Aggregates

- To assign a task to an aggregate, select the aggregate, then assign it a task as you would any individual entity.

11.2.1. Independently Tasking Aggregate Members

Members of a disaggregated aggregate can have individual plans or be assigned tasks independently of the aggregate. If a member of an aggregate unit is independently tasked, when it completes its task it automatically becomes tasked by its superior. You do not need to give it a Set Tasked by Superior set data request. You can override this behavior by setting an object's **tasked-by-superior-upon-task-complete** parameter in the object parameter database to False.

When an entity becomes tasked by its superior, it does not execute the task that the aggregate is currently executing. It receives the next task that is sent out by the aggregate.



When a disaggregated aggregate changes to the aggregated state, the individual subordinates cease to exist. Therefore, if a subordinate is executing an independent task, when the aggregate changes state, the task activity ends immediately.

11.3. Path Planning for Movement Tasks

When you give a ground entity (vehicle, lifeform, or aggregate) a Move To task, you can specify that it move directly to the destination or that it plan a path. When an entity plans a path, it takes into account terrain features and roads. In the object parameter database, you can specify vector feature types that are to be considered impassable. By default, most ground entities treat all features in the MAK Roads group as roads, and all features in the MAK Water group as impassable.

VR-Forces considers the soil type along each path section, as well as the average slope of the terrain, and compares these values to the capabilities of the vehicle to determine the cost of moving along the path.

Depending on the complexity of the terrain, the length of the path, and the available processor power of the computer being used, it may take anywhere from under a second to multiple minutes for an entity to calculate its path. The path planning is done in a separate thread from the main simulation, so it will not affect the running of the simulation. While an entity is calculating its path, it does not move.



Because multithreading is used in this component, any VR-Forces scenario that makes use of path planning cannot run in repeatable mode.

After VR-Forces plans a path, it creates a temporary route for the entity to follow. You can edit the route and the entity will move along the modified route. Once the route is published, the entity moves along it as it would along any other route. When the entity reaches its destination, the route is removed.

In the object parameter database that ships with VR-Forces, all ground vehicles have a path movement controller.

11.3.1. Displaying and Hiding Path Routes

By default, path routes are displayed on the map and are published, which means they get displayed by other VR-Forces front-ends or MÄK Plan View Displays. You can hide the display of path routes. Entities will still follow the routes, but they will not be visible in the local or remote front-ends and you cannot edit them.

- To hide or display path routes, choose **Objects → View Objects → Path-planning Routes**.

11.4. Fixed-Wing Entity Tasks and Behaviors

This section describes the behaviors of fixed-wing entities supplied with VR-Forces and the issues you should keep in mind when assigning tasks and set data requests.

11.4.1. Placement of Newly Created Fixed-Wing Entities

When you create a fixed-wing entity, it is placed on the ground. If you want a fixed-wing entity to start a scenario in the air, you must set its altitude at the beginning of the scenario. It will loiter at the specified altitude.

11.4.2. Fixed-Wing Entity Movement on the Ground and in the Air

Fixed-wing aircraft support takeoff and landing. Since they can move on the ground and in the air, you need to understand their behavior in these different environments. [Table 11-1](#) and [Table 11-2](#) describe how fixed-wing entities respond to Move To, Move Along Route, and Patrol Route tasks depending on their current location. The rest of this section provides additional details about take-off and landing.

Table 11-1: Fixed-wing entity Move To behavior

If entity is on/in the:	and waypoint is on/in the:	the entity:
Ground	Ground	taxis to point.
Ground	Air	takes off towards the point.
Air	Air	flies to point.
Air	Ground	crashes.

Table 11-2: Fixed-wing entity route-following behavior

If entity is on/in the:	and next vertex is on/in the:	the entity:
Ground	Ground	taxis to vertex.
Ground	Air	takes off toward the vertex.
Air	Air	flies to the vertex.
Air	Ground	tries to land at the vertex.

Fixed-wing entities do not support terrain-following. Therefore, when you task a fixed-wing entity to move to a point or follow a route, you must be certain that there are no points in the terrain that are higher than the altitude of the entity's flight path, or the entity will crash. For example, if you assign a fixed-wing entity to follow a route whose vertices are set at 3000 meters above sea level, if the terrain rises above 3000 meters at some point in between two vertices of the route, the entity will crash into the terrain at that point. You can view the terrain profile of the route to check for intersections with the terrain. (For details, please see [“Displaying a Line's Terrain Profile,”](#) on page 20-10.)

11.4.3. How Fixed-Wing Entities Take Off

You can have fixed-wing aircraft take off using the Fixed Wing Takeoff task (for details, please see “[Fixed Wing Takeoff](#),” on page 11-19) or by using innate behavior. This section describes take-off using innate behavior.

Fixed-wing entities take off by moving to a waypoint that is above ground level or by following a route that has a vertex above ground level.

When you task a fixed-wing entity to move to a waypoint that is above ground level, the entity orients itself directly towards that point and accelerates in the direction of the point. When it reaches its minimum lift speed, it takes off and rises to the altitude of the point it is moving to. You can control the distance required to take off by setting the **max-thrust** parameter.

When a fixed-wing entity takes off, it does not take into account the soil type or terrain, except that if the slope of the terrain along which the entity must move to take off is greater than the **max-slope** parameter, the entity halts.

Fixed-wing entities do not know anything about runways that may be part of a terrain database. When you create a waypoint towards which an entity will take off, or create a route along which an entity will take off, you are responsible for ensuring that the entity is properly oriented towards the runway.

If an entity takes off as part of route following, you can define a runway with two points on the ground. If an entity detects that the point in the route after the one it is moving towards is in the air, it uses the current point as the take-off direction, but takes off as soon as possible and flies to the point in the air. [Figure 11-2](#) illustrates this behavior.

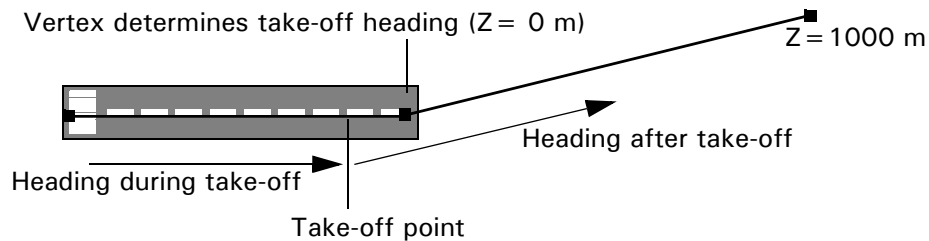


Figure 11-2. Defining a runway for take-off

11.4.4. How Fixed-Wing Entities Land

You can have aircraft land using the Fixed Wing Land task (please see “[Fixed-Wing Land](#),” on page 11-19), or as described in this section. The underlying behavior of the Fixed Wing Land task is the same as in this section. Using the Fixed Wing Land task automates the process of setting up the approach route.

A fixed-wing entity can land only in the context of following or patrolling a route. When a fixed-wing entity follows a route and determines that the next vertex in the route is on the ground, it decelerates as it reduces altitude towards that vertex. If it does not have enough distance from the previous vertex to decelerate sufficiently, it may crash. To ensure adequate deceleration, you may want to create a trigger that sets the entity’s speed when it approaches the runway.



Any time an entity is within 10 meters of the terrain and it is moving within 10 percent of its minimum lift speed, it will try to land.

To orient an entity for landing, you may have to create several vertices prior to the runway to get the entity properly lined up. [Figure 11-2](#) shows two different routes ending at an airport. The first route has vertices that line up the entity with the runway. The second route curves in towards the runway, so the entity does not approach the runway in a straight line. Therefore, as it reaches the landing point, it is not lined up with the runway and it lands on the grass.

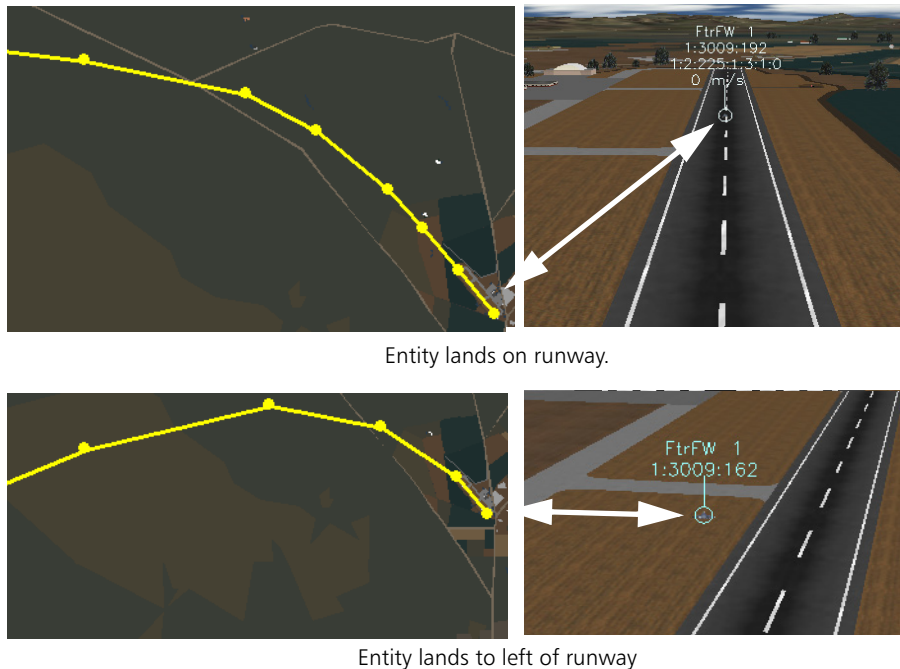


Figure 11-3. Landing fixed-wing entities

11.4.5. Specifying and Maintaining Altitude for Fixed-Wing Entities

The Set Altitude set data request moves an entity immediately to the specified altitude. If you want an entity to fly to a new altitude, assign the entity a Move to Altitude task. It spirals to the specified altitude at the same X, Y coordinates that it had when it received the task.

11.5. Rotary-Wing Entity Tasks and Behaviors

This section describes the behaviors of rotary-wing entities supplied with VR-Forces and the issues you should keep in mind when assigning tasks and set data requests.



The RotorLib Module for VR-Forces significantly improves rotary-wing entity behaviors. Please contact your MÄK salesperson for details.

Rotary-wing entities get created on the ground unless you specify an altitude at creation. (For details about specifying an altitude when you create an air platform, please see [“Specifying an Altitude for a New Entity,”](#) on page 8-6.)

If a rotary-wing entity is airborne and it is not assigned a task, it hovers at the specified location and altitude. When it completes a task, it hovers in the location where it completed the task.

The **terrain-check** parameter determines how a rotary-wing entity interacts with the terrain. If **terrain-check** is False, a rotary-wing entity ignores the terrain. It could appear to fly below ground. However, when **terrain-check** is set to False, VR-Forces does not have to check ground points, so performance may improve.

When **terrain-check** is True, rotary-wing entities interact with the terrain. If a rotary-wing entity approaches a ground point at three meters per second or less, it lands. If it approaches the ground at a greater speed, it crashes.

Helicopters have a basic terrain avoidance algorithm that helps prevent crashing if they are sent to waypoints or follow routes that do not have an altitude. The terrain avoidance logic maintains a distance above the ground; it does not look ahead. So, a helicopter could crash if the terrain rises suddenly ([Figure 11-4](#)). View the terrain profile of the route to check for intersections with the terrain. For details, please see [“Displaying a Line’s Terrain Profile,”](#) on page 20-10.

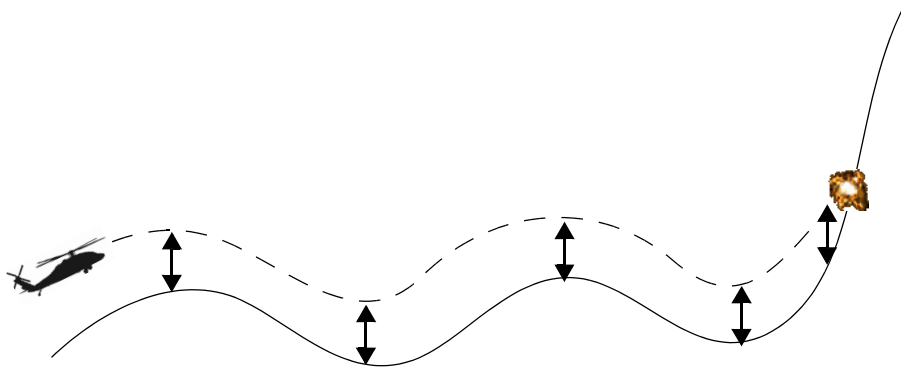


Figure 11-4. Helicopter terrain avoidance

11.5.1. Controlling Rotary-Wing Orientation

A rotary-wing entity can move laterally (sideways) without changing its orientation. In other words, it does not have to face in the direction it is moving. Rotary-wing entity movement controllers have two parameters that configure the speed at which a rotary-wing entity can move laterally. Rotary-wing entities rotate to try to align themselves with their velocity vector under the following circumstances:

- ♦ If the current speed is greater than the speed specified by **vel-to-align-actual**.
- ♦ If the speed of the entity is not greater than **vel-to-align-actual**, but the desired speed of the entity (the velocity it is attempting to achieve as a result of position or velocity commands) is greater than **vel-to-align-desired**.

If you do not want a rotary-wing entity to align itself with its direction of travel, set **vel-to-align-actual** and **vel-to-align-desired** to speeds that are greater than the speed at which you expect the entity to travel. You can set these parameters in the OPD Editor.

11.6. Task Procedures

The following sections describe the procedures for the tasks supplied with VR-Forces. If your installation uses the VR-Forces API to add additional tasks, consult with your software engineers for local procedural information. Please see [“Fixed-Wing Entity Tasks and Behaviors,”](#) on page 11-7 and [“Rotary-Wing Entity Tasks and Behaviors,”](#) on page 11-11, for additional information about assigning tasks to these entity types.

The instructions in this section for creating tasks direct you to use options on the main menu. However, all the options available on the main menu are also available in plans and on popup menus accessed by right-clicking an entity.

11.6.1. Disembark and Disembark All

The Disembark task causes an entity to move to the parent entity's egress (exit) point and disembark. If the selected entity is an aggregate (disaggregated), the disembark task is given to all embarked subordinates. The task is considered complete when all subordinates are disembarked. To disembark entities immediately, that is, without using a task, please see [“Embarking and Disembarking Entities,”](#) on page 8-10.



Aggregate entities in the aggregated state cannot embark or disembark. If a disaggregated entity is embarked, you cannot aggregate it either manually, or as a result of automated aggregation conditions.

To disembark an entity:

1. Select the entity you want to disembark.
2. Choose **Task** → **Disembark**.

Disembarking All Entities from a Parent Entity

The Disembark All task is given to a parent entity. It gives a Disembark task to all embarked entities except aggregates. When you issue a Disembark All task, VR-Forces tries to disembark the entities sequentially and have them move to sufficiently dispersed locations to avoid collision problems.

To disembark all entities from a parent entity:

1. Select the parent entity.
2. Choose **Task** → **Disembark All**.

11.6.2. DI-Guy Animation

VR-Forces can specify the movements and appearance of DI-Guy models used in 3D visualization programs such as the VR-Forces 3D Front End and the MÄK Stealth. The DI-Guy Animation task directs the 3D model to engage in a one-time or repeated series of motions. VR-Forces does not simulate the actions that the 3D model performs; it just adjusts the location and orientation of the VR-Forces entity to synchronize it with the 3D model's animated behavior. To change a 3D model's appearance, use the DI-Guy Appearance set data request. For details, please see [“Set DI-Guy Appearance,”](#) on page 12-9.



The DI-Guy Animation task applies only to lifeform entities.

To specify a DI-Guy animation:

1. Select the lifeform entity whose behavior you want to animate.
2. Choose **Task** → **DI-Guy Animation**. The DI-Guy Animation dialog box opens ([Figure 11-5](#)).

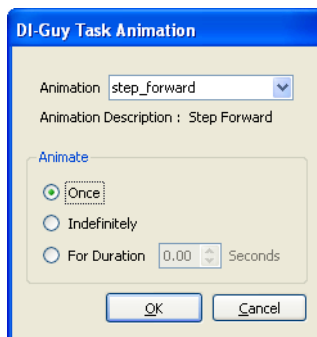


Figure 11-5. DI-Guy Task Animation dialog box

3. In the Animation drop-down list, select an animation. Animation options can be unclear. The Animation Description is a friendlier description of what the animation is.



You can edit the animation description. Descriptions are in *.config/character_animations_table.mtl*.

4. In the Animate group box, specify the duration of the animation.
5. Click OK.

11.6.3. Embark

The Embark task causes an entity to move to the ingress (entry) point of the parent entity and embark on it. If the embarking entity is a aggregate, each available taskable subordinate is given an embark task. When all subordinates have embarked, the aggregate task is considered complete.



Aggregate entities in the aggregated state cannot embark or disembark.

The Embark task is valid only if the specified parent entity is configured to accept the entity that wants to embark on it. If you task an entity to embark on an entity that is not configured to receive it, for example, you task a DI to embark on an M1A2, the entity will not respond to the task. If you want to embark an entity on an entity that is not configured to receive it, you can use the immediate embarkation process. For details, please see [“Embarking and Disembarking Entities,”](#) on page 8-10.

[Table 11-3](#) lists the entities that support embarkation and the number and type of embarked entities they can hold. High fidelity entities (HF column) have polygonal models of the entity and embarkation slots defined in such a way that the embarking entities can smoothly embark on the host entity when viewed in the MÄK Stealth.

Table 11-3: Embarkation support

Entity	Can Carry	HF
M2A2 Bradley IFV	6 DI	
M113 Armored Utility Vehicle	11 DI	
M-939A2 5-Ton Truck	14 DI	x
MT-LB Multipurpose Armored Vehicle	11 DI	
BTR-80 Armored Personnel Carrier	11 DI	
BMP-2 AVF	7 DI	
C-130 Hercules	92 DI or 3 ground vehicles	
CH-46E Sea Knight	11 DI	
CH-53E Super Stallion	55 DI	
UH-60 Blackhawk	11 DI	
OH-58 Kiowa	6 DI	
Mi-2 Hoplite	11 DI	
LCAC Landing Craft Air Cushion	12 HMMWVs or 4 trucks or 1 M1A2 or 1 generic ground vehicle	x
LSD-49 Harpers Ferry	2 LCACs and 2 helicopters	x

Table 11-3: Embarkation support

Entity	Can Carry	HF
Guided Missile Destroyer	2 helicopters	
Aircraft Carrier	12 fighters or 9 fighters and 2 cargo planes. Three helicopters. 70 planes below deck.	x

The aircraft carrier can carry both fixed-wing and rotary-wing aircraft. After the deck positions are used, additional entities embarked are stored below deck, as in a low-fidelity model.



- If you are using HLA and want to use the embarkation feature, you must use RPR FOM 2, draft 17. In Windows, VR-Forces includes entries on the Simulation Connections Configuration dialog box that start VR-Forces using the correct FED file and FOM Mapper for RPR FOM 1.0, and RPR FOM 2, draft 17.
- If the embarkation spaces on the parent entity are full, VR-Forces sends a message to the back-end console and the entity does not try to embark.
- If you give multiple entities embark tasks for the same parent, you are responsible for spreading the tasks over time so that the entities do not all converge on the parent at the same time, which would result in problems due to collision avoidance.

To embark an entity:

1. Select the entity.
2. Choose **Task** → **Embark**. The cursor changes to select mode and the Embark On dialog box opens.



Unlike the Embark On dialog box that opens when you choose **Entities** → **Embark**, the Embark On dialog box for the Embark task does not allow you to choose the embarkation point.

3. Select the parent entity (the entity to embark on) or type its name in the Name box.
4. Click OK.

11.6.4. Fire Cruise Missile

A cruise missile can fly directly to a target or follow a route.

To fire a cruise missile:

1. Select an entity that has cruise missile resources.
2. Choose **Task** → **Fire Cruise Missile**. The Fire Cruise Missile dialog box opens (Figure 11-6).

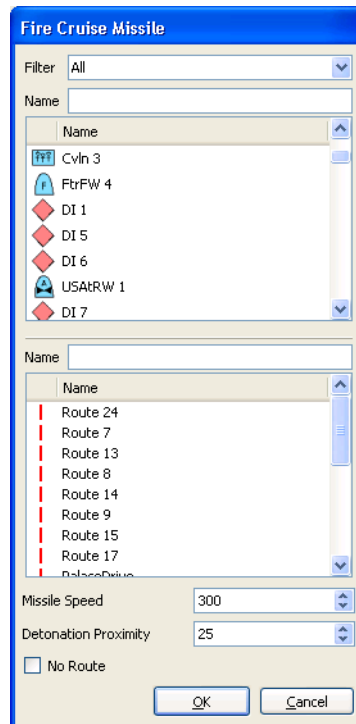


Figure 11-6. Fire Cruise Missile dialog box

3. Select the target from the list or on the map, or type its name in the Name box. Targets can be entities or points.
4. Select a route for the missile to follow or select No Route. If no route is selected, the missile flies directly to the target.
5. Specify the ordered speed for the missile.
6. Specify the detonation proximity for the warhead. It will detonate within this range of the selected target.
7. Click OK.

11.6.5. Fire for Effect

You can task artillery entities to fire for effect. The three options are:

- ♦ Fire-for-Effect on Entity
- ♦ Fire-for-Effect on Location, where location is a point in the terrain.
- ♦ Fire-for-Effect on Target, where a target is a waypoint.

To assign a Fire-for-Effect task:

1. Select the entity to which you want to assign the task. (It must be an artillery entity.)
2. Choose **Task** → **Fire-for-Effect on Entity** (or Location or Target). The appropriate dialog box opens.
3. Identify the target as follows:
 - For FFE Entity, select the target entity in the list, select it on the map, or type its name in the Name box.
 - For FFE Location, click a location on the map, or enter the coordinates. The coordinate information required is determined by the coordinate system selected in the Display Options dialog box. (For details, please see [“Specifying the Coordinate System for Dialog Boxes,”](#) on page 6-29.)
 - For FFE Target, select a point from the list, or select it on the map.



For FFE Entity and FFE Target, you can filter the target list.

5. Specify the number of rounds.
6. Optionally, specify the height above the terrain at which rounds should detonate.
7. Click OK.



- ♦ The Fire-for-Effect tasks are only meaningful when assigned to artillery entities.
 - ♦ When you choose Fire-for-Effect on Entity, VR-Forces notes the location of the entity and fires at that spot. If the targeted entity moves, the artillery does not change the location at which it is firing.
 - ♦ Artillery entities have maximum and minimum ranges. However, these ranges are not indicated visually on the map. The back-end console window prints messages when you select targets that are outside of the entity's range.
-

11.6.6. Fixed-Wing Land

“[How Fixed-Wing Entities Take Off](#),” on page 11-9, describes how fixed-wing entities land and the steps to design a landing approach. The Fixed Wing Land task automates the process of landing a fixed-wing aircraft. However, you must still specify a route to serve as the runway.

When the task is invoked, VR-Forces defines an approach route for the plane to move along. The length of this route is either the distance the plane is above the ground (altitude in meters) or the length needed to slow the plane down to landing speed (whichever is greater). The route is created and the plane moves along the route, coming to landing speed. At the end of the approach route, the plane is tasked to move along the runway.



Although it is possible to land an entity on another entity, such as an aircraft carrier, if you want to embark an entity, you must use the Embark task, not a landing task.

To land a fixed-wing aircraft:

1. Select the entity.
2. Choose **Task** → **Fixed Wing Land**. The Fixed Wing Land dialog box opens.
3. In the Name box, type the name of the route you want it to land on, or select the route in the list or on the map.
4. Click OK.

11.6.7. Fixed Wing Takeoff

You can explicitly task a fixed-wing entity to take off. (For details about implicit takeoff, please see “[How Fixed-Wing Entities Take Off](#),” on page 11-9.) In a Fixed Wing Takeoff task, the entity moves along the specified route, reaches takeoff speed (30% of minimum lift), and then moves to a point defined by the controller some distance up and away from the end of the route.

To assign a Fixed Wing Takeoff task:

1. Select the entity.
2. Choose **Task** → **Fixed Wing Takeoff**. The Fixed Wing Takeoff dialog box opens.
3. Select the route to take off on or type its name in the Name box.
4. Click OK.

11.6.8. Follow Entity

You can order an entity to follow another entity. You can specify a distance and offset between the entities. If you tell two or more entities to follow the same entity, make sure that you do not give them the same offset (please see [“Following Entities,”](#) on page 15-32).

An entity continues to follow its target entity until:

- ♦ The task is overridden
- ♦ The followed entity is destroyed.

If entity A is assigned to follow entity B, but it cannot find entity B, entity A continues to look for entity B until entity B becomes available, or until entity A is assigned another task.

The following entity tries to match the speed of the followed entity unless it has to hold back or catch up to accommodate changes in direction or terrain effects.

To order an entity to follow another entity:

1. Select the entity.
2. Choose **Task** → **Follow Entity**. The cursor changes to select mode and the Follow Entity dialog box opens.
3. Optionally, filter the entity list.
4. In the Name box, type the name of the entity to follow, or select it from the list or on the map.
5. Optionally, type an offset (in meters) in the Behind, Right, and Above text boxes. If you want an entity to follow in front, to the left, or below, put a minus sign (-) in front of the value.
6. Click OK.

How Fixed-Wing Entities Follow Entities

A fixed-wing entity can follow an entity that is on the ground, or might be on the ground, for example if it is following a fixed-wing entity that lands. To ensure that the follower does not crash, make sure that it is following above the followed entity and that the distance above is high enough to account for changes in the terrain.

11.6.9. Intercept and Destroy

The Intercept and Destroy task tells an entity to move towards the target entity and engage it in any way that is appropriate.



Intercept and Destroy turns off collision avoidance for the tasked entity. Its primary purpose is to allow entities such as car bombs and suicide bombers to approach a target entity and detonate its munition. If you give this task to an entity that does not have any offensive capability, such as a truck, it will ram the target. However, since VR-Forces does not model the effects of two entities colliding, there will be no damage to either entity and the tasked entity may end up circling the target. Therefore, you should be careful about which entities you assign this task to or the results may not be what you expect.

To assign the Intercept and Destroy task:

1. Select the entity to which you want to assign the task.
2. Choose **Task** → **Intercept and Destroy**. The Intercept and Destroy dialog box opens.
3. Select the entity that is to be the target of the assault.
4. Optionally, specify a standoff distance. The entity will not go closer to the target than this distance.
5. Click OK.

11.6.10. Lase Target

The Lase Target task simulates aiming a laser beam at a target to guide a laser guided weapons. By default, entities with laser capability lase autonomously. Use this task if you want to lase a specific target. An entity can lase a target while it is executing a movement task.

To lase a target, an entity must have a Laser Designator system. By default, rotary-wing entities based on the generic attack helicopter platform and the DI Lasing entity can lase targets.

To lase a target:

1. Select the entity that will aim the laser.
2. Choose **Task** → **Lase Target**. The Lase Target dialog box opens.
3. Select the entity that you want to lase.
4. Click OK.

11.6.11. Launch Smoke

The Launch Smoke task causes an entity to create a smoke cloud. The cloud is created as an environmental object. It grows over time.

An entity can launch a smoke cloud towards a threat or in a specific direction. Smoke clouds affect sensors. They do not affect entity movement. For details about configuring the display of tactical smoke, please see “[Displaying Tactical Smoke](#),” on page 17-15.

To launch a smoke cloud:

1. Select the entity that you want to launch smoke.
2. Choose **Task** → **Launch Smoke**. The Launch Smoke dialog box opens.
3. Select Toward Nearest Threat or Toward Compass Heading.
4. If you selected Toward Compass Heading, specify a compass heading, in degrees.
5. Click OK.

11.6.12. Move Along Route

By default, an entity moves along a route from its beginning point to its end point.



- ♦ If you edit a route while an entity is moving to the starting point of that route as part of a Move Along Route task, the entity will move to the nearest vertex, whether it is the starting point, or not.
 - ♦ When you task an air platform entity to follow a route, be sure to take into account the altitude of the route’s vertices and the terrain the entity has to pass over to complete the task.
 - ♦ Aggregates do not generate subordinate routes until they reach the beginning of the route.
 - ♦ An aggregate starts moving along a route when the leading edge of its formation is at the first point of the route. It is considered finished when the leading edge reaches the last point of the route.
-

To direct an entity to move along a route:

1. Select the entity.
2. Choose **Task** → **Move Along Route**. The cursor changes to select mode and the Move Along Route dialog box opens.
3. In the Name box, type the name of the route you want the entity to follow, or select a route in the list or on the map.
4. To have the entity move from the end of the route to the beginning, select Reverse Direction.

5. Click OK.

11.6.13. Move Into Formation

You can order a disaggregated aggregate to move to a formation at a specified location. (For aggregated aggregates, Move Into Formation has the same effect as a Set Formation set data request.)

Moving to a formation is not the same as setting formation. Setting formation changes the formation instantly. Moving to a formation causes the members of the aggregate to simulate traveling through the terrain into the new formation.

To direct an aggregate to move to a formation:

1. Select the entity.
2. Choose **Task** → **Move Into Formation**. The Move Into Formation dialog box opens.
3. Select the desired formation from the list.
4. Specify whether or not the task applies to subaggregates (if any).
5. Specify the location at which the aggregate is to move into formation by entering X, Y, and Z values, or by clicking on the map.
6. If you specify the location by clicking and the task is for an air platform that is in the air, change the Z value to a height that will prevent the entity from crashing.
7. Specify the heading the aggregate is to assume at the target location.
8. Click OK.

11.6.14. Move To Altitude

You can order an air or subsurface entity to move to an altitude. When you assign this task, the entity moves to the new altitude at the same X, Y coordinates. Fixed-wing aircraft spiral to the new coordinates. Rotary-wing and subsurface entities rise or fall. Moving to an altitude is not the same as setting altitude. Setting altitude moves an entity instantaneously.



Fixed-wing entities that are on the ground cannot respond to a Move to Altitude task. If they are given this task, a message is printed to the object console and the task is ignored.

To send an entity to an altitude:

1. Select the entity.
2. Choose **Task** → **Move to Altitude**. The cursor changes to select mode and the Move To Altitude dialog box opens.
3. Type the altitude, in meters, that you want the entity to move to. Use a negative number to submerge submarines.
4. Click OK.

11.6.15. Move To Location

You can order an entity to move to a location on the terrain. You can specify direct movement or the use of path planning. If you add Move to Location tasks to a plan, you have more options than when you give an independent task.

Moving to a location is not the same as setting location. Setting location moves an entity instantaneously. Moving to a location causes an entity to simulate traveling through the terrain.

To direct an entity to move to a location as an independent task:

1. Select the entity.
2. Choose **Task** → **Move to Location**. The cursor changes to select mode and the Move to Location dialog box opens.

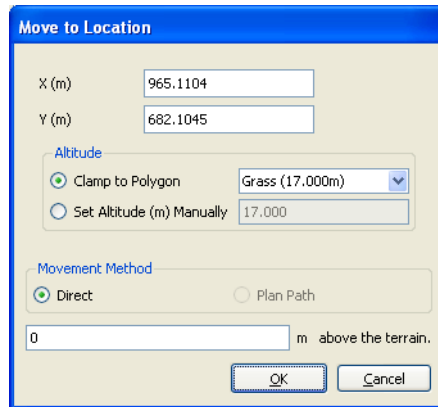


Figure 11-7. Move to Location dialog box for an independent task

3. Click on the map where you want the entity to move, or enter the coordinates of the location in the Move to Location dialog box. The coordinate information required is determined by the coordinate system selected in the Display Options dialog box. For details, please see [“Specifying the Coordinate System for Dialog Boxes,”](#) on page 6-29.
4. If there are multiple possible altitudes at the selected X, Y coordinate, you can specify the Z value manually, or select an available polygon from the list. This option is most useful for terrains that have multiple levels, such as an urban terrain in which you might be able to place an entity on the roof or several floors of a building. The default location when you click on the terrain is the uppermost polygon (the roof of a building).

To specify an available polygon, in the Altitude group box, select **Clamp to Polygon** and select a polygon from the drop-down list.

To accept the default Z value or specify the value manually, choose **Set Altitude Manually** and type a value.

i

If you specify the location by clicking and the task is for an air platform that is in the air, be sure to change the Z value to a height that will prevent the entity from crashing.

5. For ground entities only, in the Movement Method group box, specify direct movement or path planning. (For details, please see [“Path Planning for Movement Tasks,”](#) on page 11-6.)
6. If you want an entity to move to a location inside a building, specify a negative value in the meters above terrain box, where the top of the building is zero and the value entered is the distance to the floor on which you want the entity to be located. For more information about specifying a location in a building, please see [“Specifying a Location Inside a Building,”](#) on page 11-26.

7. Click OK.



When you task an air platform entity to move to a location, be sure to take into account the altitude setting for the object and the terrain the entity has to pass over to complete the task.

Specifying a Location Inside a Building

When you select a location on the map, the selected point always has the altitude (Z) of the highest elevation of the terrain at that point. Therefore, if you click a building, you select a point on the roof.

To specify a point inside a building, specify the location in either of the following ways:

- Type the coordinates of the location in the X, Y, and Z boxes.
- Click a point on the map, thereby entering the X, Y, and Z values of a point on the roof. Then type a negative value in the “m Above The Terrain” box. This value is the distance below the top of the building of the floor on which you want the entity to move to. The resulting value ($Z + [x]$ m above the ground) must be within 1.3 meters of the floor to be valid, as illustrated in (Figure 11-8).

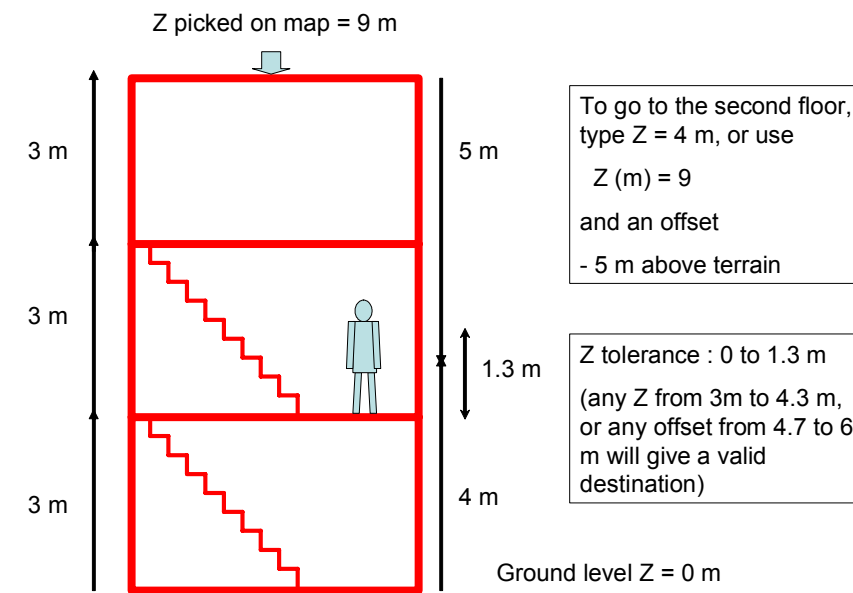


Figure 11-8. Specifying a location within a building

Adding Multiple Move To Location Tasks to a Plan

When you add a Move to Location task to a plan, you can add multiple locations without clicking OK and selecting the task again from the menu. Also, since in this method you cannot specify the Z value for each location, you can specify a height above the terrain for the Z value of the succeeding points.

To add multiple Move to Location tasks to a plan:

1. In the Plan Editor for an entity, choose **Task → Move to Location**. The Move to Location dialog box opens.
2. Select Each Map Click Generates A Task.
3. If you want to specify a Z value for the locations, type it in the [] m Above the Terrain box.
4. Click a point on the map for each location that you want the entity to move to. A Move To Location task is added to the plan for each location.
5. For ground entities only, in the Movement Method group box, specify direct movement or path planning. (For details, please see “[Path Planning for Movement Tasks](#),” on page 11-6.)
6. Click OK.

11.6.16. Move To Waypoint

You can order an entity to move to a point or another entity. Moving to an object is not the same as setting location. Setting location moves an entity instantaneously. Moving to an object simulates an entity traveling through the terrain.

To send an entity to an object:

1. Select the entity.
2. Choose **Task → Move to Waypoint**. The cursor changes to select mode and the Move To dialog box opens.
3. Optionally, filter the object selection list.
4. In the Name box, type the name of the object to move to, or select the object in the list or on the map.
5. For ground entities only, in the Movement Method group box, specify direct movement or path planning. (For details, please see “[Path Planning for Movement Tasks](#),” on page 11-6.)
6. Click OK.



When you task an air platform entity to move to an object, be sure to take into account the altitude setting for the object and the terrain the entity has to pass over to complete the task.

11.6.17. Orbit

The Orbit task allows a fixed-wing aircraft to circle around a point without needing to create a route for it to follow.

To specify an orbit task:

1. Select the entity that you want to orbit.
2. Choose **Task** → **Orbit**. The Orbit dialog box opens.
3. Specify the X and Y values of a point on the terrain around which the entity should orbit. You can click on the terrain to specify the points.
4. Specify the altitude at which to fly.
5. Specify the radius, in meters, of the circle.
6. Select or clear the Clockwise option to specify the direction of travel.
7. Click OK.

11.6.18. Patrol Along Route

When an entity patrols along a route, it moves to the nearest vertex of the route, to the end point, back to the beginning of the route, and then continues going back and forth until given another command.

To order an entity to patrol along a route:

1. Select the entity.
2. Choose **Task** → **Patrol Along Route**. The cursor changes to select mode and the Patrol Along Route dialog box opens.
3. In the Name box, type the name of the route to patrol along, or select the route in the list or on the map.
4. Click OK.



When you task an air platform entity to follow a route, be sure to take into account the altitude of the vertices and the terrain the entity has to pass over to complete the task.

11.6.19. Patrol Between

An entity can patrol between two point objects, entity objects, or both. When an entity patrols between two objects, it goes to the starting object, then moves back and forth between the two objects.

You can filter the object selection lists independently.

To order an entity to patrol between two objects:

1. Select the entity.
2. Choose **Task** → **Patrol Between**. The cursor changes to select mode and the Patrol Between dialog box opens.
3. In the Object 1 Name box, type the name of the first object to patrol between, or select an object in the list or on the map.
4. In the Object 2 Name box, type the name of the second object to patrol between, or select an object in the list or on the map.
5. Click OK.



When you task an air platform entity to patrol between objects, be sure to take into account the altitude of the objects and the terrain the entity has to pass over to complete the task.

11.6.20. Rotary-Wing Land

The Rotary Wing Land task automates the process of landing a rotary-wing aircraft. Rotary-wing aircraft can land on points.



Although it is possible to land an entity on another entity, such as an aircraft carrier, if you want to embark an entity, you must use the Embark task, not a landing task.

To land a rotary-wing aircraft:

1. Select the entity.
2. Choose **Task** → **Rotary Wing Land**. The Rotary Wing Land dialog box opens.
3. In the Name box, type the name of the waypoint on which you want the entity to land, or select the waypoint in the list or on the map.
4. Click OK.

11.6.21. Send Radio Set

The Send Radio Set task lets you send a set data request to an entity using a VR-Forces simulated radio message. If transmitters are enabled in the GUI, you can observe the sending and receipt of such a message. The receiving entity executes the set data request as if you had issued it directly to the entity from the Set menu or a set data request in a plan.

To send a set data request radio message:

1. Select the entity that will send the message.
2. Choose **Task** → **Send Radio Set** → *set_data_request*, where *set_data_request* is one of the set data requests on the menu. A dialog box for the set data request opens.
3. In the Name text box, type the name of the entity that will receive the set data request message, or select the entity in the list or on the map.
4. If the selected set data request requires input, complete the dialog box as described in Chapter 7, *Managing Objects*.
5. To send the message to all entities configured to receive messages from this entity's radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.9, “*Configuring Communication Models*”, in *VR-Forces Configuration Guide*.)
6. Click OK.

11.6.22. Send Radio Task

The Send Radio Task task lets you send a task to an entity using a VR-Forces simulated radio message. If transmitters are enabled in the GUI, you can observe the sending and receipt of such a message. The receiving entity executes the task as if you had directly tasked the entity from the Task menu or from inside a plan.

To send a task radio message:

1. Select the entity that will send the message.
2. Choose **Task** → **Send Radio Task** → *task*, where *task* is one of the tasks on the menu. A dialog box for the task opens.
3. In the Name text box, type the name of the entity that will receive the task message, or select the entity in the list or on the map.
4. If the selected task requires input, complete the dialog box as described elsewhere in this chapter.
5. To send the message to all entities configured to receive messages from this entity's radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.9, "[Configuring Communication Models](#)", in *VR-Forces Configuration Guide*.)
6. Click OK.

11.6.23. Send Text Message

The Send Text Message task lets you send a text message to an entity using a VR-Forces simulated radio message. If transmitters are enabled in the GUI, you can observe the sending and receipt of such a message. The receiving entity can test for receipt of the message in a conditional statement in its plan. (For details, please see "[The Receive Text Message Condition](#)," on page 15-13.)

To send a text message:

1. Select the entity that will send the message.
2. Choose **Task** → **Send Text Message**. The Send Radio Message dialog box opens.
3. In the Name text box, type the name of the entity that will receive the text message, or select the entity in the list or on the map.
4. In the Message Text box, type the message.
5. To send the message to all entities configured to receive messages from this entity's radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.9, "[Configuring Communication Models](#)", in *VR-Forces Configuration Guide*.)
6. Click OK.

11.6.24. Turn To Heading

The Turn to Heading task provides a realistic way for ground vehicles to turn to a new heading. Rather than turning instantly, as happens with the Set Heading request, a vehicle pivots or makes a K-turn to the new heading. The turning behavior for an entity is controlled by its **can-pivot** parameter in the object parameter database.

To order an entity to turn to a heading:

1. Select the entity.
2. Choose **Task** → **Turn to Heading**. The Turn to Heading dialog box opens.
3. Type a heading.
4. Click OK.

11.6.25. User Task

User tasks are tasks that have been added to VR-Forces using the VR-Forces toolkit. To assign a user task, you must know the name of the task and the required values for up to four parameters.



The User Task command is not available on the Task menu unless a developer adds a controller that accepts a user task.

To assign a user task:

1. Select the entity that you want to execute the task.
2. Choose **Task** → **User Task**. The User Task dialog box opens.
3. Type the name of the task.
4. Type any required parameters.

11.6.26. Wait

You can order an entity to wait indefinitely, for a specified period of time, or until a specified elapsed simulation time.



The Wait task is not equivalent to an immediate stop task. If an entity is moving and you give it a Wait task, it might not stop immediately, particularly if a controller such as the collision avoidance controller is controlling its movement.

Waiting Indefinitely

To order an entity to wait indefinitely:

1. Select the entity.
2. Choose **Task** → **Wait**.



If you give an indefinite wait, the entity does not progress through its plan until it receives another command.

Wait Duration

To order an entity to wait a specific amount of time:

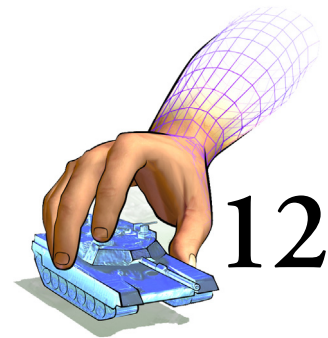
1. Select the entity.
2. Choose **Task** → **Wait Duration**. The Wait Duration dialog box opens.
3. Specify the duration of the wait in hours, minutes, and seconds.
4. Click OK.

Wait Elapsed

To order an entity to wait until a specific elapsed simulation time:

1. Select the entity.
2. Choose **Task** → **Wait Elapsed**. The Wait Elapsed dialog box opens.
3. Specify the elapsed time from the start of the simulation, in hours, minutes, and seconds.
4. Click OK.

For information about simulation time and simulated exercise time, please see [“Simulation Time and Exercise Time,”](#) on page 3-31.



Issuing Set Data Requests

This chapter explains how to issue set data requests to entities.

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12.1. Setting Entity State and Attributes

You can set the following entity state values for VR-Forces entities. The Set menu is context sensitive. It only shows the options that apply to the selected entity.

♦ Altitude	♦ Location
♦ Appearance	♦ Notify Level
♦ Armed	♦ Ordered Speed
♦ Capabilities	♦ Posture
♦ Collision avoidance types	♦ Reorganize
♦ Concealment	♦ Resource
♦ Destroyed	♦ Restore full health and resources
♦ Disembarked	♦ Rules of engagement
♦ Embarked	♦ Sector of responsibility
♦ Emitter	♦ Spot reports
♦ Fire Now	♦ Stay in Line
♦ Force	♦ Target
♦ Formation	♦ Tasked by superior
♦ Heading	♦ Weapon state.
♦ IFF	

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- ♦ The graphical user interface does not necessarily know about the state of an entity. When you open a dialog box for a Set command, any data in the dialog box represents either default values or the most recently used value, except for the Set Altitude, Set Location, and Set Heading dialog boxes, which show the current values for the selected entity.
 - ♦ You can configure how VR-Forces handles context sensitivity for the Task and Set menus by editing the `availableTaskSetRetrievalScheme` in `vrfGui.mtl`.
 - ♦ You can filter entity selection lists. For details, please see [“Filtering the Object Selection Lists,”](#) on page 11-5.
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12.2. Set Altitude

The Set Altitude request changes the altitude of entities immediately. If you want a fixed-wing or rotary-wing entity to move to an altitude, use the Move to Altitude task. You can set the altitude manually or place an entity at a specific level in a multi-level terrain features, such as a building.

To set an entity's altitude:

1. Select the entity.
2. Choose **Set** → **Altitude**. The Set Altitude dialog box opens. It displays the entity's current altitude.
3. To set the altitude manually, select the Set Altitude Manually option and type the altitude, in meters.
4. To set the altitude to a polygon in a multi-level feature, select the Clamp To Polygon option and select a polygon from the drop-down list.
5. Click OK.

12.3. Set Appearance

You can set appearance attributes for entities. The appearance attributes that are available for an entity are determined by its entry in the *appearance.mtl* file. The default list of appearance attributes is based on the DIS standard.

The Lifeform State field of the Set Appearance dialog box sets the posture for an entity. If VR-Forces does not support a selected posture, it simulates the entity using the closest similar posture. If a posture involves walking or running, VR-Forces chooses the posture to use based on the entity's speed. For more information about setting posture, please see [“Set Posture,”](#) on page 12-19.

To set appearance values:

1. Select the entity.
2. Choose **Set** → **Appearance**. The Set Appearance dialog box opens. The settings displayed are the current settings for the entity.
3. Change appearance settings as desired.
4. Click OK.

12.4. Set Armed

IEDs, car bombs, and suicide bombers must be armed to detonate. They are all armed by default. You can disarm them and re-arm them.



IEDs, car bombs, and suicide bombers have radios. Therefore, you can arm and disarm them using the Send Radio Set task.

To arm or disarm an explosive device:

1. Select the IED.
2. Choose **Set** → **Arm**. The Set Armed dialog box opens.
3. Select an option from the drop-down list.
4. Click OK.

12.5. Set Capabilities

You can set capabilities for entities. The capabilities that are available for an entity are determined by its entry in the *capabilities.mtl* file. The default list of capabilities is based on the DIS standard.

To set entity capabilities:

1. Select the entity.
2. Choose **Set** → **Capabilities**. The Set Capabilities dialog box opens. It displays the current settings for the entity.
3. Change the settings you want to change.
4. Click OK.

12.6. Set Collision Avoid Types

Sometimes entities exhibit undesired collision avoidance behavior because they try to avoid objects that are close to their line of travel, but not necessarily blocking it. You can enable and disable avoidance of entities, buildings, and trees on a per-entity basis. This option overrides the collision avoidance settings in the object parameter database entry for the entity.



- ♦ Collision avoidance settings are saved in an entity's process state repository. However, there is no indication in the GUI what these settings are. Therefore, we recommend that you not change collision avoidance settings through the GUI indiscriminately because you may lose track of which entities are avoiding which types of objects. To permanently set collision avoidance for an entity, edit its components in the object parameter database.
 - ♦ When the Set Collision Avoid Types dialog box opens, it does not reflect the settings for the selected entities. It only provides a default setting. Make sure that you review all the settings in the dialog box to be sure you do not inadvertently enable or disable a setting that you do not want to change.
 - ♦ The Set Collision Avoid Types set data request lets you specify collision avoidance only for broad categories of objects. You can set collision avoidance more specifically in the object parameter database.
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To change collision avoidance for specific object types:

1. Select the entity.
2. Choose **Set** → **Collision Avoid Types**. The Set Collision Avoid Types dialog box opens.
3. Select the check boxes for object types to avoid and clear the check boxes for the object types that the entity should not try to avoid.
4. Click OK.

12.7. Set Concealment

The Set Concealment request sets an entity's concealment attribute to True or False. This only affects the DIS or RPR FOM data sent over the network. It does not affect the simulation.

To set the concealment attribute for an entity:

1. Select the entity.
2. Choose **Set** → **Concealment**. The Set Concealment dialog box opens.
3. Select an option from the drop-down list.
4. Click OK.

12.8. Set Destroyed

You can set an entity's state to be destroyed. This can be helpful when you want an entity to be destroyed without having to first simulate its destruction by another entity.

To set an entity's state to destroyed:

1. Select the entity.
2. Choose **Set** → **Destroyed**. The entity is immediately destroyed.

12.9. Set Detonate Object

The Detonate Object set data request lets you configure detonation of improvised explosive devices (IEDs), suicide bombers, and car bombs. You can set them to detonate immediately, at a certain time delay, or based on the proximity of a target entity. If you specify proximity detonation, you can set the radius of the proximate area. If you specify time, you must set the time in seconds until detonation. Explosive devices must be armed to detonate. (For details about arming devices, please see “[Set Armed](#),” on page 12-5.)



IEDs, car bombs, and suicide bombers have radios. Therefore, you can detonate them using the Send Radio Set task.

To configure detonation of an IED or car bomb:

1. Select the IED that you want to configure.
2. Choose **Set** → **Detonate Object**. The Detonate dialog box opens.
3. In the Detonator Fuse Type drop-down list, select the fuse type (Timed, Immediate, or Proximity).
4. If you selected a Timed fuse, in the Detonation Time box, specify the elapsed time, in seconds, at which the IED should detonate.
5. If you selected a Proximity fuse, in the Detonation Proximity box, specify the radius, in meters, of the area in which an entity will trigger the detonation.
6. Click OK.

12.10. Set DI-Guy Appearance

The Set DI-Guy Appearance set data request determines the clothing and physical characteristics of a lifeform when it is displayed in a 3D simulation that uses DI-Guy characters.



The DI-Guy Appearance set data request applies only to lifeform entities.

To set an entity's DI-Guy appearance:

1. Select the entity.
2. Choose **Set** → **DI-Guy Appearance**. The DI-Guy Appearance dialog box opens.
3. Select an appearance from the drop-down list.
4. Optionally, in the 3D Front End only, select the Apply Selected Appearance Immediately check box. This displays the selected entity with the new appearance so that you can see what it looks like.
5. Click OK.

12.11. Set Disembarked

The Set Disembarked set data request immediately disembarks an entity (as opposed to simulating disembarkation, as done by the Disembark task). It is the equivalent of the **Entities** → **Disembarked** command. However, Set Disembarked allows you to include immediate disembarkation in a plan.

To set an entity to be disembarked:

1. Select the entity. If embarked objects are not displayed, you might need to select the entity in the Embarkation View on the Objects tab.
2. Choose **Set** → **Disembarked**.

12.12. Set Embarked

The Set Embarked set data request immediately embarks an entity (as opposed to simulating embarkation, as done by the Embark task). It is the equivalent of the **Entities** → **Embark On** command. However, Set Embarked allows you to include immediate embarkation in a plan.

To set an entity to be embarked:

1. Select the entity.
2. Choose **Set** → **Embarked**. The Set Embarked dialog box opens.
3. Select the entity on which to embark the child.
4. Optionally, specify a embarkation offset. The default, 0,0,0, puts the entity at the center of the parent entity.
5. Click OK.

12.13. Set Emitter

The radar sensor has an emitter component that models basic electromagnetic emissions. An entity can have multiple emitter components. Each emitter component can have multiple beams.

Emission properties (azimuth, elevation, effective radiated power, and so on) for each beam are specified in the emitter component descriptor in the object parameter database. Emission properties are published by the emitter component.

An emitter component can publish itself as a standard beam type or a tracking beam type. The type is determined by the setting for the **targeting-capable** parameter in the object parameter database. It applies to all beams emitted by the specific component. If **targeting-capable** is False, the beam is a standard beam. If **targeting-capable** is True, it is a tracking beam. If an emitter component has **targeting-capable** set to True, it registers for set-target messages. If you set a target for the entity on which the emitter is mounted, it publishes the target entity as its tracking target for all of the components beams.

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- ♦ Setting a target does not cause the beam to actually track the target. The beams behavior is determined by the parameters in its description in the object parameter database.
 - ♦ The emitter will continue to publish the targeted entity as its tracking target until you set another target, regardless of the status of that entity in the exercise. There is no way to set the target to “none”.
 - ♦ Please see Section 8.6, “[Configuring Emitters](#)” in *VR-Forces Configuration Guide*, for an explanation of how to configure individual and multiple emitters in the object parameter database.
 - ♦ Please see the online help for the OPD Editor for a description of emitter parameters.
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To turn on electromagnetic emissions:

1. Select the entity.
2. Choose **Set** → **Emitter**. The Set Emitter dialog box opens ([Figure 12-1](#)).

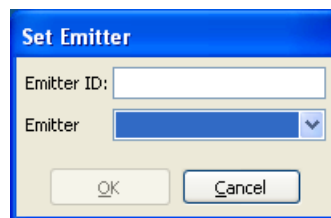


Figure 12-1. Set Emitter dialog box

3. Type the emitter ID. The ID is specified by the **system-id** parameter in the object parameter database. (For details, please see Section 8.6, “[Configuring Emitters](#)” in *VR-Forces Configuration Guide*.) The Set Emitter dialog box does not have a list of system IDs. You must know this information before you set emissions on or off.
4. In the Emitter drop-down list, select On.

12.14. Set Fire Now

The Fire Now request orders an entity to fire immediately at a specified target. It has the following behavior:

- ♦ The entity fires a single round as soon as possible. It ignores the range, rules-of-engagement, and line-of-sight to the target.
- ♦ Missiles are fired as soon as they are loaded, without aiming. The missile tracks towards the target as best it can.
- ♦ Ballistic guns load and aim toward the target before they fire. If the target is out of range, or not in line-of-sight, the round always misses. If the target is in range and within the line-of-sight, normal probability tables govern the chance of hitting the target.
- ♦ The Fire Now set data request allows you to fire on any entity, including friendly entities.
- ♦ Fire Now does not succeed if the firing entity does not have the appropriate ammunition for the selected target.

To set a Fire Now command:

1. Select an entity.
2. Choose **Set** → **Fire Now**. The Set Fire Now dialog box opens.
3. Optionally, filter the entity selection list.
4. Select the target from the list. (Or, on the map, click on the target entity.)
5. Click OK.

12.15. Set Force

You can change an entity's force during runtime. This might be useful in a simulation in which neutral forces begin assisting one force or another, or in which opposing forces capture friendly force weaponry and begin using it.

When you change an entity's force, its:

- ♦ Echelon ID changes to reflect the new force
- ♦ Icon changes to the appropriate force color and type
- ♦ Force ID changes.

Its entity enumeration does not change. So, for example, if you change the force of an M1A2, which has the country code 225 (United States), it still has the same country code, even though it might now be functioning as part of a force that is opposing United States forces.

To set the force of an entity:

1. Choose **Set** → **Force**. The Set Force dialog box opens.
2. Select a force from the drop-down list.

12.16. Set Formation

VR-Forces supports the following formations:

- ♦ Column (default)
- ♦ Line
- ♦ Wedge
- ♦ Vee
- ♦ No formation
- ♦ User-defined formations.

Formations are defined in formation files in the directory *./data/simulationModel-Sets/<model-set>/vrfSim/formation*. Formation files have the extension *.frm*. If you specify No Formation, the members of the aggregate maintain their relative positions as they move. In addition to the named formations provided by MÄK, VR-Forces supports user-defined formations.



The vee and wedge formations provided with VR-Forces place the aggregate leader at the end of one of the arms of the formation. If an aggregate has fewer than seven or eight members, it will not be symmetrical.

When you set the formation for a disaggregated aggregate, the entities that make up the aggregate snap to formation immediately. If you want entities to simulate moving into formation, rather than snapping to formation, use the Move Into Formation task.

If you set the formation for an aggregated aggregate, the aggregate remembers the formation and uses it the next time it disaggregates.

To set an aggregate's formation:

1. Select the aggregate whose formation you want to set.
2. Choose **Set** → **Formation**. The Set Formation dialog box opens.
3. In the Formation list, select the formation that you want the aggregate to use.
4. Click OK.

For information about configuring formations and about how to create user-defined formations, please see Section 8.5, “[Configuring Formations](#)” in *VR-Forces Configuration Guide*.

12.17. Set Heading

The Set Heading request instantly sets an entity's heading. If you want an entity to move to a new heading by pivoting or executing a K-turn, use the Turn To Heading task.

To set an entity's heading:

1. Select the entity.
2. Choose **Set** → **Heading**. The Set Heading dialog box opens. It displays the entity's current heading.
3. In the Heading text box, type a heading, in degrees.
4. Click OK.

12.17.1. Setting an Entity's Heading Manually

You can set an entity's heading by directly manipulating the entity.

To set an entity's heading manually:

1. Select the entity. The heading indicator changes to have a square handle at its end.

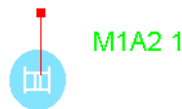


Figure 12-2. Set heading handle

2. Drag the handle to the heading you want.

12.18. Set IFF

Friendly fixed-wing entities can model a NATO Identification Friend from Foe (IFF) transponder.



- ♦ Mode 5 and mode C are equivalent.
- ♦ The dialog box does not force you to enter valid codes. It truncates invalid entries to the correct length (but not necessarily valid data).

To set the IFF transponder for a fixed-wing entity that is configured with an IFF controller:

1. Select the entity.
2. Choose **Set** → **IFF**. The IFF Settings dialog box opens (Figure 12-3).

The IFF Settings dialog box is a window with a blue title bar and a light beige background. It contains several sections for configuring IFF modes. On the left, there are sections for Mode 1, Mode 2, Mode 3, and Other. Each mode section has a 'Code' text box and an 'Enabled (On)' checkbox. The 'Other' section has three checkboxes: 'Emergency', 'Flash/Squawk', and 'STI'. On the right, there are sections for Mode 4, Mode C, and Mode S. Mode 4 has a 'Code' text box, an 'Enabled (On)' checkbox, and an 'Alternate Mode 4' section with three radio buttons: 'Valid' (selected), 'Invalid', and 'No Response'. Mode C has an 'Enabled (On)' checkbox and an 'Alternate Mode C' checkbox. Mode S has an 'Enabled (On)' checkbox and a 'TCAS Setting' section with two radio buttons: 'TCAS I' (selected) and 'TCAS II'. At the bottom right, there are 'OK' and 'Cancel' buttons.

Figure 12-3. IFF Settings dialog box

3. Complete the IFF Settings dialog box.

12.19. Set Lase Autonomous

By default, entities with laser capability lase targets autonomously as part of the built-in target acquisition and firing process. You can specifically enable and disable autonomous lasing.

To enable or disable autonomous lasing:

1. Select the entity.
2. Choose **Set** → **Lase Autonomous**. The Set Lase Autonomous dialog box opens.



The Set Lase Autonomous dialog box does not show the current lasing state of the entity.

3. Select an option from the drop-down list (Off or On).
4. Click OK.

12.20. Set Laser Code

The Set Laser Code set data request sets the code for laser beams sent by an entity and the code that the entity's missiles seek when they fire. By default, VR-Forces calculates a laser code for each laser-capable entity when it is created. You can change the laser code to a code of your choice. For information about the consequences of setting laser codes, please see "[Lasing Targets](#)," on page 13-11.

To specify an entity's laser code:

1. Select the entity.
2. Choose **Set** → **Laser Code**. The Set Laser Code dialog box opens.
3. Type a number between 111 and 8888, using only the digits 1-8.
4. Click OK.

12.21. Set Location

To move an entity instantly from one place to another, you can set its location or you can drag it to a new location. For information about dragging entities, please see [“Moving Objects,”](#) on page 7-11. For ground entities, specifying a Z value lets you place an entity at different levels (floors) in building features.

To set the location for an entity:

1. Select the entity.
2. Choose **Set** → **Location**. The Set Location dialog box opens. It displays the entity’s current location. The cursor changes to input mode.
3. Click on the map where you want to move the entity, or enter the coordinates of the location in the Set Location dialog box. The coordinate information required is determined by the coordinate system selected in the Display Options dialog box. For details, please see [“Specifying the Coordinate System for Dialog Boxes,”](#) on page 6-29.
4. If there are multiple possible altitudes at the selected X, Y coordinate, you can specify the Z value manually, or select an available polygon from the list ([Figure 12-4](#)). This option is most useful for terrains that have multiple levels, such as an urban terrain in which you might be able to place an entity on the roof or several floors of a building. The default location when you click on the terrain is the uppermost polygon (the roof of a building).

To specify an available polygon, in the Altitude group box, select **Clamp to Polygon** and select a polygon from the drop-down list.

To accept the default Z value or specify the value manually, choose **Set Altitude Manually** and type a value.

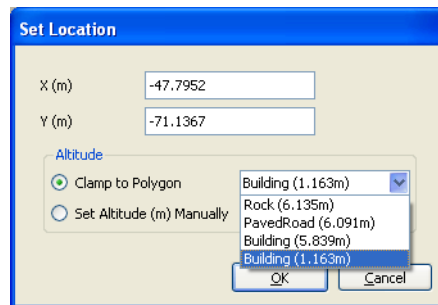


Figure 12-4. Set Location dialog box showing polygon options

5. Click OK.

12.22. Set Notify Level

You can set the notification level for entity console messages without opening the Entity Information dialog box.

To set the notification level:

1. Choose **Set Notify Level**. The Notify Level dialog box opens.
2. Select a notification level in the drop-down list.
3. Click OK.

12.23. Set Posture

A lifeform entity (civilian or dismounted infantry) has a posture that determines its position when it is not moving and its type of movement when it is moving. [Table 12-1](#) lists the position and movement relationships for each posture.

Table 12-1: Lifeform posture relationships

Posture	When it is not moving, it is:	When it is moving, it is:
standing	standing	walking or running
kneeling	kneeling	crawling
prone	prone	crawling
running	standing	walking or running
walking	standing	walking or running
crawling	prone	crawling
parachuting	standing	walking or running
jumping	standing	walking or running
sitting	standing	walking
squatting	prone	crawling
crouching	prone	crawling
wading	standing	walking or running



- ♦ For those postures listed as “walking or running”, VR-Forces sets the movement posture based on the entity’s speed.
- ♦ If an entity does not support a particular posture, it is set to the closest supported posture.
- ♦ Setting posture in the Lifeform State field of the Set Appearance dialog box has the same effect as setting the posture using the Set Posture set data request.

To set a lifeform's posture:

1. Select the lifeform.
2. Choose **Set** → **Posture**. The Set Posture dialog box opens.
3. Select a posture from the list.
4. Click OK.



If you want to view the various lifeform postures in MÄK Stealth 6.x, load the *infantryModels.mtl* file by adding it to *Stealth.mtl*, or using the command line option:

```
-l config/infantryModels.mtl.
```

12.24. Set Reorganize

If automatic reorganization is not enabled, you can reorganize an aggregate by issuing the Reorganize set data request.

To reorganize an aggregate:

1. Select the aggregate that you want to reorganize.
2. Choose **Set** → **Reorganize**.

The change takes place immediately. For more information about reorganization, please see [“Reorganizing Aggregates,”](#) on page 3-21.

12.25. Set Resources

You can specify the value to assign to a resource. The resources provided with VR-Forces that you can set are fuel and ammunition. The object parameter database lists the ammunition types available for each type of entity.

To specify a resource value:

1. Select the entity.
2. Choose **Set** → **Resources**. The Set Resources dialog box opens.
3. Select a resource from the Resource Name list. If you know that the entity supports resources that are not listed, you can type a resource in the text box.
4. Specify a value for the resource. The dialog box displays the maximum amount of the resource allowed, as configured in the object parameter database.
5. Click OK.

12.26. Set Restore

Restoring an entity returns its resources to the values specified in the object parameter database. If the entity is destroyed, it returns it to life.



When you restore an aggregate that is in the aggregated state (using Set Restore), the original configuration of the aggregate is recreated. If you restore an aggregate that is in the disaggregated state, then only those subordinates still present in the simulation are restored. Any destroyed subordinates that were previously removed from the simulation as result of a disaggregate-->aggregate-->disaggregate transition are be restored. To fully recover all subordinates, restore the aggregate while in the aggregated state.

To restore an entity:

1. Select the entity.
2. Choose **Set** → **Restore**.

The change takes place immediately.

12.27. Set Rules of Engagement

Rules of engagement specify the conditions under which an entity will fire at the enemy.



The rules of engagement for a fixed-wing entity are in effect whether it is on the ground or in the air. If you do not want fixed-wing entities to fire missiles while they are on the ground, you must change the rules of engagement.

To specify the rules of engagement for an entity:

1. Select the entity.
2. Choose **Set** → **Rules of Engagement**. The Set Rules of Engagement dialog box opens.
3. In the Rules of Engagement list, select the rule you want to apply.
4. Click OK.

12.27.1. How Fire-When-Fired-Upon Works

An entity considers itself under fire if either of the following is true:

- ♦ An “Entity Impact” detonation interaction that targeted this entity has recently (within **underFireTime** seconds (default 120)) been received.
- ♦ Any detonation has happened within **underFireDistance** (default 1000 meters) of this entity.

There is no attempt to return fire specifically at the attacking entity. If an entity thinks that it is under fire, it will fire at any enemies that it can target.



The **underFireTime** and **underFireDistance** parameters are top-level entity parameters (like **max-speed**), but they are not in the default *vrfSim.opd* file.

12.28. Set Ordered Speed

When you set an entity’s speed, you are setting its ordered speed, the speed at which you want it to move. It may not move at that actual speed due to soil type, slope, and so on. If you set the speed while an entity is moving, it accelerates or decelerates from the current speed to the new ordered speed.



- ♦ Regardless of the speed that you enter, an entity’s speed cannot exceed the value set by the **max-speed** parameter in the object parameter database.
 - ♦ The Set Speed request sets the ordered speed of a fixed-wing entity in its current context – air or ground. The entity will not exceed the maximum speed for that context. However, if the maximum allowable ground speed is greater than the lift speed of the entity, and you assign an ordered speed greater than the lift speed, when the entity reaches that speed, it will take off.
-

To set the ordered speed of an entity:

1. Select the entity.
2. Choose **Set** → **Ordered Speed**. The Set Ordered Speed dialog box opens.
3. In the Ordered Speed text box, set the speed, in meters per second.
4. Click OK.

12.29. Set Sector of Responsibility

An entity's sector of responsibility is used with detection tables to determine the priority of targets. Normally, the priority of targets that are outside an entity's sector of responsibility is lower than the priority of targets in its sector of responsibility. For information about the target detection tables, please see Section 8.2, “[Detection Probability Tables](#)” in *VR-Forces Configuration Guide*.

You must specify a sector center and a sector size. Sector center is the center of the area you wish to designate, and sector size is the size of the area, both in degrees. Degrees are measured as 0 to the front (based on the heading), increasing clockwise. If the Turret Scan Controller is mounted on an entity with an articulating turret, then the turret scans the sector of responsibility specified. Sector center is the midpoint of the area. [Figure 12-5](#) illustrates these parameters. The sector size is approximately 140 degrees, a bit less than half the circle. The sector center is at 0 degrees.



The default sector of responsibility is 90 degrees, centered at zero degrees.

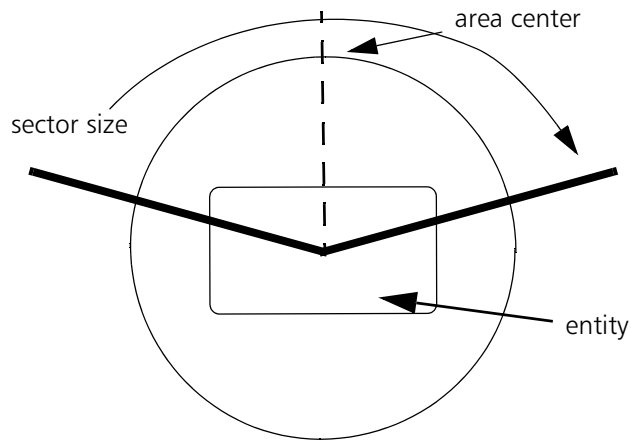


Figure 12-5. Sector of responsibility parameters

To set an entity's sector of responsibility:

1. Select the entity.
2. Choose **Set** → **Sector of Responsibility**. The Set Sector of Responsibility dialog box opens.
3. In the Size text box, set the size of the area to be scanned, in degrees.
4. In the Center text box, set the center of the scan area, in degrees.
5. Click OK.

12.30. Set Spot Reports

You can set spot reports on or off for all entities from the Spot Reports dialog box. You can also set them for individual entities. When you set spot reports on, it means that the entity sends them. Visualization of spot reports is enabled or disabled for the GUI as a whole in the Spot Reports dialog box.



You cannot set an aggregate entity to send spot reports; you can only set spot reports for individual entities. However, you can select multiple individual entities and set spot reports for all of them at the same time.

To set spot reports on or off for an entity:

1. Select the entity.
2. Choose **Set** → **Spot Reports**. The Set Spot Reports dialog box opens.
3. Select an option from the drop-down list.
4. Click OK.

12.31. Set Stay in Lane

If a ground vehicle has Stay in Lane enabled, and it encounters a road that is nearly along its desired path of movement, the vehicle drives parallel to the road, maintaining a configured distance from the center line of the road. Once the road ends or is no longer going in the direction the vehicle is moving, the vehicle leaves the road and moves normally.



- ♦ The distance to maintain from the road's center line is specified by the **road-center-offset** parameter in the object parameter database. Positive values are to the right of the center line; negative values are to the left.
 - ♦ To change the default Stay In Lane setting for a vehicle type, change the **stay-in-lane** parameter in its object parameter database entry.
 - ♦ The object parameter database files that ship with VR-Forces disable road following for all entities except the civilian vehicle.
-

To set an entity to stay in its lane:

1. Select the entity.
2. Choose **Set** → **Stay in Lane**. The Set Stay in Lane dialog box opens.
3. Select an option from the drop-down list.
4. Click OK.

12.32. Set Surrendered

When an entity is in the surrendered state, it does not fire at other entities and other entities do not fire at it. If a lifeform is in the surrendered state, when it is not moving, VR-Forces assigns it the surrendered posture.

To set an entity to be surrendered:

1. Select the entity.
2. Choose **Set** → **Surrendered**. The Set Surrendered dialog box opens. The Surrendered check box indicates whether or not the entity is currently surrendered.
3. Select the check box to set the entity to be surrendered. Clear the check box to free the entity.
4. Click OK.

12.33. Set Synchronize Laser Code

The Set Synchronize Laser Code set data request lets an entity with laser-guided weapons easily synchronize its laser code with the laser code of the lasing entity. The alternative to this command would be to use Set Laser Code to set the code for the lasing entity and the firing entity.

To synchronize laser codes:

1. Select the entity that has a laser-guide weapon.
2. Choose **Set** → **Synchronize Laser Code**. The Synchronize Laser Code dialog box opens.
3. Select the lasing entity that you want this entity to synchronize with.
4. Click OK. The laser code for the selected entity is changed to match that of the lasing entity.

12.34. Set Target

You can command an entity to specifically target another entity. For this set data request to be effective, the target must be visible to the targeting entity. When you set a target, you override the priorities set by the target selection controller. If the specified target is in the list of candidate targets, it gets the highest priority as a target. However, if the specified target is not visible as a target to the targeting entity, the entity fires at the other available targets. It does not keep looking for the specified target. (You could achieve this behavior by putting a Set Target statement inside a While statement.)

To set an entity's target:

1. Select the entity.
2. Choose **Set → Target**. The Set Target dialog box opens.
3. Optionally, filter the entity selection list.
4. In the Target list, or on the map, select the entity to target.
5. Click OK.

12.35. Set Tasked by Superior

You can order an entity that is part of an aggregate, and which is executing its own plan or is conducting an independent task, to stop executing those tasks and take commands from its aggregate. When you order an entity to be tasked by its superior, it stops conducting independent tasks and waits for the next order from the aggregate. (It does not execute the aggregate's current task, if any.) For more information about being tasked by superior, please see [“Independently Tasking Aggregate Members,”](#) on page 11-6.

To order an entity to be tasked by its superior:

1. Select the entity.
2. Choose **Set → Tasked by Superior**.

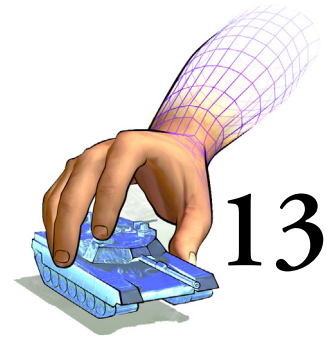
The change takes place immediately.

12.36. Set Weapon State

You can set the weapon state for dismounted infantry entities. The options are stowed, deployed, and in-fire-position.

To set the weapon state:

1. Select the entity.
2. Choose **Set** → **Weapon State**. The Set Weapon State dialog box opens.
3. Choose a weapon state from the list.
4. Click OK.



Target Detection and Combat Features

The chapter describes VR-Forces features related to target detections and acquisition – spot reports, hostility relationships, lasing, and munition damage.

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13.1. Displaying Entities Based on Spot Reports

A spot report is a report by an entity to members of its force that it has detected a member of another force.

By default, VR-Forces displays entities based on complete ground truth. That is, it shows all entities in their exact location. However in real-world combat and training situations, participants rarely know where all other entities are, including those in their own force. This is called the fog-of-war. VR-Forces can simulate a semblance of the fog-of-war by displaying entities based on spot reports, rather than ground truth.

When you display entities based on spot reports, you do not see all members of forces other than your own. You only see spot reports for other-force entities that have been detected by members of your force. Spot reports are represented by icons that are similar to entity icons, but they do not move as entity icons do. Furthermore, since spot reports lose value over time as entities move to different locations, VR-Forces maintains a certainty level for the location of other forces. If a detected entity is not detected again for a period of time, its certainty decreases and its icon becomes increasingly transparent to show that it is less certain that the entity is at the reported location.

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- ♦ Spot reports only affect the display of entities on the map. The various object lists continue to list all objects in the simulation.
 - ♦ Generating spot reports can reduce the performance of the simulation engine.
 - ♦ When you rewind a scenario, the viewpoint configuration stays the same as in the previous run of the scenario. However, the settings for enabling spot reports are lost. Therefore, each time you rewind a scenario, you must enable spot reports for those entities for which you want to generate spot reports. If you do not enable spot reports, you will not be able to see any of the entities in the hidden forces.
-

13.1.1. Enabling or Disabling Spot Reports

You can enable or disable spot reports globally or per entity.

Enabling or Disabling Spot Reports for an Entity

To enable or disable spot reports by entity:

1. Select the entity for which you want to enable or disable spot reports.
2. Choose **Set** → **Spot Reports**. The Set Spot Reports dialog box opens.
3. Select On or Off from the list.
4. Click OK.

Enabling or Disabling Spot Reports for all Entities

When you enable or disable spot reports globally, any per-entity spot report settings are overridden.

To enable or disable spot reports for all entities:

1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens.
2. Select the Enable/Disable Spot Reports tab (Figure 13-1).

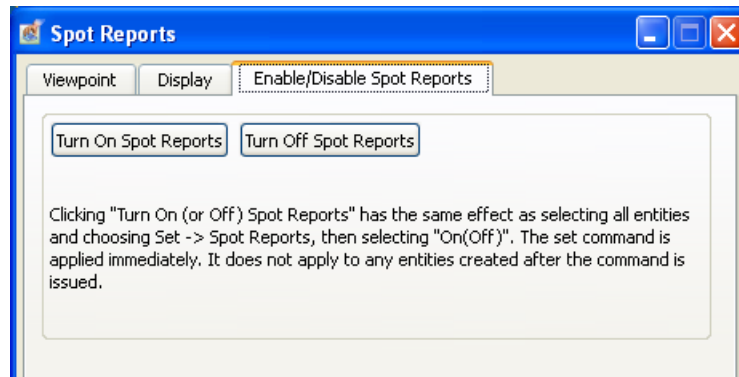


Figure 13-1. Spot Reports dialog box, Enable/Disable Spot Reports tab

3. Click Turn on Spot Reports or Turn Off Spot Reports. The change takes effect immediately.



Clicking Turn On Spot Reports or Turn Off Spot Reports is the equivalent of executing a **Set** → **Spot Reports** (On or Off) for all entities. If you add an entity to the scenario after you click one of these buttons, it is created with the default value for generating spot reports, so it might not be consistent with other entities.

13.1.2. Configuring the Spot Reports Viewpoint

The spot report viewpoint determines which entities and objects are shown using ground truth and which are shown using only spot reports. You can select preconfigured viewpoints or create custom viewpoints.



When you rewind a scenario, the viewpoint configuration stays the same as in the previous run of the scenario. However, the settings for enabling spot reports are lost. Therefore, each time you rewind a scenario, you must enable spot reports for those entities for which you want to generate spot reports. If you do not enable spot reports, you will not be able to see any of the entities in the hidden forces.

Selecting a Preconfigured Spot Report Viewpoint

VR-Forces provides viewpoints for the Friendly, Opposing, Neutral, and Other forces. In each of these viewpoints, VR-Forces displays ground truth for the viewpoint force and spot reports for the other forces. For example, if you select the Friendly force viewpoint, all entities in Force 1 are displayed showing ground truth. All other entities are displayed only if they have been detected by a friendly entity that is configured to send spot reports.

When you select a preconfigured viewpoint, the check boxes in the windows in the Map View group box are automatically set to match the selected viewpoint.

To configure spot reports:

1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens (Figure 13-2).

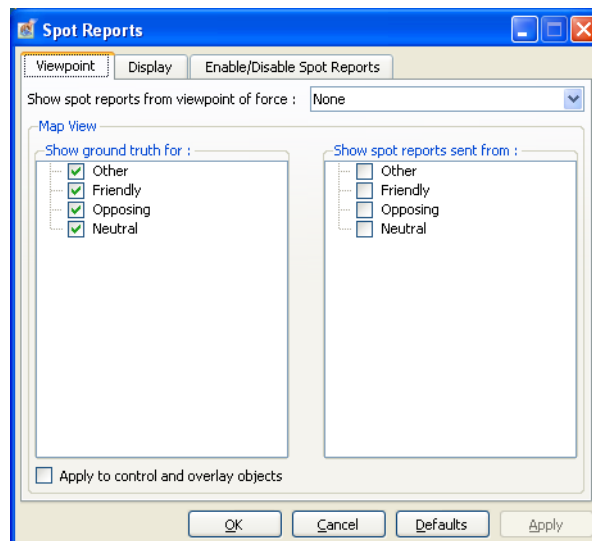


Figure 13-2. Spot Reports dialog box, Viewpoint tab

2. Select an option in the Show Spot Reports from Viewpoint of Force list.

Configuring Custom Spot Report Viewpoints

If you do not want to use a preconfigured viewpoint, you can create a custom viewpoint. This option allows you to see ground truth and spot reports from a mix of forces. When you create a custom viewpoint, the Show Spot Reports from Viewpoint of Force list displays the viewpoint that you have created (usually Custom).

It is possible to create a custom configuration in which no objects are displayed, so think carefully about your choices.

To configure a custom viewpoint:

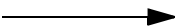
1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens (Figure 13-2).
2. In the Show Ground Truth For window, select the forces for whom you want ground truth to be displayed. You would usually select the same forces as the ones selected in the Show Spot Reports Sent From window.
3. In the Show Spot Reports Sent From window, select the forces whose spot reports you want to display. In other words, if you are not showing ground truth for the Opposing force and only want to see the Opposing force entities that are detected by Friendly and Neutral entities, then select the Friendly and Neutral check boxes.

Configuring Same-Side Fog-of-War

There may be cases when you want to simulate same-side fog-of-war. That is members of a force do not know where other members of their force are unless detected by an entity and reported using a spot report.

To simulate same-side fog-of-war, you must edit the *spot-report-generator.sysdef* file. You might want to create a customized file that you can assign only to the entities that you want to simulate same-side fog-of-war. (You can use the Entity Editor to change the spot report systems that entities use.) In the system definition file change the **send-spot-reports-on-own-force** parameter to True, as follows:

```
(spot-report-generator-system
  (controllers
    (spot-report-generator
      (component-descriptor-type
        "spot-report-generator-controller-descriptor")
      ...
      (object-types-to-spot-report
        (object-type 1 (1 -1 -1 -1 -1 -1 -1))
        (object-type 1 (3 -1 -1 -1 -1 -1 -1))
        (object-type 1 (5 -1 -1 -1 -1 -1 -1))
      )
      (send-spot-reports True)
      (send-spot-reports-on-own-force True)
      (send-spot-reports-on-hostile-forces True)
      (send-spot-reports-on-neutral-forces True)
    )
  )
  ...
)
```



You can edit the system definition file by hand or in the OPD Editor. For details about the OPD Editor and the Entity Editor, please see *VR-Forces Configuration Guide*.

13.1.3. Configuring the Spot Reports Certainty Level

It is assumed that as time passes the validity, or certainty, of a spot report declines. To simulate this decline in certainty, VR-Forces can display the icons that represent spot reports at increasing levels of transparency. You can configure the amount of time that VR-Forces displays icons for each certainty level.

To configure the amount of time, in seconds, that an icon is displayed at each certainty level:

1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens.
2. Select the Display tab (Figure 13-3).
3. Double-click the value in the Time at Level column that you want to change. The value changes to edit mode.
4. Type a new value.
5. Click outside the list.

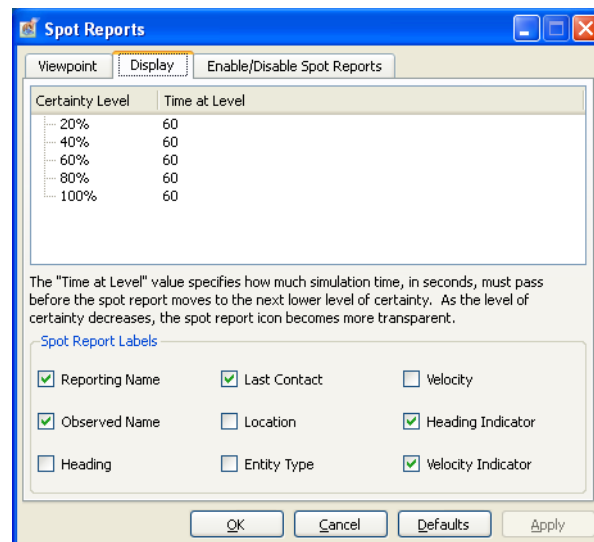


Figure 13-3. Spot Reports dialog box, Display tab

13.1.4. Configuring Spot Report Labels

You can configure the information displayed with a spot report.

To configure spot report labels:

1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens.
2. Select the Display tab (Figure 13-3).
3. In the Spot Report Labels group box, select or clear the appropriate check boxes.

13.1.5. Applying Spot Reports to Graphical Objects

You can display control objects and overlay objects based on spot reports rather than ground truth. The same criteria are applied to their display as are applied to the display of entities. For information about how to assign objects to a force, please see [“Creating Graphical Objects,”](#) on page 16-8.

To apply spot reports to graphical objects:

1. Choose **Options** → **Spot Reports**. The Spot Reports dialog box opens ([Figure 13-2](#)).
2. Select the Viewpoint tab.
3. Select the Apply to Control and Overlay Objects check box.

13.2. Managing Force Hostility Relationships

By default, VR-Forces categorizes entities as members of friendly, opposing, or neutral forces. Friendly forces and opposing forces are hostile to each other. Neither is hostile towards neutral forces. You can change force hostility relationships dynamically. This may be particularly useful if you are simulating an environment in which civilian populations become hostile to a particular force, or in which armed militias, for example, switch allegiances to other forces.

You can add new forces in the Entity Editor. For details, please see Section 5.12, “Managing the Forces List” in *VR-Forces Configuration Guide*. You can change a force’s hostility in a global or entity plan. For details, please see “Changing a Force’s Hostility in a Plan,” on page 13-9.

You can change the default hostility relationships by editing the *forceHostility.mtl* file for the simulation model set you are using (for example, *./data/simulationModel-Sets/default/forceHostility.mtl*).

When you change force hostility at runtime, the changes are saved as part of the scenario. The hostility loaded with a scenario overrides the hostility loaded by the simulation model set’s hostility file.

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Hostility relationships are not reciprocal. For example if you set neutral force entities to be hostile to friendly force entities, that does not mean that friendly force entities are hostile to neutral force entities.

To change the force hostility matrix:

1. Choose **Simulation** → **Hostility Matrix**. The Hostility Matrix opens (Figure 13-4). Each row in the matrix lists the hostility relationships between that row’s force and all of the other forces (represented by color-coded columns).



Figure 13-4. Hostility Matrix

2. For each row in the matrix, select the check boxes in the columns for the forces that you want to be hostile to that row’s force. Clear the check boxes for forces that you do not want to be hostile.
3. Click OK.

13.2.1. Changing a Force's Hostility in a Plan

To change a force's hostility in a global or local plan:

1. Open a global plan or an entity's plan.
2. Choose **Command** → **Change Hostility**. The Change Hostility dialog box opens (Figure 13-5).

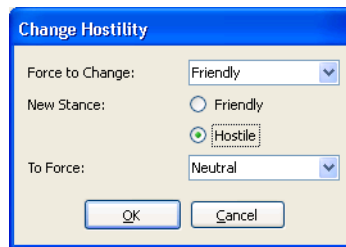


Figure 13-5. Change Hostility dialog box

3. In the Force to Change list, select the force whose hostility you want to change.
4. In the To Force list, select the force towards which you want to change hostility.
5. Select the new force relationship (New Stance), either Friendly or Hostile. (By default, the Change Hostility dialog box selects a new stance that is the opposite of the current stance.
6. Click OK. The command is added to the plan.

13.3. Detecting Targets

Entities can have one or more sensors, for example, visual, sonar, or radar, for detecting and identifying other entities. When an entity detects another entity, it assigns it a combat identification (CID) level. If it continues to maintain contact with the entity, it upgrades the CID level as follows:

- ♦ CID Level 0 – not detected
- ♦ CID Level 1 – Detected: the entity is detected, but only its platform is known, for example, ground
- ♦ CID Level 2 – Classified: the entity's category is known, for example, tank
- ♦ CID Level 3– Identified: the entity's category and subcategory are known, for example M1A2
- ♦ CID Level 4 – Full Knowledge: all visible information about the entity is known.

CID levels are assigned based on the distance to the detected entity and the length of time that the entity has been in contact. You can configure these values in the detection tables (*./data/simulationModelSets/default/vrjSim/detection/*.csv*). For details about these configuration files, please see Section 8.2, “[Detection Probability Tables](#)”, in *VR-Forces Configuration Guide*.

By default, entities do not fire at a detected hostile entity until it achieves the Identified level. You can configure this behavior by changing the **detection-level-to-set-hostility** parameter in the entity's sensor system. For details about editing entity parameters, please see *VR-Forces Configuration Guide*.

Figure 13-6 shows a series of screen captures of an entity as its CID level is advanced from Detected through Identified. In this scenario, spot reports are enabled. Therefore, when an entity is detected, it is displayed with a yellow icon, rather than the normal color for the force. It is not given the correct force color until the detected entity is CID level Identified.

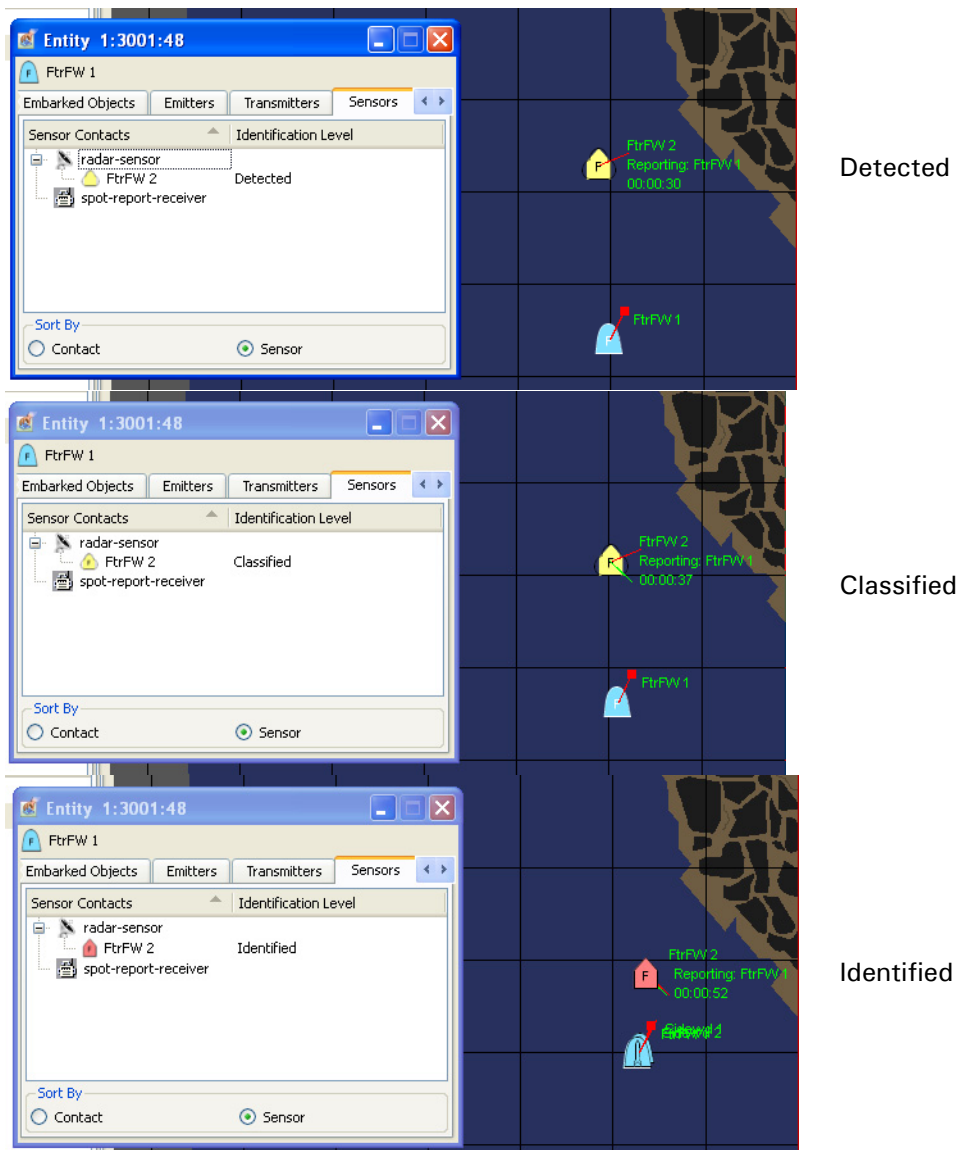


Figure 13-6. Entity classification and display when spot reports are enabled

13.3.1. Target Detection and Spot Reports

Entity detection and classification can be enhanced by enabling spot reports. Detected entities are assigned CID levels based on length of contact and distance from the detecting entity. In some cases, such as a fixed-wing aircraft flying quickly over a battle-field, or an entity that is at the extreme of its range from a target, contact might not be sufficient to advance to the Identified CID level. In such cases, even though the entity is technically capable of firing on the target, it might not do so because the CID level is not high enough.

If spot reports are enabled, the classification of entities in the spot reports that an entity receives is combined with the directly sensed information. Therefore, if an entity classifies a target at a low CID level, but it receives a spot report that classifies the target at a high CID level, it can fire on the target based on the CID level in the spot report. For example, as noted in the previous paragraph, a fixed-wing aircraft is unlikely to maintain contact with a ground-based entity long enough to elevate its CID level to Identified. However, if a member of its force on the ground identifies the target and sends out a spot report indicating CID level 3 or 4, when the fixed-wing aircraft receives the spot report, it can add the target to its target list.

13.3.2. Lasing Targets

Some entities, such as DI Lasing, have laser-targeting capability. Others, such as attack helicopters, have laser targeting capability and carry laser-guided missiles. Laser-guided missiles do not use the standard VR-Forces targeting mechanisms. They only fire on targets that are identified by laser beams that have the same laser code as the laser-guided missile launcher. The laser beam could be generated by a laser designator on the same entity (autonomous lasing), or could be generated by another entity.

Laser codes are numbers in the range of 111-8888, using only the digits 1-8. By default, VR-Forces calculates a unique laser code for each entity when it is created. When you assign a laser code to an entity, any laser beams sent by that entity use the assigned laser code and the missiles carried by that entity (if applicable) use the same code. Therefore, for example, the default behavior for attack helicopters would be to fire their laser-targeted missiles only at targets that they have lased.



A laser-guided missile launcher must be able to see a laser spot and an appropriate target before it fires. If the missile loses the laser spot before it hits the target, it tracks to the last known laser spot.

Autonomous Lasing

By default, entities that have laser-guided missiles are configured for autonomous lasing. This means that they can lase targets and fire at them without outside intervention (for example, using the Lase Target task). Entities with autonomous lasing enabled identify and fire at targets independently, just like entities that use conventional munitions.

Synchronizing Laser Codes

There are cases in which you will want more than one entity to use the same laser code. For example, you might want one entity to lase targets (the designator), and another one to fire on them (the shooter). In this case you would assign both entities the same laser code. The designator would be given the hold-fire rule of engagement or not have any missile resources. The shooter would be configured to not lase targets (Set Laser Autonomous would be set to Off). It would just fire on the targets identified by the designator's laser.

Figure 13-7 shows an attack helicopter firing a missile at a target being lased by a dismounted infantry entity. The laser code is displayed to the right of the laser target circle.



Figure 13-7. Firing at a lased target

You can synchronize the laser codes of the lasing entity and the firing entity by setting them for each entity with the Set Laser Code set data request, or you can let VR-Forces synchronize the codes with the Set Synchronize Laser Code set data request. For details, please see “[Set Laser Code](#),” on page 12-17 and “[Set Synchronize Laser Code](#),” on page 12-25.

Enabling and Disabling Laser Targeting Graphics

VR-Forces can display a laser target graphic and a line from the lasing entity to the target (Figure 13-7).

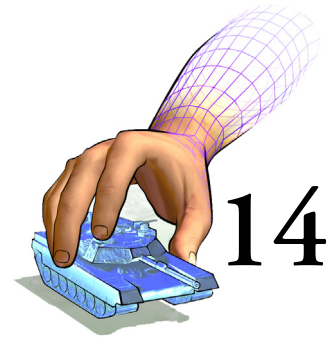
To enable or disable laser targeting graphics:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab.
3. To enable or disable the targeting line, select or clear the Laser Designator Line check box.
4. To enable or disable the targeting cross-hairs, select or clear the Laser Designator Spot check box.
5. Click OK.

13.4. Taking Damage from Munitions

Entities can be damaged by munitions fired by other entities. They can be damaged by direct fire – a munition that hits the entity or within a configurable distance of the entity, and by indirect fire – a munition that explodes within a configurable distance of the entity. An entity can also suffer collateral damage. This can occur if an entity is hit by direct fire of sufficient power to damage nearby entities.

The types of munitions to which an entity is vulnerable is determined by its damage system. Each damage system has a damage actuator, which specifies damage files. These damage files specify how entities are damaged by direct and indirect fire from specific munitions. *VR-Forces Configuration Guide* describes damage systems and damage files. The important point to remember as a VR-Forces user is that an entity will not be harmed by a munition unless it has a damage system that knows about that munition. And, if you introduce a new munition type, it will not harm any entities unless their damage systems have a damage file for the new munition.



Managing Indirect Artillery

This chapter explains how to create and edit indirect artillery events.

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Creating an Indirect Artillery Event	14-3
Editing Indirect Artillery Events.....	14-5
Deleting Indirect Artillery Events.....	14-5
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14.1. Introduction

The indirect artillery feature allows you to create, configure, and schedule indirect artillery events. Indirect artillery events are not associated with a particular entity. VR-Forces does not model the launcher or trajectory of the munitions. Indirect fire results in one or more salvos of one or more rounds in or near a designated area of the terrain. Entities do not take damage from indirect fire unless they are configured to do so. [Figure 14-1](#) illustrates indirect artillery fire within an indirect artillery area.

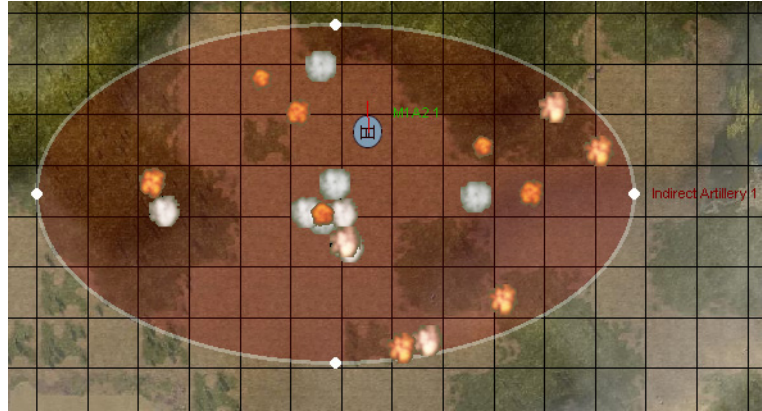


Figure 14-1.

Indirect artillery types are configured in *indirectArtilleryTypes.mtl*. Please see the comments in the file for details.

You can apply a wind offset to artillery detonations. When enabled, detonations are offset from where they would take place if wind offset was not enabled. This might result in a detonation taking place outside of the indirect artillery area.



Indirect artillery does not take into account any weather simulation that VR-Forces might implement. It only applies the offset specified in the Create (or Edit) Indirect Artillery dialog box.

14.2. Creating an Indirect Artillery Event

When you create an indirect artillery event, you specify an area in which the event is to take place, the parameters of the event, and a starting time. The area in which an indirect artillery event takes place is specified as an overlay object. Therefore, you also have all the usual options for configuring overlay objects.

Indirect artillery areas are placed on the Indirect Artillery layer (which is created for the first indirect artillery object). You can put other objects on this layer. You cannot put indirect artillery objects on any other layer.

To create an indirect artillery event:

1. Choose **Simulation** → **Indirect Artillery**. The Indirect Artillery Manager opens (Figure 14-2).

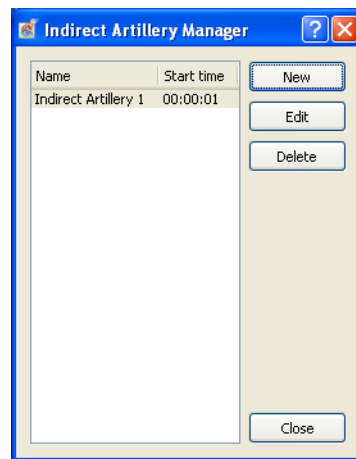


Figure 14-2. Indirect Artillery Manager

2. Click New. The Create Indirect Artillery dialog box opens (Figure 14-3) and the cursor changes to create mode.
3. Draw an ellipse on the map to specify the area of the artillery event, or specify its coordinates in the Edit Vertex group box. An ellipse is added to the Indirect Artillery overlay. If an Indirect Artillery overlay does not already exist, it is created.

Figure 14-3. Create Indirect Artillery dialog box

4. Type a name for the event in the Object Name text box, or accept the default name (Indirect Artillery *n*).
5. Configure the parameters of the artillery event, as follows:
 - Select the detonation start time. The options are Immediate or At Simulation Time. If you select At Simulation Time, enter the simulation time at which you want the artillery to start firing.
 - In the Number of Salvos box, enter the number of salvos you want to fire.
 - If you specified more than one salvo, in the Time Between Salvos box enter the amount of time you want to pass between each salvo.
 - In the Rounds Per Salvo box, enter the number of rounds you want to fire for each salvo.
 - In the Scatter Time box, enter the length of time for each salvo. The rounds in each salvo will be detonated at random times within this time period.
 - Select the munition type in the Munition Type drop-down list.

- Optionally, select the Wind Offset check box to enable specification of a wind offset. If you enable Wind Offset, enter a direction, in degrees, for the offset and a distance, in meters.
- 6. Optionally, make changes to the color, drawing style, fill style, and other configuration options that are common to graphical objects. For details about these options, please see Chapter 16, *Overlays and Graphical Objects*.
- 7. Click OK. The Indirect Artillery event is added to the Indirect Artillery Manager. The area is added as an ellipse overlay object on the Indirect Artillery layer.

14.3. Editing Indirect Artillery Events

You can edit the parameters of an indirect artillery event. You can also directly manipulate the area that specifies the event. For instructions for directly manipulating the event area, please see “[Editing Graphical Objects](#),” on page 16-19 in general and “[Rotating an Ellipse](#),” on page 16-23 specifically.

To edit an indirect artillery event:

1. Choose **Simulation** → **Indirect Artillery**. The Indirect Artillery Manager opens ([Figure 14-2](#)).
2. Select the artillery event that you want to edit.
3. Click Edit. The Edit Indirect Artillery dialog box opens.
4. Change the parameters that you want to change.
5. Click OK.

14.4. Deleting Indirect Artillery Events

To delete an indirect artillery event:

1. Choose **Simulation** → **Indirect Artillery**. The Indirect Artillery Manager opens ([Figure 14-2](#)).
2. Select the artillery event that you want to delete.
3. Click Delete.
4. Click Close.

14.5. The Indirect Artillery Algorithm

For each round R_i in a salvo a detonation time t_i is calculated so that:

$$t_i = \text{startTime} + \text{RAND} \text{ scatterTime}$$

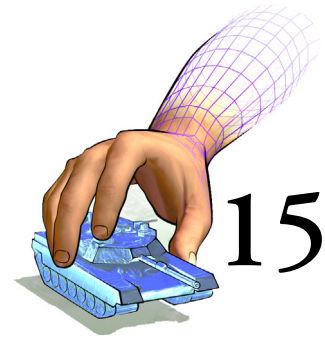
where RAND is a uniformly distributed random number between 0 and 1. When the simulation time reaches t_i , the detonation occurs at location P_i . P_i is calculated as follows:

$$\begin{aligned} \text{Theta} &= 2 \text{ PI RAND} \\ P_i &= C + R_w (\cos(\text{Theta}_w), \sin(\text{Theta}_w)) + \\ &\quad \text{RAND} (R1 \cos(\text{Theta}) + R2 \sin(\text{Theta})) \end{aligned}$$

where:

- ♦ $R1$ = Major axis of the ellipse
- ♦ $R2$ = Minor axis of the ellipse
- ♦ R_w = Offset range due to wind
- ♦ Theta_w = Wind direction

The process is repeated at the specified interval for the remaining salvos.



Writing Plans

This chapter explains how to combine tasks, set data requests, global commands, and conditions into plans.

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15.1. Introduction to Entity Plans and Global Plans

A plan contains one or more statements that get executed by VR-Forces without human intervention. You build these statements in dialog boxes. VR-Forces writes the statement to the plan, so you do not have to worry about syntax errors in your statements when you first create them. You must understand the meaning of individual commands and parameters and the implications of how you order them, to make sure that a plan does what you want it to do.

VR-Forces supports two types of plans, entity plans and global plans, which have the following characteristics:

- ♦ Entity plans apply to a specific entity. They contain tasks and set data requests that are specific to the entity and which get executed sequentially. The sequence of task execution can be interrupted by receipt of a task from an external actor (a global plan command or independent task). The task sequence can also be interrupted if a trigger (a form of conditional statement) is activated.



Entity plans can include global commands (which are described later in this section). However, you must be careful not to use global tasks or sets when you really want entity-specific tasks or sets. Entity tasks are executed sequentially. Sending an entity a global command, even from within its own plan, terminates its plan.

- ♦ Global plans are independent of any entity. The statements in a global plan affect the scenario as a whole (create and delete object commands) or a specific entity (task and set commands). Tasks sent to an entity from a global plan have the same effect on the entity as independent tasks assigned by a human player. They interrupt any task that the entity is engaged in and terminate its plan. Furthermore, if a global plan has a series of tasks for the same entity, they get sent in order without regard to completion of the previous task (as if you issued a series of commands from the Task menu, one immediately after another). In such a case, only the last command sent is likely to be completed.

In [Figure 15-1](#), note that the entity plan (on the right) is tied to a particular entity (shown in the title bar). It has the same menus as the global plan, plus additional Task and Set menus. The commands on the Task and Set menus in the entity plan apply implicitly to the entity for which you are writing the plan.

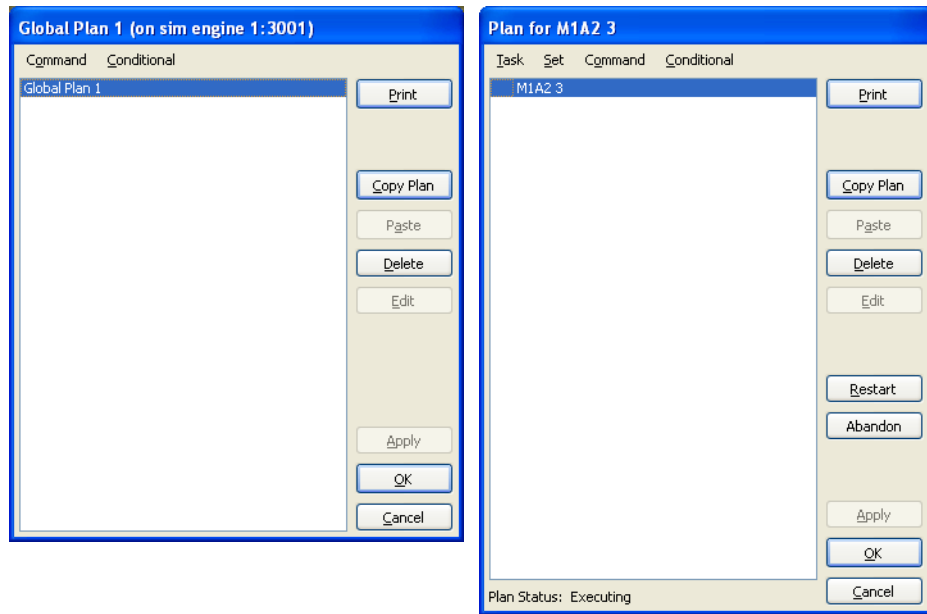


Figure 15-1. Global plan and entity plan

The Command menu, which is common to both types of plans, contains global commands. These commands allow you to:

- ♦ Create and delete objects
- ♦ Assign tasks and set data requests to entities
- ♦ Attach and detach the MÄK Stealth observer to an entity
- ♦ Send console messages.

Global commands must explicitly state the entity to which they apply.

15.2. Conditional Statements

Many of the statements used in plans set a parameter or direct an entity to perform a specific task unconditionally. However, the plan language also includes the conditional statements, `If`, `When`, and `While`. A conditional statement specifies a condition and a block of plan statements.

- ♦ An `If` statement is evaluated once, when the plan arrives at the statement. If the condition is true at that point, VR-Forces executes the statements in the `If` block.
- ♦ A `When` statement is also called a trigger. It specifies a condition that is evaluated periodically by VR-Forces. If the condition becomes true, VR-Forces executes the statements in the trigger block. A trigger statement lets you plan for a condition without knowing in advance when the condition will occur.
- ♦ A `While` statement executes a block of statements repeatedly while the condition remains true. VR-Forces evaluates the condition when the plan first arrives at the `While` statement. Then it executes the statements in the block. When it completes the statements, it evaluates the condition again. If it is still true, VR-Forces executes the statements again. It continues to do so as long as the `While` condition is true.

The conditions supported by VR-Forces are:

- ♦ Is an entity in a given area? (`EntInArea`)
- ♦ Is an entity to the left of a phase line? (`EntLeftOfLine`)
- ♦ Is an entity destroyed? (`EntDestroyed`)
- ♦ Is an entity under fire? (`EntUnderFire`)
- ♦ Has an entity located a target? (`EntHasTarget`)
- ♦ Has an entity's embarkation state changed? (`EntEmbarked`)
- ♦ Is an entity above or below a specified altitude? (`EntAltitude`)
- ♦ Has an entity detected another entity? (`Entity Detected`)
- ♦ Has an entity received a radio message? (`Receive Text Message`)
- ♦ Has a lifeform surrendered? (`LifeformSurrendered`)
- ♦ Does a lifeform have a particular DI-Guy animation? (`Entity-DiGuyAnimation`)
- ♦ Does a lifeform have a particular DI-Guy appearance? (`Entity-DiGuyAppearance`)
- ♦ Is a random probability true? (`Random`)
- ♦ Is an entity resource at a certain level? (`Resource`)
- ♦ Is the simulation time greater than or less than a specific elapsed time? (`Sim Time`)

Conditional statements can include the boolean operators `True` and `False`, and the logical operators `AND`, `OR`, and `NOT`.

15.2.1. Specifying Names or Patterns in Conditional Statements

When you add a conditional statement to a plan, you must specify the entity or entities for which the condition will be tested. You can specify:

- A specific named entity, for example, when entity M1A2 1 is in Area 1.
- That the condition applies to “Self”, for example, when “I” am in Area 1. Specifying a condition for one’s self makes it easy to copy and paste plans or plan statements to the plans of other entities without doing any editing.
- An entity enumeration, for example, any entity with enumeration 1:1:225:1:1:3:0 (any M1A2).
- The inverse of the selection, for example, any entity but myself, or any entity except an M1A2.
- That for aggregates, the entire aggregate must satisfy the condition (the default), or that any subordinate member of an aggregate satisfies the condition. For example, the default behavior when Entity Is Destroyed is applied to an aggregate is that all members of the aggregate must be destroyed for the condition to be true. The alternative is that the condition is true if any member of the aggregate is destroyed.

The Name and Pattern specifications are mutually exclusive. You cannot specify a name and a pattern. The tab that is visible when you click OK is the specification that gets applied.

Specifying a Name in a Conditional Statement

To specify a named entity in a condition statement:

1. In a conditional statement dialog box, select the Name tab (Figure 15-2).

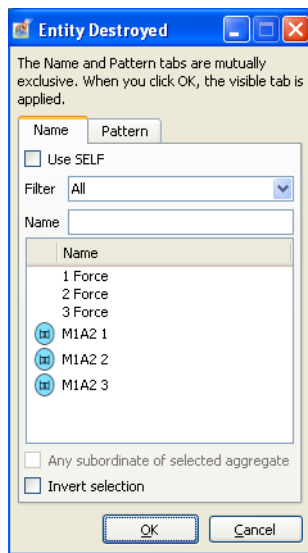


Figure 15-2. Name tab in condition dialog box

2. Do one of the following:
 - To specify the entity whose plan this is as the entity in the condition, select the Use SELF box.
 - To specify an entity by name, select the entity in the list.
3. If you select an aggregate entity in the list, the Any Subordinate of Selected Aggregate check box is enabled. If you want the condition to be satisfied when any entity in the aggregate meets the condition, select the check box.



If an aggregate is aggregated, there are no subordinates, so this form of the condition is meaningless.

4. To specify the inverse of the name, that is, any entity except the selected one, select the Invert Selection check box.
5. Click OK.

Specifying an Entity Pattern in a Conditional Statement

The enumeration value lists on the Pattern tab include a subset of the enumerations typically used for entities in simulations. However, you can enter any numeric value you want in the enumeration value boxes.

The enumerations used in the Pattern tab are loaded from the file `./config/condition-entity-types.csv`. If you expect that you will consistently need to specify enumeration values that are not part of that file, such as a particular country code, you can edit it to add the patterns you need.

To specify an entity pattern in a condition statement:

1. In a conditional statement dialog box, select the Pattern tab (Figure 15-3).



Figure 15-3. Pattern tab in condition dialog box

2. Optionally, specify a force to test for.
3. For each element of the enumeration, type a value in the left column or, if available, select an option from the drop-down list in the right column.
4. If the enumeration you enter is for an aggregate entity, the Any Subordinate Of Selected Aggregate check box is enabled. If you want the condition to be satisfied when any entity in the aggregate meets the condition, select the check box.
5. To specify the inverse of the name, that is, any entity except the selected one, select the Invert Selection check box.
6. Click OK.

15.2.2. The If/Else Statement

An `If/Else` statement consists of:

- ♦ The word `If`
- ♦ A condition to be evaluated
- ♦ A block of statements
- ♦ An `else` statement
- ♦ Optionally, statements for the `else` condition.

If the condition is true at the moment the `If` statement is reached, control passes to the first statement of the `If` block. If the condition is false, control passes to the first statement in the `else` block, if you have one, or to the first statement after the complete `If/Else` block if you do not have an `else` block. You can nest `If/Else` statements within `If/Else` statements. The syntax is as follows:

```
If (condition) then
    zero_one_or_more_statements
else
    zero_one_or_more_statements
endif
```

When VR-Forces reaches the end of the block of `If` or `else` statements, control passes to the first statement after the `If/Else` statement.

The Add Conditional Expression dialog box ensures that you have the correct syntax. It does not ensure that your `If/Else` block makes logical sense.

15.2.3. When Statements (Triggers)

A trigger consists of a **When** statement followed by a block of statements that are executed only if the condition in the **When** statement is true.

When VR-Forces reads a **When** statement, it registers the trigger and checks the condition. If the condition is true, control passes to the first statement in the **When** block. Task execution proceeds as follows:

- If the **When** block contains any tasks that are mutually exclusive with the currently executing task, the current task is discarded and the statements in the **When** block are executed. (If a **When** block is at the beginning of a plan, there might not be a current task. For a discussion about where to place triggers, please see [“Deciding Where to Put Trigger Statements,”](#) on page 15-31.)
- If the tasks in the **When** block are not mutually exclusive with the current task, or if the **When** block only has set data request statements, the **When** statements are executed and the current task continues. For more information about this case, please see [“Using Triggers That Do Not Have Mutually Exclusive Tasks,”](#) on page 15-32.
- After the tasks in the **When** statement block are completed, control returns to the next statement in the entity’s plan.

If the condition is false, VR-Forces continues to the next statement in the plan. It continues to check the trigger condition periodically. If at any point, the condition evaluates as true, control passes to the block of statements associated with the trigger. Task execution proceeds as described in the previous paragraph.

[Figure 15-4](#) illustrates the process when a trigger has a task that is mutually exclusive with the current task. After the tasks in the **When** statement block are completed, control returns to the next statement in the entity’s plan. If the entity was in a **While** loop when the trigger fired, it returns to the next statement in the **While** block.

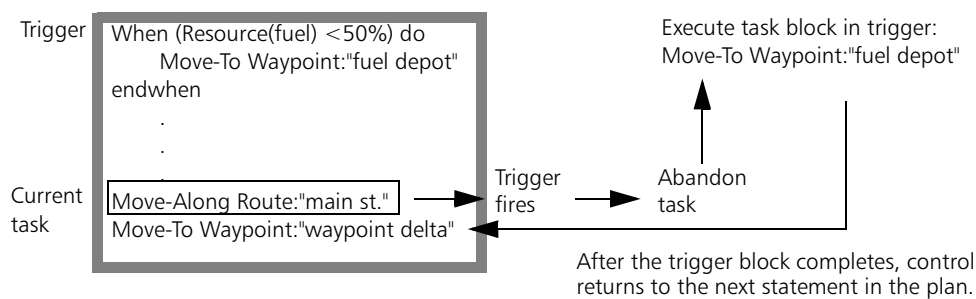


Figure 15-4. Flow of control for triggers

After a trigger fires, it is removed from the list of registered triggers. If you want to continue to test for the same condition, you need to execute another **When** statement for that condition.

Unregistering Triggers

You cannot unregister triggers while a scenario is running. If you do not want a trigger to be executed, you have the following options:

- ♦ Before you start the scenario, remove the trigger from the plan.
- ♦ During a simulation, abandon the plan.
- ♦ During the simulation, remove the trigger from the plan and save the plan. The new plan will erase the old one. However, the plan will begin executing at the first statement, which may not be the behavior you want.

15.2.4. While Statements

A `While` statement consists of:

- ♦ The word `While`
- ♦ A condition to be evaluated
- ♦ A block of statements.

If the condition is true at the moment the `While` statement is reached, control passes to the first statement of the `While` block. If the condition is false, control passes to the first statement after the complete `While` block. You can nest `While` statements within `If`, `When`, and `While` statements.

When VR-Forces reaches the end of the `While` block, it evaluates the condition again. If the condition is still true, VR-Forces executes the statements again. If it is false, control passes to the first statement after the `While` block.



- ♦ VR-Forces re-evaluates a `while` condition only after it has executed all of the statements in the block. If the condition becomes false while VR-Forces is executing statements in the block, VR-Forces continues to execute all statements because it does not re-evaluate the condition until it completes the `while` block.
 - ♦ If you put a continuous task such as `Wait` or a `Patrol Between` in a `while` block, it is possible that the condition will never be evaluated, because the tasks in the block will never be completed.
-

15.2.5. Conditional Tests

This section describes each of the conditions that VR-Forces can test. When you set up conditions, keep in mind the following:

- ♦ If there is no entity with the specified name, the result is always false.
- ♦ If the specified name is destroyed, the condition might never be satisfied. Your plan should take this possibility into account.

The Entity-Has-Target Condition

Entity-Has-Target returns true if the entity specified in the condition identifies a target. For example, consider the entities in [Figure 15-5](#). The condition in M1A2 1's plan is true when BMP 1 has a target, not when M1A2 1 targets BMP 1.

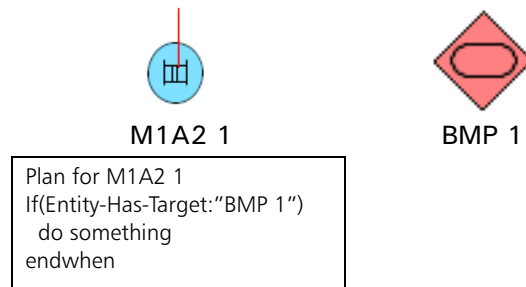


Figure 15-5. Entity Has Target condition

The Entity-In-Area Condition

Entity-In-Area returns true if the entity (or member of an aggregate) reports that it is in the named area. You can use the NOT boolean operator, to test whether an entity is outside the area.

The Entity-Left-Of-Line Condition

Entity-Left-Of-Line returns true if the entity (or member of an aggregate) reports that it is to the left of the specified phase line.

An entity is considered to be to the left of a phase line if it is on the left side of an infinite extension of the phase line as viewed from a point on the line facing in the direction of the line. For a description of phase line direction, please see [“Phase Lines,”](#) on page 3-25.

The Entity-Destroyed Condition

Entity-Destroyed returns true if the entity (or member of an aggregate) is destroyed.



The definition of destruction for an aggregate is implementation specific. The aggregates supplied by MÄK for VR-Forces report that they are destroyed if every member of the aggregate is destroyed. If you have implemented aggregates locally using the VR-Forces Toolkit, they could have a different definition of destroyed.

The Entity-Embarked Condition

Entity-Embarked returns true if the named entity is embarked.

The Detect Entity Condition

The Detect Entity condition tests to see if an entity has been detected at a particular identification level. The identification levels are Detected, Classified, Identified, Full Knowledge. Identification levels are determined by the detection probability configuration files, based on the distance between the detecting entity and the target and for how long the entity has been detected. For details about the detection probability files, please see Section 8.2, “[Detection Probability Tables](#)”, in *VR-Forces Configuration Guide*.

The Entity-Under-Fire Condition

Entity-Under-Fire returns true if the entity (or member of an aggregate) is under fire.

The Altitude Condition

Altitude returns true if the entity (or member of an aggregate) is at a higher or lower altitude than the one specified.

The Receive Text Message Condition

The Receive Text Message condition tests to see if an entity has received a text message (sent by the Send Text Message task) that contains the text specified in the Receive Text Message dialog box.

The Entity-DiGuyAnimation Condition

The Entity-DiGuyAnimation condition tests the current DI-Guy animation for a lifeform. This condition may be useful if you are scripting a series of animations. For example, if a particular entity is using a threatening or hostile animation, you might want to have other entities respond a certain way.

The Entity-DiGuyAppearance Condition

The Entity-DiGuyAppearance condition tests the current DI-Guy animation for a lifeform. This condition may be useful if you are scripting a lifeform’s interaction with another lifeform based on ethnicity or how they are dressed.

The Lifeform Surrendered Condition

The Lifeform Surrendered condition tests to see if a lifeform entity has surrendered (using the Set Surrender set data request).

The Sim Time Condition

The Sim Time condition returns true if the elapsed simulation time is greater than (Sim Time >) or less than (Sim Time <) the time specified in the statement. Sim Time is the elapsed simulation time in days, hours, minutes, and seconds.

The Resource Condition

The Resource condition tests the amount of a specified resource using comparison operators.

The Random Condition

You can use the Random condition to randomly decide an entity's behavior at run time.

Percentage – A floating point probability percentage value between 0% (zero) and 100%. Random returns true if a random number between zero and 100 is less than or equal to the specified value.

If you use the Random condition, consider the following issues:

- ♦ Random is not very useful in triggers, since triggers may evaluate their condition expressions as often as once per tick. This means that a trigger expression of “Random Probability:50%” is likely to fire within the first couple of times it is evaluated. Therefore, we recommend that you not create triggers that are based on a random condition.
- ♦ If you use a random condition in a cascading sequence of **If/Else** statements, and you want to ensure the correct probability distribution, be careful how you specify the percentage value. For example, randomly selecting one of three paths with equal probability would be done like this:

```
If (Random Probability:33.33%) then
    Move-Along Route:"1"
Else
    If (Random Probability:50%) then
        Move-Along Route:"2"
    Else
        Move-Along Route:"3"
    Endif
Endif
```

- ♦ As with all other random numbers used in VR-Forces, if the scenario initializes a random number seed value (for details, please see “[Scenario Parameters](#),” on page 3-4 in *VR-Forces Configuration Guide*), then the results of the Random condition can be made repeatable. (For details about repeatability, please see “[Exercise Clock Modes](#),” on page 3-32.)

Boolean and Logical Operators

You can use the following boolean and logical operators in conditional expressions:

- ♦ `True`
- ♦ `False`
- ♦ `AND (expression, expression)` – evaluates as true if both conditional expressions are true.
- ♦ `OR (expression, expression)` – evaluates as true if either of the expressions are true.
- ♦ `NOT (expression)` – evaluates as true if the conditional expression is false.

You can nest and combine conditional expressions.

15.3. Viewing Plans

You can view an entity's plan and observe its progress through the plan. You can view the plans for as many entities at a time as you want. In addition to viewing plan status in the Plan window, you can view the current task on the State tab of the Entity Information dialog box.

To view an entity's plan:

1. Select the entity whose plan you want to view.
2. Choose **Entities** → **Plan**. The Plan window opens.

The task that an entity is executing is highlighted in the Plan window. when the entity completes its plan, a message is displayed in the status area at the bottom of the Plan window.

15.4. Writing Entity Plans

This section explains how to write entity plans. For conceptual information about plans, please see “Plans,” on page 3-27 and the previous sections in this chapter.

When you write a plan, keep the following considerations in mind:

- If you edit a plan during a simulation, when you apply the changes, the entity whose plan has been changed begins executing it from the beginning. This might mean its activities are no longer synchronized with those of the other entities, unless the updated plan only includes statements that you want to execute starting at the current point of the simulation. Therefore, we recommend that you edit plans when you first load a scenario, before you start running the simulation.
- If you have two or more Plan windows open at the same time, and you open a dialog box, such as Move To, but do not complete the command, you cannot open that same dialog box from another Plan window until you complete the one that is open.

To edit an entity's plan:

1. Select an entity.
2. Choose **Entities** → **Plan**. The Plan window opens. The entity's plan is displayed.

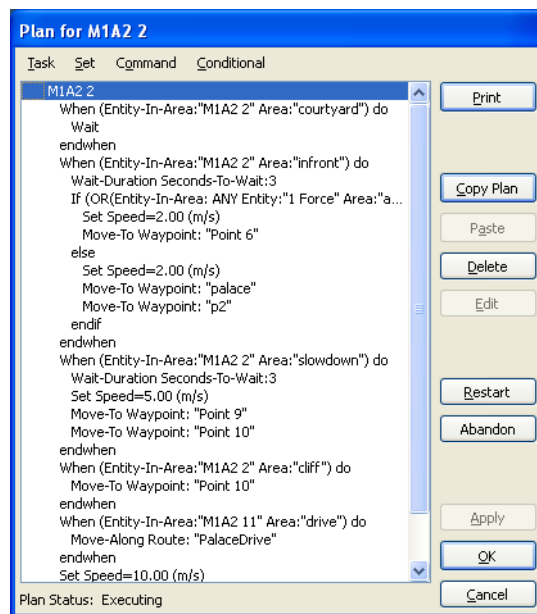


Figure 15-6. Plan window

3. Add new statements, edit statements, or delete statements as described in the following sections.

15.4.1. Adding an Entity Task or Set Data Request to a Plan

When you add statements to a plan, you add them after the currently selected statement.

To add a task to a plan:

1. Open the Plan window for an entity.
 2. In the Plan window, select the statement immediately above where you want to insert a new statement. If the plan does not have any statements yet, the plan root – “*Entity_name*” is already selected.
 3. Choose **Task** → *Task*, where *Task* is a task listed on the menu. A dialog box appropriate to the task opens. The procedures for filling out each type of task dialog box are described in Chapter 11, [Assigning Tasks](#).
 4. Complete the required parameter information.
 5. Click OK in the task dialog box to add the statement. You can click Cancel at any time to exit a task dialog box.
- To add a set data request to a plan, follow the same procedure as for adding a task, except choose **Set** → *Set Data Request*.

The procedures for filling out Set statement dialog boxes are in Chapter 12, [Issuing Set Data Requests](#).

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Some task and set statements, such as Wait, or Reorganize, do not require you to specify any values. They are added immediately to the plan without any intermediate dialog boxes.

15.4.2. Adding a Conditional Statement to a Plan

To add a conditional statement to a plan:

1. Open the Plan window for an entity.
2. In the Plan window, select the statement immediately above where you want to insert a new statement. If the plan does not have any statements yet, the plan root – *Entity_name* is already selected.
3. Choose **Conditional** → *condition*. The conditional expression dialog box opens.
4. Complete the conditional expression dialog box as described in [“Building Statements in the Conditional Expression Dialog Box,”](#) on page 15-19.



Once you make a selection from a list, you cannot change it. If you make an error building a conditional expression, you will have to Cancel out of the dialog box and start over again.

5. Click OK. A conditional statement block is added to the plan, with the syntax (the condition plus an “end” statement) that defines the bounds of the block of tasks that are executed if the condition is true. You need to add the task statements that you want to have executed. To add the task statements, follow the procedure in [“Adding an Entity Task or Set Data Request to a Plan,”](#) on page 15-17.

Building Statements in the Conditional Expression Dialog Box

The conditional expression dialog box is a dynamic dialog box that lets you build a conditional statement. It contains lists that have the permissible options for each step of a condition. As you select options, the dialog box redisplay, adding additional fields. You can build conditional statements using comparison operators, logical operators, and tests of entity status.

Using Prefix Notation to Establish Grouping and Precedence

To specify grouping, the Conditional Expression dialog box uses prefix notation, in which the operator comes first, followed by the operands. For example, a condition that you might say as, “If entity 1 is in area A and entity 2 is in area B,” is expressed in prefix notation as:

```
AND(entity 1 in area A, entity 2 in area B)
```

(For simplicity, this example does not use complete VR-Forces statement syntax.)

If you are not familiar with prefix notation, you might want to write out your conditional expressions before you begin entering them in the Conditional Expression dialog box.

[Figure 15-7](#) illustrates how the Conditional Expression dialog box might redraw as you successively add the components of a condition statement. It creates the following conditional expression:

```
If (AND(Entity-In-Area Entity:"M2A2 1" Area:"base camp",
        resource(fuel)<25%)) then
else
endif
```



The conditional expression dialog box resizes as you add conditions.

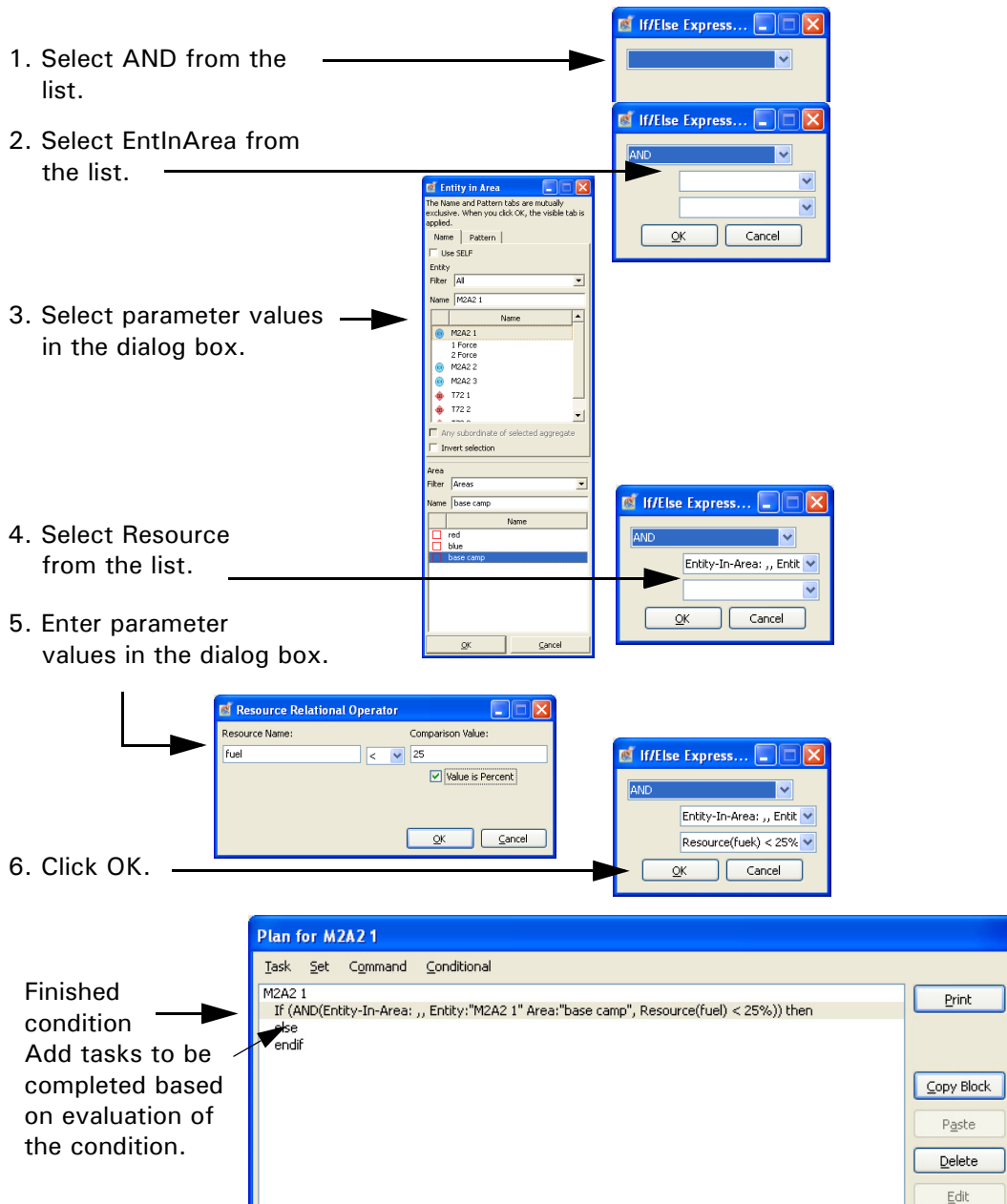


Figure 15-7. Example of building a conditional statement

15.4.3. Editing a Statement

You can edit simple statements in the Plan window. If you want to change a complex conditional statement, you must delete it and re-enter it.

To edit a plan statement:

1. Double-click the statement or select the statement and click the Edit button. An edit dialog box for the particular statement type opens.
2. Enter the changes you want to make.
3. Click OK in the edit dialog box.
4. Click OK or Apply in the Plan window.

15.4.4. Deleting Statements from a Plan

You can delete statements from a plan individually, or all at once. You can delete the individual statements in the statement block of a conditional statement. If you delete the conditional statement itself, all substatements are also deleted.

To delete a statement from a plan:

1. Open a global plan or the Plan window for the entity.
2. Select the statement you want to delete.
3. Click the Delete button.

Deleting All Statements From a Plan

To delete all statements in a plan:

1. Open a global plan or the Plan window for an entity.
2. Select the top line in the plan.
3. Click the Delete button.

15.4.5. Printing Plans

You can print plans. The printout lists the name of the scenario, the entity's name, and the plan statements.

To print a plan:

1. Open a global plan or the Plan window for the entity whose plan you want to print.
2. Click Print. A standard print dialog box for your operating system opens.
3. Complete the dialog box as you normally would.

15.4.6. Saving Changes to a Plan

You can save changes to a plan and continue editing, or save changes and exit the Plan window. The plan is saved to the scenario plan file. You do not specify a file to save it to.

- To save changes to a plan, in the Plan window, click Apply or OK.

15.5. Creating Global Plans

Global plans are not tied to a specific entity. However, since they must be executed by a simulation engine, they are assigned to a specific back-end, just like objects are.

To create a global plan:

1. Choose **Simulation** → **Global Plans**. The Global Plans window opens ([Figure 15-8](#)). It lists each global plan and the simulation engine on which it is executed.

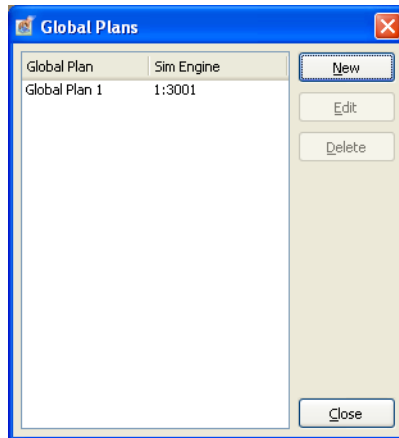


Figure 15-8. Global Plans window

2. Click New. The New Global Plan Information dialog box opens.
3. In the Plan Name box, type a name for the plan.
4. If your scenario has more than one back-end, select the back-end on which you want to run the global plan.
5. Click OK. The Global Plans window opens ([Figure 15-9](#)).

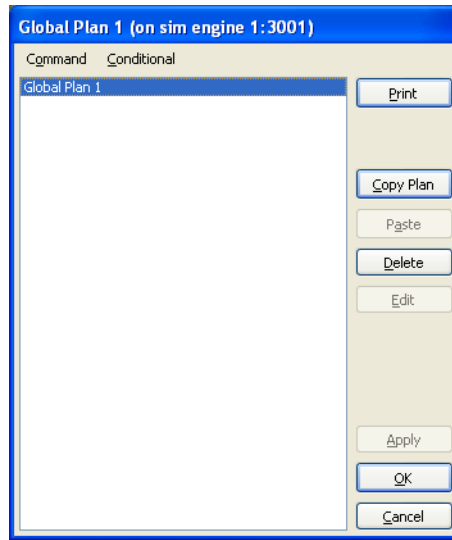


Figure 15-9. Edit Global Plan window

6. Add commands as described in [“Adding Global Commands to a Plan,”](#) on page 15-23.

15.6. Adding Global Commands to a Plan

The global command submenus mimic the Create, Task, and Set menus on the VR-Forces menu bar. There are also several global commands that are only available on the Command menu. Except as noted in this section, the procedures for adding global commands and conditional statements to a global plan are the same as the procedures for adding them to entity plans.

15.6.1. Adding a Global Task or Set to a Plan

The commands on the Task and Set menus in an entity plan apply implicitly to the entity for whom you are writing a plan. Global commands must be assigned explicitly to a target entity. Therefore, even though the list of tasks and sets on the Commands menu look the same as those in an entity plan or the main VR-Forces menu bar, the dialog boxes they use are different.

[Figure 15-10](#) shows the Follow Entity dialog box displayed if you choose **Command** → **Task** → **Follow Entity**, and the Follow Entity dialog box displayed if you choose **Task** → **Follow Entity** in an entity plan. The right pane in the global command requires the same information as the local command. The difference is that in the global command dialog box you must specify the entity to which the command will apply. You can specify an existing entity or you can specify the name of an entity that does not yet exist, but which you expect to be created during the lifetime of the scenario, perhaps as the result of a Create command in a global plan.

Other than the requirement to specify the target entity, adding a global task or set command to a plan uses the same procedure as adding any task or set to an entity plan.

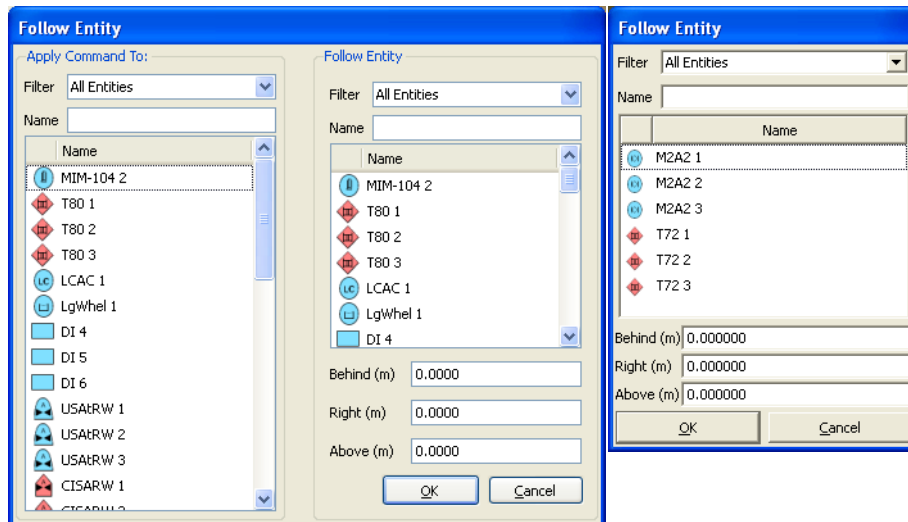


Figure 15-10. Global command task dialog box and entity plan task dialog box

To assign a global command:

1. In the Plan window or Global Plan window, choose **Command** → *command*, or **Command** → *sub_menu* → *command*, where Global Plan 1 is one of the sub menus and *command* is one of the commands listed on the menu or a sub menu. The appropriate dialog box opens for the command.
2. If the dialog box requires you to specify the entity that will execute the command (in other words, if there is an Apply Command To panel in the dialog box), select an entity from the list or type its name in the Name box. The entity does not have to exist in the scenario at the time you add the command, but you should be sure that it will be created before the command is run.



Remember that a global task command affects an entity like an independent task. It interrupts the current task and causes the entity to abandon its plan. If you are adding a global task command to an entity plan, be sure that you are assigning it to some other entity and not the entity for whom you are writing the plan. (Unless you want the entity to abandon its plan.)

3. In the command-specific panel of the dialog box, complete the command parameters. Please see Chapter 11, *Assigning Tasks* and Chapter 12, *Issuing Set Data Requests* for the details of assigning specific tasks and sets.

15.6.2. Sending Console Messages

You can send messages to be displayed in the console on an object's information dialog box and to the back-end console. Messages sent by global plans go to the back-end console. Messages sent from an entity's plan go to the console in its Entity Information dialog box. If the notification level for a console message is lower than the notification level configured for the back-end or the target entity, the message is not displayed. For example, if an entity's notification level is set to Info, it receives Error, Warn, and Info messages, but not messages set to Verbose or Debug.

To send a console message from a plan:

1. In the Entity Plan or Global Plan window, choose **Command → Console Message**. The Console Message dialog box opens.
2. Select the notify level from the list.
3. Type the message you want to send.
4. Click OK.

15.6.3. Controlling the MÄK 3D Observer from a Plan

You can attach and detach the observer (eyepoint in Stealth 6.x) in MÄK VR-Vantage applications from within a plan.

To attach the observer to an entity:

1. Open a global plan or the Plan window for an entity.
2. Choose **Command** → **Stealth Attach Entity** → **Stealth Attach**. The Stealth Attach dialog box opens (Figure 15-11).

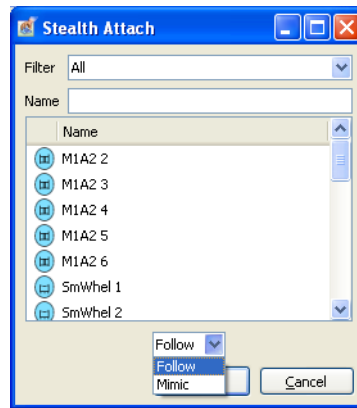


Figure 15-11. Stealth Attach window

3. Optionally, filter the list.
4. Select the entity to attach to using one of the following methods:
 - If you want to attach to an entity that is not already in the scenario, type its name in the Name box.
 - If the entity you want to attach to is in the scenario, select it in the list window or on the map.
5. In the Mode list, select the view mode to use.
6. Click OK.

Detaching the Observer

If the observer is attached to an entity, you can detach it from within a plan.

To detach the observer from a plan:

1. Open a global plan or the Plan window for an entity.
2. Choose **Command** → **Stealth Attach Entity** → **Stealth Detach**. A Stealth Detach statement is added to the plan.

15.6.4. Creating Objects from Within a Plan

You can create any of the objects on the Create menu from within a plan.

To create an object from a plan:

1. In the Entity Plan or Global Plan window, choose **Command** → **Create** → *object*, where *object* is an entity, control object, or overlay object accessible from the submenus.
2. Create the desired object on the map as you would if you were creating it directly from the main Create menu, except that if you are creating an entity, you can only create one entity at a time and you can specify a name and location for the entity in the Create Entity dialog box. When you are finished creating the object, a create command is added to the plan and the object itself disappears from the map. (The object disappears because you are not actually creating the object right now, you are just creating the command that will create it later when the plan executes.)

15.6.5. Deleting Objects from Within a Plan

You can delete any object in a scenario from a plan.

To delete an object from a plan:

1. In the Entity Plan or Global Plan window, choose **Command** → **Delete Object**. The Delete Object dialog box opens.
2. Type the name of the object you want to delete or select the object in the list or on the map.
3. Click OK.

15.7. Writing Plans for Aggregates

To write a plan for an aggregate:

1. If the aggregate is expanded, collapse it.
2. Select the aggregate.
3. Follow the procedures for writing a plan for an individual entity.



Please see [“Independently Tasking Aggregate Members,”](#) on page 11-6 for notes about how entities that are members of aggregates respond to individual plans and independent tasks.

15.8. Writing a Plan for Multiple Entities

You can write a plan and assign it to multiple entities at the same time. If any of the entities already have a plan, it is overwritten by the new plan. After you assign a plan using this procedure, you can individually edit the plans for any entity and the changes do not affect the other entities.



If, after assigning the same plan to several entities, you select some or all of them and open the Plan window again, it does not display the existing plan for the entities. In multiple entity mode, the Plan window always starts with an empty plan and overwrites whatever plans the entities already have.

If you want to update a plan that you have assigned to several entities, you could copy the plan from one of them, then paste the copied plan into the Plan window and continue editing the plan from that point.

To write a plan for multiple entities:

1. Select the entities to which you want to assign the same plan.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. Add statements to the plan as you would if you were writing a plan for an individual entity.
4. Click OK. The plan is assigned to the selected entities.

15.9. Writing Plans for Remote Entities

If you attach components to remote entities, you can write plans for those entities. To assign plans, the entities must exist in the exercise, must have attached components, and must be present in the exercise when VR-Forces saves the scenario. The plans must be appropriate for the attached components. Movements tasks are not appropriate, because VR-Forces cannot control the location of a remote entity. Appropriate plan statements might be to enable spot reporting, or to send a radio message. For details about how to attach components to remote entities, please see Section 8.12, “[Configuring VR-Forces Components on Remote Entities](#)”, in *VR-Forces Configuration Guide*.

15.10. Copying Plans and Plan Statements

You can copy plans and individual plan statements and paste them into another entity's plan.

To copy plan statements:

1. Open the Plan window for the plan that you want to copy.
2. To copy the entire plan, select the top line in the plan (*Entity_name*). To copy a statement, select the statement. If you select a conditional statement, the entire statement block is selected.
3. Click the Copy button. If you selected the top line, it reads Copy Plan. If you select a statement, it reads Copy Block.
4. Open the Plan window for the entity you want to copy the plan to.
5. Select the line below which you want to insert the copied plan.
6. Click Paste.
7. Continue editing the plan as described in the previous sections.
8. Save the plan.

15.11. Restarting a Plan

There may be occasions when you want to restart an entity's plan without restarting a scenario. You can restart a plan interactively or by placing a Restart Plan command in a plan.

When you restart a plan, VR-Forces processes the statements in the plan, starting from the first statement. However, the entity executes tasks starting from its current location, not the location it had at the start of the scenario (unless it has not moved since the start of the scenario).

To restart a plan interactively:

1. Select the entity whose plan you want to restart.
2. Choose **Entities** → **Restart Plan**.

To restart a plan from within a plan:

1. Open an entity's plan or a global plan.
2. Choose **Command** → **Restart Plan**. The Restart Plan dialog box opens.
3. Select the entity whose plan you want to restart.
4. Click OK.
5. Save the plan.

To restart a plan from the Plan window:

1. Open an entity's plan.
2. Click Restart.

15.12. Abandoning a Plan

You can order an entity to stop executing its plan. When you abandon a plan, the following things happen:

- ♦ The entity stops whatever task it is working on, even if it is an independent task.
- ♦ The plan is marked as complete.
- ♦ All registered triggers are deleted.
- ♦ The statement indicator skips to the end of the plan.
- ♦ The entity enters a wait state.

You can abandon a plan interactively or by sending an Abandon Plan command in an entity or global plan.

By default, when an entity is executing a task that is part of a plan and you issue an independent task to that entity, VR-Forces displays a prompt that tells you that the current task is part of a plan. It asks you to verify that you want to replace the entire plan with the new task. For more information about overriding plans with independent tasks, please see [“Overriding Tasks and Plans,”](#) on page 11-3.

To abandon a plan interactively:

1. Select the entity whose plan you want to abandon.
2. Choose **Entities** → **Abandon Plan**.

To abandon a plan from within a plan:

1. Open an entity's plan or a global plan.
2. Choose **Command** → **Abandon Plan**. The Abandon Plan dialog box opens.
3. Select the entity whose plan you want to abandon.
4. Click OK.
5. Save the plan.

To abandon a plan from the Plan window:

1. Open an entity's plan.
2. Click Abandon.

15.13. Considerations for Creating Plans

This section has tips for constructing plans including how to avoid problems that are hard to debug and how statements affect each other, with implications for how to organize the statements in a plan.

15.13.1. Name Changes Can Invalidate Plan Statements

Plan statements can reference named objects, such as graphical objects and entities. For example, a Follow Entity task specifies the name of the entity to follow. If someone changes the name of an entity or graphical object after you create a plan, VR-Forces will not be able to find the object referenced in the plan statement. If this happens in a task statement, the plan skips the task and moves to the next task. If a renamed object is in a conditional statement, the condition may never become true.

15.13.2. Considerations for Using Triggers

Triggers are a versatile part of plans and you should have a good understanding of their intricacies before you use them.

Deciding Where to Put Trigger Statements

VR-Forces does not evaluate a trigger condition until it executes a **When** statement and registers the trigger. If you want to ensure that a **When** statement always gets read by VR-Forces, put it at the beginning of a plan before any non-trigger statements. If you put a trigger later in a plan, it is possible that it will never be registered. This could occur if a plan is abandoned. Of course, you might decide that you do not want a trigger to be registered unless a set of preceding tasks have been completed. In that case, placing it later in the plan may be exactly what you want to do.

You can also place a trigger inside a conditional block so that it gets registered only if a particular condition is true at a particular time.

For example, if you always want entity 1 to respond to entry of hostile forces into an area, put a trigger at the beginning of the plan. If you want entity 1 to respond to a hostile entity in an area only after the simulation has progressed for 15 minutes, nest the trigger inside another trigger that fires when `Sim Time > 15 minutes`.

Using Triggers That Do Not Have Mutually Exclusive Tasks

A trigger does not have to have any task statements in its statement block. It could just have Set statements. Or, it could have sets and concurrent tasks. If a trigger block just has Set statements, it does not interrupt the task that the entity is executing when the trigger gets executed. The Set statements get executed while the entity is performing its task. This has the same effect as if you manually set the entity's state while it was performing a task.

Using a trigger that just has Set statements can be useful if you want to change an entity's state under certain conditions, but do not know in advance when those conditions might exist.

15.13.3. Moving In Formation

If you want an aggregate to move in a certain formation, add a Set Formation statement to the plan before the task that requires the aggregate to move. The default formation is a column.

15.13.4. Using the Set Tasked-By-Superior Request in a Plan

If you put the Set Tasked-By-Superior request in the body of a plan, it has no real effect. This is because, as soon as it is set, the plan goes to the next task and overrides the superior. The only way that the Set Tasked-By-Superior command gets implemented as part of a plan is if it is the last statement in a plan or the last statement in a trigger that happens to get executed after all the statements in an entity's plan have been executed.

15.13.5. Following Entities

If you tell two or more entities to follow another entity, do not give them the same offset values. If the followed entity stops, one follower will arrive at the specified offset position and stop, while the others will circle the location because they cannot all occupy the same space.

15.13.6. Planning Tasks for Aircraft

When you plan tasks for aircraft, the most important thing to remember is to pay attention to the terrain. Fixed-wing aircraft do not have terrain following capabilities. Rotary-wing aircraft have some terrain-following capacity, but it has some limitations. So if you assign aircraft an altitude that is lower than the terrain at some point along a route or the path they must follow to reach a waypoint, they will crash into the terrain. View the terrain profile for a route to see if it intersects the terrain.

You should also bear in mind that the turning radius and speed of fixed-wing aircraft affect how closely they can follow a route.

15.13.7. Using Non-VR-Forces Entities in Plans

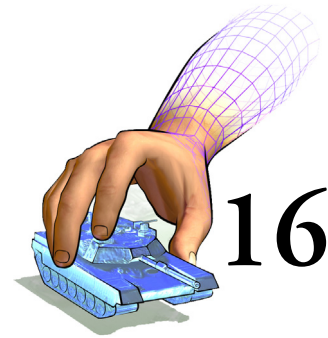
You can use a non-VR-Forces entity as a parameter in a plan, for example, following a remote entity, or testing to see if a remote entity is in an area.

To identify non-VR-Forces entities, VR-Forces uses their marking text. If a non-VR-Forces entity does not have marking text, VR-Forces uses its entity identifier as its name.

VR-Forces does not recognize remote aggregates as aggregates, so it cannot check their children. Remote aggregates are ignored by the simulation engine.



- ♦ Referring to remote entities by their marking text may have unpredictable results if there is more than one remote entity with the same marking text.
 - ♦ If you include a non-VR-Forces entity in a plan you must ensure that the remote simulator uses the same name for the entity in future runs.
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Overlays and Graphical Objects

This chapter explains how to create and edit overlays and graphical objects.

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16.1. Introduction

Graphical objects define locations and areas on the terrain. A core set of control objects (waypoints, phase lines, routes, areas, and obstacles) can be drawn on the map layer, which is always present. Other graphical objects can be drawn on overlays. Although all graphics are essentially points, lines, and areas, their graphical representation and the ability to place them on named overlays makes them useful for planning purposes.

Entities are aware of most graphical objects and can interact with them. For example, an entity can follow a line, move to a point, or avoid an obstacle. VR-Forces can test to determine if an entity is in an area or to either side of a phase line.



The Create menu is configurable. If you change the organization of the Create menu, the menu paths described in this chapter might not be accurate.

For conceptual information about graphical objects, please see [“Graphical Objects,”](#) on page 3-24.

16.1.1. Naming Graphical Objects

The names you assign to graphical objects must be unique among all objects. Names are case sensitive, so you can create three points called Waypoint Alpha, waypoint alpha, and Waypoint alpha, but you cannot create a target point called Point 1 and a point of interest called Point 1. Object names can be up to 255 characters long.



Some character sets require multiple ASCII characters to represent a displayed character. If you use one of these character sets, the maximum length of object names in visible characters may vary.

16.1.2. Draw Mode

When you create a graphical object, the cursor changes to draw mode. In draw mode, the cursor displays the object symbol when you create a point and a vertex symbol when you create any type of line or area. In both cases, the cursor includes the text *working object*. [Figure 16-1](#) illustrates some draw mode cursors.



Figure 16-1. Cursors in draw mode

16.2. Creating and Editing Overlays

Overlays allow you to add graphical objects to the VR-Forces window as if you were adding clear plastic overlays to a physical map and drawing on them. You can add any number of overlays. You can rename them, change the order of overlay tabs, and enable or disable editing of the objects they contain.

16.2.1. Creating an Overlay

To create an overlay:

1. Choose **Create** → **Overlay Manager**. The Overlay Manager opens (Figure 16-2).

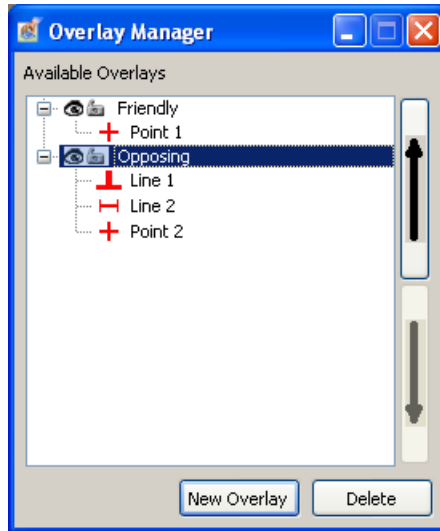


Figure 16-2. Overlay Manager

2. Click New Overlay. The Overlay toolbar is added to the VR-Forces window above the map (Figure 16-3) and an entry with a default name is added to the Available Overlays list.



Figure 16-3. Overlay toolbar

3. Optionally, change the name as described in “Changing an Overlay’s Name,” on page 16-6.

16.2.2. Selecting Overlays

When you select an overlay, its tab is highlighted and its entry in the Overlay Manager is highlighted.

- To select an overlay, click its tab, or click its name in the Overlay Manager.

16.2.3. Enabling and Disabling Editing for an Overlay

You can enable and disable editing of overlay objects. The lock icon on the overlay tab (Figure 16-3) or next to its entry in the Overlay Manager indicates whether or not it is editable.

- To enable or disable editing of an overlay's objects, click the lock icon on the overlay tab or next to the overlay's name in the Overlay Manager.

16.2.4. Changing an Overlay's Name

To change an overlay's name:

1. Choose **Create** → **Overlay Manager**. The Overlay Manager opens.
2. Select the overlay whose name you want to change.
3. Click the name again. A box is drawn around the name and the text becomes editable.
4. Type a new name.
5. Click outside the name.

16.2.5. Changing the Tab Order of Overlays

You can change the order in which overlays are displayed (left to right for the tabs, top to bottom in the Available Overlays list). Changing the tab order also changes the draw order for objects. For more information about draw order, please see “[Changing the Object Draw Order Within an Overlay](#),” on page 16-24.

To change the tab order use one of the following methods:

- In the Overlay Manager, select the overlay that you want to move, then click the Up or Down arrow to change its place in the list.
- On the Overlay toolbar, click and hold the tab for the overlay you want to move, then drag it to the position where you want to move it. Figure 16-4 illustrates this procedure.

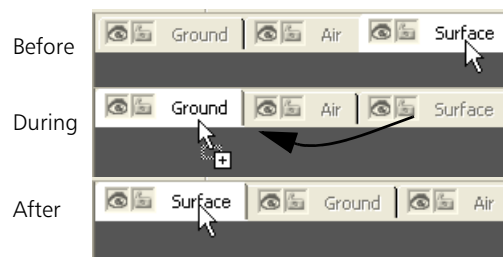


Figure 16-4. Dragging an overlay tab

16.2.6. Specifying the Location of the Overlays Toolbar

You can place the Overlay toolbar at the top of the map or the bottom of the map.

To specify the location of the Overlay toolbar:

1. Choose **Options** → **Display**. The Display Options dialog box opens (Figure 16-5).

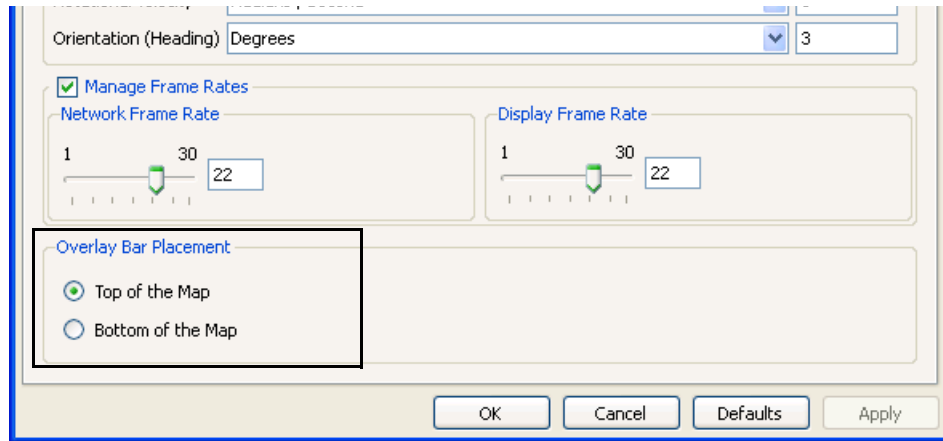


Figure 16-5. Display Options dialog box

2. On the General tab, in the Overlay Bar Placement group box, select Top of the Map or Bottom of the Map.
3. Click OK.

16.2.7. Deleting an Overlay

To delete an overlay:

1. Choose **Create** → **Overlay Manager**. The Overlay Manager opens.
2. Select the overlay you want to delete.



When you delete an overlay, all of the graphical objects on it also get deleted.

3. Click Delete.

16.3. Creating Graphical Objects

This section explains, in general terms, how to create a graphical object and points you to additional information for creating specific types of objects. To add text to an overlay, please see [“Adding Text to an Overlay,”](#) on page 16-13. For an alternate method of creating overlay objects, please see [“Creating Overlay Objects from the Overlay Palette,”](#) on page 16-10.

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- ♦ The control objects listed individually on the Create menu and on the Control tab of the Overlay Palette, are always created on the map layer. If you have any overlays in the scenario, you can ignore them when creating these objects. You can also create control objects from the Entity Palette on the Create tab of the Utility bar.
 - ♦ You can also create objects by copying existing objects. For details, please see [“Copying and Pasting Objects,”](#) on page 7-13.
-

To create a graphical object:

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 object.
2. If you are creating an overlay object, select the overlay on which you want to create it and make sure that editing is enabled for the overlay. (For details about enabling editing, please see [“Enabling and Disabling Editing for an Overlay,”](#) on page 16-6.)
3. If you plan to attach the new object to an entity, review the procedure in [“Attaching an Object to an Entity,”](#) on page 16-15.
4. To create a control object, choose **Create** → *object_type*, where *object_type* is the control object you want to create. To create an overlay object, choose **Create** → **Overlay Objects** → *object_category* → *object_type*, where *object_category* is a category of overlay object types listed on the pull right menu, and *object_type* is a specific object listed on the pull-right menu for the object category. A Create *object* dialog box opens and the cursor changes to draw mode.
5. Click on the map where you want the first point of the object to be located.
6. For all objects except points and symbols, continue clicking to define the vertices of the object. A point has one vertex. A phase line has two vertices. A line or route has two or more vertices, and areas and obstacles have three or more vertices.

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The coordinate information required to specify vertices is determined by the coordinate system selected in the Display Options dialog box. For details, please see [“Specifying the Coordinate System for Dialog Boxes,”](#) on page 6-29.

7. For the end point, right-click.



You do not have to close areas by clicking on the starting point. Doing so only creates another vertex near the first one.

8. Allow VR-Forces to generate a name for the object or type a unique name of your choice in the Object Name text box. (Please see [“Naming Graphical Objects,”](#) on page 16-3 for details about naming objects.)
9. For points, routes, and lines, you can specify a Z value, as described in [“Specifying Z Values,”](#) on page 16-11.
10. Optionally, click the More button and set any of the following characteristics of the object:
 - Color. (For details, please see [“Changing the Color of an Object,”](#) on page 16-25.)
 - Force.
 - Entity attachment. (For details, please see [“Attaching an Object to an Entity,”](#) on page 16-15.)
 - Published or non-published. (For details, please see [“Publishing Graphical Objects,”](#) on page 16-17.)
 - Line style. (For details, please see [“Editing an Object’s Line Style,”](#) on page 16-27.)
 - Line width. (For details, please see [“Changing the Width of an Object’s Lines,”](#) on page 16-26.)
 - Fill style. (For details, please see [“Editing an Object’s Fill Style,”](#) on page 16-27.)
 - Point sampling rate. (For details, please see [“Deleting Vertices Using a Sampling Rate,”](#) on page 16-22.)
 - Transparency. (For details, please see [“Editing the Transparency of an Object,”](#) on page 16-27.)



VR-Forces can remember the settings for a line and apply them to subsequent lines that you create. (For details, please see [“Saving Line Creation Settings,”](#) on page 16-14.)

11. Click OK. The object is created.

16.3.1. Creating Overlay Objects from the Overlay Palette

Instead of creating overlay objects from the Create menu, you can create them from the Overlay Palette. The Overlay Palette lets you control when the Create *object* dialog box gets displayed and allows you to create multiple instances of some objects without needing to select them in the palette each time.

To create an object using the Overlay Palette:

1. Choose **Create** → **Overlay Palette**. The Overlay Palette opens (Figure 16-6).
2. At the bottom of the Overlay Palette, select an option for the behavior of the Create *object* dialog box, as follows:
 - On selection. The Create *object* dialog box opens when you select the object you want to create.
 - On first map click. The Create *object* box opens after you click the first object vertex on the overlay.
 - On last click. The Create dialog box opens when you right-click to complete an object. If you are creating a point, the dialog box displays when you click to locate the point.
 - Do not display. Complete the object when you right-click without displaying the Create dialog box, accepting all default values for the object type.



These options are in effect only when you create overlay objects from the Overlay Palette.

3. Select the tab that has the category of overlay object that you want to create.

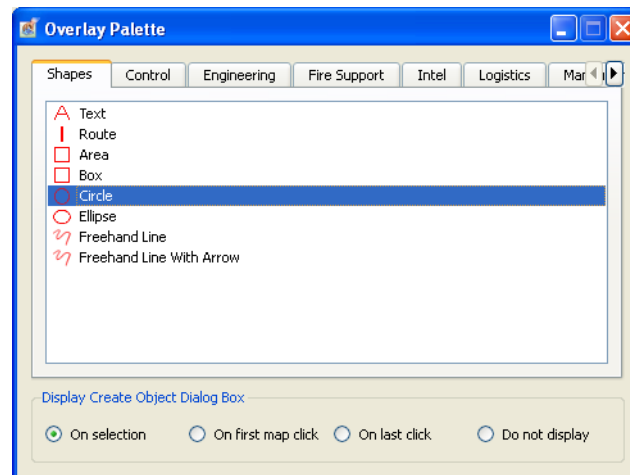


Figure 16-6. Overlay Palette

4. In the list of objects, select the one you want to create.

5. Create the object as described in “Creating Graphical Objects,” on page 16-8, except that if you selected Do Not Display, you can create multiple points, boxes, circles, and lines that require two points, without needing to select them in the Overlay Palette each time. Right-click to exit draw mode.

16.3.2. Cancelling Creation of a Graphical Object

- To cancel creation of a graphical object, click the Cancel button in the Create Object dialog box.



If you are creating objects from the Overlay Palette, and you selected Do Not Display, you cannot cancel creation of an object. You will have to delete it after it is created.

16.3.3. Specifying Z Values

The vertices of points, routes, and lines can have an altitude (a Z value). This allows air and subsurface entities to move to or follow them. In some terrains, an X, Y coordinate may have multiple possible Z values, because there are multiple polygons at that location. This is typical in urban terrains that have buildings with multiple levels. VR-Forces makes it easy to select among these available polygons.



If a coordinate has multiple polygons, when you click on the map, the default is to select the uppermost polygon.

As you add points to a route, you can edit the X, Y, and Z values for each point as you go along, or you can wait until you finish defining the route. Any Z value that you specify before the route is complete gets carried forward to the next point you add. So if you want the route to be at some altitude other than the default (0), you can make the process easier by specifying the altitude right after you add the first point.

To specify a Z value.

1. For a route or line, select a point in the list of points.
2. If you are creating a point, in the Create *object* dialog box or Edit *object* dialog box for a graphical object, in the Altitude group box, select Clamp to Polygon or Set Altitude (Figure 16-7).

If you are creating a route or a line, in the Create *object* dialog box or Edit *object* dialog box for a graphical object, in the Altitude group box, select Clamp to Polygon, Set Altitude, or Height Above Terrain.

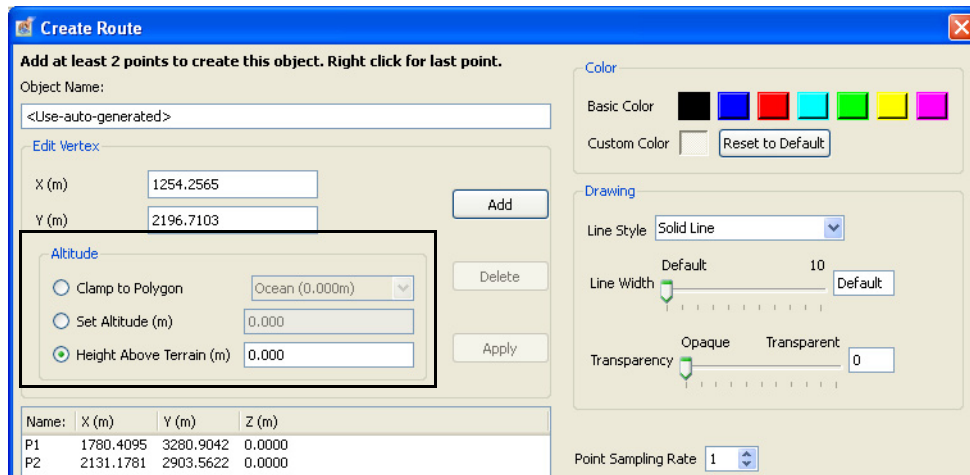


Figure 16-7. Specifying a Z value

3. If you selected Set Altitude, type the altitude above sea level that you want to assign to the point or vertex.
If you selected Clamp to Polygon, select a polygon from the drop-down list.
If you selected Height Above Terrain (routes and lines only), type the height above the terrain at which you want to place this point or vertex.
4. Click Apply.
5. Repeat steps 2 through 4 for each vertex that needs a different Z value.
6. Click OK.

Setting the Default Z Value for Points and Lines

The default Z value (height) for points and routes is zero meters above the terrain. You can change the default Z value and its relationship to terrain or sea level for a point or route.

To set the default Z value:

1. In a Create *object* dialog box or Edit *object* dialog box, click the More button.
2. In the Global Default Z Value group box (Figure 16-7), type a new value in the Height text box.
3. If you are editing a point, click Apply. The Z value of the point changes. All points that you create in the future use the new Z value.
If you are editing a route, clicking Apply changes the Z value for future routes. Click Apply to All to apply the new Z value to the points in the route you are creating or editing.
4. Click OK.

16.3.4. Adding Text to an Overlay

You can place text on an overlay. After you create the text object, you can resize the text box to change its dimensions. You can also edit the text. (For details, please see [“Editing Graphical Objects,”](#) on page 16-19.)

To add text to an overlay:

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 object.
2. Select the overlay on which you want to add the text.
3. Choose **Create** → **Overlay Objects** → **Shapes** → **Text**. The Create Text dialog box opens and the cursor changes to draw mode, showing a rectangle.
4. In the Text text box on the Create Text dialog box, type the text that you want to display on the overlay. The maximum length of a text object is 255 characters.
5. Specify any other attributes that you want to change from the default, such as color, force type, and so on.
6. Click on the map where you want to locate the text.
7. Click OK.

16.3.5. Adding Shapes to an Overlay

The Shape category includes some objects that get created differently from the standard points, lines, and areas.

- To create a box, click where you want the upper left corner of the box to be located. To change the dimensions, edit the box after you create it.
- To create a circle, click to specify the center, then click to set the circumference of the circle.
- To create an ellipse, click to specify the center, then drag to the side and above or below to specify the width and height.

Drawing Freehand Lines

You can draw freehand lines and freehand lines with directional arrows. Although you draw the lines in one continuous movement, VR-Forces converts the line into a series of vertices at an interval that you can specify.

To draw a freehand line:

1. Choose **Create** → **Overlay Objects** → **Shapes** → **Freehand Line**. The Create Freehand Line dialog box opens.
2. Press the left mouse button at the point on the overlay where you want to start drawing the line, and while holding down the mouse button, draw the line on the overlay.
3. When you are done drawing, release the mouse button.
4. Make any optional configuration or style changes to the line in the Create Freehand Line dialog box.
5. Click OK.

Saving Line Creation Settings

You can configure VR-Forces so that when you create a line it has the same color, width, sampling and force settings as the previous line that you created. To configure this behavior, set the `storeLineValuesMode` parameter to 1 (applies only to freehand lines) or 2 (applies to all lines) in *vrfGui.mtl*. Settings are maintained only within an application session.

16.3.6. Attaching an Object to an Entity

To allow embarked entities to move about on the parent entity, you can attach objects such as routes and points to entities. Attachment details are on the Attached To tab of the object's information dialog box. Attachment details are also listed on the Attached Objects tab of the Embarked Objects tab of the Entity Information dialog box. The object's label states that it is attached to an object.

i

- Although the intent of attaching objects to entities is to make it easier to assign movement tasks to embarked entities, you can also attach objects that are not physically within the bounding box of a parent entity. The attached objects move with the parent, maintaining the same offset as when it was attached.
- You can change the location of an attached object (using the normal methods for changing the location of an object). It maintains its attachment and continues to move with the parent entity at its new relative offset.

To attach an object to an entity when you create it:

1. Display the bounding volume of the parent entity.
2. Draw the new object within the entity's bounding volume.
3. After you define the object, in the Create object dialog box, click the More button.
4. In the Attach To Entity group box, click Select (Figure 16-8). The Select Entity dialog box opens.

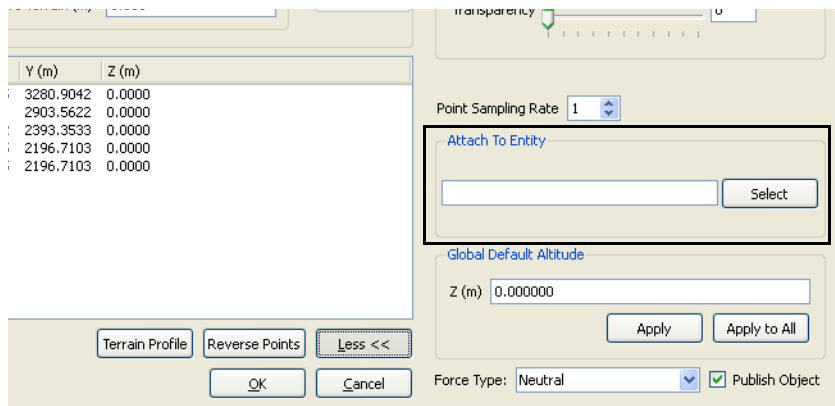


Figure 16-8. Attach to Entity in Create object dialog box

5. Select the entity to which you want to attach the object.
6. Finish creating the object.

Attaching an Object to an Entity After You Create the Object

To attach an object to an entity after the object is created:

1. Select the object.
2. Choose **Objects** → **Attach Object To**. The Attach Object To dialog box opens.
3. Select the entity to which you want to attach the object.
4. Click OK.

Detaching an Object from an Entity

To detach an object from an entity:

1. Select the object. You may have to zoom in on an entity to see the object of select it in the Objects List Panel.
2. Choose **Objects** → **Detach Object From**.

16.3.7. Creating Routes for Aircraft

When you create a route for a fixed-wing entity, remember that as an aircraft flies between the vertices of a route, it starts at the altitude of the first vertex and rises or falls to the altitude of the next vertex. If a terrain feature in between the two vertices is higher than the altitude specified for the vertices, the aircraft will fly into the terrain. There is no terrain following built into the route following process for fixed-wing entities.

This caution applies to rotary-wing entities if there are abrupt changes in elevation in the terrain. Rotary-wing entities can follow the terrain, but they only look down, not ahead, so abrupt changes in terrain could cause a crash.

To make sure that there are no terrain obstructions along a route, you can examine its terrain profile. For details, please see [“Displaying a Line’s Terrain Profile,”](#) on page 20-10.

16.3.8. Publishing Graphical Objects

If you want a graphical object to be visible on the network, you must publish its presence. This is the default behavior. However, you can choose not to publish an object, in which case it is visible only to the front-end on which you create it. This option may be useful if you are engaged in an exercise with other players and want to create overlay objects that are not visible to them.



Published objects are modeled in the back-end. Objects that are not published are modeled in the front-end.

- To publish an object, in the Create *object* or Edit *object* dialog box, click the More button, then select the Publish Object check box. To prevent publication of an object, clear the Publish Object check box.

16.4. Saving and Loading Overlay Objects

If you publish an overlay object, it is automatically saved to the order of battle file. If you do not publish an overlay object, it is automatically saved to the overlay file. There may be cases where you want to create a set of overlays for use in multiple scenarios. You can save them to an overlay file independently of the scenario, or even save the overlays and not save the scenario at all.



When you save overlay objects, only unpublished overlay objects get saved.

To save overlays and overlay objects:

1. Choose **File** → **Overlays** → **Save**. The Save Overlays dialog box opens.
2. By default, overlay data is saved in geocentric coordinates. If you want to save it in local coordinates, clear the Save Locations As Geocentric Values check box.
3. Type a name for the overlay file and click Save.

16.4.1. Loading Overlay Objects

You can load overlays and overlay objects that you have saved from a previous session.

To load overlays and overlay objects:

1. Choose **File** → **Overlays** → **Load**. The Load Overlays dialog box opens.
2. Select the overlay file you want to load.
3. If you want to publish the overlays that you are loading, select the Publish Objects check box.
4. Click Open.



When you load overlay objects, you must use the same terrain database for which you created them, or a terrain database that includes the area in which they were created.

16.5. Displaying a Route's Direction Arrow

The location of a route's name indicates its starting point. However for greater clarity about a route's direction, you can display an arrow at the end point.

To display direction arrows for all routes:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 10-4).
3. In the Icon Labels group box, select the Route Direction check box.
4. Click Apply. An arrow is added to the end of all routes.

16.6. Editing Graphical Objects

You can edit a graphical object in the following ways:

- ♦ Change the coordinates of its vertices
- ♦ Change its name
- ♦ Change the altitude reference (where applicable)
- ♦ Add and delete vertices
- ♦ Change the direction of a line
- ♦ Change the line style, width, and transparency
- ♦ Change the fill of an area
- ♦ Move it to a different location
- ♦ Move an overlay object to a different overlay
- ♦ Change the draw order within an overlay
- ♦ Change the colors of objects individually or as a group.



To edit an overlay object, the overlay on which the object is placed must be unlocked.

To edit a graphical object:

1. Select the object that you want to edit.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box for that type of object opens.
3. Click the More button to expand the dialog box and make all attributes available for editing.
4. Change the values as desired. To change the coordinates of a vertex of a route, line, box, or area, follow the instructions in [“Editing an Object’s Vertices,”](#) on page 16-20.
5. Click OK.

16.6.1. Editing an Object's Vertices

You can add, delete, and edit vertices. An object's vertices are indicated by small dots (Figure 16-9). If you select a vertex by clicking it or by selecting it in the vertex list of an Edit *object* dialog box, it is highlighted.



Boxes and text objects have limits on vertex editing because they are always rectangular. For details, please see “Resizing Boxes and Text Objects,” on page 16-22.

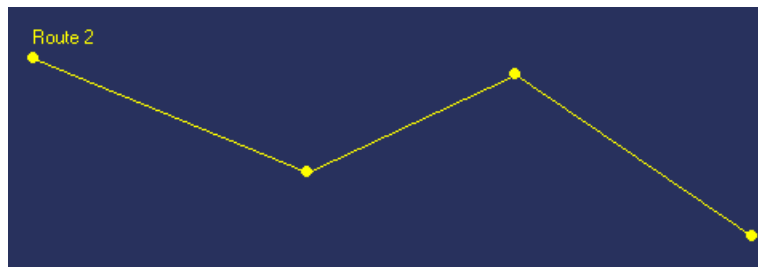


Figure 16-9. Line vertices

Adding Vertices to an Object

You can add vertices in the Edit *object* dialog box for an object or directly to the object.

To add a vertex to an object in the Edit *object* dialog box:

1. Open the Edit *object* dialog box for the object you want to edit.
2. In the vertex list, select the vertex above which you want to add a vertex. If you want to extend a route, click an empty area in the list box.
3. Enter the coordinates of the new vertex in the Edit Vertex group box.
4. Click the Add button. The vertex gets added.
5. Click OK.



When the Edit *object* dialog box is open, you cannot add vertices by clicking on the overlay.

To add a vertex directly to an object, use one of the following methods:

- ♦ Right-click on the point on the object where you want to add a vertex, and select Add Point from the popup menu.
- ♦ **Ctrl+Shift**-click the location on the object where you want to add a vertex.

Editing an Object's Vertices

You can edit the vertices in the Edit *object* dialog box for an object or directly to the object.

To edit a vertex, in the Edit *object* dialog box:

1. Open the Edit *object* dialog box for the object you want to edit.
2. In the vertex list, select the vertex you want to edit.
3. In the Edit Vertex group box, enter the new coordinates for the vertex, or click on the map where you want the vertex to be located.
4. Click Apply.
5. Click OK.

To edit a vertex directly:

1. Click the vertex you want to edit to select it.
2. Drag the vertex to its new location. You can undo the move by pressing the **Escape** key or right-clicking while you are still holding down the left mouse button.

Deleting Individual Vertices from an Object

You can delete vertices directly or in the object's Edit *object* dialog box.

To delete a vertex, in the Edit *object* dialog box:

1. Open the Edit *object* dialog box for the object you want to edit.
2. In the vertex list, select the vertex you want to delete.
3. Click the Delete button. The vertex is deleted. VR-Forces redraws the object.
4. Click OK.



- ♦ You cannot delete a vertex if deleting it would mean that the object has fewer than the minimum number of required vertices
 - ♦ When the Edit *object* dialog box is open, you cannot select vertices by clicking on the map.
-

To delete a vertex directly:

1. Click the vertex that you want to delete to select it.
2. Press the **Delete** key, or select Delete Point from the popup menu. VR-Forces redraws the object.

Deleting Vertices Using a Sampling Rate

You can reduce the number of vertices in an object by a specific factor using a point sampling rate. For example, if the point sampling rate is 2, every second point is retained. If the sampling rate is 4, every fourth point is retained. This feature is primarily intended to reduce the number of points in a freehand line, but it is applicable to any object.

To reduce the number of vertices in an object using a sampling rate:

1. Select the object you want to edit. (If you are creating a new object, start with step 3.)
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click More. The dialog box expands to show additional configuration options.
4. Specify the rate at which to reduce vertices by changing the Point Sampling Rate value. The point sampling rate affects all points except the start and end points.
5. Click OK.

Enabling and Disabling Editing of Freehand Line Vertices

You can enable and disable editing of freehand lines. Because freehand lines have so many vertices, there is a greater chance than with other objects that you may inadvertently select and change them when you try to select a line. Therefore, you may want to disable editing to prevent changes to lines.

- To enable or disable editing of freehand lines, choose **Objects** → **Allow Freehand Point Edit**.

Undoing Object Vertex Edits

You can undo and redo vertex edits made in the front-end.

- To undo an edit, choose **Objects** → **Undo** (or **Redo**).

16.6.2. Resizing Boxes and Text Objects

You cannot edit the individual vertices of a box or a text object, you can only resize them.

- To resize a box or text object, grab one of its vertices and drag it to create the new object size.

16.6.3. Rotating an Ellipse

In addition to changing the width and height of an ellipse, you can rotate it around its center point. You can undo and redo ellipse rotation.

To rotate an ellipse:

1. Select the ellipse.
2. Choose **Objects** → **Edit**. The Edit Ellipse dialog box opens.
3. Select the Free Rotate check box.
4. Click OK.
5. Grab one of the points on the ellipse and drag it in a circular direction.

16.6.4. Moving an Object

You can drag multiple graphical objects the same way you drag individual objects. They maintain their spacial relationship. You can also drag entities and objects at the same time. You can undo and redo an object move. (For details, please see [“Undoing or Redoing an Object Move,”](#) on page 7-12.)

- To change an object’s location, edit its coordinates or drag it to a new location.
- To move a circle or ellipse, grab it by its center point and drag it to its new location.

16.6.5. Reversing the Direction of a Line

All lines have a direction, indicated by the placement of its label, and for routes and those lines that have them, the direction of its arrow. You can reverse the direction of a line.

- To reverse a line's direction, in the Create Line dialog box (for new lines) or the Edit Line dialog box (for existing lines), click Reverse Points. The points are reordered in the dialog box's list. On the map, the name is moved to the new start point. If the line has an arrow, it is moved to the new end point.

Name:	X (m)	Y (m)	Z (m)
P1	128650.63	59751.15	0.00
P2	134747.17	49691.87	0.00
P3	152731.95	52435.31	0.00
P4	153798.84	41613.96	0.00
P5	146178.17	33840.88	-0.00

Before

Name:	X (m)	Y (m)	Z (m)
P1	146178.17	33840.88	-0.00
P2	153798.84	41613.96	0.00
P3	152731.95	52435.31	0.00
P4	134747.17	49691.87	0.00
P5	128650.63	59751.15	0.00

After

Figure 16-10. Reversing line direction

16.6.6. Moving an Object to a Different Overlay

To move an overlay object from one overlay to another:

1. Open the Overlay Manager.
2. Enable editing for the object's current overlay and the overlay to which you want to move it. (For details, please see [“Enabling and Disabling Editing for an Overlay,”](#) on page 16-6.)
3. Move the object using one of the following methods.
 - In the Available Overlays list, drag the object from its current overlay to the destination overlay.
 - Select the object in the Available Overlays list and use the arrow buttons to move it.
 - In the VR-Forces window, drag the object onto the tab of the overlay you want to move it to.

16.6.7. Changing the Object Draw Order Within an Overlay

The order in which objects are listed within each overlay reflects the order in which they are drawn. If objects overlap, objects drawn on top may obscure those drawn below. You can change the draw order to make a particular object more visible.

- To change an object's draw order, in the Overlay Manager, select the object and click the Up or Down arrow.

16.6.8. Changing the Color of an Object

You can change the color of graphical objects and their labels individually, or as a group.

To change the color of all objects of a given type:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Colors tab (Figure 16-11).
3. Click the button next to the color swatch for the type of object whose color you want to change. A color picker opens.
4. In the color picker, choose a color or define a custom color, then click OK to close the color picker.
5. Click Apply or OK. All objects of this type that are using the default color change to the new color. Any objects that are not using the default color continue to use their custom color.

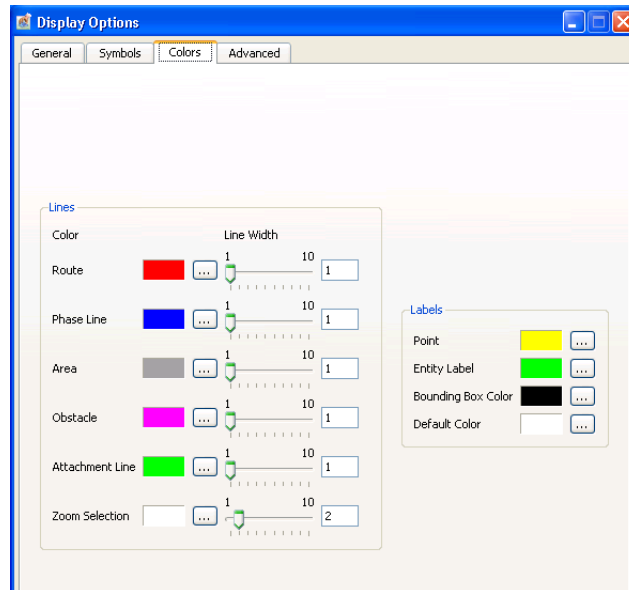


Figure 16-11. Display Options dialog box, Colors tab



- ♦ You cannot change the color of a waypoint. You can change the color of a waypoint's label.
- ♦ The Default Color setting applies to any objects other than entity labels and the specified graphical object types.

To change the color of an individual object:

1. Select the object whose color you want to change.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click the More button.
4. Click a color button or click the Custom Color button to choose a new color from the Color Picker.
5. To change the object's color to the default color, click Reset to Default.
6. Click OK.

16.6.9. Changing the Width of an Object's Lines

You can change the width of the lines that make up an object. You can change width globally or for individual objects.

To change the line width for all objects of a given type:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Colors tab ([Figure 16-11](#)).
3. Adjust the Line Width slider for the type of object whose width you want to change, or type a width value (from 1 –10) in the text box.
4. Click Apply or OK.

The line width setting for an individual object overrides the global default line width.

To change the width of an object's lines:

1. Select the object you want to edit.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click More. The dialog box expands to show additional configuration options.
4. Adjust the Line Width slider to the width you want.
5. Click OK.

16.6.10. Editing an Object's Line Style

The outline of an object can be displayed as a solid line, no line, or as dashed and dotted lines.

To edit an object's line style:

1. Select the object you want to edit.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click More. The dialog box expands to show additional configuration options.
4. In the Color group box, select an option from the Line Style list.
5. Click OK.

16.6.11. Editing the Transparency of an Object

You can vary the transparency of an object between 100% opaque and 100% transparent.



Use of transparency can degrade performance.

To edit an object's transparency:

1. Select the object you want to edit.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click More. The dialog box expands to show additional configuration options.
4. Adjust the Transparency slider to the degree of transparency you want.
5. Click OK.

16.6.12. Editing an Object's Fill Style

You can assign a fill style to areal objects. Fill styles include degrees of solid fill and various types of line and grid fills.

To edit an object's fill style:

1. Select the object you want to edit.
2. Choose **Objects** → **Edit**. The Edit *object* dialog box opens.
3. Click More. The dialog box expands to show additional configuration options.
4. In the Color group box, select an option from the Fill Style list.
5. Click OK.

16.7. Deleting Graphical Objects

To delete a graphical object:

1. Select the object you want to delete.
2. Choose **Objects** → **Delete**.

You can also delete any graphical object by selecting it and pressing **Delete**.

16.8. Overlay Graphics Catalog

This section illustrates each overlay graphic type, organized according to the tabs in the Overlay Palette.

16.8.1. Directionality of Lines

As you might expect, when you draw a line that has an arrow, the arrow points in the direction of the end point. Other lines also have a direction. The points on fortified lines, lines of contact, and ditches indicate the direction of the line, as follows:

- ♦ If you draw a line east-to-west, it points down
- ♦ If you draw a line west-to-east, it points up
- ♦ If you draw a line north-to-south, it points right
- ♦ If you draw a line south-to-north, it points left.

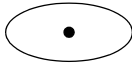
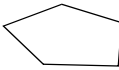
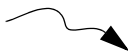
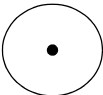
16.8.2. Object Labels are Color Coded

The default object names indicate the type of object, for example, Point 1, Line 2, and so on. However there is nothing in the naming convention to distinguish different kinds of lines that may look alike. The object labels have different default colors, as follows:

- ♦ Blue label – phase line
- ♦ Red label – route or line
- ♦ Gray label – area
- ♦ Yellow label – point.

16.8.3. Shapes

The Shapes tab has the following objects:

♦ Text	1		5	
♦ Route (1)	2		6	
♦ Area (2)	3		7	
♦ Box (3)	4			
♦ Circle (4)				
♦ Ellipse (5)				
♦ Freehand line (6)				
♦ Freehand line with arrow (7).				

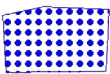
16.8.4. Control

Control objects are created on the map, not on overlays. The Control tab has the following objects:

♦ Waypoint (1)	1	
♦ Phase line (2)	2	
♦ Route (3)	3	
♦ Area, obstacle, disaggregation area (4).	4	

16.8.5. Engineering

The Engineering tab has the following objects:

♦ Minefield (1)	1	
♦ Planned minefield (1)	2	
♦ Fortified line (2)	3	
♦ Ditch (3)		
♦ Fortified ditch (3).		



Minefields are for display or informational purposes only. There are no munitions associated with them.

16.8.6. Fire Support

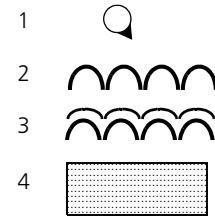
The Fire Support tab has the following objects:

♦ Target point (1)	1	
♦ Linear Target (2).	2	

16.8.7. Intel

The Intel tab has the following objects:

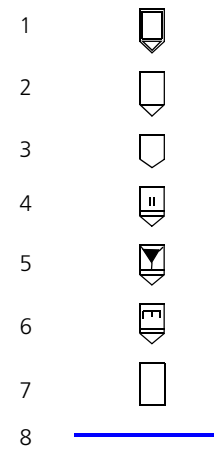
- ♦ Text
- ♦ Point of interest (1)
- ♦ Line of contact -friendly (2)
- ♦ Line of contact -hostile (3)
- ♦ Alert Area (4).



16.8.8. Logistics

The Logistics tab has the following objects:

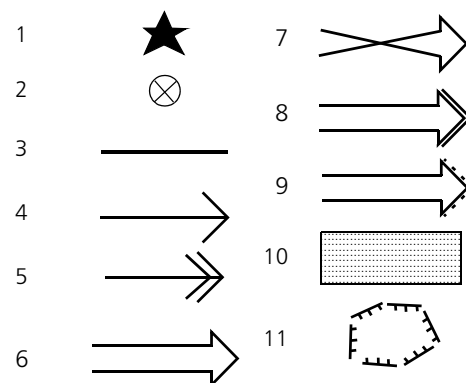
- ♦ Text
- ♦ Waypoint (1)
- ♦ Supply point (2)
- ♦ Class I point (3)
- ♦ Class II point (4)
- ♦ Class III point (5)
- ♦ Class IV point (6)
- ♦ Class V through Class IX points (7)
- ♦ Supply Route (8)
- ♦ Supply route – 1 way (8)
- ♦ Supply route – 2 way (8)



16.8.9. Maneuver

The Maneuver tab has the following objects.

- ♦ Decision point (1)
- ♦ Coordination point (2)
- ♦ Line (3)
- ♦ Direction (4)
- ♦ Direction main (5)
- ♦ Axis (6)
- ♦ Air axis (7)
- ♦ Main axis (8)
- ♦ Feint (9)
- ♦ NoGo area (10)
- ♦ Fortified area (11).



16.8.10. Symbols

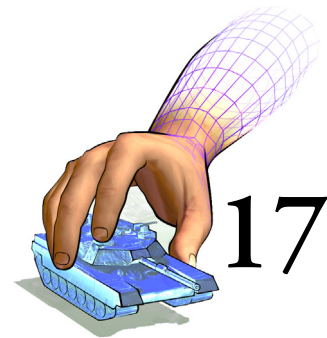
You can add translucent entity symbols for the following entities:

- ♦ AAV
- ♦ ACE
- ♦ Avenger
- ♦ AVLB
- ♦ BMP
- ♦ CEV
- ♦ FIST V
- ♦ HMMWV MK19
- ♦ HMMWV 50 CAL
- ♦ IMR
- ♦ LAV
- ♦ MTK
- ♦ M113
- ♦ M1A2
- ♦ M2A2
- ♦ M88
- ♦ PALADIN
- ♦ SA-9
- ♦ T80.

16.8.11. Puffs (Hazard Clouds)

The puffs tab has five objects, all of which display the same graphic. They differ in the entity ID associated with the object.





Using Special Effects

This chapter explains how to configure and display special effects, such as track histories, and animation.

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Configuring the Display of Emissions	17-2
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17.1. Displaying Electromagnetic Emissions

If an entity simulates electromagnetic emissions, such as radar, VR-Forces can display the emissions. [Figure 17-1](#) illustrates emissions from a fixed-wing entity.

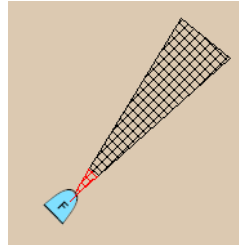


Figure 17-1. Entity emissions

- To enable or disable the display of entity emissions, choose **Options** → **Emitter Beams**.

17.1.1. Configuring the Display of Emissions

You can configure the type of emissions displayed, the colors used to display them, the frequencies displayed, and the range of the display.

To configure the display of emitter beams:

1. Choose **Options** → **Emitter Beam Options**. The Emitter Beam Options dialog box opens ([Figure 17-2](#)).

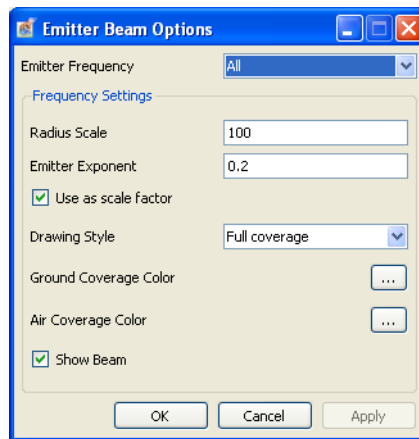


Figure 17-2. Emitter Filter Panel dialog box

2. To set the frequencies displayed, select an option in the Emitter Frequency list. The list shows the frequencies of all emitter beams that VR-Forces has detected.

3. By default, the Use as Scale Factor check box is selected and the length of the beam is displayed as a percentage of the radius. To change the scale factor, type a value in the Radius Scale text box. To specify the length of the beam as an absolute value, clear the Use as Scale Factor check box and type a value, in meters, in the Beam Range box.
4. To specify the display of beams on the ground, in the air, or both, select an option from the Drawing Style list.
5. To change the color used to display the emission types, click the Ground Coverage Color button or the Air Coverage Color button and choose a new color from the color selector.
6. To disable display of the selected emitter frequency, clear the Show Beam check box. To enable display of the frequency, select the check box.
7. Click Apply or OK to apply changes.

17.2. Displaying Hazard Clouds

You can display chemical and biological hazard clouds. You can display the clouds as a series of individual ellipses (for each puff associated with a cloud), as a bounding volume that encompasses the entire cloud, or as an image. [Figure 17-3](#) illustrates, left to right, a bounding volume displayed as an image, the same bounding volume displayed as an ellipse, and a hazard cloud displayed as individual ellipses.

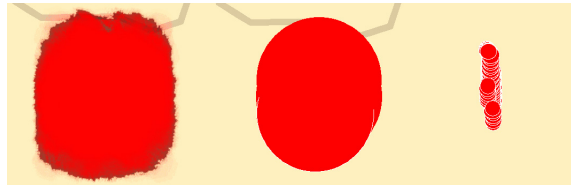


Figure 17-3. Hazard clouds

Hazard cloud settings are saved to the *vrGuiSettings.mtl* file.

You can enable and disable display of hazard clouds globally. You can also enable or disable and configure the display of each type of supported hazard cloud.



Using images to display hazard clouds will dramatically decrease GUI performance.

To enable or disable the display hazard clouds and configure individual cloud types:

1. Choose **Options** → **Hazard Cloud Options**. The Hazard Cloud Options dialog box opens (Figure 17-4).

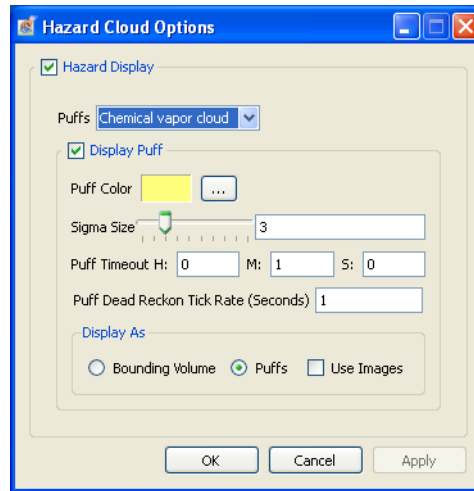


Figure 17-4. Hazard Options dialog box

2. Select or clear the Hazard Display check box to enable or disable the display of hazard clouds.
3. Choose a cloud type from the Puffs list.
4. To enable the display of this type of cloud, select the Display Puff check box.
5. Optionally, specify the color, timeout, sigma size, and dead-reckoning tick rate for the clouds.
6. In the Display As group box, specify how you want clouds to be displayed (bounding boxes or puffs).
7. Optionally, check the Use Images check box to display hazard clouds using images instead of bounding volumes.
8. Click Apply or OK. If you click Apply, you can continue to configure other cloud types without re-opening the dialog box.
9. Click OK.

17.2.1. Displaying Information About a Hazard Cloud

You can display an information dialog box for hazard clouds and their individual segments (Figure 17-5). You can select only one hazard cloud segment at a time.

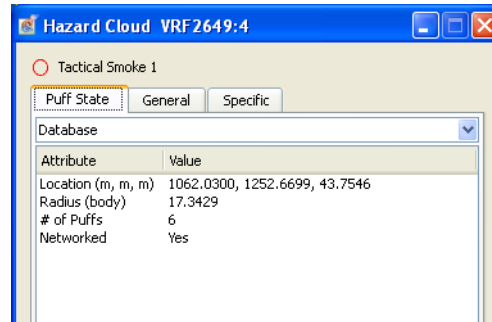


Figure 17-5. Hazard Cloud Information dialog box

- To display information about a hazard cloud or hazard cloud segment, double-click the object or select the object and choose **Objects** → **Information**.

17.3. Displaying Transmitter Data

You can display graphics for radio transmissions. If two or more entities transmit on a channel within a configurable amount of time of each other, VR-Forces assumes that they are communicating with each other. When you enable display of transmitters, a transmitter icon (A, in [Figure 17-6](#)) is added to the entity labels of those entities that have transmitters. When an entity sends a transmission, squawk lines (B) are displayed around the entity. If you enable communication lines, lines are drawn between the communicating entities (C). If you enable transmitter squawk, squawk lines (D) are displayed around the transmitter.

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- ♦ The DIS and RPR FOM standard signal information does not provide enough information to determine which radios actually receive a given signal. Any transmitter that broadcasts within five seconds of a transmission from another transmitter is assumed to be communicating with it, and that communication is represented by a communications line. VR-Forces radio messages have enough information to accurately draw communication lines between the entities without making such potentially incorrect assumptions. Unless you have to display the communications lines for radios that are not modeled by VR-Forces, it is recommended that you configure transmitter to disable Display Communication Lines and enable Display VRF Communication Lines, as described in “[Configuring the Display of Transmitter Data](#),” on page 17-7.
 - ♦ The transmitter icon is displayed for all foreign entities that are publishing a transmitter. It is displayed for VR-Forces entities only if publication of transmitters has been enabled for that entity type in its OPE file. For details, please see Section 9.2.1, “[Enabling Radio Transmitter Publishing](#)”, in *VR-Forces Configuration Guide*.
-

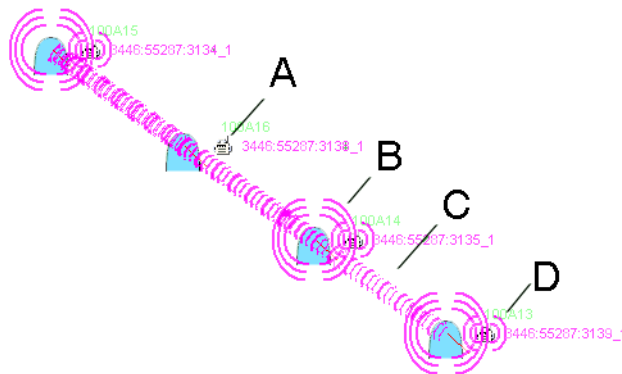


Figure 17-6. Transmitter graphics

To display radio transmissions:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab.
3. Select Transmitters to enable the display of transmitters.
4. Click OK.

17.3.1. Configuring the Display of Transmitter Data

You can configure the display of all frequencies and of specific frequency ranges.

To configure the transmitter display:

1. Choose **Options** → **Transmitters**. The Transmitter Options dialog box opens (Figure 17-7).

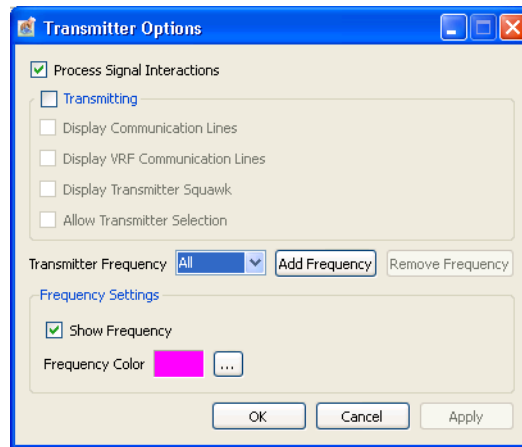


Figure 17-7. Transmitter Options dialog box

2. To enable display of transmitters and configure them:
 - a. To enable display of communication and squawk lines, in the Transmitting group box, select the Transmitting check box.
 - b. Select Display Communication Lines to display lines for standard signal messages between transmitting entities.
 - c. Select Display VRF Communication Lines to display lines for VR-Forces-specific radio messages such as those sent by the Send Text Message task.
 - d. Select Display Transmitter Squawk to display graphics around the transmitters that are sending.
 - e. Select Allow Transmitter Selection to enable selection of transmitter icons.

3. In the Transmitter Frequency list, select the frequency that you want to configure (either All or a specific frequency). To add a frequency:
 - a. Click Add. The Add Frequency dialog box opens ([Figure 17-8](#)).

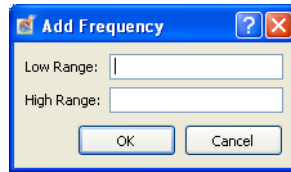


Figure 17-8. Add Frequency dialog box

- b. Type the low and high values for the frequency range you want to add.
 - c. Click OK.
4. To display the selected frequency, in the Frequency Settings group box, select the Show Frequency check box.
5. To specify a color for the selected frequency:
 - a. In the Frequency Settings group box, click the button next to the Frequency Color color swatch. A color picker dialog box opens.
 - b. Choose the color you want to use for this frequency and click OK.
6. Click OK or click Apply and configure additional frequencies.

17.3.2. Displaying Information about a Transmitter

You can display information about a transmitter (Figure 17-9).

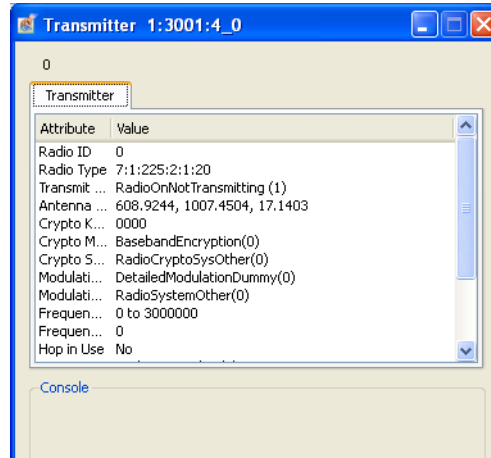


Figure 17-9. Transmitter Information dialog box

To display transmitter information:

1. Enable the display of transmitters.
2. Choose **Options** → **Transmitters**. The Transmitter Options dialog box opens (Figure 17-7).
3. In the Transmitting group box, select Allow Transmitter Selection.
4. Select the transmitter for which you want information.
5. Choose **Objects** → **Information**.

17.3.3. Displaying an Entity's Transmitter Information

- To display information about an entity's transmitter, select the Transmitters tab on the Entity Information dialog box (Figure 17-10).

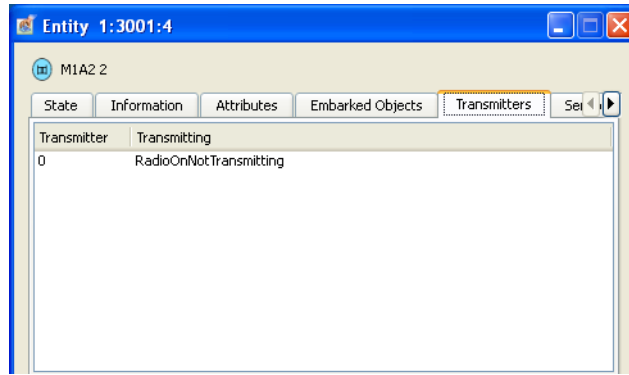


Figure 17-10. Entity Information dialog box, Transmitters tab



The Transmitter tab is displayed only if publishing of transmitters is enabled for an entity. For details about enabling publishing of transmitters, please see Section 9.2.1, “[Enabling Radio Transmitter Publishing](#)”, in *VR-Forces Configuration Guide*.

17.4. Displaying Entity Track Histories

You can display the path that an entity follows as it moves over the terrain (Figure 17-11). The track uses the force color. VR-Forces remembers the track of entities that are visible on the map and displays them as follows:

- When you display track histories, VR-Forces displays the track history for each visible entity starting at the point that it became visible; it does not start the display of tracks at the current entity location.
- If you change the map view to include entities that were not visible when you started to display track histories, the tracks for the newly visible entities start at the point at which they become visible, not at the point when track histories were first displayed.
- Turning off the display of track histories does not discard the track history data. If you display track histories again the entire track history is displayed.
- You can discard the stored histories. For details, please see “[Clearing Track Histories](#),” on page 17-12.

Track histories degrade over time. The track is a line constructed from points laid down every 10 meters. After 60 seconds, the first point is removed from the history. Each successive point is removed 60 seconds after it was created. You can configure the distance between points and the degradation time with the `minTrackHistoryMovement` and `trackHistoryTimeout` parameters in *vrfGui.mtl*.

By default, track histories do not degrade for entities that are not moving or are destroyed. This is done to improve performance. If you want track histories for these entities to degrade, edit the `decayTrackHistory` parameter in *vrfGui.mtl*.

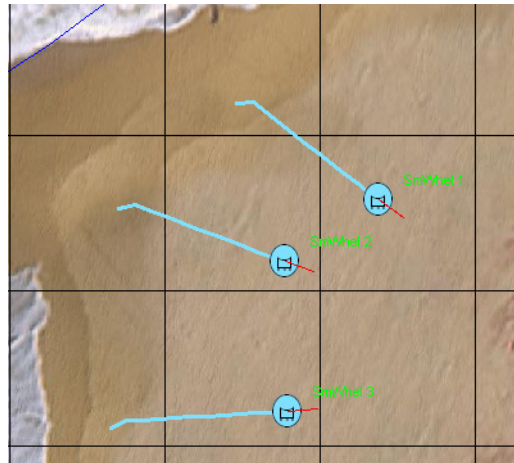


Figure 17-11. Entity track history

To enable the display of track histories:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
 2. Select the Symbols tab (Figure 10-4).
 3. In the Icon Labels group box, select Track Histories. To disable display of track histories, clear the check box.
 4. Click Apply or OK.
- To display track histories, choose **Options** → **Track Histories**.

17.4.1. Viewing a Track History Terrain Profile

You can view a terrain profile for a track history. This can be particularly useful for examining the path of a missile, determining why an aircraft crashed into terrain, or why a ground vehicle is not moving over the terrain. For an introduction to terrain profiles, please see “[Terrain Profiles](#),” on page 20-9.



If an entity, such as a missile, is removed from the simulation, its terrain profile window is automatically closed, unless you select Do Not Remove Terrain Profile When Object Is Deleted.

To view the terrain profile for a track history:

1. Select the entity whose track you want to view. If you want to view the terrain profile of a transient entity, such as a missile, you may need to pause the simulation.
2. Choose **Objects** → **Show Terrain Profile**.
3. If you open the terrain profile for a transient entity and you want to continue to view the profile after the entity is removed from the simulation, select Do Not Remove Terrain Profile When Object Is Deleted.

17.4.2. Clearing Track Histories

When you clear track histories, VR-Forces discards all track history data to that point. Then it starts saving track history data from the current location of each entity.

- To clear track histories, choose **Options** → **Clear Track Histories**.

17.4.3. Enabling and Disabling the Collection of Track History Data

To improve performance, you may want to completely disable all track history collection and display. When track histories are enabled, data is recorded whether or not the histories are displayed. When you clear track histories, you just delete the stored data, you do not stop VR-Forces from gathering data.

To enable or disable the track history feature:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the General tab.
3. To disable track histories, in the General group box, clear the Track Histories check box. To enable track histories, select the Enable Histories check box.
4. Click OK.

17.5. Displaying Fire and Detonation Graphics

You can control the display of fire and detonation interactions. If they are enabled, you can control the display of fire and detonation lines.

17.5.1. Displaying Fire and Detonation Interactions

By default, VR-Forces displays graphics when an entity fires a munition. It also displays graphics when a munition detonates. You can hide these graphics.

To enable or disable the display of fire and detonation interactions:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 17-12).

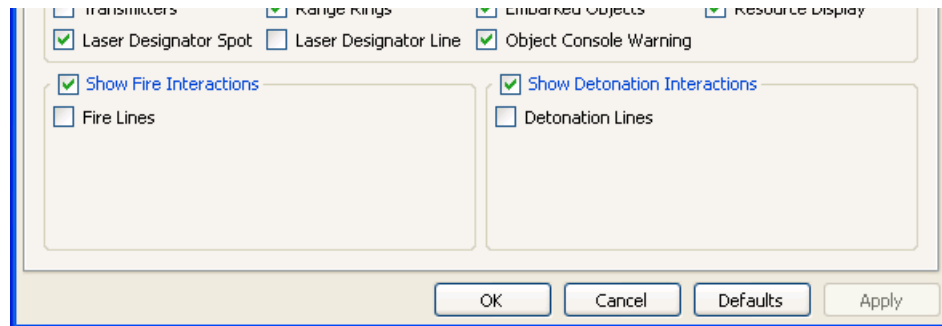


Figure 17-12. Display Options, Symbols tab

3. To display fire interactions, select Show Fire Interactions.
4. To display detonation interactions, select Show Detonation Interactions.
5. Click Apply or OK.

17.5.2. Displaying Fire and Detonation Lines

When an entity fires a munition, VR-Forces can display lines between the shooter and its target (Figure 17-13). Fire lines are dotted. Detonation lines are solid. The line uses the force color of the shooter.

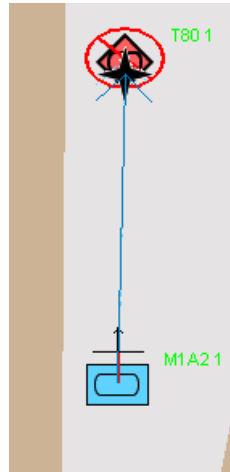


Figure 17-13. Detonation line

To display fire and detonation lines:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab (Figure 17-12).
3. To display fire lines, select Show Fire Interactions. Then select Fire Lines. To disable fire lines, clear the Fire Lines check box.
4. To display detonation lines, select Show Detonation Interactions. Then select Detonation Lines. To disable detonation lines, clear the Detonation Lines check box.
5. Click Apply or OK.



The Fire and Detonation Lines option on the Options menu toggles both fire and detonation lines on or off. The display of fire interactions and detonate interactions must be enabled to display fire and detonation lines.

17.5.3. Displaying Detonation Animation Graphics

When a munition detonates, you can display an animation of the explosion (Figure 17-14).

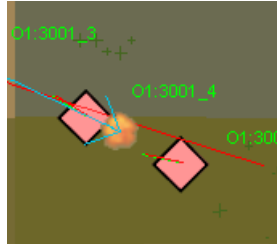


Figure 17-14. Detonation animation

- To toggle detonation animations on or off, choose **Options** → **Animation**.

17.6. Displaying Tactical Smoke

VR-Forces entities can launch tactical smoke. Tactical smoke interferes with line-of-sight. You can enable and disable the display of tactical smoke and configure how it is displayed.

To display or hide tactical smoke:

1. Choose **Options** → **Tactical Smoke**. The Tactical Smoke dialog box opens (Figure 17-15).

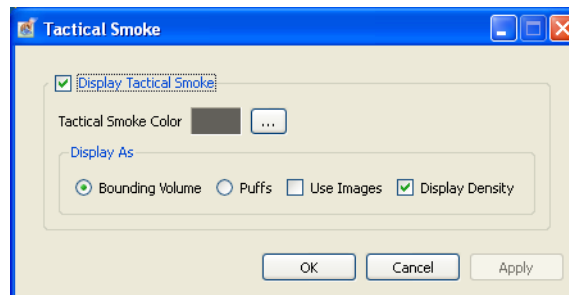


Figure 17-15. Tactical Smoke dialog box

2. Select or clear the Display Tactical Smoke check box.
3. Click OK.

17.6.1. Configuring Tactical Smoke

You can configure the color of tactical smoke and how it is displayed. [Figure 17-16](#) illustrates the different ways that you can display tactical smoke. The area covered by the smoke increases over time. If you are displaying the smoke using puffs, and Display Density is selected, the density of the smoke cloud begins to decrease approximately half way through its total length of visibility. If Display Density is not enabled, the cloud maintains the same density until its display time ends, at which point it is removed from the display.

You can configure the length of time a cloud is displayed, the rate of growth and the maximum size. To configure these values, edit the *Tactical-Smoke_1_4_2_-1_1_-1_-1_.ope* file.

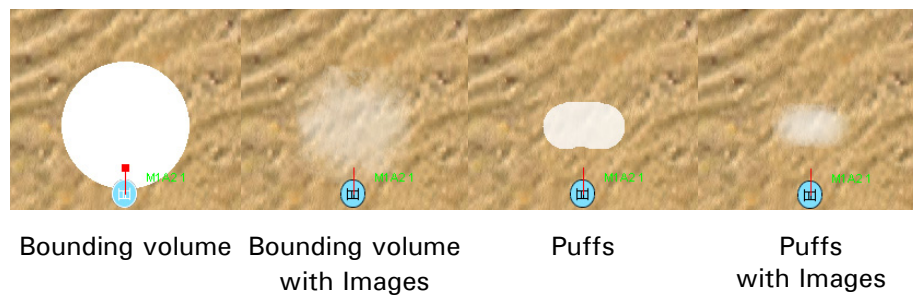


Figure 17-16. Tactical smoke

To configure tactical smoke:

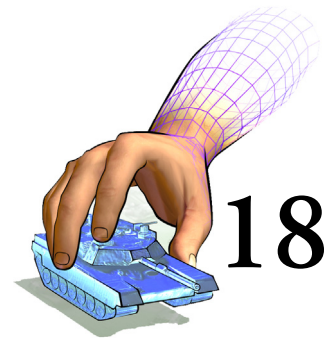
1. Choose **Options** → **Tactical Smoke**. The Tactical Smoke dialog box opens ([Figure 17-15](#)).
2. To configure the color used for tactical smoke:
 - a. Click the browse button next to the Tactical Smoke Color box. A color picker opens.
 - b. Select the color that you want to use.
 - c. Click OK. The chosen color is displayed in the Tactical Smoke Color box.
3. To configure how the smoke is displayed, select Bounding Volume or Puffs.
4. Optionally, select Use Images, to display an image of smoke instead of a solid area of color.
5. Optionally, select Display Density to enable gradual dispersal of the smoke images. (Only applies to puffs.)

17.7. Displaying Sensor Contacts

VR-Forces entities have various types of sensors for detecting opposing force entities. Sensor contacts are listed on the Sensors tab of the Entity Information dialog box. You can display instances of sensor contacts on the map. They are shown using dashed green lines that include direction indicators.

To display sensor contacts:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab ([Figure 17-12](#)).
3. In the Icon Labels group box, select the Sensor Contacts check box and click Apply or OK.
4. Select the entities for which you want to display sensor contacts.
5. Choose **Objects** → **Display Sensor Contacts**.



Intervisibility

This chapter explains how to use the intervisibility feature. For an introduction to intervisibility, please see “Intervisibility (Line-of-Sight),” on page 3-30.

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18.1. Types of Intervisibility

VR-Forces supports the following types of intervisibility:

- ♦ Point-to-point
- ♦ Intervisibility fan
- ♦ Intervisibility grid
- ♦ Entity intervisibility.

The intervisibility fan and grid, and entity intervisibility, are all displayed as a circular area. However, intervisibility calculations are made within a cylindrical area extending above and below the terrain, so that intervisibility calculations can be made for air platform entities and subsurface entities.

18.1.1. Point-to-Point Intervisibility

Point-to-point intervisibility ([Figure 18-1](#)) shows the line-of-sight between any two points. The portion of the line that is visible from the starting point is green. The portion that is not visible is red.

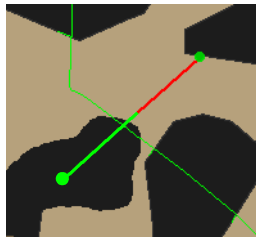


Figure 18-1. Point-to-point intervisibility

18.1.2. Intervisibility Fan

An intervisibility fan (Figure 18-2) shows a series of lines radiating from the center of a circle to its outer edge. Each ray shows intervisibility along its path from the origin to the border. You can configure the distance between rays. (For details, please see “Configuring Intervisibility,” on page 18-9.)

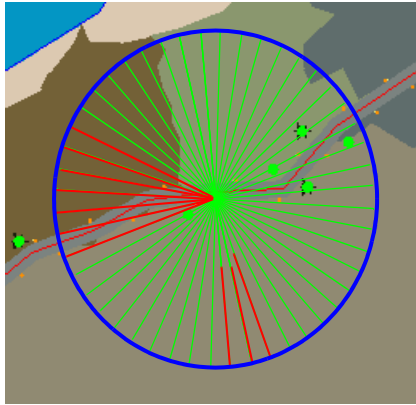


Figure 18-2. Intervisibility fan

18.1.3. Intervisibility Grid

The intervisibility grid (Figure 18-3) overlays obstructed terrain with a grid. Visible areas are clear.

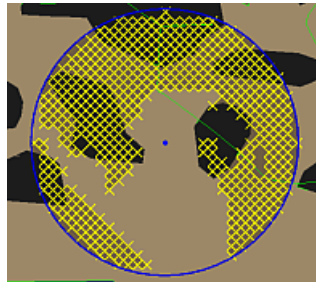


Figure 18-3. Intervisibility grid

The information provided by the intervisibility grid differs from the information provided by the intervisibility fan in that the rays of the fan only show visibility up to the first point at which they are blocked, while the grid shows all areas that are visible. For example, in the terrain illustrated in Figure 18-4, an intervisibility fan would show blockage at the point where the terrain dips below the tank's view. An intervisibility grid would show the area represented by the dotted line as being blocked, but the area past the valley would show as visible. You can configure the resolution of the grid. (For details, please see “Configuring Intervisibility,” on page 18-9.)

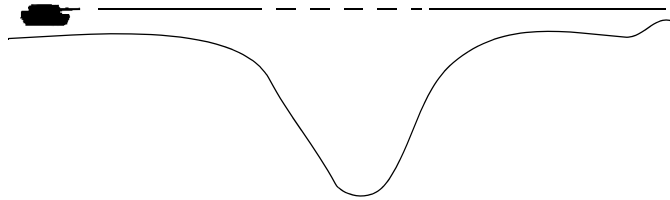


Figure 18-4. Interrupted visibility

18.1.4. Entity Intervisibility

Entity intervisibility (Figure 18-5) shows which entities are visible from the center of a defined area and whether or not the entities can see the center point. If you center the intervisibility circle on a point on the terrain, you can see which entities can see that point. If you lock the circle to an entity, you can see which entities can see that entity and which it can see. You can configure the display of intervisibility from the origin (Who can I see?) and to the origin (Who can see me?). (For details, please see [“Configuring Intervisibility,”](#) on page 18-9.)

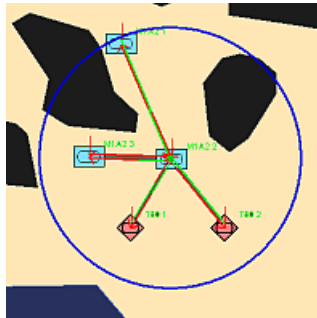


Figure 18-5. Entity intervisibility

18.2. Intervisibility Objects can be Transient or Permanent

You can configure intervisibility objects to be transient or permanent. (For details, please see “[Configuring Intervisibility](#),” on page 18-9.) A transient intervisibility object displays intervisibility from the origin point (defined by a mouse click) to wherever you move the cursor. If you click the mouse again, you reset the origin. You cannot use the mouse for other actions until you exit intervisibility mode (by right-clicking). This mode is convenient when you want to quickly check intervisibility, but do not want to keep intervisibility objects in the display.

A permanent intervisibility object stays in the display after you create it. You can resize the object, edit drawing options, and move it around the display.

18.2.1. Creating a Transient Intervisibility Object

Transient intervisibility objects do not remain in the display when you exit intervisibility mode.

To display transient intervisibility:

1. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens ([Figure 18-6](#)).

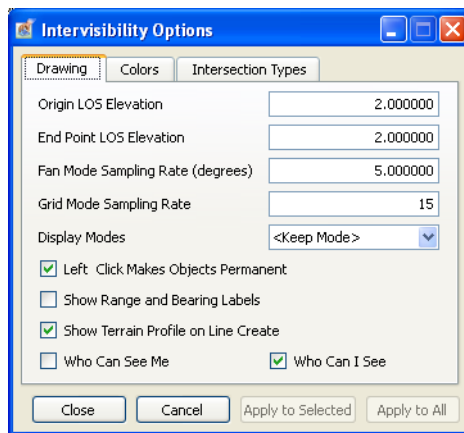


Figure 18-6. Intervisibility Option dialog box, Drawing tab

2. Select the Drawing tab.
3. Clear the Left Click Makes Objects Permanent check box.
4. Click Apply to All.
5. Choose **Intervisibility** → *intervisibility_type*. The cursor changes to draw mode.
6. Click on the map to set the origin of the intervisibility display.
7. Move the cursor around the map to expand and contract the display. For point-to-point intervisibility, moving the cursor also changes the direction of the line.

8. To change the origin of the intervisibility display, click another location on the map.
9. Right-click to cancel intervisibility mode.

18.2.2. Creating a Permanent Intervisibility Object

Permanent intervisibility objects remain on the map after you create them.

To create a permanent intervisibility object:

1. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens (Figure 18-6).
2. Select the Drawing tab.
3. Select the Left Click Makes Objects Permanent check box.
4. Click Apply to All.
5. Choose **Intervisibility** → *intervisibility_type*. The cursor changes to draw mode.
6. Click on an entity or on a location on the map where you want the origin of the object to be located. An intervisibility object is displayed. As you move the cursor closer to the origin, or farther away from it, the circle or line contracts and expands. If you are displaying point-to-point, you can rotate the line around the origin before you specify the end point.
7. Click on the map where you want to fix the end point of a line or border of a circle.

18.3. Displaying Range and Bearing Data

You can display range and heading data for a point-to-point intervisibility line. The heading and location is displayed for each end of the line and the range is displayed at the end of the line (Figure 18-7).

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The difference between the Z value and the elevation in the range and bearing labels is because the calculation is done using geocentric coordinates, which are then converted to topographic coordinates. The elevation value reflects the curvature of the earth.

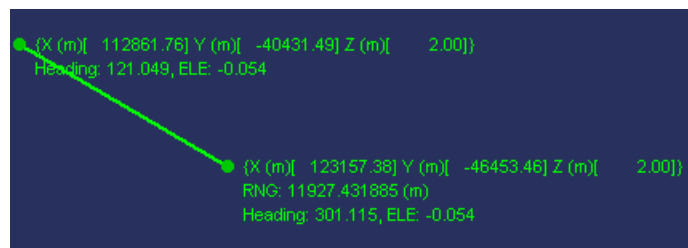


Figure 18-7. Intervisibility range and heading

To display range and bearing data, use one of the following methods:

- ♦ Choose **Options** → **Range and Bearing Labels** to toggle the display of labels on and off.
- ♦ On the Intervisibility Options dialog box, Drawing tab, select the Show Range and Bearing Labels check box and click Apply to Selected or Apply to All.

18.4. Editing an Intervisibility Object

You can change an intervisibility object's length, direction, and display mode.

- To change the length of an intervisibility object, select it, then drag the endpoint towards or away from the origin.
- To change the direction of an intervisibility line, select the line, then drag an endpoint in a circular motion around the other endpoint.



To select an intervisibility object, you must be in Objects selection mode.

18.4.1. Specifying an Intervisibility Line's Endpoints

In addition to moving the end points of an intervisibility line with the mouse, you can set them to specific coordinates.

To specify the endpoints of an intervisibility line:

1. Select the line.
2. Choose **Intervisibility** → **Set Line Location**. The Set Line Location dialog box opens (Figure 18-8).

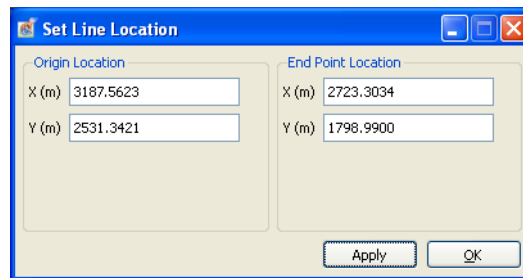


Figure 18-8. Set Line Location dialog box

3. Edit the coordinates for the start and end points.
4. Click Apply.

18.4.2. Changing an Intervisibility Object's Display Mode

You can change an intervisibility object's display mode, for example, from intervisibility fan to entity intervisibility. If you change a fan, grid, or entity intervisibility display to point-to-point, the line is displayed to the point you clicked when you specified the outer boundary of the object's circle.

To change an intervisibility object's display mode:

1. Select the objects that you want to change.
2. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens (Figure 18-9).
3. Select the Drawing tab.
4. Choose a display mode from the Display Modes list.
5. Click Apply to Selected.
6. Click Close.

18.5. Configuring Intervisibility

You can configure how VR-Forces draws intervisibility, the directionality of intervisibility calculations, and the types of objects that VR-Forces considers when it calculates intervisibility. You can apply changes to all current intervisibility objects and those to be created, or you can apply changes to selected intervisibility objects.

18.5.1. Configuring Intervisibility Drawing Options

To change intervisibility drawing options:

1. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens (Figure 18-9).

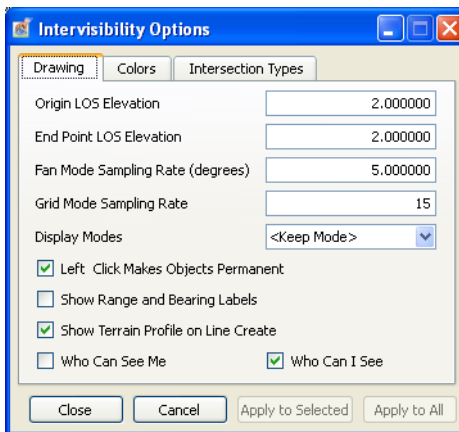


Figure 18-9. Intervisibility Option dialog box, Drawing tab

2. Change the drawing options as desired. [Table 18-1](#) describes the options.

Table 18-1: Intervisibility drawing options

Option	Description
Origin LOS Elevation	The height above the terrain at the origin point from which to calculate intervisibility.
End Point LOS Elevation	The height above the terrain at the end point to use to calculate intervisibility.
Fan Mode Sampling Rate	The distance, in degrees, between each ray in the fan.
Patchwork Mode Sampling Rate	The distance, in pixels, between each line in the patchwork grid.
Display Modes	Specifies the type of display mode for an object. “Keep Mode” (the default) keeps current objects in their existing display modes.
Left Click Makes Objects Permanent	If checked, you can create intervisibility objects that persist in the display. If clear, each left click creates a transient intervisibility display with its origin at the location of the left click. (For details, please see “Intervisibility Objects can be Transient or Permanent,” on page 18-5.)
Show Range and Bearing Labels	If checked, displays location, range, and heading at each end of a point-to-point intervisibility line. (For details, please see “Displaying Range and Bearing Data,” on page 18-7.)
Show Terrain Profile Dialog on Line Create	If checked, when you create a point-to-point intervisibility line, the Terrain Profile window is automatically displayed. (For details, please see “Displaying an Intervisibility Line’s Terrain Profile,” on page 18-14.)
Who Can See Me	If checked, display intervisibility between entities within the fan and the origin.
Who Can I See	If checked, display intervisibility from origin to entities within the fan.

3. To apply the changes to specific intervisibility objects, select the objects and click Apply to Selected.

To apply the changes to all intervisibility objects and to objects that you create in the future, click Apply to All.



Be careful not to inadvertently apply changes to all intervisibility objects if you only want to apply the changes to specific objects.

4. Click Close to exit the dialog box.

18.5.2. Specifying Intervisibility Colors

To change intervisibility colors:

1. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens.
2. Select the Colors tab.
3. Click the color button for the feature whose color you want to change. A color picker dialog box for your windowing system opens.
4. Select the color you want to use or create a custom color.
5. Click OK.
6. To apply the changes to specific intervisibility objects, click Apply to Selected.

To apply the changes to all intervisibility objects and to objects that you create in the future, click Apply to All.



Be careful not to inadvertently apply changes to all intervisibility objects that you only want to apply to specific objects.

7. Click Close to exit the dialog box.

18.5.3. Specifying the Types of Objects to Check for Intersections

You can specify what VR-Forces looks at when it checks intervisibility. By default, VR-Forces checks the terrain (polygons) for obstructed sight lines. VR-Forces can also check terrain features, such as buildings, and entities. When VR-Forces checks entity intersections, it uses the bounding volumes specified in *boundingVolume.mtl*.

To specify the types of intersections to check:

1. Choose **Intervisibility** → **Options**. The Intervisibility Options dialog box opens.
2. Select the Intersection Types tab ([Figure 18-10](#)).

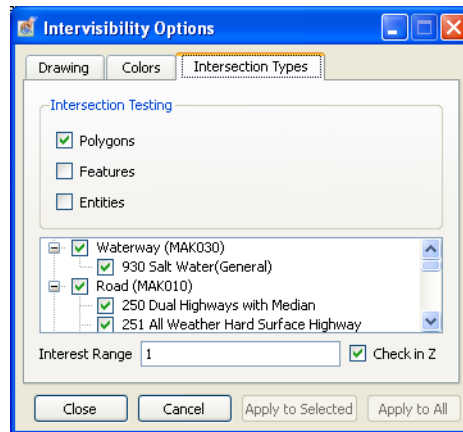


Figure 18-10. Intervisibility Options dialog box, Intersection Types tab

3. In the Intersection Testing group box, select the intersection types you want to test for (polygons, features, and entities). Clear the check boxes for intersections you do not want to test.



Depending on the complexity of the terrain database and the number of entities in the simulation, increasing the types of intersections tested may degrade performance.

4. If you check for feature intersections, select which features you want to check for by selecting or clearing the features listed in the Feature window.
5. To specify the distance around a point, in meters, that should be checked, type a value in the Interest Range box.
6. To specify that VR-Forces consider the height of an object when checking intersections, select the Check in Z check box. To only check the two-dimensional footprint of an object, clear the Check in Z check box.



The interest range and check in Z only apply to polygons and features. Entities just check within the bounding volume.

18.6. Pinning an Intervisibility Object to an Entity

When you pin an intervisibility object to an entity, the intervisibility object moves with the entity and you know that its origin is centered on the entity.

To pin an intervisibility object to an entity:

1. Select the entity to which you want to pin the intervisibility object.
2. Choose **Intervisibility** → *intervisibility_type*.
3. Specify the end point for the intervisibility object.



Alternatively, you can choose an intervisibility command, then click an entity and an end point.

18.7. Moving Intervisibility Objects

- To move an intervisibility object, select it, then drag it to another location on the map.



If an intervisibility object is pinned to an entity, you cannot move it without also moving the entity.

18.8. Displaying an Intervisibility Line's Terrain Profile

You can display a terrain profile for a point-to-point intervisibility line. The terrain profile can be very helpful when you try to understand how terrain changes are affecting intervisibility. [Figure 18-11](#) shows an obstructed intervisibility line and its terrain profile, whose graph illustrates the line intersecting the terrain.

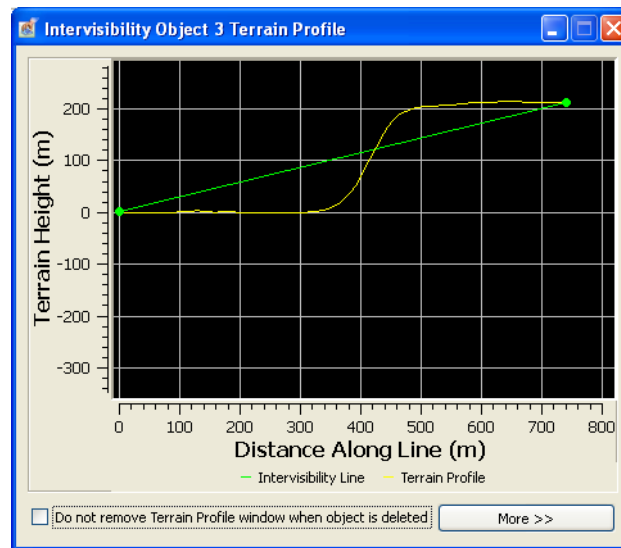


Figure 18-11. Terrain profile for an intervisibility line

The terrain profile for an intervisibility line and the procedures for using the Terrain Profile window are identical to the Terrain Profile window and procedures as described in [“Displaying a Line’s Terrain Profile,”](#) on page 20-10, except that an intervisibility line only has two points – a starting point and ending point. In the Intervisibility Options dialog box, you can specify that a terrain profile be displayed automatically when you create an intervisibility line.

18.9. Analyzing Terrain Using a Terrain Profile Line

A terrain profile line is a special line used to analyze the terrain. It is more versatile than a point-to-point intervisibility line because it can have multiple points, which allows a finer analysis of the terrain. Unlike a route (for which you can also view terrain profiles), a terrain profile line is not published, so it has less overhead and does not clutter up object lists.

To create a terrain profile line:

1. Choose **Intervisibility** → **Terrain Profile Line**. A Terrain Profile window opens and the cursor changes to draw mode.
2. Click on the terrain to place the vertices of the line. As you add vertices, the Terrain Profile window updates to show the profile of the line ([Figure 18-12](#)).

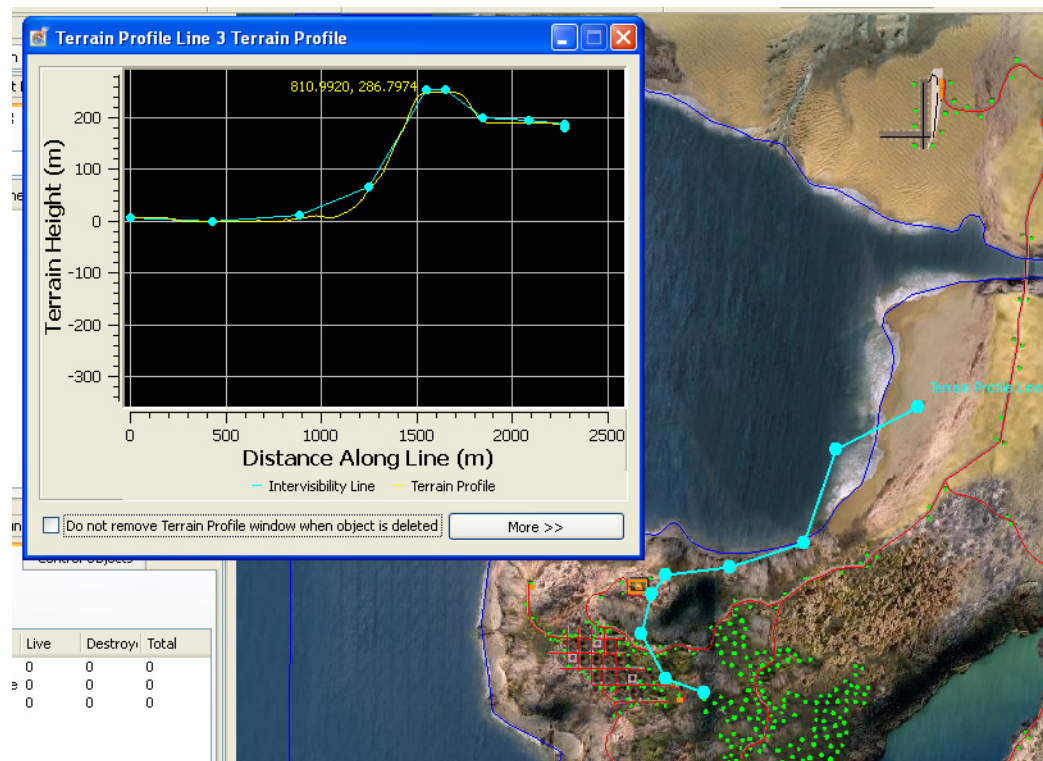


Figure 18-12. Terrain profile line

3. Right click to finish the line.

After you create a terrain profile line, you can edit it just like any other line. For details, please see [“Editing Graphical Objects,”](#) on page 16-19.

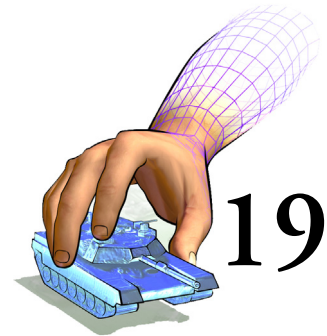
18.10. Deleting Intervisibility Objects

Before you delete an intervisibility object, note the following:

- ♦ If you delete an entity that has an intervisibility object pinned to it, the intervisibility object also gets deleted.
- ♦ If an intervisibility object is pinned to an entity, you can delete the intervisibility object without affecting the entity by selecting the outer circle or end point and deleting it.

To delete an intervisibility object:

1. Select the intervisibility object.
2. Choose **Objects** → **Delete**, or press the **Delete** key.



Controlling MÄK 3D Applications

This chapter explains how to manipulate the VR-Vantage observer and the observer in the VR-Forces 3D Front End from the VR-Forces 2D GUI.

Attaching the Observer to Entities	19-2
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19.1. Attaching the Observer to Entities

If you are using the MÄK Stealth to view an exercise while VR-Forces is running, you can attach the observer to an entity from the VR-Forces window.



The various commands for managing the Stealth observer from the VR-Forces 2D GUI also affect the observer in the VR-Forces 3D Front End.



The MÄK Stealth has changed significantly from release 6.2 to 7.0. It is now a VR-Vantage application instead of being built on Vega Prime. The VR-Forces 3D Front End is now also built using VR-Vantage. Therefore, VR-Forces has been updated to align itself with VR-Vantage terminology and features. The point of view in the terrain called the eyepoint in Stealth 6.2 is now called the observer. The number of view modes and their behavior has changed. However, if you are still using Stealth 6.x, the Stealth control features in VR-Forces should work as they did in previous VR-Forces releases.

19.1.1. Attaching the Observer to Individual Entities

To attach the observer to an entity:

1. In the VR-Forces window, select the entity you want the observer to attach to.
2. Choose **Stealth** → **Attach** → *mode*, where *mode* is one of the view modes on the menu.

Iterating the Observer Attachment through the Entity List

You can attach the observer to successive entities by iterating through the entity list.

- To attach the observer to the next or previous entity in the entity list, choose **Navigation** → **Attach to Next Entity** (or **Attach to Previous Entity**).

19.2. Detaching the Observer from an Entity

- To detach the observer from an entity, choose **Stealth** → **Detach**, or attach the observer to a different entity.

The Detach menu command puts the observer at the default location in absolute view mode.

19.3. Moving the Observer

You can move the observer by dragging its icon in the VR-Forces window or by teleporting it.

19.3.1. Dragging the Observer Icon

If the Stealth is broadcasting the status of its observer, VR-Forces displays an icon for it.

- To change the location of the observer, drag its icon to the new location.

19.3.2. Teleporting the Observer

To teleport the observer:

1. Click the cursor on the map where you want to place the observer.
2. Choose **Stealth** → **Teleport**.

19.3.3. Changing the Observer's Direction

You can change the direction in which the observer faces.



If you are running the VR-Forces 3D Front End, the 2D front-end displays a Stealth icon that represents the observer of the 3D Front End.

- To change the observer's direction, with the mouse, grab the observer's direction indicator (Figure 19-1) and rotate it around the Stealth icon.

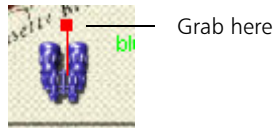


Figure 19-1. Stealth icon and direction indicator

19.4. Controlling the Observer's Position and Orientation

You can control the observer view from VR-Forces using a navigation toolbar that is similar to the Navigation toolbar in the Stealth. For an explanation of how to use the Stealth Navigation toolbar, please see your MÄK Stealth documentation or *VR-Forces 3D Front End Users Guide*.

- To open the Stealth Navigation toolbar (Figure 19-2), choose **Stealth** → **View Stealth Toolbar**.

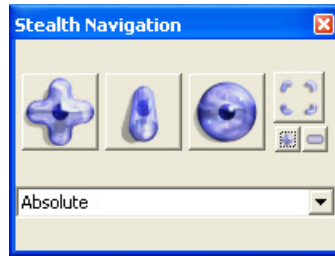


Figure 19-2. Stealth Navigation toolbar

19.4.1. Controlling the Observer from the Keyboard

To control the observer from the keyboard:

1. Select the Stealth icon.
2. Choose **Objects** → **Information**. The Stealth Information dialog box opens.
3. While the Stealth Information dialog box has focus, use the keyboard control keys as described in Stealth documentation or *VR-Forces 3D Front End Users Guide*.

19.5. Changing the Color of Attachment Lines

If you attach the observer to a group, VR-Forces displays lines from the Stealth icon to the members of the group (Figure 19-3). You can change the color of these lines.

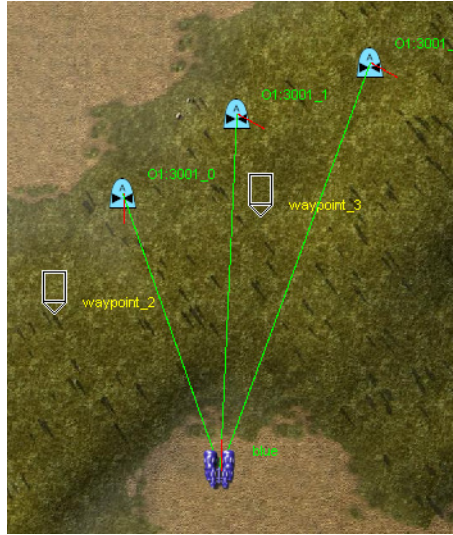
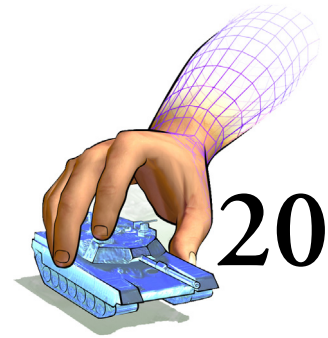


Figure 19-3. Stealth attachment lines

To change the color of attachment lines:

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Colors tab.
3. Click the Attachment Line button. A color picker opens.
4. Select a color or create a custom color and click OK to exit the color picker.
5. Click OK or Apply.



Terrain Databases and Feature Data

This chapter explains how to get information about a terrain database and how to manipulate feature data.

Displaying Information About a Terrain Database	20-2
Displaying Information about a Point	20-3
Selecting Terrain Features.....	20-4
Selecting Features	20-4
Selecting All Features of A Particular Type.....	20-5
Displaying Feature Information.....	20-6
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20.1. Displaying Information About a Terrain Database

You can display the following information about the loaded terrain database:

- ♦ Projection
 - ♦ File information
 - ♦ Origin
 - ♦ Extent information
 - ♦ Datum
 - ♦ Polygon information.
- To display terrain database information, choose **File → Terrain Information**. The Terrain Database Information window opens (Figure 20-1).

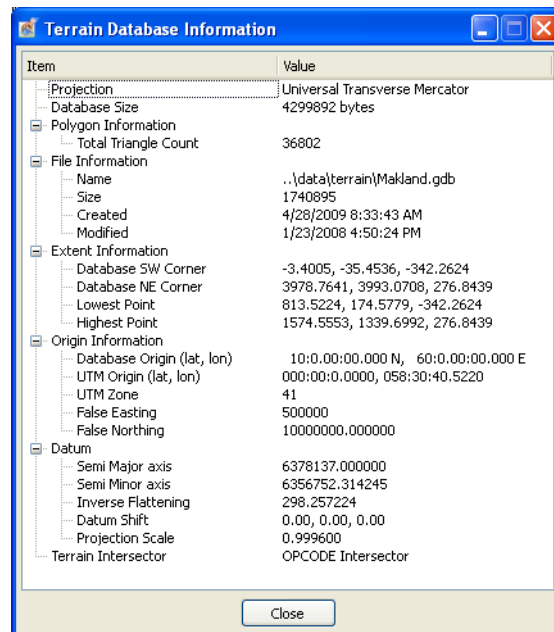


Figure 20-1. Terrain Database Information window

20.1.1. Displaying Information about a Point

The Terrain Information Toolbar displays information about the selected point or entity. If you select an entity, you can also view information about the point underneath it. If there are multiple polygons at a selected point, you can choose which polygon you want to see information about. The Intersects spin box lists the default polygon level for which the toolbar displays information.

To display information about a point:

1. Click a point or an object.
2. In the Terrain Information toolbar, view the coordinates of the point, the number of intersections at the point, and the type of the selected polygon. If you select an object or there is more than one polygon at the selected point, the Intersects label lists the number of objects and polygons selected (Figure 20-2).

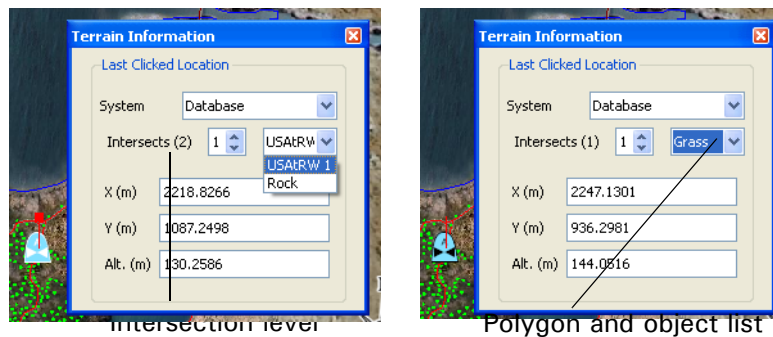


Figure 20-2. Terrain Information Toolbar

3. To view information about an object or polygon other than the one at the default level, select it from the list. In (Figure 20-2), note the change in altitude displayed when the helicopter is selected versus when the underlying grass polygon is selected.
4. To set the default polygon level to display in the toolbar, change the value in the Intersects spin box.

20.2. Selecting Terrain Features

Some terrain databases contain feature data, such as roads, buildings, trees, and so on. You can select features and display information about them. You can also create routes and points based on feature data.



Among the databases provided with VR-Forces, the *makland.mtd*, *VR-Village.mtd*, and *berkeley.mtd* databases contain feature data.

20.2.1. Selecting Features

To select a feature:

1. Choose **Objects** → **Select** → **Features**, or select Features on the Selection Mode toolbar (Figure 20-3).



Figure 20-3. Selection Mode toolbar

2. Click the feature you want to select. It is highlighted (Figure 20-4).



Figure 20-4. A selected feature

20.2.2. Selecting All Features of A Particular Type

You can select all terrain features of a selected type in the Terrain Features dialog box.

To select all features of a given type:

1. Choose **Options** → **Terrain Features**. The Terrain Features opens (Figure 20-5).

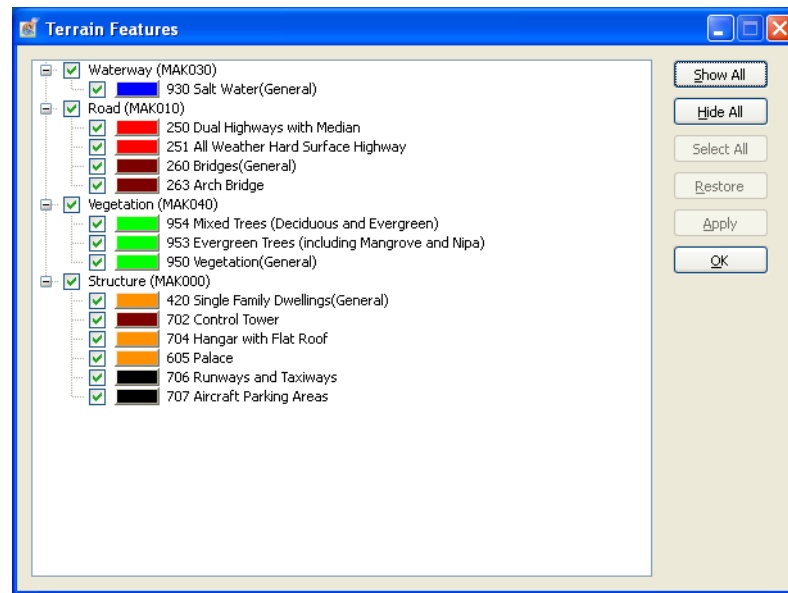


Figure 20-5. Terrain Features dialog box

2. Choose **Objects** → **Select Features**.
3. Select the check boxes for the feature types that you want to select on the map. The Select All button is enabled.
4. Click Select All. All features of the selected type are highlighted on the map.
5. Click Apply or OK.

20.2.3. Displaying Feature Information

To display information about a feature:

1. Select a feature.
2. Choose **Objects** → **Information**. The Terrain Feature Information dialog box opens (Figure 20-6).

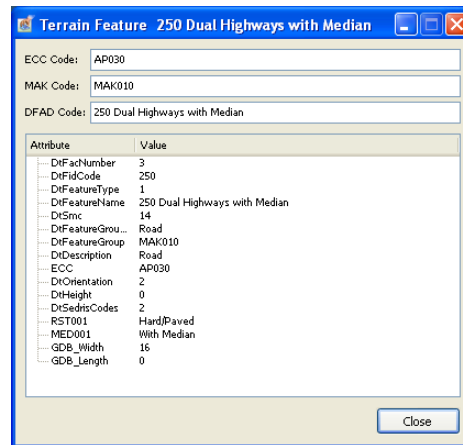


Figure 20-6. Terrain Feature Information dialog box

20.2.4. Displaying a Feature's Terrain Profile

To display a terrain profile for a feature:

1. Select a feature.
2. Choose **Objects** → **Show Terrain Profile**. A terrain profile opens ([Figure 20-7](#)).

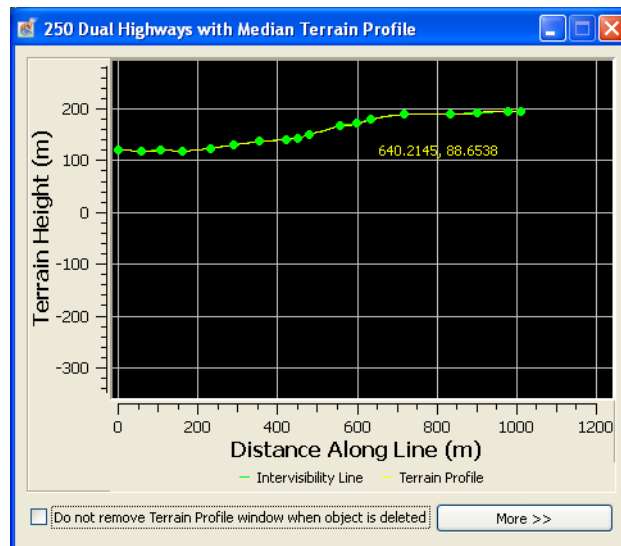


Figure 20-7. Terrain profile for a terrain feature

20.3. Creating Objects from Features

You may want entities to be able to move to or along the points and lines represented by terrain features. However, except for path following and obstruction avoidance, entities do not know about terrain features and cannot interact directly with them. To work around this problem, you can create routes from line features and points from point features.

When you create a route from a line feature, the vertices of the route are placed at the intersection of each feature segment. You can create a waypoint at the location of a point feature, or create an entity. (Some VR-Forces users model environmental features as entities to facilitate interaction with entities.)

Figure 20-8 illustrates creation of a route from a feature. The left panel shows the selected feature. The right panel shows the route created on top of the line.



Figure 20-8. Creating a route from a line feature

To create an object from a feature:

1. Choose **Objects** → **Select** → **Features**.
2. Select the feature from which you want to create an object.
3. Choose **Create** → *object_type*, where *object_type* is line, waypoint, or an entity type, depending on the type of feature you have selected. The object is created at the location of the feature.

20.4. Terrain Profiles

Terrain Profile windows are available for line objects that have height (in other words, routes and lines, but not phase lines), for intervisibility lines, and for an entity's track history. You can also create lines specifically for the purpose of showing the terrain profile. A terrain profile displays (numbers correspond to callouts in Figure 20-9):

- ♦ A graph of the line or track against the terrain (1)
- ♦ Entities within a specified distance of the line or track (2)
- ♦ Location data for the start point and end point of each line segment (3)
- ♦ The length of the selected line segment (4)
- ♦ Heading of each point (5)
- ♦ Elevation of each point (6)
- ♦ Location of any point specified in the plot window (7)
- ♦ The total length of the line or track (8).

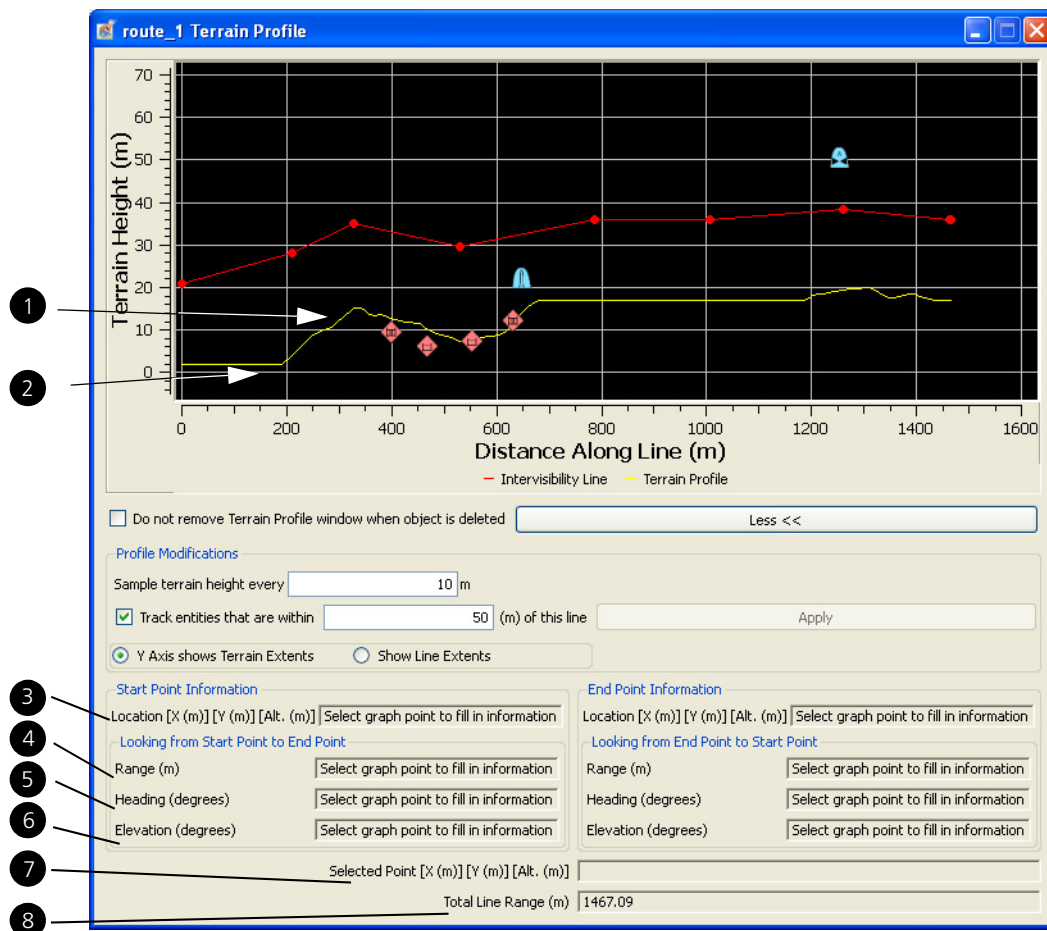


Figure 20-9. Terrain profile

You can specify the distance between the points used when VR-Forces samples the terrain to create the graph. You can also specify that a terrain profile for an entity remain on screen even if the entity is removed from the simulation. This is most useful for viewing the terrain profile of short-lived entities, such as missiles.

If you are viewing a geodetic database, you can display distance as a straight line (which may cut through the curvature of the earth, or as a great circle, which takes into account the earth's curvature.

For details about opening and viewing terrain profiles, please see:

- ♦ “Tracking Entities Along a Line,” on page 8-9
- ♦ “Displaying an Intervisibility Line’s Terrain Profile,” on page 18-14
- ♦ “Viewing a Track History Terrain Profile,” on page 17-12
- ♦ “Displaying a Line’s Terrain Profile,” on page 20-10.

20.4.1. Displaying a Line’s Terrain Profile

To view a line’s terrain profile, use one of the following methods:

- ♦ Select a line and choose **Objects** → **Show Terrain Profile**.
- ♦ Right-click a line and choose **Show Terrain Profile** from the popup menu.
- ♦ Open the Edit Line dialog box for a line and click Terrain Profile.

The Terrain Profile window opens (Figure 20-10). You can resize the window.

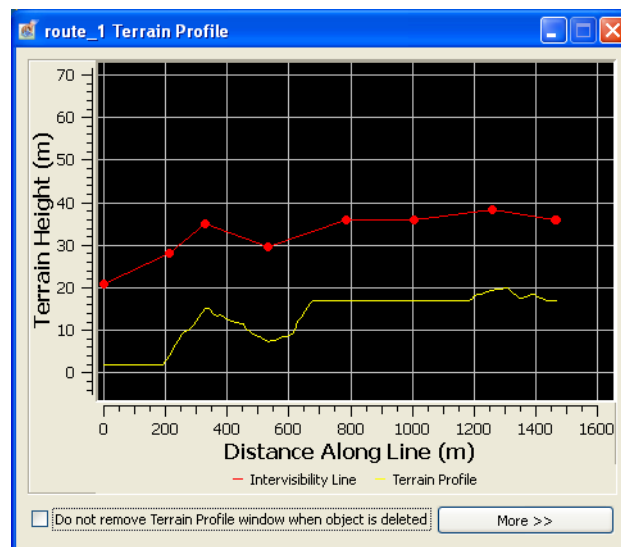


Figure 20-10. Terrain Profile window for a line

To conserve space, Terrain Profile windows open in a collapsed format, showing only the profile graph.

- To expand a Terrain Profile window, click More. To collapse the window, click Less.

Specifying the Frequency at which Terrain Height is Sampled

You can specify the frequency, in meters, at which terrain height is sampled to create the graph in the Terrain Profile window.

To specify the frequency with which terrain height is sampled:

1. Open the Terrain Profile window.
2. Click More to expand the window ([Figure 20-9](#)).
3. Type a value in the Sample Terrain Height Every box.
4. Click Apply.

Specifying a Line Segment for Start Point and End Point Data

To display the Start Point and End Point data in the Terrain Profile window, you must select a point. Selecting a point determines the line segment used to calculate the Start Point and End Point data.

- To select a point, click in the Terrain Profile graph. The Selected Point box displays the coordinates of the point. The data for Start Point and End Point is displayed.

Specifying how Distance is Calculated for Geodetic Databases

If you are using a geodetic database, you can calculate the length of line segments as straight lines or as great circles, which take into account the curvature of the earth. If you calculate lines as great circles, the calculation does not take into account the altitude of the start and end points.

To calculate line length as a great circle:

1. Choose **Options** → **Display**. The Display Options dialog box opens.

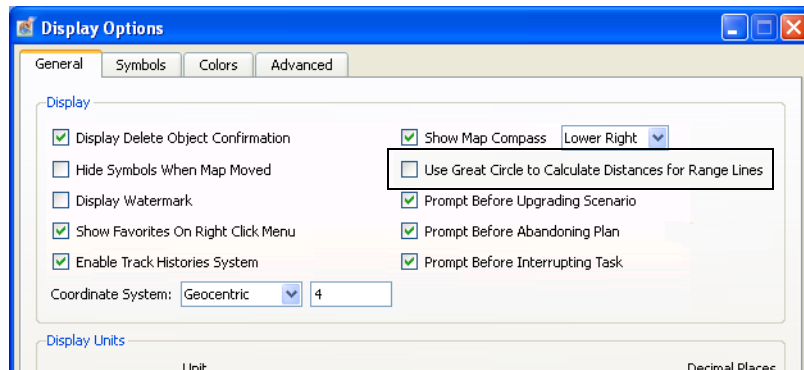


Figure 20-11. Display Options, General tab for geodetic database

2. On the General tab, select the Use Great Circle to Calculate Distances for Range Lines check box to calculate line length as a great circle. Clear the check box to calculate line length as a straight line.

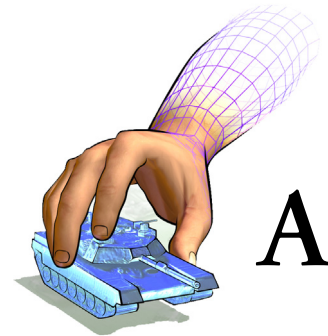


The Use Great Circle to Calculate Distances for Range Lines check box is not visible unless you load a geodetic database.

20.5. Terrain Databases Provided with VR-Forces

This section lists the terrain databases provided with VR-Forces, organized by type and purpose.

- ♦ *Antigua-shape* is composed of polygonal and vector data from ESRI shapefiles, covering the island of Antigua.
- ♦ *berkeley* is a terrain that covers the area near Berkeley, California, U.S.A. It contains feature data and a raster map overlay.
- ♦ *ExtentExample* is a simple flat test terrain.
- ♦ *ground-db* is a small, relatively flat terrain.
- ♦ *Kabul* is a database of the area around Kabul, Afghanistan.
- ♦ *LittlePond* is a detailed suburban inset in a larger, less detailed terrain covering Boston, Massachusetts, U.S.A. and points west.
- ♦ *Makland* is a fantasy database created by MÄK Technologies. It includes a variety of terrain and feature data, including underwater features.
- ♦ *Makland-geocentric* is a geocentric version of the Makland database.
- ♦ *nellis* covers terrain near Nellis Air Force Base, in Nevada, U.S.A.
- ♦ *SanLuisObispo* is a terrain that covers a portion of California, U.S.A.
- ♦ *TerraSim_SampleUrban* is an urban database based on Pittsburgh, Pennsylvania, U.S.A., with a highly detailed segment that includes buildings with multiple floors.
- ♦ *VR-Village* is a fantasy database created by VT MÄK. It has a highly detailed small town in a larger, sparsely detailed desert environment. The town includes multi-level buildings, underground tunnels, and a road that tunnels through a mountain.
- ♦ *world* is a high resolution raster map of the geodetic projection of the world. VR-Forces also includes the following versions of the world database:
 - Flat earth
 - Flat earth with no elevation data
 - Geocentric
 - No elevation.



Example Scenarios

VR-Forces includes several sample scenarios. This appendix explains how to create the breaching scenario and the embarkexample scenario. It assumes some basic knowledge of VR-Forces concepts and the VR-Forces interface, such as how to select objects, how to pan and zoom the map, and so on. If you have not yet reviewed the sample tutorial in *VR-Forces Getting Started Guide*, you may want to try that tutorial before trying these example scenarios.

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A.1. The Breaching Scenario

This scenario simulates a breaching exercise. In this exercise, four hostile vehicles are arrayed behind a minefield. Three platoons of four tanks each suppress the hostile vehicles, allowing two engineering vehicles to clear the minefield.

Figure A-1 illustrates the order of battle and graphical objects in the scenario.

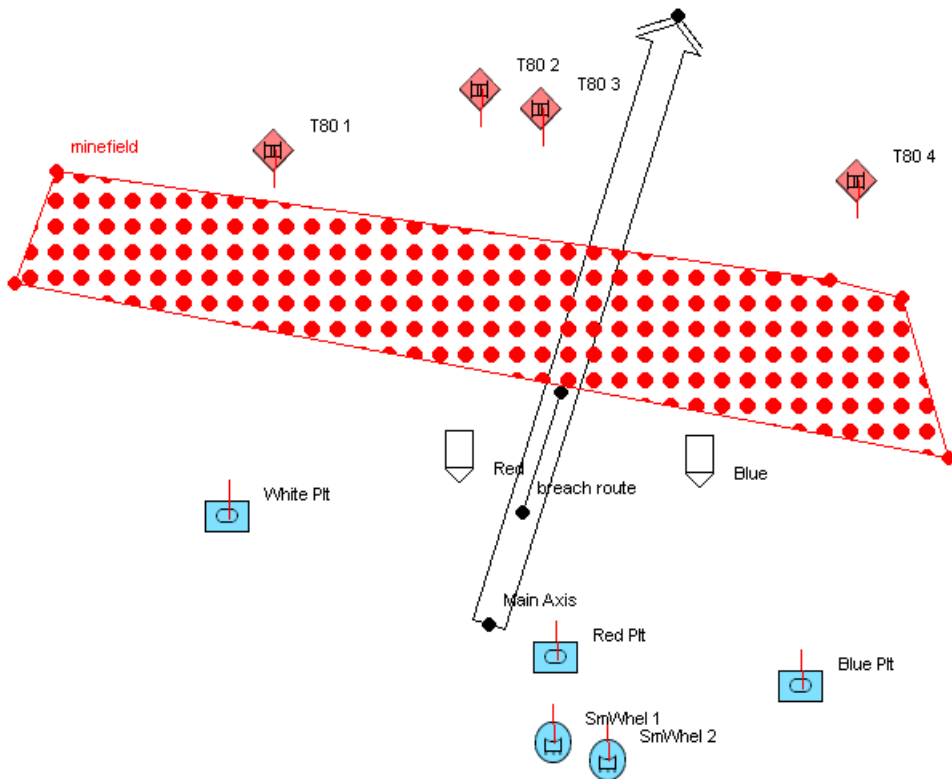


Figure A-1. Breaching exercise

The scenario demonstrates the following features of VR-Forces:

- ♦ Creating entities from the Create menu and the Create toolbar
- ♦ Creating graphical objects (waypoints, routes, minefields)
- ♦ Creating a pre-defined aggregate and creating an aggregate from individual entities
- ♦ Creating plans, using:
 - Move To
 - Follow entity
 - Follow route
 - Conditions.

The scenario plays out as follows for the Blue force units:

- ♦ White Platoon stays in position and fires on hostile forces.
- ♦ Red Platoon advances to waypoint red and provides cover for the engineers.
- ♦ Blue Platoon advances to waypoint blue and provides cover for the engineers.
- ♦ The engineering entities follow behind Red Platoon. When the hostile forces are destroyed, the engineering entities advance on the minefields to clear them.



The scenario simulates the movement of entities that represent engineering entities, but VR-Forces does not have models for simulating actual minefields or engineering entities.

A.1.1. Create the Scenario

To create the scenario:

1. Start VR-Forces. The VR-Forces window opens.
2. Choose **File** → **New Scenario**. The Select Simulation Database dialog box opens.
3. Select a terrain database. We used the *SanLuisObispo.mtd* database.
4. Click Open. The New Scenario dialog box opens.
5. Type a name in the Scenario Name box, such as Breaching Scenario. We will accept all of the default values for the scenario parameters.
6. Click OK. The San Luis Obispo database is displayed. This database covers a portion of California, U.S.A.

Save the Scenario

Save the scenario periodically as you work on it.

To save the scenario:

1. Choose **File** → **Save Scenario**. The Save Scenario dialog box opens.
2. Click the New Folder icon. A new folder is added to the window.
3. Type a name for the new folder, such as myBreaching.
4. Select the folder.
5. Type a name for the scenario, such as myBreaching.
6. Click OK.

A.1.2. Create the Overlays

This scenario uses two overlays, one for Blue and one for Red. We need them to draw the minefield and axis of advance.

To create the overlays:

1. Choose **Create** → **Overlay Manager**. The Overlay Manager opens.
2. Click New Overlay. An overlay is added to the list with a default name.
3. Click the overlay name twice to make it editable.
4. Type Red Force.
5. Repeat steps 2 through 4 to create an overlay called Blue Force.
6. Close the Overlay Manager. (Click the Close button on the Title bar.)

A.1.3. Create the Minefield

We will create the minefield first, since it becomes a good reference around which to create the entities and other objects.

To create the minefield:

1. Zoom in on a relatively flat portion of the terrain. This is to minimize the impact of hilly terrain and intervisibility issues on how the simulation runs. For this scenario, we used an area just to the Northeast of the center of the terrain ([Figure A-2](#)).

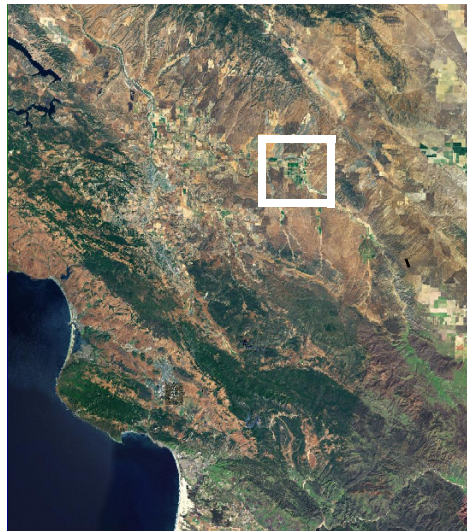


Figure A-2. San Luis Obispo terrain

2. On the overlay tab bar at the top of the map, select the Red Force tab ([Figure A-3](#)).

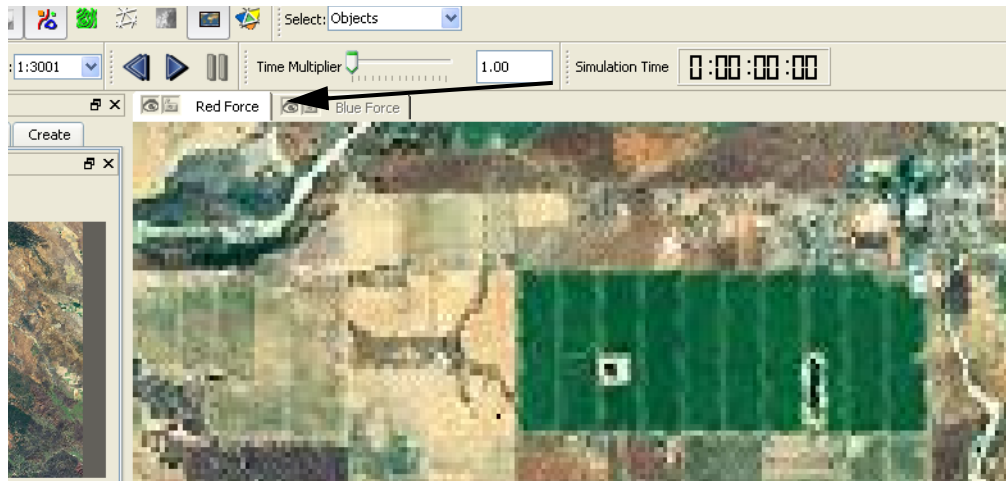


Figure A-3. Red Force overlay selected

3. Choose **Create** → **Overlay Objects** → **Engineering** → **Minefield**. The Create Minefield dialog box opens and the cursor changes to draw mode.
4. Drag the dialog box out of the way if it obscures the map. Draw an oblong area to define a minefield, as in [Figure A-1](#). Click to define the first four vertices. Right-click to define the last vertex.

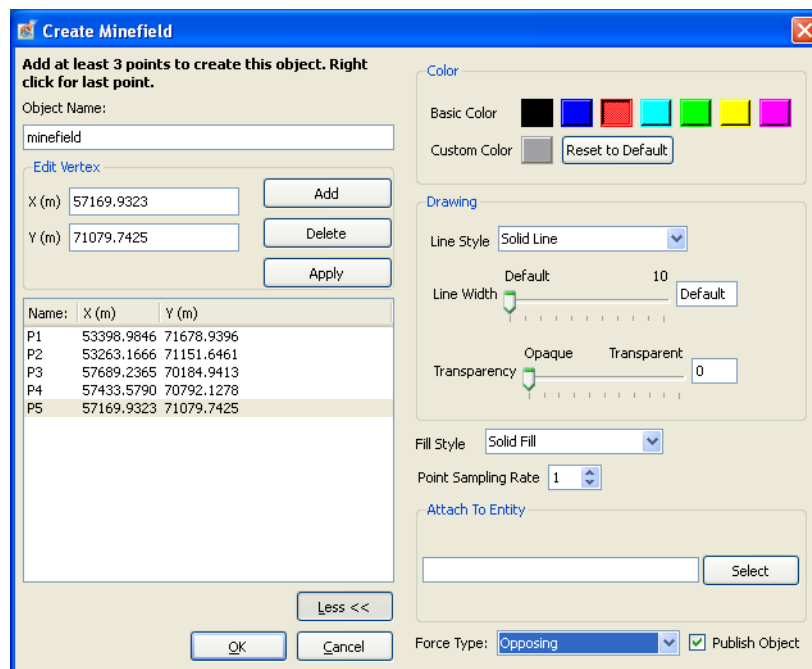


Figure A-4. Create Minefield dialog box

5. In the Create Minefield dialog box, in the Object Name box, type minefield.

6. Click the More button. This displays additional parameter options.
7. In the Color group box, click the Red button to make the minefield red.
8. In the Force Type list, select Opposing.
9. Click OK.

A.1.4. Create the Opposing Forces

Now that we have the minefield as a reference point, create the hostile entities.

1. Choose **Create** → **Ground** → **Opposing** → **T-80 Main Battle Tank**. The cursor changes to draw mode and shows an entity icon.
2. Click on the map north of the minefield four times, as indicated in [Figure A-1](#), to place the T-80s.
3. Right-click to exit create mode.

Aggregate the Opposing Forces

We will want to test for when all of the opposing forces are destroyed. This will be easier to do if they are in an aggregate.

To aggregate the opposing forces:

1. Select the four T-80 tanks.
2. Choose **Entities** → **Aggregates As**. The Aggregate As dialog box opens ([Figure A-5](#)).

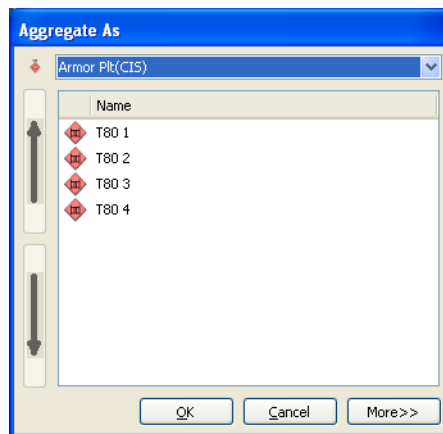


Figure A-5. Aggregate As dialog box

3. In the list, select Armor Plt(CIS).
4. Click OK. The tanks are aggregated into a platoon.
5. In the Echelon View tab on the Object tab, expand the aggregate ([Figure A-6](#)).

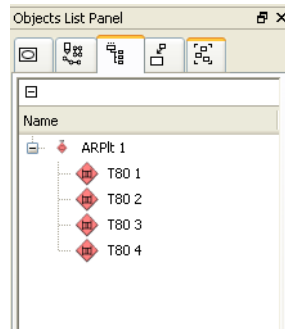


Figure A-6. Echelon View

A.1.5. Create the Graphical Objects

We need to create two waypoints and a route for the Blue Force.



Waypoints, routes, and other control objects are created on the map, not on overlays.

Create the Waypoints

To create the waypoints:

1. Choose **Create** → **Waypoint**. The Create Waypoint dialog box opens and the cursor changes to draw mode, showing a waypoint.
2. Using [Figure A-1](#) as a guide, click on the map where you want to place the waypoint for Red platoon.
3. Give the waypoint a name.
4. Click OK.
5. Repeat steps 1 through 4 for the waypoint for Blue platoon.

Create the Route

The route will guide the engineers as they swing past the Red Platoon and move to the minefield. The route is shown as breach route in [Figure A-1](#).

1. Choose **Create** → **Route**. The Create Route dialog box opens and the cursor changes to draw mode.
2. Click on a point just east of waypoint red.
3. Move the mouse cursor to the edge of the minefield.
4. Right-click to place the end point in the route.
5. Give the route a name (we call it breach route).
6. Click the More button.
7. Click the light blue button.
8. From the Force Type list, select Friendly.
9. Click OK.
10. Save the scenario.

At this point, the scenario should look something like [Figure A-7](#).

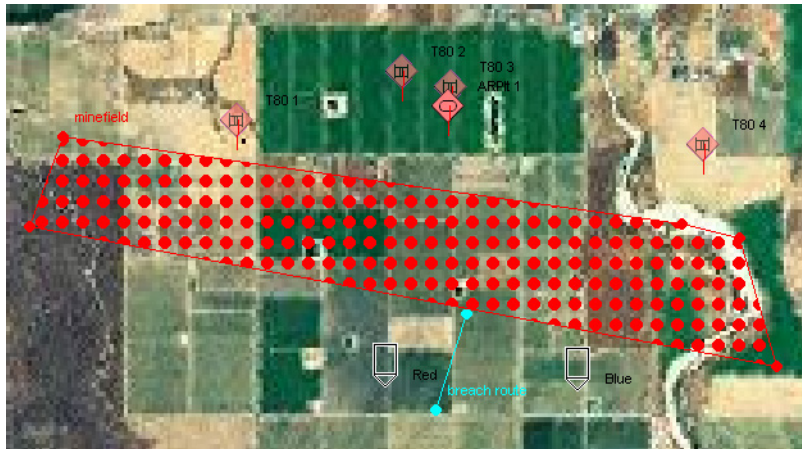


Figure A-7. Breaching scenario progress

A.1.6. Create the Friendly Entities

Using [Figure A-1](#) as a guide to location, create the friendly entities. We will create one platoon from individual entities, and the other two using pre-configured platoons.

1. On the Utility Bar, click the Create tab.
2. In the Categories drop-down list, select Aggregate.
3. In the Force drop-down list, select Friendly.
4. In the list of entities displayed, select Armor Plt(US).
5. Click on the map to place the red platoon and blue platoon as shown in [Figure A-1](#). Right-click to exit create mode. The aggregates are created with default names (ARPlt 1 and ARPlt 2).
6. Select one of the platoons. Choose **Objects** → **Edit**. The Edit Aggregate dialog box opens.
7. In the name text box, replace the default name with Red Plt or Blue Plt, depending on which platoon you selected.
8. Rename the other platoon that you created.
9. On the Create tab, in the Categories drop-down list, select Ground.
10. In the list of entities, click M1A2 Tank. The cursor changes to draw mode.
11. Click on the map where White Platoon should be. An entity icon is displayed.
12. Click three more times to create the rest of the tanks in White Platoon. Right-click to exit create mode. (We will create the aggregate from these entities in the next section.)
13. In the list of entities on the Create tab, select M58 MICLIC.
14. Click twice on the map to the South of Red Plt to create two MICLIC entities.
15. Right-click to exit create mode.
16. Save the scenario.

Create White Platoon

1. Select the four members of White Platoon.
2. Choose **Entities** → **Aggregates As**. The Aggregate As dialog box opens.
3. Select Armor Plt(US) from the list.
4. Click OK.
5. Select the new platoon.
6. Choose **Objects** → **Edit**. The Edit Aggregate dialog box opens.
7. Change the name to White Plt. (HLA limits the length of aggregate names to 10 characters. If you make the name longer than this, for example, White Platoon, when VR-Forces loads the scenario, it will rename the platoon to something like Plt 1.)
8. Save the scenario.

A.1.7. Create an Axis of Advance

To create the axis of advance for Blue Force:

1. On the overlay tab bar at the top of the map, select the Blue Force tab.
2. Choose **Create** → **Overlay Palette**. The Overlay Palette opens.
3. In the Display Create Object Dialog Box group box, click the On Last Click option (Figure A-8). By selecting this option, the Create dialog box will not obscure the map when you draw the axes.

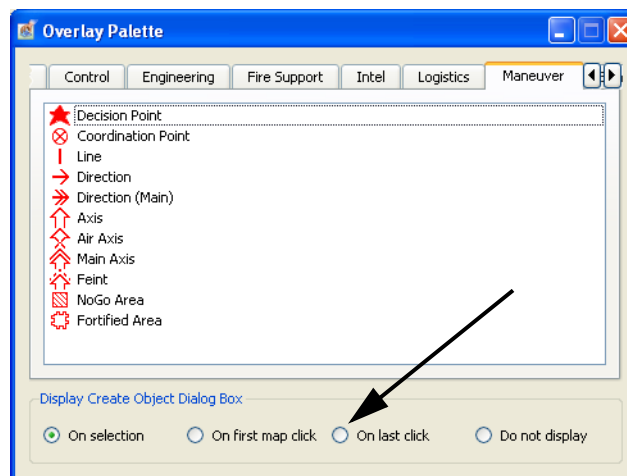


Figure A-8. Overlay Palette

4. Select the Maneuver tab.
5. Click Main Axis.

6. Left click on the map South of Red Plt.
7. Draw a line through the middle of the minefield and right click. The axis should roughly parallel the route that the engineering units will follow. The Create Main Axis dialog box opens and a main axis is drawn on the overlay.
8. In the Create Main Axis dialog box, type a name for the main axis.
9. Click the More button.
10. Click the light blue button.
11. From the Force Type list, select Friendly.
12. Click OK.
13. Close the Overlay Palette.

At this point, the scenario looks like (Figure A-9).

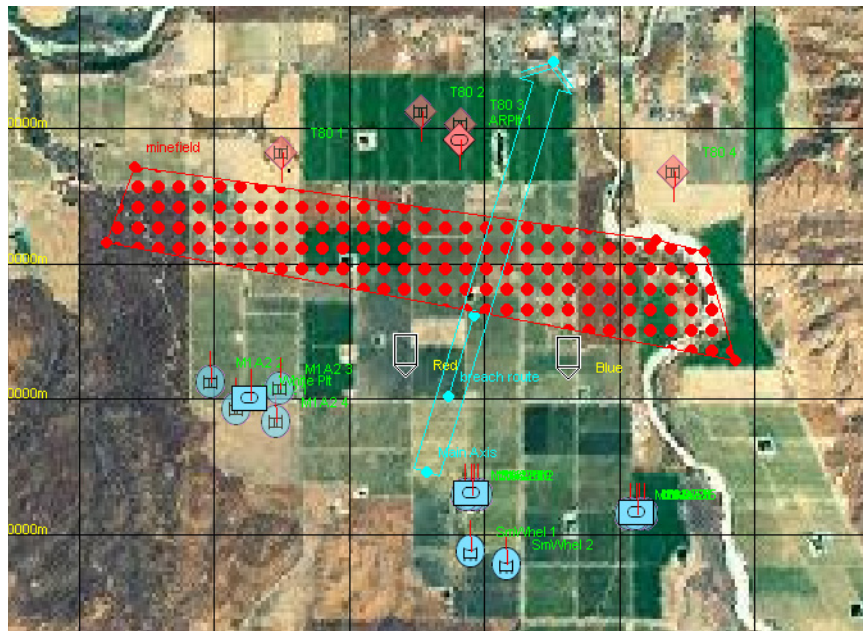


Figure A-9. Breaching scenario - all objects created

A.1.8. Write the Plans

The plans tell the entities how to carry out their roles in the scenario. The White platoon just stays in place. We do not give it a plan. It will just respond to any Opposing Force entities that it detects.

Write the Plan for Blue Platoon

Blue Platoon will move to a waypoint. As it moves it responds to any Opposing Force entities that it detects. The plan is quite simple to write.

To write the plan for Blue Platoon:

1. Select Blue Platoon.
2. Choose **Entities** → **Plan**. The Plan window opens ([Figure A-10](#)).

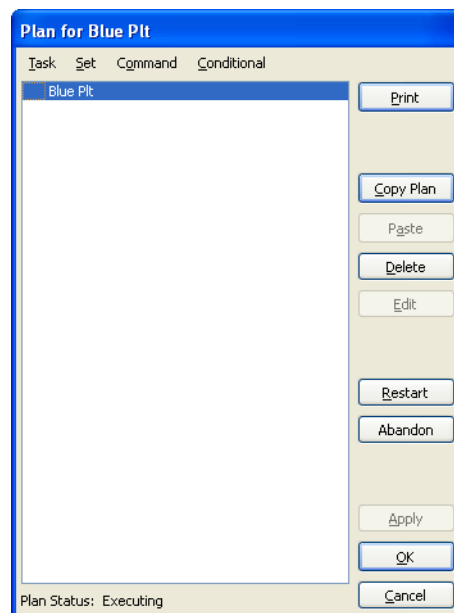


Figure A-10. Blue Platoon plan

3. In the Plan window, choose **Task → Move To Waypoint**. The Move To dialog box opens (Figure A-11).

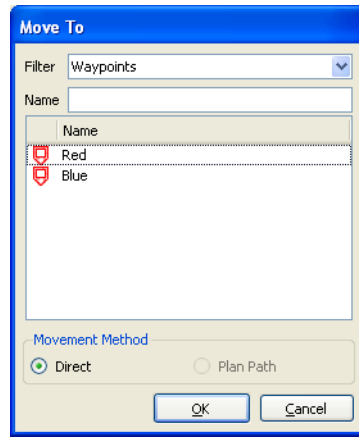


Figure A-11. Move To dialog box

4. In the Move To dialog box, or on the map, select the Blue waypoint.
5. Click OK. The task is added to the plan. The plan is now complete (Figure A-12).

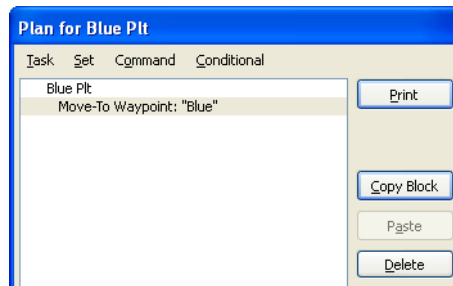


Figure A-12. Blue plan - complete

6. In the Plan window, click OK.

Write the Plan for Red Platoon

The Red Platoon moves to the Red waypoint. It has another job to do. When all the opposing forces are destroyed, it sends a message on the radio network. The MICLICs are listening for the message. They will not try to clear the minefield until they receive it.

1. Select Red Platoon.
2. Press **p**. The Plan window opens.
3. In the Plan window, choose **Task** → **Move To Waypoint**. The Move To dialog box opens (Figure A-11).
4. In the Move To dialog box, or on the map, select the Red waypoint.
5. Click OK. The task is added to the plan (Figure A-13).

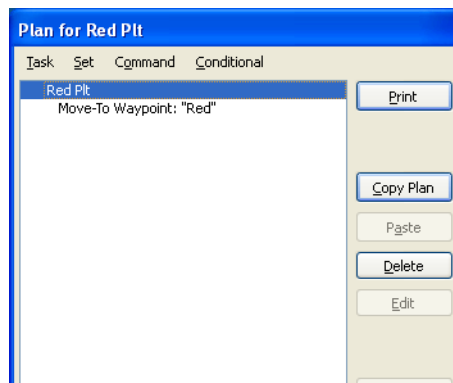


Figure A-13. Plan for Red Platoon - move to waypoint

6. Select the top line in the plan.
7. In the Plan window, choose **Conditional** → **When**. The When Expression dialog box opens (Figure A-14).

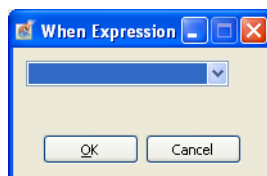


Figure A-14. When Expression dialog box

8. In the drop-down list, select EntDestroyed. The Entity Destroyed dialog box opens.

9. In the list of entities, select ArPlt 1 (Figure A-15).

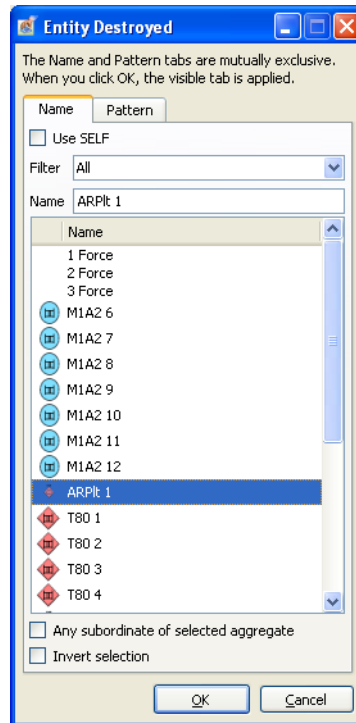


Figure A-15. Entity Destroyed dialog box

10. Click OK. The expression is added to the When Expression dialog box (Figure A-16).

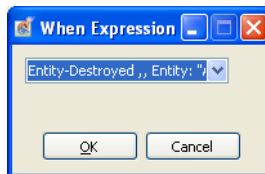


Figure A-16. Completed When Expression dialog box

11. In the When Expression dialog box, click OK. The When expression is added to the plan ([Figure A-17](#)). Now we need to add tasks to execute when the expression becomes true.

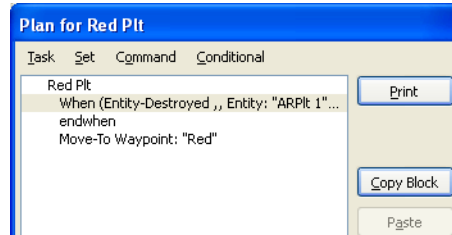


Figure A-17. Red Plan with incomplete When expression

12. The When expression should be selected. If not, select it.
13. Choose **Task** → **Send Text Message**. The Send Radio Message dialog box opens.
14. In the Send Radio Message dialog box, select the Broadcast check box. This means the message will be sent to all entities.
15. In the Message Text box, type Opposing Force Destroyed. The dialog box looks like [Figure A-18](#).

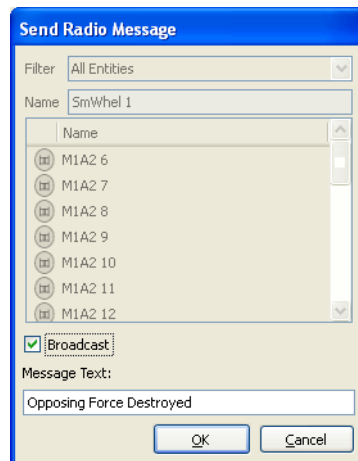


Figure A-18. Send Radio Message dialog box

16. Click OK. The plan for Red Platoon is finished (Figure A-19).

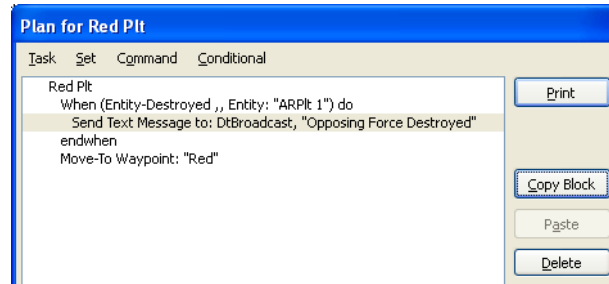


Figure A-19. Completed plan for Red Platoon

17. Click OK.
18. Save the scenario.

Write the Plans for the Engineering Units

We want the MICLICs to follow Red Platoon at a distance. When they are notified that the opposing force has been destroyed, they move along a route to the edge of the minefield. Then they clear it.

The MICLICs provided with VR-Forces do not actually have the ability to simulate clearing a minefield. We are going to provide some visual interest by using global commands to remove the original minefield and replace it with two minefields with a space between them.

We will start with the plan for SmWhel 1:

1. Select SmWhel 1.
2. Press **p**. The Plan window opens.
3. In the Plan window, choose **Conditional** → **When**. The When Expression dialog box opens.
4. In the list, select Receive Text Message. The Receive Text Message dialog box opens.

5. Type the message that we are waiting for (Opposing Force Destroyed) (Figure A-20).



Figure A-20. Receive Text Message dialog box

6. Click OK.
7. In When Expression dialog box, click OK. The empty expression is added to the plan window (Figure A-21). Now we need to tell the entity what to do when it gets this message (move along the route, then redraw the minefield).

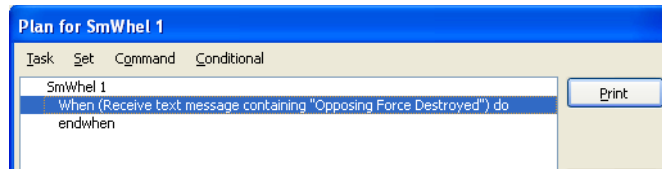


Figure A-21. Plan for SmWhel 1

8. In the Plan window, choose **Task** → **Move Along Route**. The Move Along Route dialog box opens.
9. Select breach route, then click OK. The task is added to the plan.
10. Choose **Command** → **Delete Object**. The Delete Object dialog box opens.
11. In the Filter list, select Overlay Objects. The overlay objects are now listed in the window.

12. Select the minefield (Figure A-22).

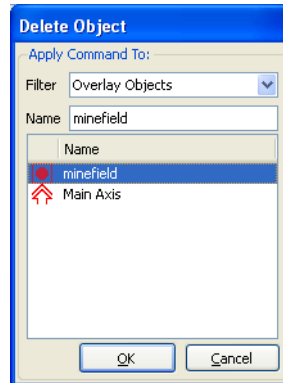


Figure A-22. Delete Object dialog box

13. Click OK. After the MICLIC deletes the minefield, we want to draw two new minefields that occupy most of the space of the original one, but leave a corridor along the main axis, so we need to add two create object commands to the plan.
14. Choose **Command** → **Create** → **Overlay Objects** → **Engineering** → **Minefield**. The Create Minefield dialog box opens.
15. Draw a minefield over most of the minefield to the left of the main axis.
16. Click OK. You will not see this new minefield, because it does not exist in the simulation yet. It will not exist until such time as the command gets executed.
17. Repeat steps 14 through 16, but this time draw the minefield to the right of the main axis. The plan should now be similar to Figure A-23.

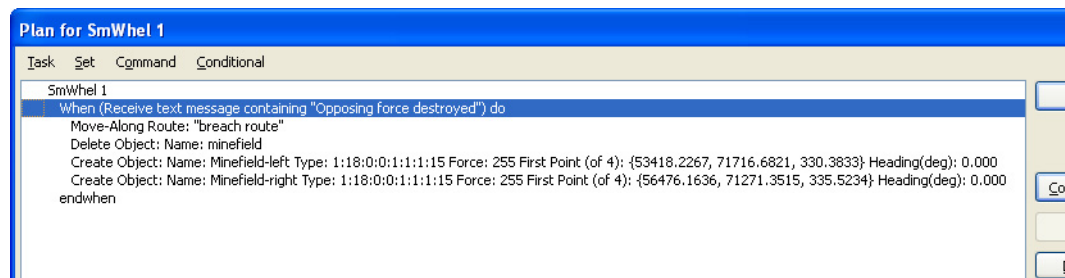


Figure A-23. Plan for SmWhel 1 after When expression complete

18. We will finish the plan by having the entity follow Red Platoon. Select the last line of the When block (endwhen).
19. Choose **Task** → **Follow Entity**. The Follow Entity dialog box opens.
20. In the list, select Red Plt.

21. In the Behind box, type 500. The dialog box should look like [Figure A-24](#).

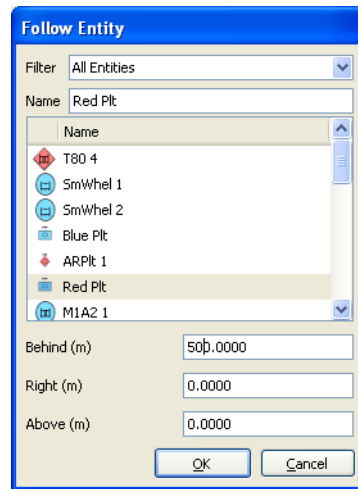


Figure A-24. Follow Entity dialog box

22. Click OK. The plan is now complete ([Figure A-25](#)).

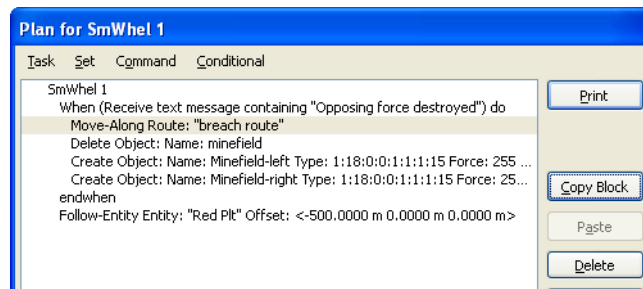


Figure A-25. Complete plan for SmWhel 1

23. Click OK.

24. Save the scenario.

Write the Plan for SmWhel2 2

The plan for SmWhel 2 is a bit simpler than that of SmWhel 1. It follows SmWhel 1. When it receives the message that the opposing force is destroyed, it continues to follow SmWhel 1, but instead of following behind it, it moves parallel, so that it arrives at the minefield next to the other entity. Try creating the plan yourself. It should look like (Figure A-26).

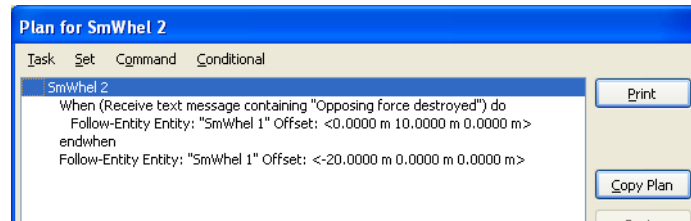


Figure A-26. Plan for SmWhel 2

A.1.9. Save the Scenario

Be sure to save the scenario before you run the simulation. If you want to save it in its starting state, do not save it after you run the simulation.

A.1.10. Running the Scenario

Once you have created the scenario and saved it, click the Run button and watch the simulation run. Open the plan windows for the MICLICs and observe the progression of tasks through the plan.

If hostile entities do not get destroyed, it may be that the blue entities cannot see them. If they cannot see them, they cannot shoot each other. Use the intervisibility feature to text line-of-sight. Move the entities around, or find a flatter section of the terrain until you get the results you want.

You can run the breaching scenario included with VR-Forces and see how it compares to the one that you created.

Figure A-27 shows the breaching scenario after the MICLICs have completed their plans. All of the aggregates are expanded so that you can see the individual entities.

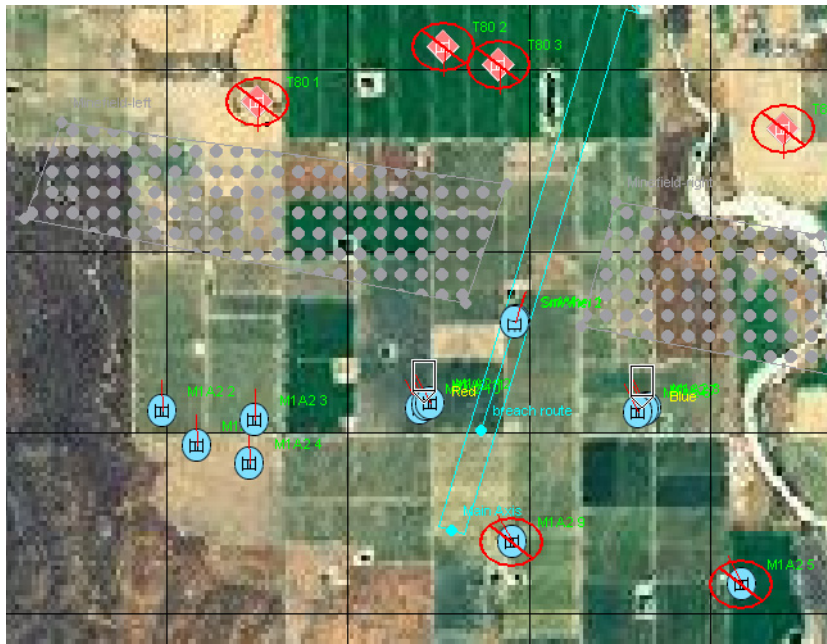


Figure A-27. Breaching scenario after minefield cleared

- Embarking and disembarking DIs to and from a Bradley vehicle
- Embarking and disembarking a helicopter to and from a Harpers Ferry and an aircraft carrier
- Embarking a fixed-wing aircraft on an aircraft carrier
- Embarking DIs onto a helicopter and disembarking one of them onto a carrier
- Directly embarking a DI on an aircraft carrier and walking on the flight deck.

A completed scenario is included with in `./data/scenarios/embarkeexample`. This section is a step-by-step explanation of how to create the scenario.

If you are using HLA, you must use RPR FOM 2 draft 17 for scenarios that use embarkation.



A.2.1. Create the Entities and Objects

The scenario has the following entities:

- ♦ A fixed-wing aircraft on the airport runway
- ♦ A helicopter embarked on an LSD-49 Harpers Ferry ship
- ♦ A dismounted infantry entity (DI) embarked on an aircraft carrier
- ♦ A DI standing behind a Bradley vehicle in the town
- ♦ A DI standing in the courtyard of the palace.

The scenario has the following control objects:

- ♦ A route for the fixed-wing plane to follow to take off
- ♦ A waypoint in front of the palace for the Bradley vehicle to drive to
- ♦ A waypoint in front of the palace for the helicopter to land at
- ♦ A waypoint on the carrier deck for the DI to walk to.

Create the Surface Entities

1. Start VR-Forces.
2. Choose **File** → **New Scenario**. The Open Database dialog box opens.
3. Select *Makland.mtd*.
4. Click Open. The New Scenario dialog box opens.
5. Click OK. The Monterey database is displayed.
6. On the Create tab of the Utility bar, in the Category drop-down list, select Surface.
7. In the Force drop-down list, select Friendly.
8. In the entity list, select Aircraft Carrier.
9. Click in Makland Bay midway to the left of the peninsula.
10. Right click to exit create entity mode.
11. Place a LSD- 49 Harpers Ferry Class Ship in the middle of Makland Bay.
12. Save the scenario.

Create the Aircraft

1. Zoom in on the airport, located in the Northeast quadrant of the map.
2. On the Entity Palette, select the Fixed Wing category.
3. Select an F/A 18 Hornet entity.
4. Click the northern end of the North/South runway.
5. Right-click to exit create entity mode.
6. Select the entity.
7. Choose **Set** → **Heading**. The Set Heading dialog box opens.
8. Type 180 and click OK.
9. Zoom out to see a larger area of the map.
10. On the Entity Palette, select the Rotary Wing category.
11. Select a CH46E Sea Knight entity.
12. Click anyplace on the map.
13. Select the helicopter.
14. Choose **Entities** → **Embark On**. The Embark On dialog box opens.
15. In the list window, select the LSD 49 (Harper 1).
16. Click OK. The helicopter is immediately embarked on the LSD 49. You can no longer see it in the map, but if you select the Echelon View on the Objects tab of the Utility toolbar, you can see that the helicopter is listed as being embarked on the LSD 49 (Figure A-29).

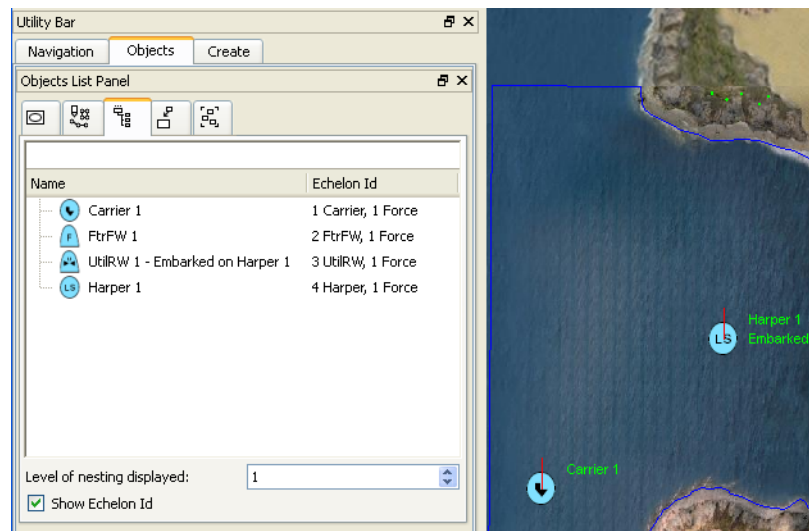


Figure A-29. Helicopter embarked on LSD 49 Harpers Ferry

17. Save the scenario.

Create the Bradley Vehicle

1. Zoom in on the town on the peninsula.
2. On the Entity Palette, change the category to Ground.
3. Select an M2A2 Bradley IFV entity.
4. Place the Bradley vehicle where the road to the palace intersects a North/South street, as shown in [Figure A-30](#).



Figure A-30. Bradley vehicle

5. Save the scenario.

Create Dismounted Infantry

The scenario has two dismounted infantry that take rides in the Bradley vehicle and the helicopter, and one that is embarked on the aircraft carrier. Embarking the DI on the carrier requires a bit of discussion.

There are two ways to embark an entity – immediate embarkation and the embarkation task. If you want to use the Embark task, the receiving entity must be configured to accept the embarking entity. We will use the Embark task a little later in this example.

We want to embark one of the DI entities on the aircraft carrier. However, aircraft carriers are not configured to accept DI entities, so we cannot use an Embark task to do this. However, we can use the immediate embark feature to embark an entity on any other entity. To do this, we must specify the coordinates at which to place the entity. In this example, we want to place a DI on the carrier deck and make it look good in the MÄK Stealth. Through experimentation, we know that using the model supplied with the MÄK Stealth, the Z offset to place an entity on the carrier deck is 31 meters. We also offset the X value to move the entity to the side of the deck.



If you want to view the carrier in the MÄK Stealth, you must use Stealth 5.4.1 or later.

1. On the Entity Palette, change the category to Lifeform.
2. Select a Dismounted-Infantry entity.
3. Place one DI directly behind (south of) the Bradley vehicle.
4. Place one DI in the courtyard area of the palace at the top of the hill in Makland.
5. Place a third DI anyplace in town. This is just a temporary location. In a moment you will embark this entity on the aircraft carrier.
6. Select the DI in the palace. Drag the heading indicator to 270 degrees.
7. Select the DI that you placed temporarily in town.
8. Choose **Entities** → **Embark On**. The Embark On dialog box opens.
9. In the entity list, select the carrier.
10. Select the Use Position Override option.
11. In the Coordinate Override group box, set the Offset: X value to 15 and the Offset: Z value to 31. This places the DI at the deck level of the carrier ([Figure A-31](#)).

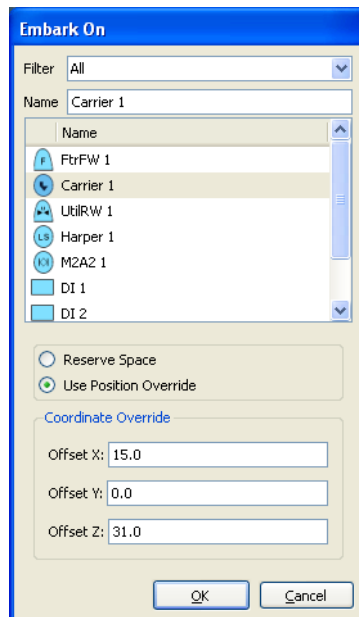


Figure A-31. Embark On dialog box

12. Click OK. The DI is embarked on the carrier.
13. Save the scenario.

Create the Control Objects

We need a few control objects to specify the movement tasks for the entities.

Create a Runway at the Airport

At the airport, create a route from North to South along the runway. Call it runway.

Create Waypoints at the Palace

1. Zoom in on the palace at the top of the hill near the town.
2. Place a waypoint on the edge of the road just before the palace entryway. Call it palace.
3. Place a waypoint on the ground in front of the palace between the trees. Call is helipad.

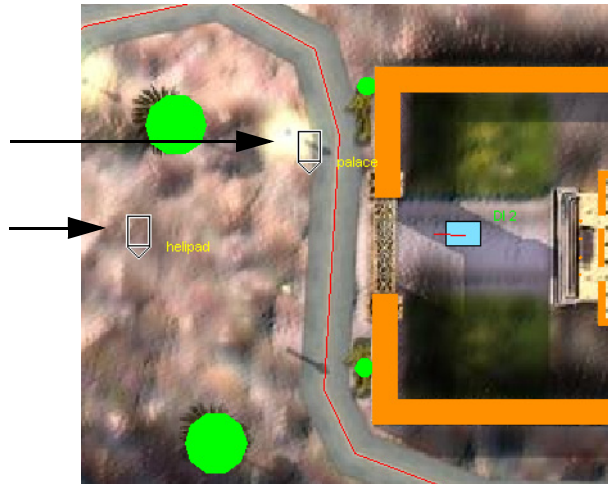


Figure A-32. DI and waypoints at palace

Attach a Waypoint to the Carrier

1. Choose **Options** → **Display**. The Display Options dialog box opens.
2. Select the Symbols tab.
3. In the Icon Labels group box, select the Bounding Box check box.
4. Zoom in on the aircraft carrier.
5. Choose **Create** → **Waypoint**.
6. Click within the aircraft carrier's bounding box, toward the southern end.
7. In the Altitude group box, select Set Altitude.
8. Type a Z value of 31 (to put the waypoint on the carrier deck).
9. In the Edit Point group box, click Apply.
10. In the Create Waypoint dialog box, click More.

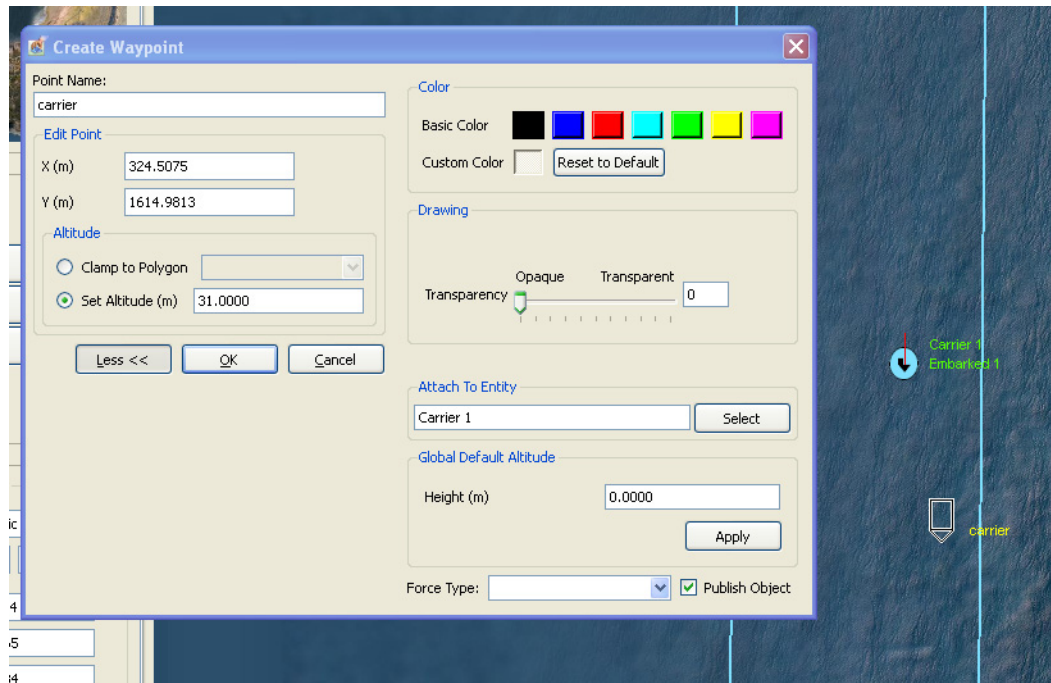


Figure A-33. Create waypoint on carrier

11. In the Attach To Entity group box, click Select. The Select Entity dialog box opens.
12. Select Carrier 1 and click OK.
13. In the Point Name box, type carrier.
14. Click OK to create the waypoint.
15. Save the scenario.

A.2.2. Write the Plans for the Entities

We need to write plans for the entities to do the following:

- ♦ The jet will take off from the airport and embark on the carrier (land and taxi to a parking place).
- ♦ The helicopter will disembark from the LSD-49 and fly to the palace, where it will land. Two DI will embark on it. Then it will embark on the carrier, disembark, and embark back on the LSD-49.
- ♦ The DI in town will embark on the Bradley and ride with it to the palace. It will then disembark from the Bradley and embark on the helicopter.
- ♦ The DI in the palace courtyard will embark on the helicopter.
- ♦ The DI on the carrier will walk to the waypoint.

Write the Fixed-Wing Aircraft's Plan

1. Select the fixed-wing entity.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. In the Plan window, Choose **Task** → **Fixed Wing Takeoff**. The Fixed Wing Takeoff dialog box opens.
4. In the Fixed Wing Takeoff dialog box, select runway from the list of routes.
5. Click OK. The task is added to the plan.
6. Choose **Task** → **Embark**. The Embark On dialog box opens.
7. In the Embark On dialog box, select Carrier 1 from the list and click OK (Figure A-34).

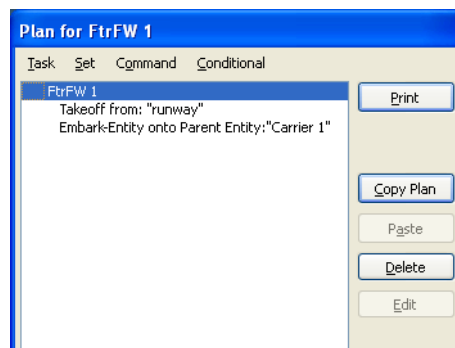


Figure A-34. Fixed-wing entity plan

8. In the Plan window, click OK. The plan for the fixed-wing entity is finished.

Write the Helicopter's Plan

1. In the Objects List Panel, Entity List view, select the helicopter entity. (Since the helicopter is embarked, it is not visible on the map, so you cannot select it there.)
2. Choose **Entities** → **Plan**. The Plan window opens.
3. Choose **Task** → **Disembark**.
4. Choose **Task** → **Move To Altitude**. The helicopter is going to fly to the palace, which is on top of a hill with steep cliffs. Sometimes the terrain following feature of the helicopter cannot handle steep cliffs well, causing the helicopter to crash, so we want to get it up to a good altitude to avoid crashing.
5. Set the altitude to 200 meters and click OK.
6. Choose **Task** → **Rotary Wing Land**. The Rotary Wing Land dialog box opens.
7. In the list of waypoints, select helipad and click OK.

After the helicopter lands at the palace, it needs to wait until the two DI have embarked before it takes off. So we use a When statement with an Entity Embarked condition. The helicopter doesn't need to watch for this entity to be embarked until it lands at the palace, so we can put the When statement in the middle of the plan rather than at the beginning as we might with other conditions.
8. Choose **Conditional** → **When**. The When Expression dialog box opens.
9. Select EntEmbarked. The Entity Embarked dialog box opens.
10. On the Name tab, in the top list, select DI 2. This is the entity whose embarkation status we want the helicopter to monitor.
11. In the bottom list, select UtilRW1. This is the name of the helicopter. We want to test the condition that DI 2 is embarked on UtilRW 1.
12. In the Entity Embarked dialog box, click OK. Then, click OK in the When Expression dialog box. The condition is added to the plan. Now we need to specify what the helicopter should do when the condition is true.
13. The line in the plan window that starts "When (Entity-Embarked)" should already be selected. If it is not, select it now.
14. In the Plan window, choose **Task** → **Embark**.
15. Specify that the helicopter embark on Carrier 1.
16. In the Plan window, choose **Task** → **Wait Duration**.
17. Specify a duration of 1 minute. This is how long the helicopter will wait on the carrier deck after it embarks.
18. In the Plan window, choose **Task** → **Disembark**. This disembarks the helicopter from the carrier.
19. In the Plan window, choose **Task** → **Embark**.

20. Specify that the helicopter is to embark on the LSD-49 Harpers Ferry.
21. The plan is complete (Figure A-35), so click OK.

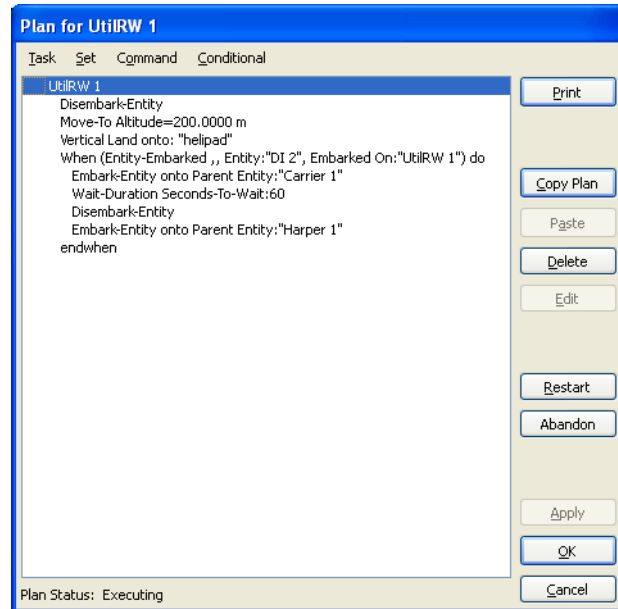


Figure A-35. Rotary-wing entity plan

Write the Plan for the DI on the Carrier

By now you should have a pretty good feel for the mechanics of adding tasks to a plan, so we will just tell you which tasks to add to the plans for the DI entities. To view the plans for the entities, load the supplied example scenario and open the Plan window for the entity you are interested in.

Give the DI on the carrier a task to move to Waypoint "carrier".

Write the Plan for the DI in Town

1. Task this entity to embark on the Bradley vehicle.
We want the DI to get out of the Bradley when it reaches the palace waypoint. There is no test for arriving at a waypoint, so we have two options. We can create an area around the waypoint and test for Entity In Area, or we can figure out how long it takes the Bradley to drive to the waypoint and have the DI wait that long before doing anything. For this scenario, we use the simulation time test.
2. Select the top line in the plan window. (The line that says *entity_name*.) We want this condition to be at the top of the plan so it gets registered immediately because we do not know when it will come true.
3. Choose **Conditional** → **When**.
4. In the When Expression list, select Sim Time.>. The Simulation Time Expression dialog box opens.
5. Select > (greater than) from the drop-down list.
6. Specify a simulation time of 1 minute, 40 seconds.
7. Click OK to exit the dialog boxes for the condition.
8. In the When block, add a Disembark task.
9. After the Disembark task, add a task to embark on the helicopter.
10. Add another When condition. Select the EntEmbarked condition and specify the helicopter embarked on the carrier.
11. In the When block, add a Wait Duration, 30 seconds task. This task means that when the helicopter embarks on the carrier, the DI entity waits 30 seconds.
12. Add a Disembark task. This disembarks the DI from the helicopter. Since the helicopter is embarked on the carrier, the DI is automatically embarked on the carrier.
13. Add a Move To task and specify Waypoint “carrier”. After the DI disembarks from the helicopter, it walks across the deck to the waypoint.
14. Save the plan.

Write the Plan for the DI in the Courtyard

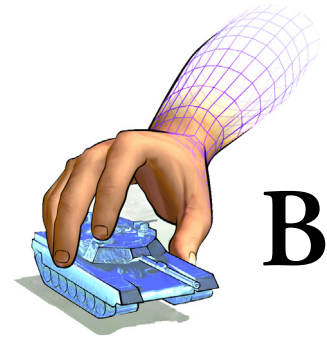
The DI in the courtyard (DI 2) waits until DI 1 embarks on the helicopter, then DI 2 embarks.

1. Open the Plan window for DI 2.
2. Add a When condition that tests for DI 1 being embarked on the helicopter.
3. In the When block, add an Embark task for DI 2 to embark on the helicopter.
4. Save the plan.

Write the Bradley's Plan

We want the Bradley to wait until DI 1 embarks on it, then drive to the palace.

1. Add a When statement that tests for DI 1 being embarked on the Bradley.
2. Within the When block, add a Move To task for the Bradley to move to Waypoint “palace”. In the Move To dialog box, select Plan Path, so that the Bradley will drive along the road, rather than directly up the hill.
3. Save the plan.



Customizing the GUI Layout

This appendix provides details about using and customizing toolbars. It also explains how to tear off menus.

Using Tear-Off Menus	B-2
Docking and Undocking Toolbars	B-3
Displaying and Hiding Toolbars	B-4
Customizing Toolbars	B-4
Adding Command Icons to a Toolbar	B-5
Removing Commands from a Toolbar.....	B-5
Changing a Command's Keyboard Shortcut.....	B-6
Removing a Toolbar	B-6
Creating a Toolbar.....	B-7
Reorganizing Toolbars	B-7
Adding a Separator to a Toolbar	B-8
Reverting to the Default Toolbars.....	B-8
Filtering the Toolbar Command List	B-9

B.1. Using Tear-Off Menus

You can “tear-off” some menus and leave them displayed on the desktop.

To tear off a menu:

1. Click a menu title to display the submenu.
2. Move the cursor over the grab bar (dashed line) at the top of the menu to highlight it (Figure B-1).
3. Click the grab bar. The menu is displayed as a toolbar that you can leave open and reposition.

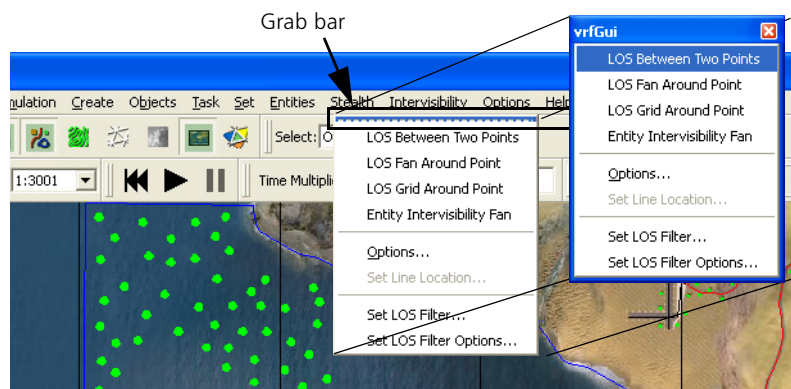


Figure B-1. Tearing off a menu

B.2. Docking and Undocking Toolbars

You can undock (detach) toolbars from the VR-Forces window and move them around the desktop (Figure B-2). Toolbars that are part of the Utility toolbar can only be docked on the Utility toolbar. The other toolbars can be docked to any side of the window.

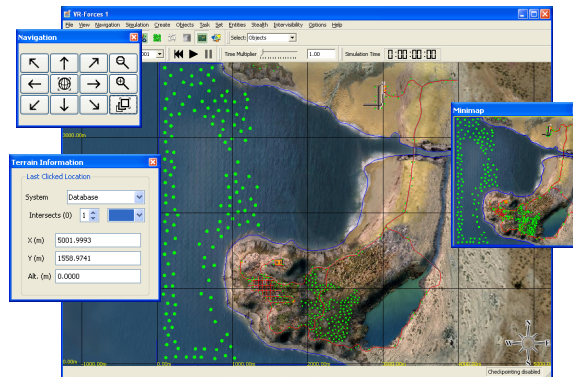
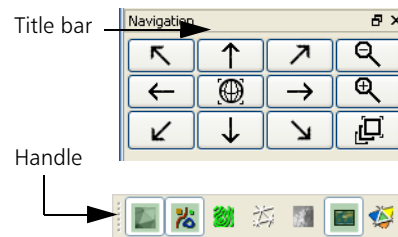


Figure B-2. VR-Forces window and undocked toolbars

To undock a toolbar:

1. Place the cursor over the toolbar's title bar or handle.
2. Press and hold the left mouse button.
3. Drag the toolbar away from the window.



To dock a floating toolbar:

1. Drag the toolbar to the utility bar where you want to dock it.
2. When the border of the utility bar expands to show an empty space in which it can receive the toolbar, release the mouse button.

i

- If you have trouble docking a toolbar that has a title, double-click the title bar and it will dock itself.
- When you select an undocked toolbar, its associated VR-Forces window becomes active. Therefore, if you have multiple VR-Forces windows open, you cannot inadvertently dock a toolbar to the wrong window.

B.3. Displaying and Hiding Toolbars

You can hide the display of any of the toolbars, including the main menu.

- To hide or view a toolbar, select it or clear it on one of the **View → Toolbars** sub-menus.
- To hide all toolbars except the Menu toolbar, choose **View → Hide All Toolbars**.
- To show all toolbars, choose **View → Show All Toolbars**. Toolbars are displayed in their previous docked or undocked state. If the menu bar is hidden (as the result of viewing full screen), click the middle mouse button anyplace in the window for a menu that allows you to display toolbars.

B.4. Customizing Toolbars

You can customize toolbars in the following ways:

- ♦ Add command icons
- ♦ Remove command icons
- ♦ Change the keyboard shortcut assigned to a command
- ♦ Remove toolbars
- ♦ Create new toolbars
- ♦ Revert to default toolbars.

B.4.1. Adding Command Icons to a Toolbar

To add a command icon to a toolbar:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens (Figure B-3).

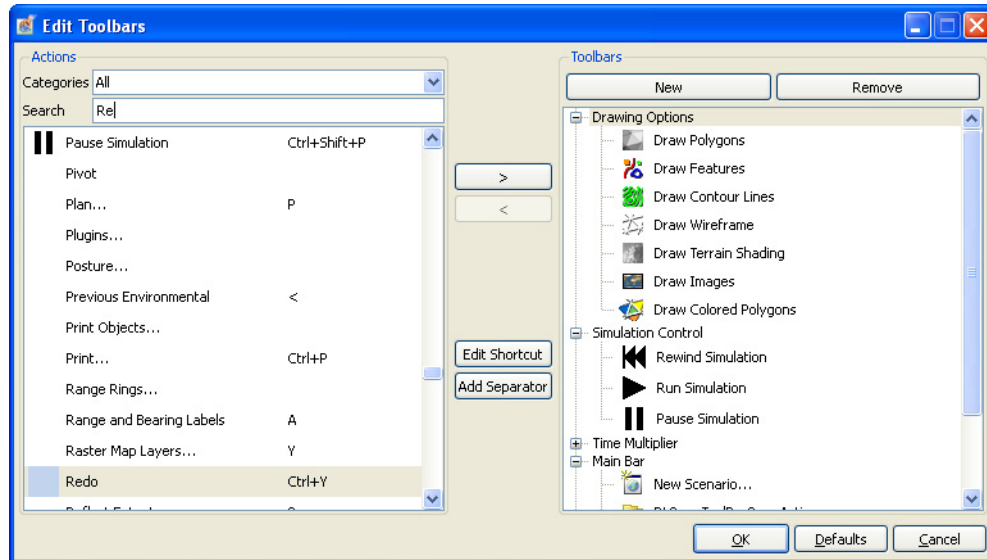


Figure B-3. Edit Toolbars dialog box

2. In the Toolbars group box, select the toolbar to which you want to add a command icon.
3. In the Actions group box, select the command you want to add to the toolbar.
4. Click the right-pointing arrow. The command is added to the toolbar.
5. Click OK.

B.4.2. Removing Commands from a Toolbar

To remove a command icon from a toolbar:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens (Figure B-3).
2. In the Toolbars group box, expand the toolbar from which you want to remove a command icon.
3. Select the command you want to remove.
4. Click the left-pointing arrow. The command is removed from the toolbar.
5. Click OK.

B.4.3. Changing a Command's Keyboard Shortcut

Many menu commands have keyboard shortcuts. You can change these shortcuts in the Edit Toolbars dialog box. You can also add a shortcut to a command that does not currently have one. If you try to specify a shortcut that is already assigned to a command, VR-Forces warns you about the conflict.

To change a command's keyboard shortcut:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens (Figure B-3).
2. In the Actions group box, select the command whose shortcut you want to change.
3. Click Edit Shortcut or double-click the shortcut column. The shortcut column becomes editable.
4. Type the new shortcut.
5. Click OK.

Removing a Keyboard Shortcut

To remove a keyboard shortcut:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens (Figure B-3).
2. In the Actions group box, select the command whose shortcut you want to remove.
3. Click Edit Shortcut or double-click the shortcut column. The shortcut column becomes editable.
4. Right-click the value.
5. On the popup menu, choose **Delete**. The shortcut is removed.
6. Click OK.

B.4.4. Removing a Toolbar

To remove a toolbar:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens (Figure B-3).
2. In the Toolbars group box, select the toolbar that you want to remove.
3. Click Remove. The toolbar is removed from the toolbar list.
4. Click OK.

B.4.5. Creating a Toolbar

To create a toolbar:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. In the Toolbars group box, click New. The Add Toolbar dialog box opens.
3. Type a name for the new toolbar.
4. Click OK. The toolbar is added to the list.
5. Add command icons to the toolbar as described in “[Adding Command Icons to a Toolbar](#),” on page B-5.
6. Click OK.

B.4.6. Reorganizing Toolbars

You can change the order of icons and separators on a toolbar. You can also move icons from one toolbar to another.

To reorganize toolbars:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. In the Toolbars group box, expand the toolbar whose icons you want to reorganize.
3. To reorganize within a toolbar, drag an icon to a new location in the list. As you drag an icon over other icons, the stationary icon has a black box drawn around it. When you drop the dragged icon onto another icon, it is placed above it in the tree (which places is to the left of the icon on a horizontal toolbar.)
4. To drag an icon to a different toolbar, drop the icon on the target toolbar’s name, or expand the toolbar and drop the icon into a specific location.
5. Click OK.

B.4.7. Adding a Separator to a Toolbar

Separators are thin lines that help organize the icons on a toolbar. Separators are always added to the end of the list of commands. However, after you add a separator, you can move it to a new location the same way that you can move commands. (For details, please see “[Reorganizing Toolbars](#),” on page B-7.)

To add a separator to a toolbar:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. In the Toolbars group box, select the toolbar to which you want to add a separator.
3. Click Add Separator. A separator is added to the end of the list of commands.
4. Click OK.

Removing a Separator

To remove a separator:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. In the Toolbars group box, select the toolbar from which you want to remove a separator.
3. Select that separator.
4. Click the left-pointing arrow.
5. Click OK.

B.4.8. Reverting to the Default Toolbars

You can return the toolbar configuration to the set of toolbars that are shipped with VR-Forces.

To revert to the default toolbars:

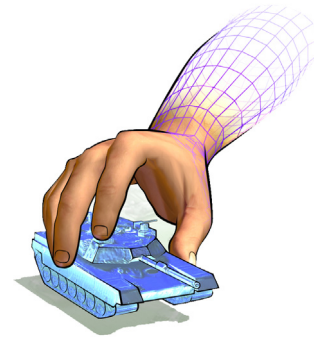
1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. Click Defaults.
3. Click OK.

B.4.9. Filtering the Toolbar Command List

You can filter the list of commands in the Actions group box to make it easier to find the command you want to add to a toolbar. You can filter by category or by searching for a text string.

To filter the list of commands:

1. Choose **View** → **Toolbars** → **Customize**. The Edit Toolbars dialog box opens ([Figure B-3](#)).
2. To filter by category, select a category from the Categories drop-down list. The categories are the menu options on the VR-Forces menu.
3. To filter by search, in the Search box, type the first few letters of the target command's name. As you add additional letters, the command list redisplay to show any commands that match the text string you have typed.



MÄK Products Glossary

This glossary defines terms used in MÄK product documentation.

absolute dead reckoning

A method of [dead-reckoning](#) in which an application uses the time stamps contained within state updates if the sender is using absolute time stamping. Contrast with [relative dead reckoning](#).

aggregate

The combination of individual entities, aggregates, or both into a single object. For example, an organizational group such as a platoon.

AMO

[Application Management Object \(AMO\)](#).

Application Management Object (AMO)

An AMO is a standard TENA object that is supposed to be used by every TENA application. It gives other applications information about the local application. The VR-Link exercise connection, by default, publishes an AMO object, updates it at a specified rate (the rate is part of the AMO's state repository; the default is 30 seconds), and updates the number of objects published and proxies (TENA reflected objects) held.

API

Application Programming Interface.

articulated part

A part of an entity that is capable of movement relative to the entity, such as a turret or gun.

attached part

An object that is attached to another object, such as a rocket attached to a jet.

body coordinate frame

A coordinate framework centered on an entity. To represent the orientation of an entity, an application uses Euler angles or a rotation matrix that rotates from a reference frame to the body coordinate frame.

channel

A channel renders the view of an observer in a 3D visualization application.

clipping

A feature that prevents the display of terrain and objects or parts of objects, that are closer than or farther than specific distances from the eyepoint.

clipping planes

The range of distances from the eyepoint (near clipping and far clipping) in which an application clips objects.

culling

The process of discarding database objects which are not within view, and therefore need not be rendered and displayed.

Cartesian coordinates

A system for indicating location by means of three planes intersecting at right angles to one another at the origin.

dead-reckoning

A process by which an application calculates the expected location of an entity during periods between state updates, based on velocity, acceleration, and rotational velocity.

Defense Modeling and Simulation Office

The executive secretariat for the Executive Council on Modeling and Simulation (EXCIMS), which provides a full-time focal point for information concerning Department of Defense modeling and simulation (M&S) activities. Currently the DMSO promulgates M&S policy, initiatives, and guidance to promote cooperation among DoD components to maximize efficiency and effectiveness.

DIS

[Distributed Interactive Simulation](#).

DIS data packets

See [Protocol Data Unit](#).

display engine

An object in an application that can render 3D data.

Distributed Interactive Simulation

The DIS protocol is a set of standards that govern how participating applications share information about the virtual world. The protocol specifies a set of packets, called protocol data units (PDUs), that communicate this information. Each PDU identifies the sender and contains other information depending on the PDU type. The DIS protocol also specifies when and how frequently PDUs are sent.

The DIS protocol has been superseded by the [High-Level Architecture](#) for use by the Department of Defense.

DMSO

[Defense Modeling and Simulation Office.](#)

emitter

A simulated device on an entity that emits electromagnetic radiation, for example, radar.

entity

An element in a simulation, such as a vehicle or a person, that is represented in the simulation through the issuance of state messages.

entity maintenance

A process by which the MÄK Data Logger compensates for discontinuities following a time jump. The Logger sends out interim state messages for entities that were present before the time jump so that they do not time out before the next update message arrives.

entity-type

A list of seven components as specified by the DIS protocol and the HLA RPR FOM. If none of the seven components contains a wildcard (-1) value, then the entity type refers to a specific, narrowly-defined entity. If some components contain a wildcard, then the entity type refers to a class of entities. A larger number of wildcards indicates a broader, more general class.

The components of an entity-type are:

- ♦ Entity kind
- ♦ Domain
- ♦ Country
- ♦ Category
- ♦ Subcategory
- ♦ Specific
- ♦ Extra.

environmental process

According to the IEEE 1278.1a specification (DIS), environmental process PDUs communicate simple environment variables, small scale environmental updates, and embedded processes.

Euler angles

A set of three angles used to describe the orientation of an entity as a set of three successive rotations about three different orthogonal axes (x, y, and z). These angles specify successive rotations needed to transform from a reference coordinate system to the entity's body coordinate system.

event

An interaction between objects or between an object and the terrain, such as firing of a munition, or a collision of entities.

execution

The TENA term for one or more interacting simulation applications.

Execution Manager

An Execution Manager governs a TENA execution for applications joining, resigning, or changing subscriptions to that execution.

exercise

The DIS term for a one or more interacting simulation applications. Compare to [federation execution](#) in HLA.

exercise connection

The object (*DtExerciseConn*) through which a VR-Link application connects to the network. State messages are sent through the exercise connection and information about remote entities is received through the exercise connection. (All MÄK products are VR-Link applications.)

exercise ID

A numeric identification for a DIS simulation exercise.

FED file

Federation Execution Data file. The Federation Execution Data is the subset of [FOM](#) data needed and read by the [RTI](#). VR-Link applications also read the FED file.

federate

A connection to the [RTI](#). Typically a single simulation application can be thought of as a federate.

federation

A group of HLA federates capable of playing in the same [federation execution](#).

Federation Object Model

Defines the data content of a federation execution.

federation execution

The federation execution represents the actual operation, over time, of a subset of the federates and the RTI initialization data taken from a particular federation. A federation execution is the logical equivalent of a DIS simulation exercise.

field of view

Field of view controls the perspective of the eyepoint.

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

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

filter range

A setting that prevents distant entities from being processed while allowing distant terrain to appear normally.

FOM

[Federation Object Model](#).

frame rate

The rate at which the application displays updated images.

ground clamping

A process by which the a 3D visualization application keeps an entity anchored to the surface of its terrain database, regardless of the altitude data contained in its entity state message.

geocentric coordinates

A coordinate system calculated with respect to the earth's center. The origin of the geocentric coordinate system is the center of the earth. The positive X-axis passes through the prime meridian at the equator; the positive Y-axis passes through 90 degrees east longitude at the equator; and the positive Z-axis passes though the north pole.

geodetic coordinates

A coordinate system in which position is determined relative to a reference ellipsoid, such as the surface of the earth at sea level. In MÄK applications, geodetic coordinates consist of latitude and longitude in radians, and altitude in meters above the reference ellipsoid.

gridded data

Data that has been processed in a rectangular array of points, in X, Y or latitude/longitude, at which single data values define a two dimensional function. According to the IEEE 1278.1a specification, gridded data transmits information about large-scale or high-fidelity spatially and temporally varying ambient fields and about environmental processes and features.

guise

An alternative entity type used to display an object depending on the force ID. For example, a tank could look like an M1A1 to friendly forces and a T72 to hostile forces.

head-up display

A set of indicators and readouts superimposed onto a graphics display. Also called an overlay.

heartbeat

In DIS, the frequency with which current PDUs are sent to the network regardless of whether or not the entity's state has changed.

High-Level Architecture

The High Level Architecture (HLA) for simulations is a U. S. Department of Defense (DOD)-wide initiative to provide an architecture to support interoperability and reuse of simulations. The HLA supersedes DIS for the DOD.

HLA

[High-Level Architecture](#).

interaction

A [message](#) describing a simulation event. An interaction describes an event, it does not update an object's state.

Logger control PDUs

A set of DIS PDUs or HLA interactions that let you control the MÄK Logger remotely.

logical range

A suite of TENA Resources, sharing a common object model, that work together for a given range event. Similar in concept to the HLA Federation.

Local RTI Component

The libraries on a computer that implement an RTI. A federate communicates with the HLA network through the LRC.

Logical Range Object Model

The data definition file for TENA exercises. It contains the set of object and message definitions that may be used in the exercise.

LRC

Local RTI Component

LROM

[Logical Range Object Model](#).

MÄK Technologies Lisp

An adaptation of the Lisp language used in configuration files for MÄK products.

message

A general term used to refer to [DIS PDUs](#) and [HLA interactions](#) and state updates. In TENA, a message is similar to an HLA interaction.

MTL

[MÄK Technologies Lisp](#).

Network Naming Service

Acts as a registry for TENA Execution Managers.

NNS

Network Naming Service.

orientation clamping

Adjusts the pitch and roll of an entity so that it appears properly seated when the terrain is inclined. For example, if a tank is moving horizontally across the face of a hill, orientation clamping prevents the tank from appearing level, and therefore, partially embedded into the hillside. Used with [ground clamping](#).

object

An element in a simulation that has persistence, as opposed to an interaction, which is a transient element.

object handle

An integer that an application uses to identify a particular object in RTI service calls. An object handle is meaningful only to a particular federate. The same object can be known to different federates by different object handles.

object name

A character string that can be used to identify an object. In HLA, the object name is known to the RTI, and the RTI provides functions to find out an object's name, given its handle, and vice versa. Object names can be chosen by applications that register the objects with the RTI, however if you do not want to choose names for objects, the RTI will assign names for you.

PDU

[Protocol Data Unit](#).

Protocol Data Unit

A unit of data message (packet) that is passed on a network between DIS simulation applications.

proxy

In TENA, a reflected object ([Stateful Distributed Object](#)).

radio transmitter

A simulated device on an entity, capable of transmitting radio communications.

radio receiver

A simulated device on an entity, capable of receiving radio communications.

range resource

A participant in a TENA execution (similar in concept to the HLA federate).

Realtime Platform Reference FOM

An [HLA](#) reference [FOM](#) based on the [DIS](#) protocol.

recording

A Data Logger file that stores a history of the interactions in a simulation for playback.

reflected entity list

A list of entities simulated by remote applications (federates in HLA) and about which the local simulation has received information over the network.

reference FOM

A [FOM](#) designed to be used as a whole, or with modification, by a wide variety of similar [federation executions](#).

relative dead reckoning

A method of dead reckoning in which an application approximates the location of an object based on the local time of receipt of the last state update message.

remote display engine

A display engine running in an application that is separate from the master application, and which is controlled by the master application.

RTI Initialization Data (RID)

The initialization data required by the RTI for operation.

Data required by an RTI during initialization, independent of the FOM being used. RID data is usually dependent on a specific implementation of the RTI.

RPR FOM

[Realtime Platform Reference FOM](#).

RTI

[Run-Time Infrastructure](#).

Run-Time Infrastructure

A library and other supporting software that implements the HLA interface specification. All federates communicate with one another in an HLA environment through RTI functions.

SDO

[Stateful Distributed Object](#).

servant

A published object (SDO) in TENA.

Simulation Interoperability Standards Organization

A group that seeks to promote modeling and simulation interoperability and reuse for the benefit of diverse M&S communities, including developers, procurers, and users, world-wide.

simulation time

In VR-Forces, simulation time is used in dead-reckoning of remote entities and thresholding of local entities. Typically, simulation time is set once during each iteration of the application's main simulation loop so that all entities are dead-reckoned based on the same value of current time.

SISO

[Simulation Interoperability Standards Organization.](#)

smooth period

The period of time over which [trajectory smoothing](#) takes place.

smoothing

A method of ensuring that transitions from an entity's dead-reckoned position to its actual position are not so abrupt as to be visually disconcerting.

state

The current status of an object, including location, direction of movement, extent of damage, and so on.

Stateful Distributed Object

An object in a TENA exercise.

tape

An alternative term for a Logger recording. Not a physical magnetic tape.

TENA

[Test and Training Enabling Architecture.](#)

TENA Middleware

“The software that links range resources together into a logical range. The “TENA Middleware” is the software component that is in between (that is, in the middle of) range resources during a logical range execution.” – from www.tena-sda.org

terrain following

In a 3D visualization application, causes the observer (eyepoint) to maintain a constant distance above the terrain surface. The observer's height changes in tandem with the peaks and valleys as it passes over the geography.

Test and Training Enabling Architecture

Test and Training Enabling Architecture (TENA) is an interoperability architecture used to pass data in the form of object updates and messages (like HLA objects and interactions) from one application to another.

timeout

The period of time in which an application continues to display an entity after that entity's update messages have stopped appearing on the network. Time-outs are usually not used in HLA because there is no set frequency (no heartbeat) for transmitting messages.

timescale

A factor by which time is accelerated or slowed during playback of a Data Logger recording.

topographic coordinates

A right-handed Cartesian coordinate system whose X-Y plane is tangent to the earth's surface at the origin, with the positive X axis pointing north, the positive Y axis pointing east, and the positive Z axis pointing down. There are an infinite number of topographic coordinate systems – one for each point on the earth's surface.

topographic coordinate frame

A coordinate frame in the context of the terrain.

trajectory smoothing

A method used by to smooth positional discontinuities that could occur when new state updates arrive.

UDP port

A network channel through which an application sends and receives data for DIS exercises.

Universal Transverse Mercator

In general, a non-cartesian coordinate system in which the X, Y, and Z correspond to easting (nearly east), northing (nearly north), and height above an ellipsoid that approximates the surface of the earth.

UTM coordinates

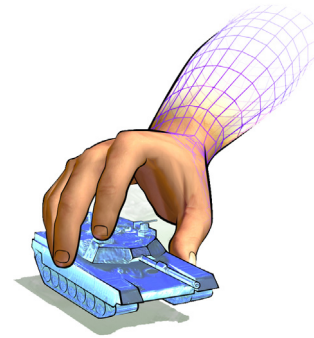
[Universal Transverse Mercator](#) coordinates.

view control messages

A set of programmatic messages that let you control the VR-Vantage remotely.

view floor

In MÄK Stealth 6.x and earlier, a minimum height above the terrain in Absolute or Track mode, below which the eyepoint is not allowed to go. The view floor is measured relative to the terrain surface.



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VR-Forces Quick Reference Card

VR-Forces Command-Line Options

Options	Description	Options	Description
-a <i>app_number</i>	Application number.	--mcastTtl	The multicast time-to-live. (DIS)
-A <i>dest_addr</i>	Address for point-to-point mode. (DIS)	-N <i>federate_name</i>	The federate name to use. (HLA)
--addTranslation-File	Load specified translation file. (vrfGui)	-n <i>notify_level</i>	The level for application messages.
--appIdRange <i>low-high</i>	Range of application IDs for VR-Forces objects.	--noPluginDirectory	Do not load MTL files in <i>./plugins</i> .
-B <i>file</i>	Runs the specified batch file.	-o <i>file_name</i>	Overlay menu file to load.
-c <i>PID</i>	The process ID for the front-end.	--outputLogFile <i>file</i>	The name of the log file for messages.
-c <i>file</i>	A configuration file other than <i>vrf.ent</i> .	-p <i>app_number</i>	The application number for the back-end in combined mode. (vrfGui)
-D	Do not load or save a settings file.	-P <i>port</i>	The port number for DIS.
-d <i>file</i>	An alternate to <i>vrfSim.mtl</i> . (vrfSim)	--physicalWorldFile <i>file</i>	Physical world file to load. (vrfSim)
-d <i>file</i>	A file for loading and saving settings. (vrfGui)	--pluginFile <i>file</i>	Plug-ins configuration file.
--daemon	Runs vrfSim as a daemon. (Linux)	-q	Do not display a console. (vrfSim)
--defaultConfig-File <i>file</i>	An alternate to <i>vrfGui.mtl</i> . (vrfGui)	-r	Start the back-end in run mode (if -L and -T are also specified).
--deviceAddress <i>address</i>	Device address to connect to network if there are multiple ethernet cards. (DIS)	-R <i>file</i>	Loads the specified MTL script file. (vrfGui)
--diGuyAnimations-File <i>file_name</i>	Additional DI-Guy animations file. (vrfSim)	--recvBufferSize <i>size</i>	The receive buffer size. (DIS)
--diGuyCharacer-DataFile <i>file_name</i>	Additional DI-Guy character data file. (vrfSim)	--rprFomRevision <i>revision</i>	The RPR FOM 2, draft 17 revision to use. (HLA)
--disVersion	The DIS version to use.	--rprFomVersion <i>version</i>	The version of the RPR FOM to use. (HLA)
-f <i>FOM_mapper</i>	The FOM Mapper to use. (HLA)	-S <i>multicast_addr</i>	The address for multicast mode. (DIS)
-F <i>FED_file</i>	The FED file to use. (HLA)	-s <i>site_ID</i>	The site ID.
--fomMapperInit-Data <i>data</i>	Initialization data for a FOM Mapper, if required.	--simulationModelSet	Default SMS for the front-end.
-g	Runs with a global Minimap. (vrfGui)	--simulationModelSet-File	Default SMS for the back-end.
-G <i>code</i>	The language used for the GUI text. (vrfGui)	--sendBufferSize <i>size</i>	The send buffer size. (DIS)
-h	Displays help information in a console window.	--suppressSelfReflect	Represses self reflection of DIS exercise connection.

VR-Forces Command-Line Options

Options	Description	Options	Description
<code>-H address</code>	The ethernet address to use on a computer that has multiple ethernet cards. (vrfGui)	<code>-t site_ID</code>	The site ID for the back-end in combined mode. (vrfGui)
<code>-I</code>	Use asynchronous I/O. (DIS)	<code>-T terrain</code>	The terrain database to load. Mutually exclusive with <code>-L</code> .
<code>-i session_ID</code>	The session ID.	<code>--targetFrameRate rate</code>	Specifies frame rate above which vrfSim yields CPU to other processes.
<code>--ignore_rest</code>	Ignore any options after this one.	<code>--tickManagingEnabled</code>	Perform advanced tick management. (vrfGui)
<code>--ignoreAdvisories</code>	Ignore HLA advisory messages.	<code>--timeManagement</code>	Enables time management. (vrfSim)
<code>-L "scenario_path"</code>	Load specified scenario. Mutually exclusive with <code>-T</code> .	<code>--useAsyncIO</code>	Use asynchronous I/O. (DIS)
<code>-l file</code>	A configuration file to load. (vrfGui)	<code>--useIpv6</code>	Exercise connection uses Ipv6. (DIS)
<code>--loadPlugin file</code>	Plug-in file to load.	<code>-v version</code>	Specifies version information.
<code>--logDirectory dir</code>	Directory for log files. (vrfGui)	<code>-x execution_name</code>	The HLA federation execution name.
<code>--logFrameRate-Statistics</code>	Enable logging of frame rate statistics. (vrfSim)	<code>-x exercise_ID</code>	The DIS exercise ID.
<code>-m symboplMapFile</code>	Default symbol map file. (vrfGui)	<code>-Z</code>	Specify combined mode without specifying a back-end.
<code>-M symbolMapFile</code>	Additional symbol map file to load. (vrfGui)	<code>-z back-end</code>	Run in combined mode. (vrfGui)

VR-Forces Quick Reference Card

Navigation and View Quick Reference

Task	Action
Zoom in	♦ Click zoom in button on Navigation toolbar. ♦ Choose Navigation → Zoom In. ♦ Rotate mouse scroll wheel away. ♦ Shift-click on point. ♦ Hold shift key and draw bounding outline around area to zoom in on. ♦ Select smaller area on Minimap. ♦ Press plus key on keyboard.
Zoom out	♦ Click zoom out button on Navigation toolbar. ♦ Choose Navigation → Zoom Out. ♦ Rotate mouse scroll wheel toward you. ♦ Shift-right-click on point. ♦ Select larger area on Minimap. ♦ Press minus key on keyboard. ♦ Choose Navigation → Reset to Global View. ♦ Click Global View icon on Navigation toolbar.
Pan	♦ Click a pan command on Navigation menu. ♦ Click pan button on Navigation toolbar. ♦ Press number key on keypad that corresponds to direction to pan. ♦ Hold left mouse button and drag to edge you want to pan towards.
Center and zoom	♦ Shift-click on point to zoom in. ♦ Shift-right-click on point to zoom out.
Center	♦ Ctrl-shift-click to change center.

VR-Forces Keyboard Shortcuts

Command	Shortcut	Command	Shortcut	Command	Shortcut
Always Mirror Extents	Ctrl + M	New Scenario	Ctrl + N	Select Aggregates	Ctrl + Shift + W
Animation	M	New Window	Ctrl + W	Select Control Objects	Ctrl + Shift + C
Attach to Next Entity	Ctrl + .	Next Environmental	>	Select Entities	Ctrl + Shift + E
Attach to Next Group	Ctrl + '	Open Batch File	Ctrl + Shift + B	Select Features	Ctrl + Shift + T
Attach to Previous Entity	Ctrl + ,	Open Terrain	Ctrl + O	Select Objects	Ctrl + Shift + A
Attach to Previous Group	Ctrl + ;	Pan	1 through 9	Select Overlay Objects	Ctrl + Shift + V
Center Selection	C	Paste	Ctrl + V	Show Full Screen	Ctrl + Return
Clear Track Histories	Shift + H	Pause Simulation	Ctrl + Shift + P	Terrain Features	F
Clear Tracking	R	Plan	P	Time Managment	Ctrl + Shift + M
Collapse Aggregate	O	Previous Environmental	<	Track Histories	H
Copy	Ctrl + C	Print Map View	Ctrl + P	Track Next Entity	.
Create Selection Group	Ctrl + G	Range and Bearing Labels	A	Track Previous Entity	,
Delete	Delete	Raster Map Layers	Y	Track Selection	T
Emitter Beams	B	Redo	Ctrl + Y	Undo	Ctrl + Z
Exit	Ctrl + Q	Reflect Extents	0 (zero)	View Control	Shift + C
Expand Aggregate	X	Reset to Global View	Ctrl + 5	View Transmitters	N
Fire and Detonation Lines	D	Rewind Pauses Back-end	K	Zoom In	+
Global Plans	Ctrl + Shift + K	Rewind Simulation	Ctrl + B	Zoom Out	-
Information	I	Run Simulation	Ctrl + R	Zoom to Extents	5
Load Scenario	Ctrl + L	Save Scenario	Ctrl + S	Zoom to Next Selection Group	'
New Overlay	Ctrl + Shift + L	Save Scenario As	Ctrl + Shift + S	Zoom to Previous Selection Group	;



Link - Simulate - Visualize