MAK TECHNOLOGIES

VR-Engage Users Guide



Version 1.7

ST Engineering North America

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Preface

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

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

How the Manual Is Organized

This manual is organized as follows:

- "Chapter 1. Introduction to VR-Engage" on page 23, describes the basic features of VR-Engage.
- "Chapter 2. Installing VR-Engage" on page 33, explains how to install VR-Engage software, the license manager, and an RTI.
- "Chapter 3. Starting VR-Engage" on page 43, explains how to start and stop VR-Engage, load a terrain, and connect to a simulation.
- "Chapter 4. Common Player and Entity Features" on page 83, describes features that apply to all platform types.
- "Chapter 5. Controlling People" on page 97, explains how to play a human character, including moving, changing weapons, firing weapons, and embarking and disembarking.
- "Chapter 6. Controlling Ground Vehicles" on page 121, explains how to drive ground vehicles, including the LAV, M1A2, and civilian vehicles.
- "Chapter 7. Controlling Aircraft" on page 129, explains how to control aircraft and how to request SAR images.
- "Chapter 8. Controlling Drones" on page 151, explains how to deploy and control the quadcopter drone.
- "Chapter 9. Sensor Operator Role" on page 157, explains the sensor operator role and how to control the sensor interface.
- "Chapter 10. Video Stream and Image Capture" on page 167, describes how to stream video or save images to a file from a quadcopter drone or sensor operator.
- "Chapter 11. Mouse, Keypad, and Controller Mappings" on page 171, illustrates the mouse, keyboard, and game controller mappings configured in VR-Engage.
- "Chapter 12. Controllable Entities" on page 211 lists the entity types that you can control in VR-Forces from VR-Engage if VR-Forces is running a scenario that uses VR-Engage.sms.
- "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247, explains how to extend the VR-Engage simulation model set.
- "Chapter 14. Adjusting Entity Settings" on page 253, provides instructions for customizing entities.
- "Chapter 15. Creating VR-Engage Scenarios in VR-Forces" on page 259, describes what is involved in creating your own scenarios.
- "Chapter 16. Customizing Overlays" on page 263, describes how to edit entity configurations to customize what players can see and do.
- "Chapter 17. Activating Scripts in VR-Forces" on page 271 explains how to add scripts that you can send to VR-Forces.

Documentation Set

VR-Engage documentation is provided as manuals in PDF format and online help. Electronic versions of the documentation are in *vrengage/doc*. On Windows, you can access the documentation from the VR-Engage folder on the Start menu. You can also find the most current documentation at *https://www.mak.com/support/product-user-guides*. The VR-Engage documentation set is as follows:

- *VR-Forces Users Guide* describes how to use the VR-Engage applications.
- *VR-Engage First Experience Guide*. The First Experience Guide provides a brief guided tour of the most important VR-Engage features. It is primarily for new users and persons evaluating VR-Engage.
- Online help. The online help, accessible from the Help menu, replicates most of the information in *VR-Forces Users Guide*.
- *VR-Vantage Users Guide*. The VR-Engage startup view gives you access to many settings that affect the visual quality of your role-playing experience. These and other aspects of the graphical user interface are shared with VR-Vantage and VR-Forces. *VR-Vantage Users Guide* is included to provide documentation for display settings, navigation of the GUI, and other information that may be of use to VR-Engage users, but which is not central to using VR-Engage.
- *Adding Content to MAK Applications Reference Manual* explains how to add visual models and terrain to VR-Engage.
- *VR-Engage Release Notes* lists system requirements, release-specific requirements, new features and updates, bug fixes, and known problems.

MAK Products

The MAK Technologies product line includes the following:

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

  VR-Link includes a set of sample debugging applications and their source code. The source code serves as an example of how to use the VR-Link Toolkit to write applications. The executables provide valuable debugging services such as generating a predictable stream of HLA or DIS messages, and displaying the contents of messages transmitted on the network.
- MAK RTI. An RTI (Run-Time Infrastructure) is required to run applications using the High Level Architecture (HLA). The MAK RTI is optimized for high performance. It has an API, RTIspy®, that allows you to extend the RTI using plug-in modules. It also has a graphical user interface (the RTI Assistant) that helps users with configuration tasks and managing federates and federations.

- VR-Forces®. VR-Forces is a computer generated forces application and toolkit. It provides an application with a GUI, that gives you 2D and 3D views of a simulated environment.

  You can create and view entities, aggregate them into hierarchical units, assign tasks, set state parameters, and create plans that have tasks, set statements, and conditional statements. You can simulate using entity-level modeling, which focuses on the actions of individual people and vehicles, and aggregate-level modeling, which focuses on the interaction of large hierarchical units.

  VR-Forces also functions as a plan view display for viewing remote simulation objects taking part in an exercise. Using the toolkit, you can extend the VR-Forces application or create your own application for use with another user interface.

- VR-Vantage™. VR-Vantage is a line of products designed to meet your simulation visualization needs. It includes three end-user applications (VR-Vantage Stealth and VR-Vantage IG) and the VR-Vantage Toolkit.
  - VR-Vantage Stealth displays a realistic, 3D view of your virtual world, a 2D plan view, and an exaggerated reality (XR) view. Together these views provide both situational awareness and the big picture of the simulated world. You can move your viewpoint to any location in the 3D world and can attach it to simulation objects so that it moves as they do.
  - VR-Vantage IG is a configurable desktop image generator (IG) for out the window (OTW) scenes and remote camera views. It has most of the features of the Stealth, but is optimized for its IG function.
  - SensorFX. SensorFX is an enhanced version of VR-Vantage that uses physics based sensors to view terrain and simulation object models that have been materially classified. It is built in partnership with JRM Technologies.
  - The VR-Vantage Toolkit is a 3D visual application development toolkit. Use it to customize or extend MAK's VR-Vantage applications, or to integrate VR-Vantage capabilities into your custom applications. VR-Vantage is built on top of OpenSceneGraph (OSG). The toolkit includes the OSG version used to build VR-Vantage.
- MAK Data Logger. The Data Logger, also called the Logger, can record HLA and DIS exercises and play them back for after-action review. You can play a recorded file at speeds above or below normal and can quickly jump to areas of interest. The Logger has a GUI and a text interface. The Logger API allows you to extend the Logger using plug-in modules or embed the Logger into your own application. The Logger editing features let you merge, trim, and offset Logger recordings.
- VR-Exchange™. VR-Exchange allows simulations that use incompatible communications protocols to interoperate. For example, within the HLA world, using VR-Exchange, federations using the HLA RPR FOM 1.0 can interoperate with simulations using RPR FOM 2.0, or federations using different RTIs can interoperate. VR-Exchange supports HLA, TENA, and DIS translation.

- VR-TheWorld™ Server. VR-TheWorld Server is a simple, yet powerful, web-based streaming terrain server, developed in conjunction with Pelican Mapping. Delivered with a global base map, you can also easily populate it with your own custom source data through a web-based interface. The server can be deployed on private, classified networks to provide streaming terrain data to a variety of simulation and visualization applications behind your firewall.
- DI-Guy™. DI-Guy is an SDK that allows you to embed the DI-Guy library in your real-time application and populate your world with lifelike human characters. DI-Guy provides high-fidelity human characters that move realistically, respond to simple high-level commands, and travel throughout the environment as directed by the hosting visual application. It comes with thousands of ready-to-use characters, appearances, and motions. DI-Guy character simulation is an integral part of all MAK's visual applications, including VR-Engage, VR-Forces, and VR-Vantage.
- RadarFX. RadarFX is a client-server application that simulates synthetic-aperture radar (SAR). The server application, which is based on VR-Vantage and SensorFX, loads a terrain database and, optionally, connects to simulations. A client application requests SAR images from the server. RadarFX includes a sample client application.
- VR-Engage. VR-Engage is a multi-role virtual simulator that lets users play the role of a first person human character, a ground vehicle driver, gunner or commander, a sensor operator, or the pilot of a fixed wing aircraft or helicopter. It incorporates the VR-Force simulation engine and the VR-Vantage graphics rendering capabilities.
- WebLVC Server. WebLVC Server implements the server side of the WebLVC protocol so that web-based simulation federates can participate in a distributed simulation. It is part of the WebLVC Suite, which includes the server and several sample applications that work with VR-Forces and VR-Vantage.
- MAK Legion. MAK Legion is a collection of applications and an SDK designed to support simulations with millions of simulation objects.

How to Contact Us

For MAK Applications technical support, information about upgrades, and information about other MAK products, you can contact us in the following ways:

Telephone

Call or fax us at:

Voice: 617-876-8085 (extension 3 for support)
Fax: 617-876-9208

E-mail

Sales and upgrade information: info@mak.com
Technical support: support@mak.com

Internet

MAK web site home page:	www.mak.com
License key requests:	www.mak.com/support/get-licenses
Technical support:	jira.mak.com/servicedesk/customer/portal/1
Product version and platform information:	www.mak.com/support/product-versions
For the free, unlicensed MAK RTI:	www.mak.com/support/bonus-material

Post

Send postal correspondence to:	MAK Technologies 10 Fawcett Street, Suite 204 Cambridge, MA 02138 USA

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

Document Conventions

This manual uses the following typographic conventions:

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

Directory names are preceded with dot and slash characters that show their position with respect to the MAK Applications home directory. For example, the directory *vrforces#/doc* appears in the text as *./doc*.

Mouse Button Naming Conventions

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

Third Party Licenses

MAK software products may use code from third parties. This section contains summary license information and where required, specific license documentation required by these third parties.

The following libraries are covered by the GNU Lesser General Public License (LGPL) license:

- CIGI
- DevIL
- GEOS
- GStreamer
- LibIconV
- LibWebSockets
- OPCODE
- OpenAL
- OSG
- OsgEarth
- Pthread
- Qt
- Qwt.

The following libraries are covered by the ZLib license:

- Bullet Physics
- LibPNG
- LibSDL
- Minizip
- Zlib.

The following libraries are covered by the MIT license:

- Expat
- FreeGLUT
- GDAL
- GeoTiff
- GLM
- HarfBuzz
- LibCURL
- LibSquish
- LibXML
- LUA
- LuaBind
- Proj
- SMHasher
- TCLAP
- Qt Visual Graph Editor.

The following libraries are covered by the BSD license:

- FreeType
- GLEW
- JPEG
- LibTiff
- Protobuf
- PCRE
- Ogg Vorbis.

The following libraries are covered by the commercial licenses:

- FlexLM
- Gameware
- GLStudio
- JRM Technologies SenSimRT and SigSimRT
- OpenFlight
- SpeedTree
- Sundog Triton
- Sundog SilverLining
- CDB API.

The following libraries are covered by custom licenses:

- NVidia CG Toolkit
- FreeImage (FreeImage Public License)
- Boost (Boost Software License)
- Poco (Boost Software License).

COLLADA DOM is covered by the SCEA Shared Source license.

Thread Building Blocks is covered by the GPL license:

SQLLite is in the public domain.

SWIG is covered by the GPL license.

Boost License

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libXML and libICONV

VR-Link and all MAK software that uses VR-Link, links in libXML and libICONV. On some platforms the compiled libraries and header files are distributed with MAK Products. MAK 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/.

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1. Introduction to VR-Engage

This chapter is a brief introduction to VR-Engage.

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1.1. VR-Engage Features

VR-Engage was developed for use in training simulations or laboratory experimentation. It lets users play the role of a first person human character, a vehicle driver, gunner or commander, a sensor operator, or the pilot of an airplane or helicopter.

VR-Engage is built on mature proven technologies. It gets its simulation engine from VR-Forces, its game-quality 3D graphics from VR-Vantage, and its network interoperability from VR-Link.

VR-Engage includes:

- A high-fidelity vehicle physics engine needed for accurate vehicle motion.
- Ground, rotary and fixed-wing vehicles, and the full library of friendly, hostile, and neutral DI-Guy characters.
- Radio and voice communications over DIS and HLA.
- Sensors, weapons, countermeasures, and behavior models for air-to-air, air-to-ground, on-the-ground, and person-to-person engagements.
- Vehicle- and person-specific interactions with the environment (open and close doors, move, destroy, and so on.)
- Terrain agility. As with VR-Vantage and VR-Forces, you can use the terrain you have or take advantage of innovative streaming and procedural terrain techniques.

1.1.1 VR-Engage Versions

VR-Engage has the following run-time versions:

- VR-Engage Ground. Allows you to control humans and ground vehicles.
- VR-Engage Air. Allows you to control fixed-wing and rotary-wing aircraft.
- VR-Engage Sensor Operator. Allows you to control a gimbaled sensor or a camera.
- VR-Engage. Allows you to control air, ground, and human entities.

All four configurations are installed as part of the standard VR-Engage installation process. Your access to them depends on your VR-Engage license. For simplicity, the procedures in this manual assume you are using VR-Engage.

1.1.2 Simulation (Role-Playing) Capabilities

VR-Engage lets you choose which entity you want to simulate. Said another way, you choose the role you want to play. You can play:

- Dismounted soldiers and other human characters.
- A member of the crew of a ground vehicle.

- A helicopter or fixed-wing aircraft pilot.
- The operator of a gimbaled sensor on a UAV or a mounted camera.

Dismounted Soldiers and Other Human Characters

If you take the role of a dismounted soldier or other human character, you have access to the full DI-Guy library of friendly, hostile, and neutral characters. Your character has the following capabilities:

- Individual movement (look, run, walk, crawl, crouch, prone).
- Interact with environment (open and close doors).
- Interact with other characters (shoot at and be shot at).
- Sensors (binoculars and night vision goggles (NVG)).
- Weapons (rifles, grenades).
- Use carried gear, such as a flashlight, range finder, or compass.
- Lase targets for other players or simulated entities.
- CGF Assist (passenger, fast-roping). When you are running a VR-Forces scenario, you can give up control of your character and let the simulation engine manage complex behaviors.
- Embark and disembark. Enter and leave vehicles and take on roles of vehicle crew members.

Figure 1. Dismounted infantry



Ground Vehicle Crew

VR-Engage allows you to take on the roles of the driver, gunner, or commander of a ground vehicle that has the following capabilities:

- Physics-based ground vehicle dynamics model.
- Interact with environment (destroy).
- Ground-to-ground engagements:
  - Sensors (EO, IR, NVG).
  - Weapons (main gun, machine gun).
  - Signals/Countermeasures (smoke grenades).
- Vehicle controls (headlights, tail lights).
- CGF Assist (drive, gun). In a VR-Forces scenario, as you switch roles, the simulation engine can take over the tasks and plans that manage the other roles for the vehicle. For example, if you are the gunner, VR-Forces can manage driving the vehicle.

Figure 2. LAV gunner



You can easily switch roles and can disembark from the vehicle to assume the role of a dismounted soldier.

Pilot

As a pilot, you can fly an aircraft with the following capabilities:

- Physics-based fixed & rotary wing dynamics models.
- Multi-function cockpit display. Flight instruments, map/chart, imagery.

- Air-to-Air Engagements:
  - Sensors (radar scope, radar warning receiver).
  - Weapons (missiles).
  - Countermeasures (chaff, flares).
- Air-to-Ground Engagements:
  - Sensors (IR targeting, SAR (requires RadarFX Server)).
  - Weapons (missiles, guns, bombs).
  - Countermeasures (chaff, flares).

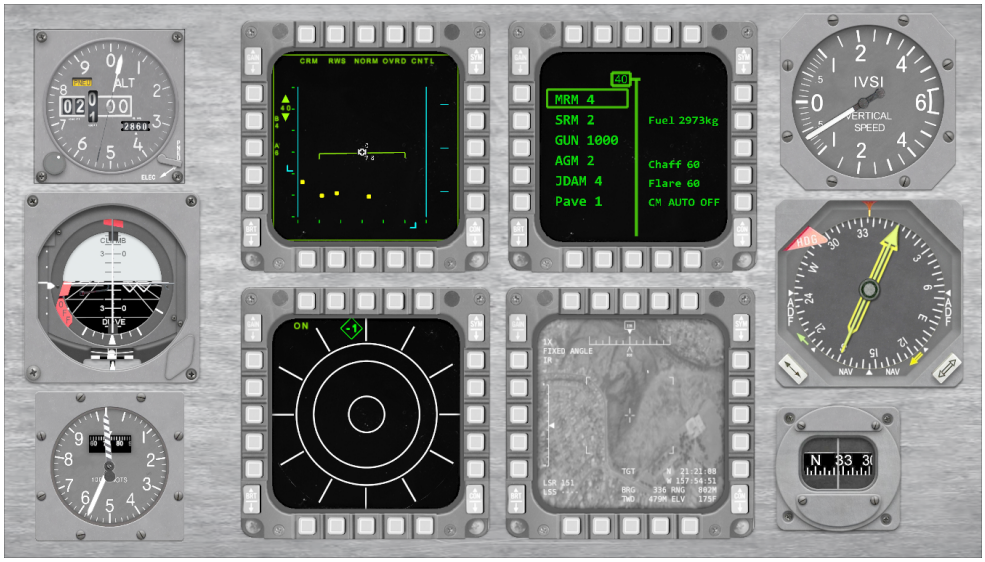
Pilots use their out-the-window views and head-up display (HUD) (Figure 3) to understand their environment and control their aircraft.

- Single screen. Out-the-window view, on-screen controls, and HUD.
- Dual screen. Out-the-window view, on-screen controls, and HUD.
- On-screen multi-function display (IR, SAR (requires SensorFX)) (Figure 4).
- Slaved IG (requires VR-Vantage Remote Display Engine).
- Head-mounted display (HMD). Oculus Rift, HTC Vive, or Varjo XR-1 and VR-2.

Figure 3. Head-up display with instruments



Figure 4. Instrument panel



Sensor Operator

In the sensor operator role, you can perform common surveillance and reconnaissance tasks, such as tracking fixed and moving targets, using a simulated E/O camera or IR sensor. You can control gimbaled sensors using joysticks or Gamepads or configure VR-Engage to work with sensor-specific hand controller devices. VR-Engage lets you attach cameras to entities and structures and set their initial heading and pitch. VR-Engage can also automatically attach cameras to remotely simulated (that is, non-VR-Forces) entities.

Figure 5. Sensor view



Drone Operator

As a drone operator, you can deploy a small drone equipped with a camera and then fly it around. This role is designed to train people how to safely fly a drone without risking an actual device. You can use these in many different types of scenarios, such as simple infrastructure inspection or surveillance and reconnaissance.

Figure 6. Drone operator



1.1.3 User Interface

You can control your character using the keyboard, mouse, and game controllers. The graphical user interface provides command menus and cockpit and crew cabin displays. Other interfaces include:

- Radio (push-to-talk, radio channels, MAK Data Logger support).
- Control with role specific devices (driver-steering wheel, pilot-HOTAS).
- Display system support (monitors, projectors, Oculus Rift).
- Audio (engine sounds, environmental noise, event effects, warning tones).

1.1.4 Image Generator

VR-Engage includes a built-in image generator, based on VR-Vantage IG, that can support multiple display channels, to the limits of your installed graphics card. It can also be extended to fill larger multi-channel display systems by adding VR-Vantage IG Remote Display Engines. This is an example of the flexibility of MAK's product architecture that lets you configure a system of any size.

Regardless of which role your VR-Engage simulator is playing, VR-Engage delivers realistic scene rendering (terrain, entities, interaction effects, weather, clouds, time-of-day, lighting, shadows, high dynamic range (HDR) lighting.)

The image generator supports the following configurations:

- Single screen.
- Dual screen.
- Multi-channel distributed rendering (requires VR-Vantage Remote Display Engine). Spread the view across multiple monitors run by multiple computers.
- IR and NVG Sensors using the included CameraFX or optional SensorFX.
- On screen Multi-function Display (IR, SAR (requires SensorFX)).
- Head-mounted displays.

1.1.5 Terrain

VR-Engage, like VR-Vantage and VR-Forces, lets you use the terrain you have or take advantage of innovative streaming and procedural terrain techniques to simulate on large, complex terrains.

- Terrain agile (all types supported by VR-Vantage and VR-Forces).
- Dynamic terrain. Destroyable buildings, bridges, and props.
- Dynamic ocean. Waves, spray, wakes, wind.

VR-Engage includes a set of useful geo-specific terrains and options for building more. Please see *Adding Content to MAK Applications Reference Manual* for information about terrain support. (*Adding Content to MAK Applications Reference Manual* is included with VR-Engage.)

1.2. Integration with VR-Forces

When VR-Engage is used with a compatible version of VR-Forces and other MAK products, you can reap the additional benefits of a common system architecture:

- Common representation of the environment across player and CGF stations, including synchronized weather, time-of-day, and dynamic terrain.
- Build terrains, models, and configurations once, and deploy them across VR-Engage player stations, VR-Forces simulation engines and front-ends, and any other applications that use VR-Vantage IG.
- Role-play multiple entities at a time by switching between manual and CGF control on-the-fly. Take control of VR-Forces-driven entities.
- Configure players with the VR-Forces Simulation Object Editor.
- Create scenarios in VR-Forces and load them in VR-Engage for stand-alone use.
- Automatic WebLVC integration (tablet-based IOS, and so on.)

1.3. Integration with Other MAK Products

Previous sections have discussed VR-Engage's integration with VR-Forces and VR-Vantage. Additionally, like all MAK products, VR-Engage uses VR-Link for network interoperability and supports DIS and HLA. It integrates seamlessly with our other

Link products, such as MAK Data Logger for recording and AAR, the MAK RTI for HLA support, and VR-Exchange for data interchange in heterogeneous simulation environments.

1.3.1 After Action Review – Using MAK Data Logger

Whether in standalone mode or when playing with other simulation applications, VR-Engage publishes to the DIS or HLA network. Therefore, you can use the MAK Data Logger to record your simulation and play the recording back for after-action-review (AAR).

1.3.2 Network Interoperability with Other Federates

VR-Engage is natively compliant with DIS and HLA, so it can participate in any topology of networked simulators and simulation support systems, including multi-player classroom environments. It can interoperate with existing simulation applications and 3rd party simulators, SAFs, and CGFs.

1.4. Extensibility

VR-Engage is ready to use out-of-the-box. It can be deployed as a trainee simulator, as a role player station, an instructor aid, a desktop simulation game, or even as a VR headset experience.

Because MAK focuses on the needs of system integrators, we designed flexibility into VR-Engage. It can be customized and extended to meet program-specific requirements, and can be integrated into a diverse range of system configurations. MAK has a pricing and support model that has proven to be effective with system integrators both before and after they choose MAK.

1.5. Licensing

The VR-Engage application requires a VR-Engage run-time license in order to run. Internally, VR-Engage relies on VR-Vantage capabilities for its 3D visualization, VR-Forces capabilities for its ownship simulation, VR-Link for its networking, and so on. These capabilities are part of VR-Engage and do not require separate run-time licenses of these MAK products.

1.5.1 Vortex License (for Ground Vehicle Dynamics)

VR-Engage uses Vortex from CM Labs for its ground vehicle dynamics. This capability is included with VR-Engage. You do not need a separate license.

1.5.2 RTDynamics License (For Aircraft)

VR-Engage uses RTDynamics for its aircraft vehicle dynamics. This capability is included with VR-Engage. You do not need a separate license.

1.5.3 License Requirements for Hosting a VR-Forces Session

With only a VR-Engage license, you can run VR-Engage, choose a terrain database to simulate on, create and place an entity, and control that entity. VR-Engage can only simulate and control a single entity at a time. When you change roles and create a different entity to simulate, the entity you were previously simulating is deleted and replaced by the new one.

If you are running a copy of VR-Forces on your network (which requires a VR-Forces license, of course), then VR-Engage can interact with VR-Forces in the following ways:

- VR-Engage allows you to join a VR-Forces session and take manual control of one of the entities in the VR-Forces scenario. If you are controlling a VR-Forces entity, and then change roles and ask to control a different entity, the original entity will still exist, as it is owned by VR-Forces.
- VR-Engage can initiate and receive changes to the terrain, for example, opening doors or destroying buildings. (VR-Forces acts as the dynamic terrain server.)
- VR-Engage can reflect changes to time-of-day and weather that are published by VR-Forces.
- VR-Engage allows you to assign certain tasks to entities that are simulated by VR-Forces (for example, tell a subordinate to follow you, or move to a location you designate).

In order to simplify the startup workflow for certain use cases, VR-Engage gives you the ability to launch a VR-Forces back-end directly from the VR-Engage user interface, and to instruct VR-Forces to load and host a scenario of your choosing. This allows you to avoid separately launching VR-Forces from the start menu or command line, and automatically ensures that VR-Forces uses the same interoperability parameters as VR-Engage. A VR-Forces back-end license is always required to run VR-Forces, whether you launch it from the VR-Engage user interface, or launch it separately from the Start Menu or command line. If you do not have a VR-Forces back-end license available, VR-Engage will not allow you to launch VR-Forces and host a VR-Forces scenario.

When VR-Engage starts up, it looks for a running VR-Forces and if it finds one, it connects to it. If it does not find one, it offers you the option to host and load a VR-Forces scenario, or start an unhosted session. If you host a VR-Forces scenario, you will consume a VR-Forces license, which will prevent you from starting VR-Forces independently if you only have one license. If you start an unhosted session, you can start or join a session only as an individual player - you cannot load and run a scenario.



2. Installing VR-Engage

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

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2.1. Installing VR-Engage

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

VR-Engage has an application installer and a data package (*.MAK-targz*) that has multiple files. You must run the application installer and then install the data package. The application installer can automatically install the data package if you configure it to do so. MAK also provides optional data packages that have additional terrains.

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

2.1.1 Installing VR-Engage on Windows

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

Windows versions of VR-Engage are provided as executable installer files on DVD, or as downloaded files. The installers are named to indicate the compiler used to build that version of VR-Engage.

➤ To install VR-Engage, run the application installer. Follow the instructions in the installation wizard. You can specify that the application installer automatically find and install the application's data (it must be in the same directory as the application installer), or you can specify that the MAK Data Setup Wizard open and allow you to select the data to install.

Default Windows Installation Directory

On Windows, the default is that VR-Engage installs in the *C:/MAK* directory. You can use another directory by defining a MAK_INSTALL_DIR environment variable. If you set up this environment variable, the product installs in the directory you specify instead of *C:/MAK*.

Installing the VR-Forces Plug-in

When the VR-Engage installer completes the data installation, it informs you of the plug-in that is available for VR-Forces. The VR-Forces plug-in allows you to take control of VR-Forces entities from VR-Engage if they are configured to be controlled by VR-Engage. If you have VR-Forces installed and want to install the plug-in, run the *VR-ForcesVR-EngageAdd-ons.exe* installer. This is packaged separately from the VR-Engage installer.

The VR-Forces plug-in makes the following changes to VR-Forces:

- Installs the *./data/simulationModelSets/VR-Engage.sms* and custom models.
- Replaces some VR-Forces level data or configuration files. In those cases, it saves the original version is preserved by the installer by copying it to <*original file name*>.*vrengage-addons-backup*. If you uninstall the VR-Engage add-ons installer, any VR-Forces files that the installer modified are restored by copying those **.vrengage-addons-backup* files to their original names.
- Adds RTDynamics and VREngage simulation model sets.
- Adds the VR-Engage revision to the About dialog box.

You must install the *VR-ForcesVR-EngageAdd-ons.exe* plug-in on top of a compatible version of VR-Forces. The *VR-ForcesVR-EngageAdd-ons.exe* installer attempts to check that the version of VR-Forces is compatible with your version of the VR-Engage add-ons. You can also refer to the VR-Engage release notes to learn which version of VR-Forces you can use with your version of VR-Engage. If you install the plug-in on an incompatible version of VR-Forces, it is not guaranteed to run reliably or correctly (if at all).

2.1.2 Uninstalling VR-Engage from Windows

MAK Technologies product installations include an uninstaller application, which you can find in the installation directory. When you uninstall VR-Engage, the uninstaller does not remove the data package. Delete the data files manually unless you want to save scenarios or SMSs for use in another release. In that case, we recommend leaving all the data files in place.

2.2. Upgrading VR-Engage Simulation Model Sets

When you upgrade to new, compatible versions of VR-Engage and VR-Forces, you must upgrade your simulation model set, as well. Refer to the documentation for the new version of VR-Forces, specifically the *VR-Forces Migration Guide* and “Upgrading Old Simulation Model Sets” in the *VR-Forces Users Guide*.

2.3. The VR-Engage Directory Structure

The installation process creates the VR-Engagedirectory structure shown in Figure 7.

Figure 7. VR-Engage directory structure

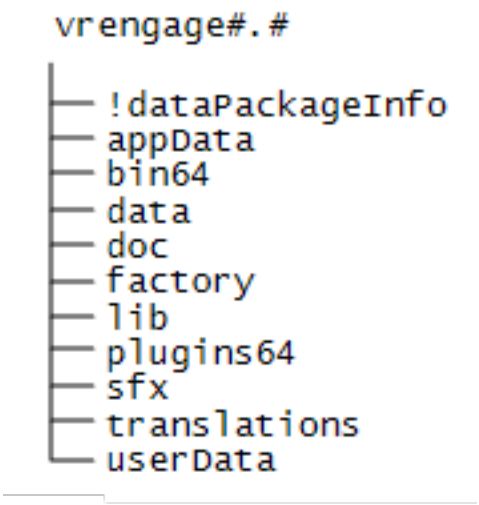


Table 1 describes the contents of the directories.

Table 1. Contents of VR-Engage directories

Directory	Directory contents
!dataPackageInfo	Contains version information for post.DataInstall.MAK-targz, a data overlay package installed automatically as the final step of the installer.
./appData	Subdirectories contain data required by the VR-Engage applications, such as model definitions and saved settings. Also contains data required by the SensorFX plug-in for VR-Engage.
./bin64	Executables and dynamic link libraries.
./data	Sample databases, images, and vehicle models.
./doc	VR-Engage documentation and class reference files.
./factory	Backups of the application data and settings provided by MAK. Also includes the default settings for SensorFX (for reverting to “factory” settings).
./lib	Libraries for Tracy client.
./plugins64	Plug-in shared libraries.
./sfx	Sound files.
./translations	Translation files for localizing VR-Engage menus.
./userData	Terrain and scenario files.

2.4. Installing and Setting Up the MAK License Manager

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

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

The License Manager installer is included on MAK installation media. It is separate from the product installers. You can download the installers from our web site at https://www.mak.com/support/license-support.

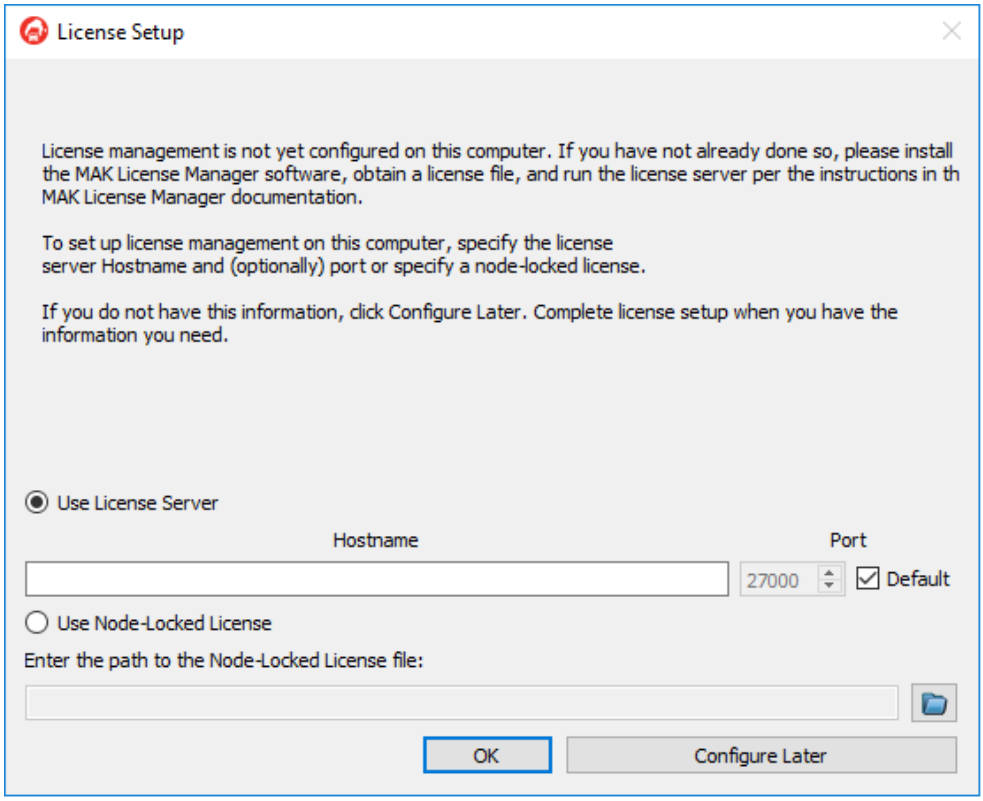
Complete installation and configuration instructions are included with the License Manager installer. Instructions are also available at the license support page.

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

2.4.1 Specifying the License Server

The first time you run a MAK application on a particular computer, the License Setup dialog box opens (Figure 8). It prompts you to enter the hostname of the license server and optionally, a port number.

Figure 8. 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 MAK applications until you set up license management.

If you know the hostname, type it in the Hostname box and then click OK. The application will start.

Under limited circumstances, MAK issues node-locked licenses. If you have a node-locked license, select the Use Node Locked License option and enter the path to the license file.

- If you are running MAK 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 MAK application.
- You can clear the saved license configuration by deleting the cache file. On Windows, it is *C:\Users\user_name\AppData\Roaming\MAK\licenses<n>.txt*. (The *AppData* directory is hidden by default.) On Linux, it is *.mak/license<n>.txt*. (There may be more than one cache file, for example, *licenses1.txt* and *licenses2.txt*.) You can also clear the cache in the RTI Assistant.

The MAKLMGRD_LICENSE_FILE Environment Variable

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

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

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

Windows

➤ **To add the MAKLMGRD_LICENSE_FILE in Windows:**

1. On the Start menu, click the Settings button. The Settings window opens.
2. In the search box, type environment. A list of choices is displayed.
3. Select Edit the System Environment Variables. The System Properties dialog box opens.
4. Click Environment Variables. The Environment Variables dialog box opens.
5. In the System Variables group box, click New. The New System Variable dialog box opens.
6. In the Variable Name field, enter MAKLMGRD_LICENSE_FILE.
7. In the Variable Value field, enter *@server_name*, where *server_name* is the name of the license server.
8. Click OK to back out of each dialog box and set the variable.

2.5. Installing an RTI

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

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

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

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

2.5.1 Installing the MAK RTI

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

Configuring Your System to Use the MAK RTI

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

- Linux — LD_LIBRARY_PATH
- Windows — PATH

The MAK 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 MAK RTI

➤ **To run a MAK application with the MAK RTI:**

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

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

2.6. Localizing the Graphical User Interface

You can localize your MAK Technologies product's graphical user interface so that it uses languages other than English. For details, please see *"Localizing the Graphical User Interface,"* in *VR-Vantage User Guide*.



3. Starting VR-Engage

This chapter describes how to start up VR-Engage, connect to a session, and choose a role.

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3.1. Starting VR-Engage

When you start VR-Engage, it looks for an instance of VR-Engage that is already running or an instance of VR-Forces that is running, checking for a session to join. A session manages the relationship between the simulation engine, or back-end, and the GUI, or front-end. For more information, see Chapter 3, *VR-Forces Application Concepts*, in the *VR-Forces Users Guide*.

If VR-Engage finds a session, it immediately connects to it, loads the terrain it is using, and then asks you what character you want to control. If it does not find a session, it stops and ask you what to do. You can host a VR-Forces session or start an unhosted session.

You can set some of the startup behaviors with a startup configuration script. For details, see "3.10. Creating a Startup Configuration" on page 64.

3.1.1 Hosting a VR-Forces Session

VR-Engage includes scenarios that were created using VR-Forces. When you host a VR-Forces session, you can load one of these scenarios or start an empty scenario on any installed terrain. If you run an existing scenario, you can control any of the entities in them. You can also add and control one other entity. If you start an empty scenario, you can only add and control one entity.



You cannot save scenarios in VR-Engage. The principal benefit of hosting a VR-Forces session and creating an empty scenario is that a VR-Forces session supports global weather and dynamic terrain. If you want to create and save scenarios for use with VR-Engage, you must run VR-Forces with the VR-Engage add-ons.

If other instances of VR-Engage are running, they can connect to the session. Each instance can only add and control one entity.



When you host a VR-Forces session, you use a VR-Forces license. If you only have one VR-Forces license and you host a VR-Forces session from VR-Engage, you will not be able to start the VR-Forces application.

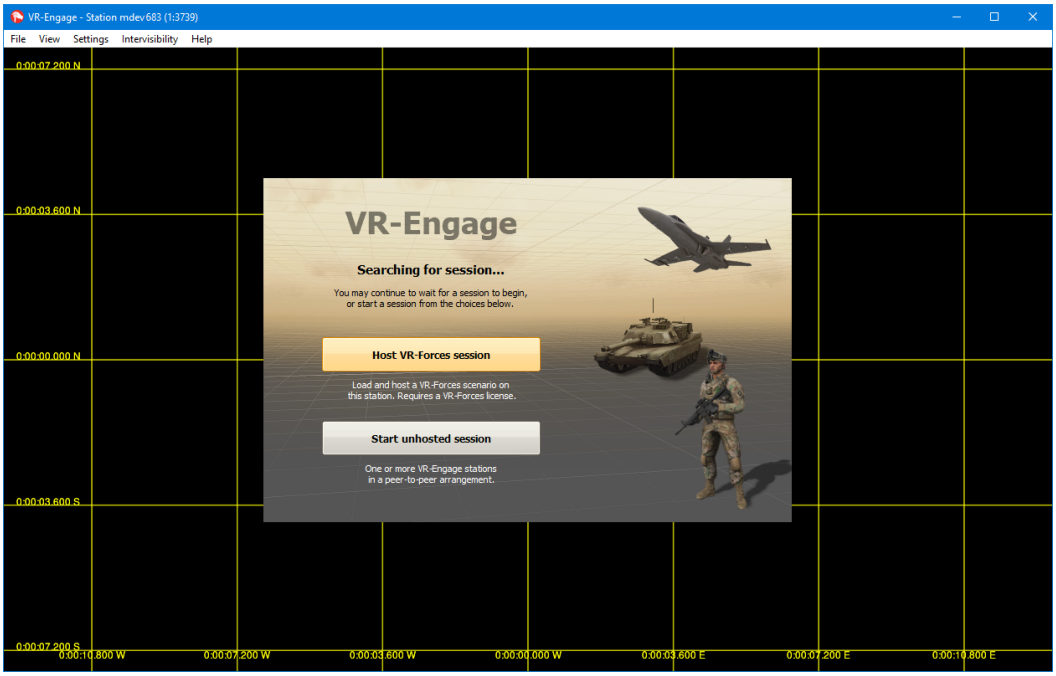
➤ **To start VR-Engage and host a VR-Forces session:**

1. On the Start menu, choose **MAK Technologies > VR-Engage**. The VR-Engage window opens.

   If VR-Engage finds a VR-Forces session, it connects to it. You can cancel this auto-join if you do not want to participate in that session.

   If it does not find a session, the Searching for Session dialog box opens (Figure 9).

Figure 9. Searching for Session dialog box



During the initial stages of joining a session, the VR-Engage window has a title bar and menu bar typical of most windowed applications. We call this windowed mode. Once you select a character and start controlling it, you enter full-screen mode. Full-screen mode does not have menus or other window controls. Although full-screen mode is the default for controlling characters, you can also control them in windowed mode. For details, please see "3.8. Playing in Windowed Mode" on page 59.

2. Click Host VR-Forces Session. The Choose a Scenario for this Session dialog box opens, where you can load a scenario or create a new scenario.
3. If you want to load a scenario:
   a. Select the scenario you want to load.
   b. Click OK. VR-Engage loads the scenario. It displays the scenario in 3D View mode and opens the Choose Role Panel (Figure 10 on page 48).

   If you want to create a new scenario:
   a. Click Create Empty Scenario Using Terrain File. The Choose a Terrain for this Session dialog box opens.
   b. Select the terrain you want to load. (If you want to use different terrains for the GUI and the simulation engine, select the Use Alternate Simulation

Terrain check box and select a terrain from the list.)

c. Click OK. VR-Engage loads the terrain. It displays the scenario in 3D View mode and opens the Choose Role Panel.

4. Choose a role, as described in "3.2. Choosing a Role" below.

3.1.2 Starting an Unhosted Session

In an unhosted session, you cannot load scenarios. You can load an installed terrain and create a single entity on it to control. If there are other simulations or other VR-Engage unhosted sessions running on the network, you can interact with them.

Unhosted sessions do not support dynamic terrain. Destructible buildings and buildings with switchable state windows or doors do not function in an unhosted session. As a result, players cannot damage buildings and cannot open and close doors or windows on buildings.

➤ **To start VR-Engage and host a VR-Forces session:**

1. On the Start menu, choose **MAK Technologies > VR-Engage**.

   The VR-Engage window opens. If VR-Engage finds a VR-Forces session, it connects to it. If it does not find a session, the Searching for Session dialog box opens (Figure 9 on the previous page).

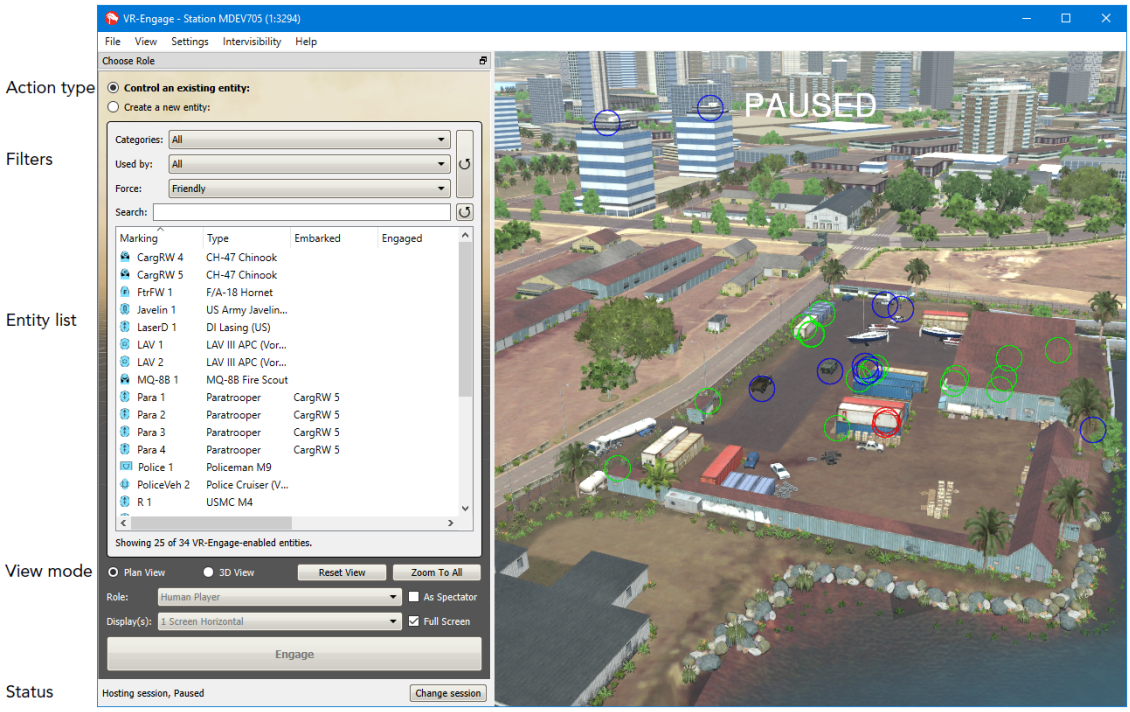
2. Click Start Unhosted Session. The Choose a Terrain for this Session dialog box opens.
3. Select a terrain. (If you want to use different terrains for the GUI and the simulation engine, select the Use Alternate Simulation Terrain and select a terrain from the list.)
4. Click OK. VR-Engage displays the terrain in 3D View mode and the Choose Role Panel opens (Figure 10 on the next page).
5. Choose or create a role, as described in "3.2. Choosing a Role" below.

3.2. Choosing a Role

When you connect to or start a session, you must choose a role to play. The VR-Engage window lists the available roles in the Choose Role Panel (Figure 10). If another player station is controlling a role, that is indicated in the Engaged column and you cannot take control of that role.

If you load a scenario or connect to a simulation, you can choose one of the entities in the simulation or create a new entity. If you start a new scenario or an unhosted session, you must create a new entity and choose that entity.

Figure 10. Choose Role Panel



VR-Engage users usually control a character in the simulation. However, you can also participate as a spectator. A spectator attaches to an entity just like a player would, but cannot control the entity. The entity would be controlled by another player or by another application, such as VR-Forces.

Multiple players should not try to control the same vehicle or person in the same role. If multiple players take control of an entity in the same role, and then one of the players relinquishes control by returning to the Choose Role Panel, the remaining player also loses control of that entity. If this happens, the remaining player can regain control of the entity by going through the Choose Role process. Note that two players can concurrently control the same vehicle if they are in different roles (for example, one player is Driver, and the other is Gunner or Commander).

3.2.1 Choosing an Existing Role

If you load a scenario or connect to a simulation that is publishing entities, you can select one of them as your role.

➤ **To choose a role:**

1. In the Choose Role Panel, select Control an Existing Entity. The panel lists the entities in the loaded scenario.
2. Optionally, filter the list by category, country (used by), force, or search string.
3. Optionally, switch from 3D view to the Plan View display mode (2D) by selecting an option at the bottom of the panel. You can also zoom to the extents of the entities in the entity list by clicking Zoom to All. (Filtering the list affects the results of Zoom to All.)
4. Select an entity by choosing it from the list or clicking it on the terrain.
5. If the selected entity has multiple roles, such as those on a vehicle, select an option from the Role list.
6. If the selected entity is an aircraft, select a display option from the Display(s) list. (For information about aircraft display options, please see "7.1.4 Aircraft Display Options" on page 134.)
7. If you just want to observe the simulation from the perspective of the selected character, but not actually control it, select the As Spectator check box.
8. Click Engage. VR-Engage changes to full-screen mode. You can now control your character and participate in the scenario.

3.2.2 Creating a New Entity

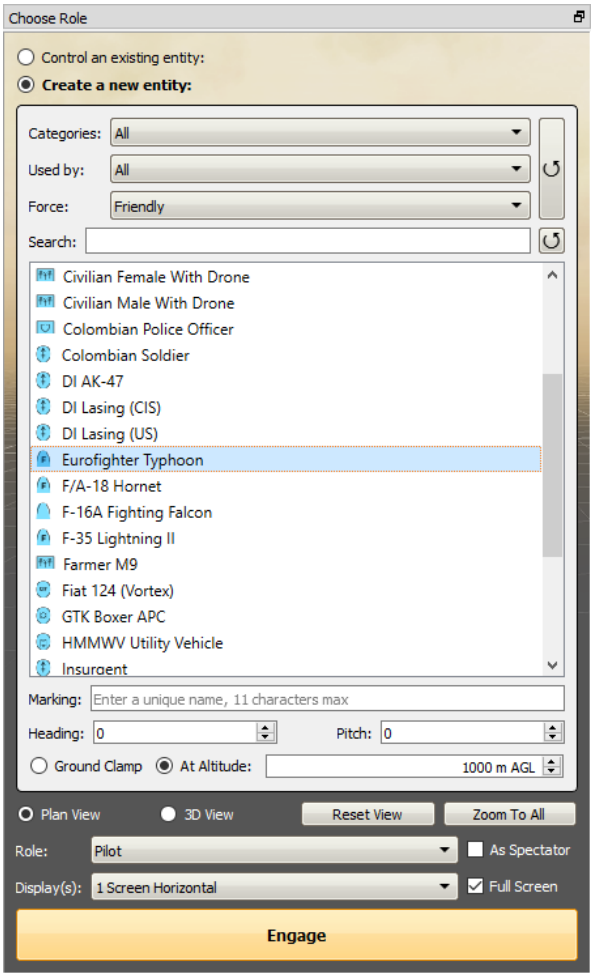
If you are running an unhosted session, or if you host a session but do not load a scenario, you can create a single entity and control it. You can also create an entity if you are connected to a session. That entity can participate in the simulation, but if you change roles, it will be removed from the simulation.

If you add a cultural feature, such as a remote camera, you can attach it to (embark on) an entity.

➤ **To create an entity:**

1. In the Choose Role Panel, select the Create a New Entity option. The window lists the entity types that you can create.
2. Optionally, filter the list by category, country (used by), force, or search string.
3. Optionally, switch from Plan View display mode (2D) to the 3D view by selecting an option at the bottom of the panel. If you have loaded a scenario, you can also zoom to the extents of the entities in the entity list by clicking Zoom to All. (Filtering the list affects the results of Zoom to All.)
4. Select an entity in the list (Figure 11).

Figure 11. List of entities to create



5. Optionally, in the Marking box, you can type a name for the character. The maximum length is 11 characters.
6. Optionally, specify a heading. For remote cameras, the heading is relative to the object it is attached to.
7. Optionally, if you are adding a cultural feature, such as a remote camera, you can specify the initial pitch.
8. Optionally, specify an altitude. By default, humans and ground vehicles are placed on the ground. Aircraft are placed at the altitude specified in the Altitude box. If you want an aircraft to be placed on the ground, you can change the specified altitude or select the Ground Clamp option. Similarly, if you want to create a paratrooper in the air, select the At Altitude option and specify an altitude.
9. Click on the terrain where you want to place the entity. (You can navigate the Plan View or 3D view using your mouse and keyboard. For details about navigating the terrain, please see Chapter 15, *Moving the Observer*, in *VR-Vantage Users Guide*. If you are adding a remote camera, clicking on an entity

attaches the camera to the entity.

10. If the selected entity has multiple roles, such as those on a vehicle, select an option from the Role list.
11. If the selected entity is an aircraft, select a display option from the Display(s) list. (For information about aircraft display options, please see "7.1.4 Aircraft Display Options" on page 134.)
12. If you just want to observe the simulation from the perspective of the selected character but not actually control it, select the As Spectator check box.
13. If you want to VR-Engage in full-screen mode, select the Full Screen check box.

    If you want to use VR-Engage in windowed mode, clear the Full Screen check box.
14. Click Engage. You can now control your character and participate in the scenario (or watch, if you chose to be a spectator).

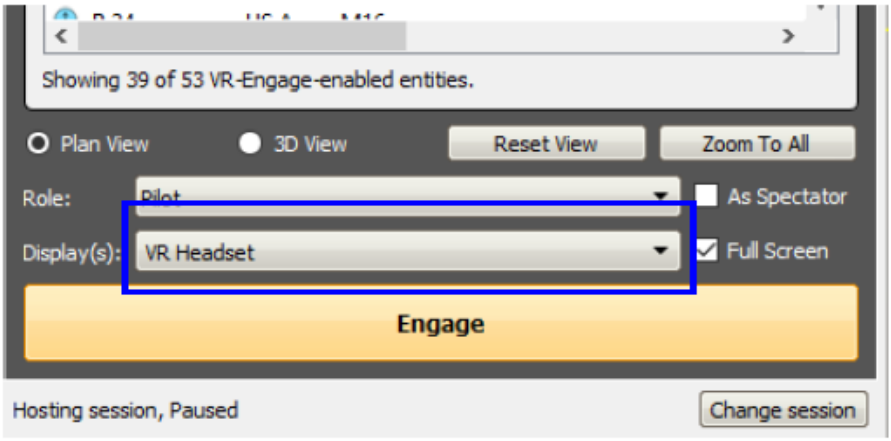
3.2.3 Using an HMD with an Entity

VR-Engage supports use of head-mounted displays to provide a virtual reality or mixed reality experience when you are controlling an entity. VR-Engage includes some entities that are configured for virtual or mixed reality. For entities that are configured for it, you can choose to use a VR or MR headset when one is connected. For details about configuring HMDs, see "3.9. Introduction to Virtual Reality Head-Mounted Displays" on page 59.

➤ **To use a head-mounted display to control an entity:**

1. Start VR-Engage.
2. Join a session or load a scenario.
3. Create a new entity or select an existing entity.
4. On the Displays list, select VR Headset (virtual reality) or MR Headset (mixed reality), as appropriate.

Figure 12. Displays list



5. Engage the entity.

3.2.4 Assigning Roles from VR-Forces

If you install the VR-Engage Add-ons for VR-Forces in a compatible version of VR-Forces, you can assign roles from VR-Forces. This includes:

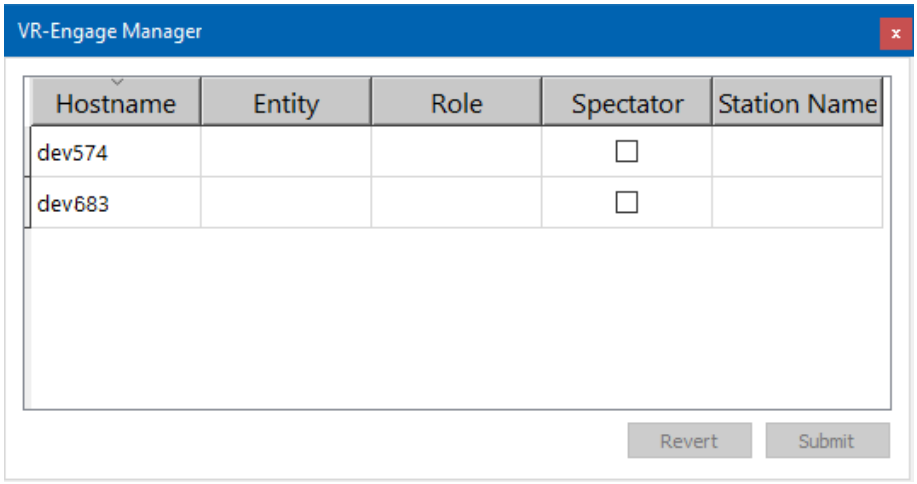
- Assigning an initial role for the player and starting the scenario.
- Specifying that the player be a spectator.
- Changing the role to None, which causes the VR-Engage session to revert to the Plan View role selection GUI.
- Changing the role to a different entity as the scenario progresses.

Managing entity assignments from VR-Forces does not prevent the VR-Engage player from using the VR-Engage GUI to select roles. If the VR-Engage player selects a role, that decision is reflected in the VR-Engage Manager Panel in VR-Forces.

➤ **To manage role assignments from VR-Forces:**

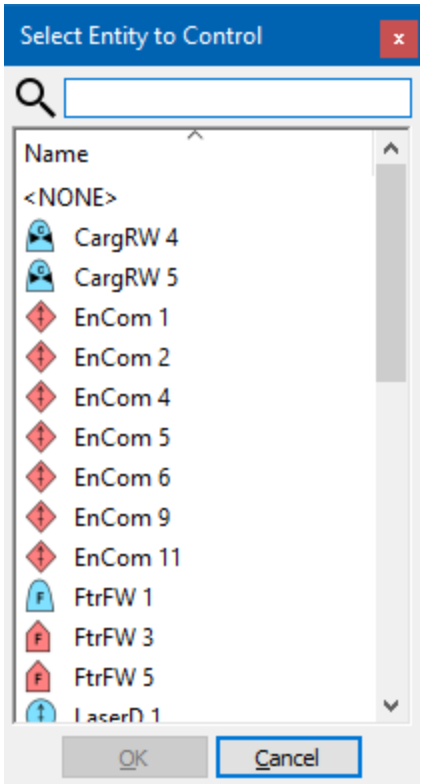
1. Start a version of VR-Forces that is compatible with your version of VR-Engage and has the VR-Engage Add-ons for VR-Forces installed.
2. Load the scenario you want to run.
3. Choose **View > VR-Engage Manager Panel**. The VR-Engage Manager Panel opens (Figure 13).

Figure 13. VR-Engage Manager Panel



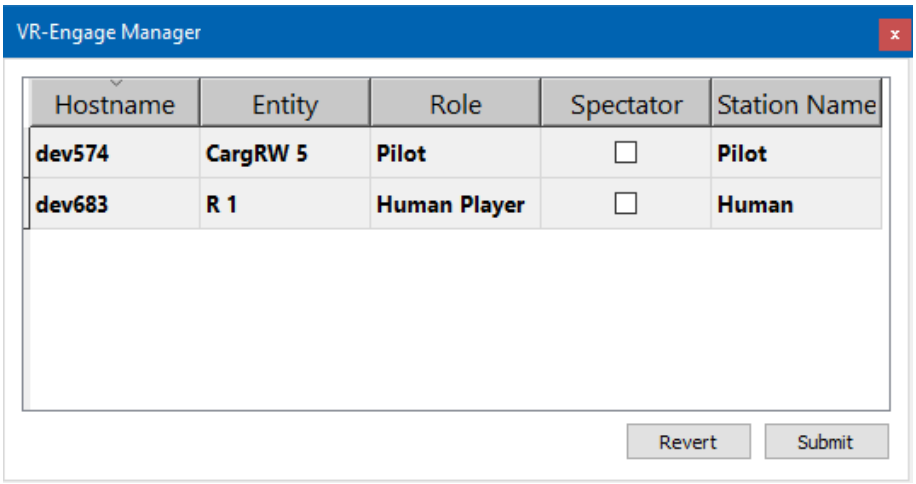
4. Start VR-Engage. It automatically connects to the VR-Forces session. The VR-Engage Manager Panel displays the hostname of the machine running VR-Engage. (If you have multiple instances of VR-Engage running, they are listed on additional rows in the panel.)
5. Click the Entity cell for the VR-Engage host to which you want to assign a role. The Select Entity to Control dialog box opens (Figure 14).

Figure 14. Select Entity to Control dialog box



6. In the list select the entity that you want the VR-Engage player to control. If the player has a role and you want to set it to no role, select <NONE>.
7. Click OK. The entity is listed in the table cell and the role is listed in the Role cell.

Figure 15. VR-Engage Manager Panel with entity selected



8. If the entity supports multiple roles, such as the LAV, you can select which role you want it to use. To select a role, click the Role cell. It becomes a list.
9. Select the role you want in the list. The panel automatically fills in the Station Name column.
10. If you want the player to participate as a spectator, select the Spectator check box.
11. Click Submit. The assignment gets sent to the host. The player is automatically engaged in the assigned role on the host machine.

3.3. Connecting to VR-Forces

VR-Engage can interact with any DIS or HLA simulation. However, it has a particular ability to participate in simulations that use VR-Forces, MAK's computer generated forces application. This allows you to switch between player and CGF control while the scenario is running. You can also use VR-Forces to create scenarios that include VR-Engage controllable entities in addition to CGF simulation objects.

By default, when you start VR-Engage, it looks for a VR-Forces session to join. If it connects to a complementary VR-Forces build that has the VR-Engage plug-ins installed, you can take control of entities being simulated by VR-Forces. You can assume control of VR-Forces entities and give up control as desired.

When you take control of a VR-Forces entity, the entity pauses the plan or task it is executing. When you give up control of the entity, control returns to VR-Forces and the entity resumes whatever task or plan it was executing before you took control of it.

To learn how to create your own VR-Forces scenarios, see "Chapter 15. Creating VR-Engage Scenarios in VR-Forces" on page 259.

You can only control entities that are in the VR-Engage SMS or your own SMS that extends that SMS. The VR-Engage SMS includes most human characters, ground vehicles configured to use the Vortex libraries, and aircraft configured to use RotorLib or FixedWingLib.

3.4. Changing Your Role

If a scenario has multiple entities, you can change the role you are playing to be any entity in a scenario. You can change your role by exiting the simulation and choosing a new role. You can also change a role by embarking on a vehicle and choosing an available role.

3.4.1 Changing Your Role in the Choose Role Panel

You can change your role by returning to the oosChoose Role Panel. When you engage characters or exit a character to the Choose Role Panel, the state of the scenario may change. For details, please see "3.5. Entity Engagement and Scenario State" on the next page.

➤ **To change your role:**

1. Press **Esc**. You return to the Choose Role Panel (Figure 10 on page 48).
2. Select the role you want, as described in "3.2. Choosing a Role" on page 47.
3. Click Engage.

3.4.2 Changing Your Role by Embarking on a Vehicle

You can change your role dynamically while you are participating in a simulation. The LAV has four roles associated with it: Gunner, Driver, Commander, and Passenger. If you embark on an LAV, you can assume any of these roles. Other vehicles have different sets of roles available.

➤ **To change your role by embarking on a vehicle:**

1. Walk towards a vehicle that supports embarkation. When you get close to the vehicle, the Embark menu opens.

Figure 16. Embark LAV menu



If the Embark menu closes before you make a selection, back up your character a few steps and approach the vehicle again.

2. Select a role using one of the following methods:
   - Use the up and down arrow keys or the up and down buttons on your D-pad to select a role. Then press the **Right Arrow** key or right button on the D-pad to embark using the selected role.
   - Press the number key associated with the embarkation option you want.
   - Click the embarkation option you want.

3.5. Entity Engagement and Scenario State

The state of a scenario – running or paused – varies depending on whether or not you are actively engaged in controlling a character and which application started the scenario. The possible cases are as follows:

- If VR-Engage is hosting a session:
  - When a player clicks Engage to control an entity, it puts the scenario in running state.
  - When a player presses **Esc** to return to the Choose Role Panel, it puts the scenario into the paused state.

- If VR-Engage is joining a session hosted by VR-Forces or another instance of VR-Engage:
  - When a player clicks Engage to control an entity, it does not change the scenario's state.
  - When a player presses **Esc** to return to the Choose Role Panel, it does not change the scenario's state.
- If VR-Engage is starting an unhosted session:
  - When a player clicks Engage to control an entity, it puts the scenario in the running state.
  - When a player presses **Esc** to return to the Choose Role Panel, it does not change the scenario's state.

When the scenario is not running, the word "Paused" displays on the screen. Players can only act while the scenario is running, not while it is paused.

If a player uses VR-Engage to join a session hosted by VR-Forces or another instance of VR-Engage and the user on the hosting application closes the scenario, a message informs the player that the session has ended and returns the player to the Searching for Session dialog box.

3.6. Starting a New Session

You can exit the session you are participating in and join or start a new session.

➤ **To change the scenario:**

1. Press **Esc**. You return to the Choose Role Panel.
2. On the Choose Role Panel, click New Session. The Searching for A Session dialog box displays.
3. Follow the procedure for starting a session, as described in "3.1. Starting VR-Engage" on page 45.

3.7. Setting Up the Simulation Connection

To participate in a simulation, you must connect VR-Engage to a simulation network. VR-Engage includes connectors for DIS, HLA 1.3, HLA 1516, and HLA Evolved (IEEE 1516-2010, also referred to as HLA 1516e). You can change the configuration values of the default connectors and you can add connectors.

VR-Engage needs to connect to a network at startup. By default, it automatically connects to the DIS network using port 3000. If you want to use a different network protocol or a different port, you must change the auto-connect setting.



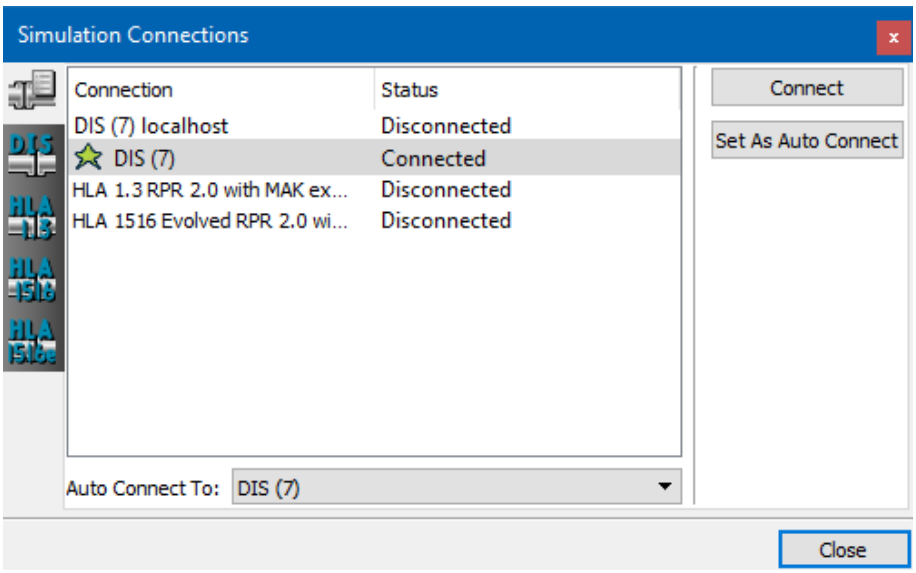
You cannot change the connection while VR-Engage is running. If you need to change the connection, you must change the auto-connect setting as described in this sectiontopic and then restart VR-Engage.

For complete details about connection settings and parameters, please see *VR-Vantage Users Guide*.

➤ **To set up the simulation connection:**

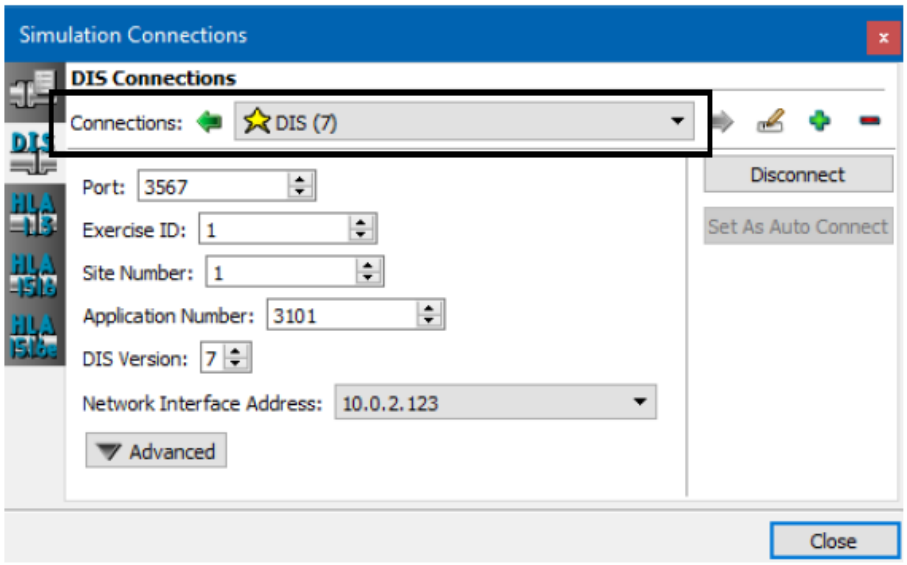
1. Start VR-Engage.
2. Choose **Settings > Connection**. The Simulation Connections dialog box opens (Figure 17).

Figure 17. Simulation Connections page



3. Select the page for the connection type that you want to use.
4. Select a connection in the Connections list (Figure 18).

Figure 18. DIS Connections page



5. Change connection parameters if necessary.
6. Click Set As Auto Connect.
7. Click Close.
8. Shut down VR-Engage.
9. Start VR-Engage. It will connect to the network you specified.

3.8. Playing in Windowed Mode

By default, when you click Engage to control a character, you go into full-screen mode. There are no menus or other window controls available. If you want access to menus without escaping to the Choose Role Panel, you can exit full-screen mode, but still control your character. This is called windowed mode.

Whenever you go from full-screen to windowed mode, VR-Engage releases mouse control so that you can use the mouse to access menus. You can toggle mouse control on and off. (For more information about mouse control, please see "5.1.1 Enabling and Disabling Mouse Control" on page 98.)

➤ To change from full-screen mode to windowed mode, press **Ctrl**+**Enter**. To return to full-screen mode, press **Ctrl**+**Enter** again.

3.9. Introduction to Virtual Reality Head-Mounted Displays

VR-Engage is integrated with several virtual reality -head-mounted displays (HMDs). VR-Engage can render stereo views, which are presented inside the HMD. The head position and orientation tracking of the HMD are reflected in the observer as the wearer of the HMD moves their head.

VR-Engage uses the OpenVR library to integrate with most virtual reality systems. The Oculus and Varjo have their own APIs. Any system that is capable of using OpenVR should work with VR-Engage.

VR-Engage is tested with the following systems:

- Oculus Rift.
- HTC Vive.
- Varjo XR-1 or VR-2.
- Windows Mixed Reality headsets.

3.9.1 Prerequisites for using an HMD

To use an HMD, you need the following software and VR-Engage setup:

- SteamVR. Required for the Vive headset. It is installed through the Steam digital distribution platform (*http://store.steampowered.com*).
- If you are using an Oculus Rift, the Oculus Runtime must be installed.

- If you are using a Varjo headset, Varjo Base must be installed. The Varjo XR-1 supports mixed reality, which requires that Thunderbolt 3 be installed. For information on Varjo system requirements, please see *https://varjo.com/use-center/getting-started/system-requirements*.
- If you are using Microsoft Mixed Reality Devices, the "Windows Mixed Reality for SteamVR" add-on must be installed through Steam.

3.9.2 Resetting the Tracking Sensor

For user comfort, you can reset the origin of the positional tracking performed by the HMD. This allows you to restart the head tracking once you have put on the HMD and assumed a comfortable position. You can reset the sensor at any time by pressing the **F8** key. You can change the keyboard assignment by changing the "Reset Virtual Reality HMD" action in the VR-Engage Key Mapping Editor.

You can also reset the tracking position as follows:

- Choose **Reset VR Head Tracking** on the Action menu.
- Press the right thumbstick on a Gamepad.
- Press button 5 on the HOTAS Warthog joystick.

3.9.3 Enabling and Disabling Virtual Reality Rendering

By default, when you start VR-Engage with an HMD connected, rendering to the HMD is enabled at startup. You can enable and disable rendering to the HMD at runtime.

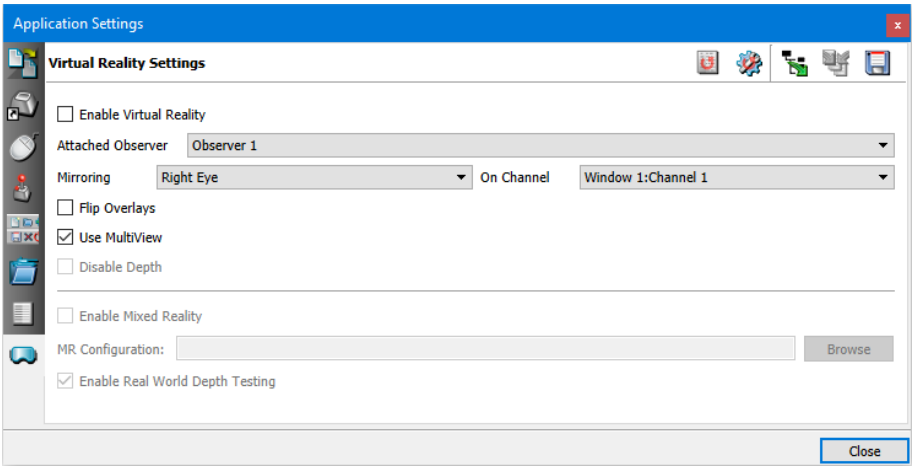
If you are using a Vive HMD, you must power on the device before starting VR-Engage. Failure to do so leads to a situation in which HMD mode appears to be available as a display option in the Choose Role panel, but nothing happens if you select that display option and then engage an entity. Always ensure that the Vive is up and running before launching VR-Engage.

➤ **To enable or disable virtual reality rendering:**

1. Choose **Settings > Application**. The Application Settings dialog box opens.
2. Select the Virtual Reality Settings page (Figure 19).

The Virtual Reality Settings page is available only if the virtual reality plug-in is loaded and an HMD is detected.

Figure 19. Virtual Reality Settings page



3. Select or clear the Enable Virtual Reality check box.

3.9.4 Configuration Options for Virtual Reality

You can set the following configuration options for virtual reality:

- Attached Observer. This is the observer that the HMD will attach to and render the perspective from. The default is to attach to Observer 1.
- Mirroring. This copies the image rendered for a given eye to the selected channel in the main display. The default is to render the right eye to the main channel. Mirroring disables the normal render pass of the attached channel to help with performance.

If mirroring is enabled and the HMD is attached to the observer that is driving a displayed channel, then the main view will be rendered from the HMD perspective. This will affect performance, because the scene will be rendered a third time.

- Flip Overlays. Currently this applies only to the HTC Vive. Enabling this option flips the overlays vertically. Select this check box if your overlays are displaying upside down.
- Use MultiView. Currently this applies only to Varjo devices. This enables MultiView rendering, allowing you to render two eyes in a single channel. MultiView reduces the number of passes required to render the scene, improving performance. Support is limited for MultiView, and there can be issues with SpeedTree shadows and certain lighting situations.
- Disable Depth. Some headsets support depth-based warping, which is a way of making image appear smooth with lower frame rates. Currently, this applies to Varjo headsets and the Oculus Rift. When you select Disable Depth, you disable the depth-based warp (VR-Engage does not pass the depth buffer to the headset

SDKs). If the depth warp is causing cockpit windows to display artifacts and otherwise look incorrect, selecting Disable Depth can help.

- Enable Mixed Reality, MR Configuration, and Enable Real World Depth Testing. These options do not apply to VR-Engage.

➤ **To set virtual reality configuration settings:**

1. Choose **Settings > Application**. The Application Settings dialog box opens.
2. Select the Virtual Reality Settings page (Figure 19 on the previous page).

> The Virtual Reality Settings page is available only if the virtual reality plug-in is loaded.

3. Change the settings as desired.

3.9.5 Setting Up Mixed Reality

VR-Engage supports the use of the forward-facing cameras on the Vive, Vive Pro, and Varjo headsets to add real elements such as a joystick, throttle, or other physical controls to the virtual world. Mixed reality modes are available for human roles and aircraft pilot roles for aircraft configured for VR. When you select a compatible entity, MR Headset is an option in the Display(s) list. Select this option to use mixed reality mode.

To use Mixed Reality mode in VR-Engage, you need a Vive, Vive Pro, or Varjo, and also SteamVR. If you are using a Vive HMD, you also need a green screen and you must start SteamVR and turn on the HMD before you start VR-Engage. We strongly recommend that you test the Vive HMD camera before each use. For details, please see "Testing the Vive Camera" below.

For the Vive and Vive Pro, green screen masks out real-world elements that should not appear in the simulation. For the VR-Engage pilot role with mixed reality, the green screen is expected to cover an area approximately 120 degrees wide at -90 degrees elevation extending up to 60 degrees wide at 0 elevation, from the player's point of view. If seated at a table or desk, the desk should be covered with a green screen approximately five feet wide and extending up to at least seated eye level. The only controls that should be visible on top of the green screen are those that you want to see in the mixed reality view. The green screen should be well-illuminated with soft, diffused light so that the green color is clear and uniform.

Mixed Reality Masks

Mixed reality masks are defined in the pilot display configuration settings in *./appData/scripts/playerDefinitions/pilot.lua*. You can also set other display layouts using the *.lua* files in the *./appData/scripts/playerDefinitions/displayLayouts*.

Testing the Vive Camera

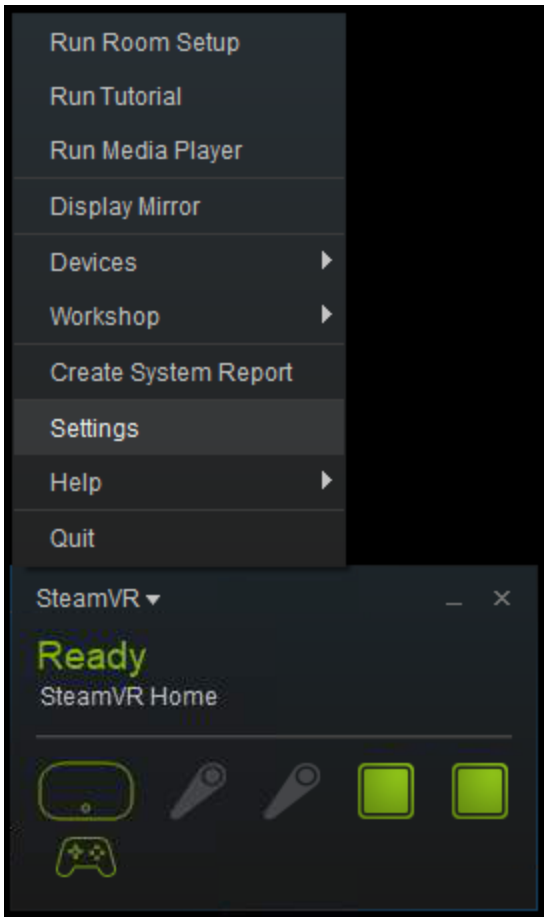
If you are using theVive HMD, you must turn it on before you start VR-Engage. We also recommend that you test the camera every time SteamVR or the computer is restarted, and prior to running VR-Engage. In some cases the camera does not work if

it is not initialized before VR-Engage is started.

➤ **To test the Vive camera:**

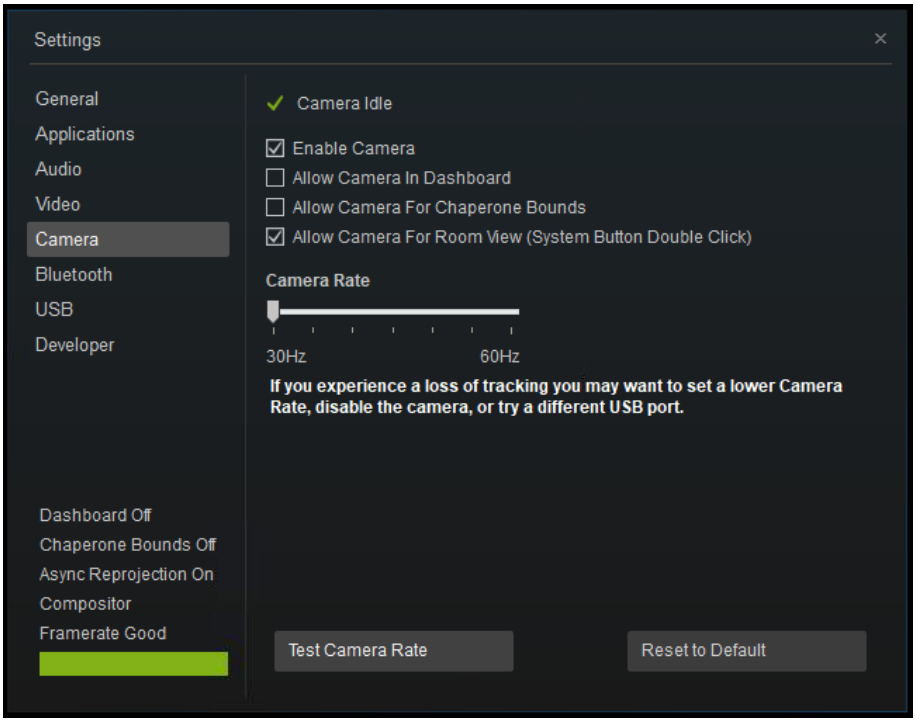
1. Turn on the Vive HMD.
2. Start SteamVR.
3. On the SteamVR menu, choose **Settings** (Figure 20). The Settings dialog box opens.

Figure 20. SteamVR menu



4. Select the Camera page (Figure 21).

Figure 21. Camera page



5. Click Test Camera Rate.
6. Confirm that the camera is working. (Wait until three green check marks appear.) If a red x appears, or if the Test Camera Rate button is not available, verify that the Vive is connected to a USB-3-capable port, and reboot the Vive headset and/or the computer.
7. If the test fails, restart the Vive HMD and SteamVR.

3.9.6 Optimizing Performance with HMDs

Virtual reality headsets require a high frame rate for a comfortable viewing experience. There are many factors that determine frame rate, such as complexity of the scene being rendered, terrain, special effects such as HDR and shadows, and environmental effects such as clouds. You may need to make trade-offs when selecting a terrain database, entity models, and applying certain visual effects at runtime.

For convenience, we have included an overlay installer that makes a number of these trade-offs to optimize performance in VR in the context air entities. The VR-Engage installation includes an installer named MR_VR_FlightSettingsOverlay.exe, located at the top level folder. Please see the associated README_MR_VR_ FlightSettingsOverlay.txt for details on the settings it modifies.

3.10. Creating a Startup Configuration

You can create a startup configuration to automate some aspects of VR-Engage startup. VR-Engage includes a fully commented example startup configuration script called *exampleStartupConfig.lua* in *./appData/scripts*.

You can specify the following startup parameters in a script:

- **mode**. Tells VR-Engage to only **join** a running session, immediately **host** a session, or immediately **start** an unhosted session.
- **scenario**. Optional. If the **mode** is **host**, specifies the scenario to host. If you do not specify a scenario, VR-Engage uses the value for **terrain** or prompts you to specify a terrain.
- **terrain**. Specifies the terrain to load in **start** mode, or in **host** mode if you do not specify a scenario.
- **guiTerrain**. Optional. Specifies the terrain to use for visualization if you want to visualize on a terrain that is different from the simulation terrain.
- **attach**. Specifies an entity to control or attach to as a spectator.
- **entity**. Optional. If **attach** is not specified, this parameter specifies an entity to create.
- **minion**. Causes this instance of VR-Engage to connect to the entity being controlled by another instance of VR-Engage.

To use a startup configuration script, create a shortcut or batch file with the following command:

```
vrEngage version.exe --initSettingsFile startupConfigFile
```

where:

- vrEngage*version*.exe is one of the VR-Engage executables (*VR-EngageAir.exe*, *VR-EngageGround.exe*, *VR-EngageCombined.exe*.)
- *startupConfigFile* is the name of your startup configuration file, including the *.lua* extension. If you use a simple file name, VR-Engage looks for the file in *./appData/scripts*. You can also specify a relative path from the *./bin64* directory or a fully qualified path.

3.10.1 Minion and Boss Configuration

The **minion** startup configuration configures one station to watch the entity engagement status of another station, and automatically engage with that same entity. You would use it in conjunction with other startup options to create a multi-head station, where you have more than one instance of VR-Engage, on one or more machines, to create a full player interface.

The most common use case is for creating aircraft stations, although it applies to other entity types. You would have one or more VR-Engage stations running an out-the-window aircraft HUD display, and another one running the instrument panels.

On a single machine, a single instance of VR-Engage is able to create a separate instrument panel window, so this can be done with only one VR-Engage instance running. For performance reasons, however, you might want to use multiple machines. In that case, you need one instance of VR-Engage on one machine to run the out-of-window view, and a second instance of VR-Engage on another machine to run the instrument panel window. One of these is the Boss, which takes player input

and controls the entity, and the other is the Minion running as Spectator. The function of Minion mode then is to make these two stations behave as one when switching which entity is engaged.



The terms Master and Slave are technically a different context, which is why we use the terms Boss and Minion to differentiate.

3.11. Starting Multiple Simulation Engines

VR-Forces scenarios can be designed to use multiple simulation engines to improve performance. Each simulation engine simulates a subset of the simulation objects in the scenario. (This is called load balancing.) If a scenario is designed to use multiple simulation engines, VR-Engage can automatically start up the required number of simulation engines and benefit from load balancing.

By default, use of multiple simulation engines is disabled and the maximum number of simulation engines to use is set to 1. To enable use of multiple simulation engines, do one of the following:

- Start VR-Engage with the `--enableMultipleBackends` command-line argument.
- In *./appsrc/scripts/playerstation.lua*, uncomment the **enableMultipleBackends** parameter and set it to true.

By default, the maximum number of simulation engines that VR-Engage can start is `number of logical processors/2`. The minimum is always 1. You can change the maximum number of simulation engines to start by uncommenting the **MaxBackends** parameter in *./appsrc/scripts/playerstation.lua* and setting it to your desired value.

If you enable multiple simulation engines but do not have enough licenses for the number of simulation engines that a scenario is configured to use, VR-Engage simulates all entities on one simulation engine.



The VR-Engage_First_Experience scenario is configured to use two simulation engines. The MAK_Suite_Demo_California scenario is configured to use three simulation engines.

If you start one of these scenarios in VR-Forces and do not have the configured number of simulation engines running, VR-Forces will prompt you to remap the entities to the existing simulation engines. For information about load balancing and remapping scenarios, please see *VR-Forces Users Guide*.

You must have a VR-Forces license for each simulation engine you start.

3.12. Command-Line Options

Table 2 lists VR-Engage's command-line options.

VR-Engage also allows you to use startup and player station configuration files to determine some options when the program launches. See "3.10. Creating a Startup Configuration" on page 64 and "3.13. Command-Line Options for Player Stations" on page 76.

Table 2. VR-Engage command-line options

Option	Description
(-- | --ignore_rest)	Ignore all command-line options after this one. This option is useful for disabling part of a command line in a script for test purposes so that you do not have to retype all of the command options at a later point.
--alphaBits *bits*	Sets the number of alpha bits (0, 8).
--antiAliasing *level*	Set the anti-aliasing level (0, 2, 4, 8, or 16). Default: 4. Depending on your graphics card and driver, some combinations of anti-aliasing and bit settings (**--depthBits**, **--stencilBits**, and **--alphaBits**) may be incompatible. For example, if you set stencil bits to 8, the depth must be set to 24 and anti-aliasing may need to be set to 0 or 2.
--appDataDir *directory*	Specifies the location of application data.
--autoReconnectPeriod *period*	Specifies the amount of time, in seconds, to wait before trying to attach to disconnected remote displays.
(-c | --showConsole)	Display a console window.
(-C | --autoConnect) *{filename | connector_name}*	Automatically connect to the network using the specified connector.
--dataDir *directory*	Specifies the location of the data directory (terrains and so on).
--depthBits *bits*	Sets the depth of graphics to 24 bits or 32 bits. Default: 24.
--disableDynamicTerrain	Disables the dynamic terrain engine. May slightly speed up terrain loading and paging.

Table 2. VR-Engage command-line options (continued)

Option	Description
`--disableOcclusionCulling`	Disables occlusion culling. This may improve performance.
`(-z | --disableReverseZBuffer)`	Disables use of reverse Z buffering, which is enabled by default. Leaving reverse Z buffering enabled can reduce Z-fighting when viewing the terrain from a distance. (3D observer modes only.)
`--discoveredModelPreloadFileName` *filename*	Specifies a file to which the list of models discovered during a session that were not preloaded is written.
`--displayEnginePort` *port*	Specifies the display engine port used by a remote display engine. Used only if **--slave** is specified.
`--dispSetting` *filename*	Specifies the display engine configuration to load.
`(-e | --extraArgs)` *string* | "*string1 ... stringn*"	Allows you to send arbitrary strings to the initializer, which can be queried for by plug-ins. This option works around the restriction on adding new command-line arguments. It can take one argument or multiple arguments. Multiple arguments must be wrapped in double quotes.
`(-E | --entTypeMap)` *filename*	Load the specified object type mapping file. The file extension determines the type of mapping.
`--enableMultipleBackends`	Causes VR-Engage to load the number of back-ends required by a scenario up to the maximum number specified in *./appsrc/scripts/playerstation.lua*.
`--enableSensorFX`	Load the SensorFX plug-in.
`--enableVSync`	Turns on VSync.
`--entDispSetting` *filename*	Specifies the entity display setting to load.
`--entityDefsDir` *directory*	Loads the *.hier* and *.leaf* files in the specified directory.

Table 2. VR-Engage command-line options (continued)

Option	Description
`--envSetting` *filename*	Specifies the environment configuration file to load.
`--factoryRootDir` *directory*	Set the root directory used to restore settings to factory defaults.
`--forceTextShaping`	Force all text to use HarfBuzz shaping. Use this option if you need support for right-to-left languages. It may affect performance.
`(-F | --frameRate)--frameRate` *rate*	If rate is 0, the frame rate is variable. Otherwise, specifies a fixed frame rate for rendering.
`--fullScreen`	Start with the window in full screen mode.
`(-G | --locale)` *language*	Specifies the locale (for localization).
`(-h | --help)`	Display command-line usage information.
`--highestPriority`	Changes the priority of the application and the main render thread to the highest available priority. This command may starve other processes.
`--initSettingsFile` *filename*	Name of the initialization settings file to load.
`(-K | --disableKDTrees)`	Disable creation of KD trees for intersections.
`(-l | --logFileName)` *filename*	Specifies the log file name.
`(-L | --loadObservers--loadObserverViews)` *filename*	Loads the saved observers observer view states in the specified file. You can use this command multiple times, for example: **--loadObservers file1 --loadObservers file2--loadObserverViews file1 --loadObserverViews file2**

Table 2. VR-Engage command-line options (continued)

Option	Description
`--mainScreenNum` *num*	Specifies the display that the main window should use. The screen number can be a number from 0 to the number of screens -1. This number matches the screen number used in the Display Engine Configuration Editor for a window.
`--mergeEntityTypeMap {`*directory* | *filename*`}`	Merges all entity type mapping files (**.metx*) in a directory or individual entity type mapping files. Can be used multiple times.
`--mergeHierarchyEntityDef {`*directory* | *filename*`}`	Merges the *.hier* files in the specified directory or the individual *.hier* file into the default hierarchy (usually loaded from *./appData/definitions*.) Merging is additive only. No nodes in a previously loaded hierarchy are replaced. Can be used multiple times.
`--mergeHierarchyTacticalGraphicsDef {`*directory* | *filename*`}`	Merges the specified *.hier* file(s) into the default hierarchy (usually loaded from *./appData/definitions*.) Merging is additive only. No nodes in a previously loaded hierarchy are replaced. Can be used multiple times.
`--mergeHierarchyUnitDef {`*directory* | *filename*`}`	Merges the specified *.hier* file(s) into the default hierarchy (usually loaded from *./appData/definitions*.) Merging is additive only. No nodes in a previously loaded hierarchy are replaced. Can be used multiple times.
`--mergeLeafEntityDef {`*directory* | *filename*`}`	Merges the leaf files in the specified directory or the individual leaf file into the default entity element definitions. Can be used multiple times.

Table 2. VR-Engage command-line options (continued)

Option	Description
`--mergeLeafTacticalGraphicsDef {`*`directory`* `|` *`filename`*`}`	Merges the leaf files in the specified directory or the individual leaf file into the default tactical graphics element definitions. Can be used multiple times.
`--mergeLeafUnitDef {`*`directory`* `|` *`filename`*`}`	Merges the leaf files in the directory or the specified individual leaf file into the default unit element definitions. Can be used multiple times.
`--mergeModelDefs {`*`directory`* `|` *`filename`*`}`	Merges all model definition files (*.*ommx*) in the specified directory or individual model definition files. Can be used multiple times.
`--mergeTacticalGraphicsTypeMap {`*`directory`* `|` *`filename`*`}`	Merges all tactical graphics type mapping files (*.*mtgx*) in a directory or individual tactical graphics type mapping files. Can be used multiple times.
`--mergeUnitTypeMap {`*`directory`* `|` *`filename`*`}`	Merges all unit type mapping files (*.*magx*) in a directory or individual unit type mapping files. Can be used multiple times.
`--modelPreloadFileName` *`filename`*	Specifies a file that has a list of models to preload.
`(-n | --notifyLevel)` *`notify_level`*	Specifies the notification level for application messages, where *`notify_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”.
`--noAppDataEntityDefs`	Do not load the entity element definitions in *./appData/definitions*.
`--noAppDataEntityTypeMap`	Do not load entity type mappings in *./appData/definitions*.
`--noAppDataModelDefs`	Do not load model definitions in *./appData/definitions*.

Table 2. VR-Engage command-line options (continued)

Option	Description
`--noAppDataTacticalGraphicsDefs`	Do not load the tactical graphics element definitions in *./appData/definitions*.
`--noAppDataTacticalGraphicsTypeMap`	Do not load tactical graphics type mappings in *./appData/definitions*.
`--noAppDataUnitDefs`	Do not load the unit element definitions in *./appData/definitions*.
`--noAppDataUnitTypeMap`	Do not load unit type mappings in *./appData/definitions*.
`(-O | --hasNTPSync)`	Enables synchronized ocean between different VR-Vantage applications, such as VR-Vantage Stealth and the VR-Forces front-end. System clocks must be synchronized.
`--plugin` *filename*	Load the specified plug-in. Can be used multiple times.
`--pseudoFullScreen`	Use pseudo full screen for full screen mode. This may improve performance when using dynamic ocean.
`(-s |--slave)`	Run as a remote display engine.
`--stationName`	Station name of application as seen by the VR-Engage manager.
`--stencilBits` *bits*	Sets the number of stencil bits (0 or 8). Default: 0.
`--tcpSendTimeout`	Sets the timeout (in seconds) for the master display engine to wait for a remote display engine before giving up on a send. Default: 30 seconds.
(*terrain_MTF_file* | *scene_MSF_file*) *terrain_MTF_file*	Specifies a terrain (MTF) or scene (MSF) file to load. The path must be a relative path (from *./bin64*) to the file, for example, *../userData/terrains/MTF_file*.
`--unplug` *filename*	Do not load the specified plug-in. Can be used multiple times.
`--userDataDir` *directory*	Specifies the :user data directory.

Table 2. VR-Engage command-line options (continued)

Option	Description
(-v | --version)	Display version information and exit.
Windows syntax: -W | --withDisplayEngine *port@netAddress;displayConfigFilename1 .... n* Linux syntax: -W | --withDisplayEngine *port@netAddress:displayConfigFilename1 .... n*	Connect to a display engine running on another computer. For more information, please see *Loading Multiple Display Engine Configurations from the Command Line* under *"Loading a Display Engine Configuration,"* in *VR-Vantage Users Guide*.
(-Z | --ignoreZoomForSpeedtreeLod)	Disable zoom for SpeedTree LOD.
HLA Only	These options are available if you specify --hla13, --hla1516, or --hla1516e.
(-a | --appNumber) *number*	Application number.
(-f | --fomMapperLib) *libname*	FOM Mapper library name.
(-F | --fedFileName) *fedfile_name*	FED file name.
--fileTransporterReceivePort *port*	Port for the file transporter. This is the port used to receive order of battle and plan files.
--fomMapperInitData *data*	FOM Mapper initialization data.
--fomModules *module*	Specifies an HLA Evolved FOM module. Can be used multiple times.
(-H | --hostAddressString) *address*	Specifies the host address. This is usually the same as the device address.
(-i | --sessionId) *ID*	Specifies the session ID for this instance of the front-end.
--ignoreAdvisories	Enables or disables HLA advisory messages. Default: true.
--localSettingsDesignator *designator*	Specifies a string that is passed to the RTI during federate connect when using HLA Evolved. It is usually used to provide additional RTI configuration, but every RTI uses it differently. Please consult your RTI documentation for proper usage.

Table 2. VR-Engage command-line options (continued)

Option	Description
(-N | --federateName) *federate_name*	Specifies a unique name that can be assigned to the federate. No two federates within the same federation can have the same name. If no name is specified, the RTI will automatically assign a unique name for the federate. Default: VR-Forces. (HLA Evolved only)
(-p | --federateType) *type*	Federate Type can be used to distinguish different categories of federates, and its only practical use is in save-and-restore.
--fileTransporterReceivePort *port*	Port for the file transporter. This is the port used to receive order of battle and plan files.
--reportedHostAddressString *address*	Specifies how VR-Forces reports its IP address to another VR-Forces application for the purpose of file transfers. It is only important when you have a GUI or remote controller on one side of a router and a simulation engine on the other, and there is some kind of network address translation occurring whereby they have to connect to one another using an IP address other than the one they recognize themselves at locally.
--rprFomRevision *revision_number*	RPR FOM revision for RPR FOM 2.0, draft 17.
--rprFomVersion *version_number*	RPR FOM version. (0.5, 0.7, 0.8, 1.0, 2.0006, 2.0014, 2.0017, or 2.0)
(-s | --siteId *ID*)	Site ID.
--useAbsoluteTimeStamps	Enables use of absolute time stamps. Otherwise uses relative time stamps.

Table 2. VR-Engage command-line options (continued)

Option	Description
! If you select **--useAbsoluteTimeStamps**, it is your responsibility to ensure that the time clocks of exercise participants are synchronized. If they are not synchronized,VR-Engage may not work properly.	
`--useGeographicDdm`	Specifies use of geographic DDM if you are using the MAK RTI. Default: false.
`(-x | --execName)` *`exec_name`*	Execution name. Default: MAK-RPR-2.0.
DIS Only	These options are available if you specify --dis.
`(-a | --appNumber)` *`number`*	Application number.
`(-A | --destAddrString)` *`address`*	Destination address.
`--appIdRange` *`range`*	The application ID range for VR-Forces back-ends.
`--defaultObjectTimeout` *`timeout`*	Specifies the timeout interval for objects.
`--deviceAddress` *`address`*	Specifies the address of the network card to use for UDP traffic.
`--disVersion`	The DIS version. Default: 7.
`--fileTransporterReceivePort` *`port`*	Port for the file transporter. This is the port used to receive order of battle and plan files.
`(-H | --hostAddressString)` *`address`*	Specifies the host address. This is usually the same as the device address.
`(-i | --sessionId)` *`ID`*	Specifies the session ID for this instance of the front-end.
`--mcastTtl` *`time`*	Specifies the multicast time-to-live. Default: -1.
`--multicastAddresses` *`address1 ... addressn`*	Specifies one or more multicast addresses.
`(-P | --disPort)` *`port`*	DIS port.
`--recvBufferSize` *`size`*	Receive buffer size.

Table 2. VR-Engage command-line options (continued)

Option	Description
`--reportedHostAddressString` *address*	Specifies how VR-Forces reports its IP address to another VR-Forces application for the purpose of file transfers. It is only important when you have a GUI or remote controller on one side of a router and a simulation engine on the other, and there is some kind of network address translation occurring whereby they have to connect to one another using an IP address other than the one they recognize themselves at locally.
`--useAbsoluteTimeStamps`	Enables use of absolute time stamps. Otherwise uses relative time stamps.



If you select **--useAbsoluteTimeStamps**, it is your responsibility to ensure that the time clocks of exercise participants are synchronized. If they are not synchronized,VR-Engage may not work properly.

(`-s` | `--siteId` *ID*)	Site ID.
`--sendBufferSize` *size*	Send buffer size. Default: -1.
`--subnetMask` *mask*	Specifies a subnet mask.
`--useAsyncIO`	Use asynchronous I/O. Default: False.
`--useIpv6`	Use the IPV6 protocol, if available.
(`-x` | `--exerciseId`) *ID*	Exercise ID.

3.13. Command-Line Options for Player Stations

You can specify additional command-line options by editing *./appData/scripts/playerStation.lua* and adding command-line options to **additionalBackendCommandLineParameters**. For example:

```
additionalBackendCommandLineParameters = --outputLogFile my-log-file
--startInRunMode --userDataDir my-data-directory
```

Please note:

- The connection settings in the VR-Engage GUI's current connection options. A warning displays in the GUI console and in *vrEngage.log* for each ignored parameter, and what the replacement is.

- If you supply a DIS-specific command to HLA, or vice versa, the application will not start correctly.

3.14. Managing Plug-ins

One way to extend the functionality of VR-Engage is by loading plug-ins that have been written for it by MAK or other software vendors. You can manage which plug-ins get loaded when VR-Engage starts up. You can also view information about the plug-ins that have been loaded. This is primarily used for back-end plug-ins.

Plug-ins are implemented as one or more dynamic linked libraries (DLL or SO files). The DLLs can be release or debug, for vrfSim or vrfGui, for Windows or Linux, and for a specific protocol or protocol-independent. Each association of an application, platform, build type, and transport type is called a configuration. The Plug-ins Editor lets you specify the DLLs to use for each of the desired configurations.

Changes to plug-in configurations do not take effect until the next time you start the affected VR-Engage application.

3.14.1 Loading Plug-ins

You can specify which plug-ins to load in either of the following ways: using the Plug-ins dialog box. Those plug-ins load the next time VR-Engage starts.

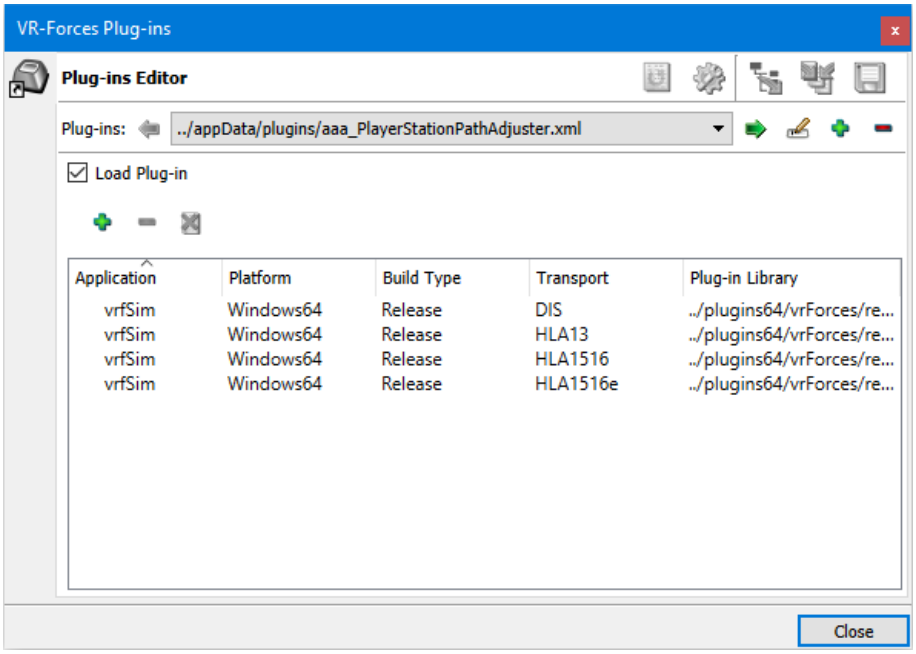
Specifying the Plug-ins to Load in the Plug-ins Dialog Box

The Plug-ins dialog box lets you specify the plug-ins that will be loaded the next time that you start VR-Engage.

➤ **To specify that a plug-in be loaded or not loaded in the Plug-ins dialog box:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens.
2. Select the Plug-ins Editor page (Figure 22).

Figure 22. Plug-ins dialog box, Plug-ins Editor page



3. In the list of plug-ins at the top of the page, select the one that you want to edit. The configurations for that plug-in are listed in the window.
4. Select or clear the Load Plug-in check box.

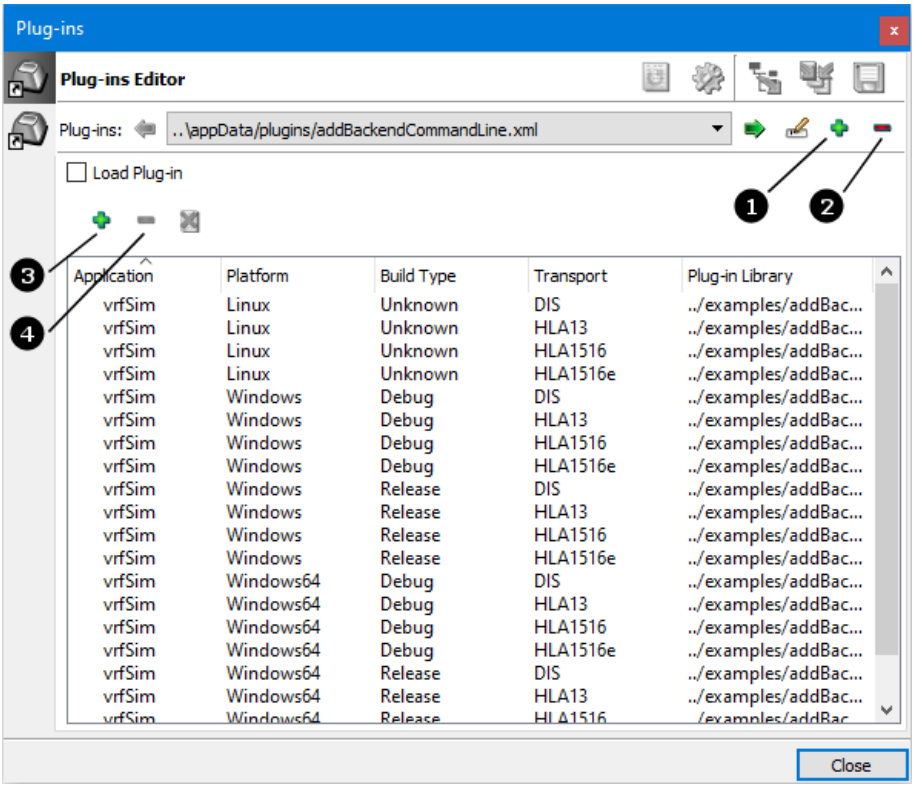
3.14.2 Adding a Plug-in

When you add a plug-in, VR-Engage creates an XML file (in *./appData/plugins*) that contains all of the information VR-Engage needs to load the plug-in. New plug-ins are added with entries for each of the configurations (application, platform, build type, transport). After you add a plug-in, you must specify the DLLs for each configuration that you want to support.

➤ **To add a plug-in:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 above).
2. Select the Plug-ins Editor page.
3. Click the Add button (+) at the upper right corner of the page (#1 in Figure 23). The New Plug-in dialog box opens.
4. Type a name for the plug-in.
5. Click OK. The plug-in is added to the Plug-ins list. It has configurations for each of the combinations of application, platform, build type, and transport (Figure 23).

Figure 23. New plug-in



6. Specify the DLL for each configuration that you want to support, as described in "3.14.3 Specifying the DLLs for a Plug-in" below.

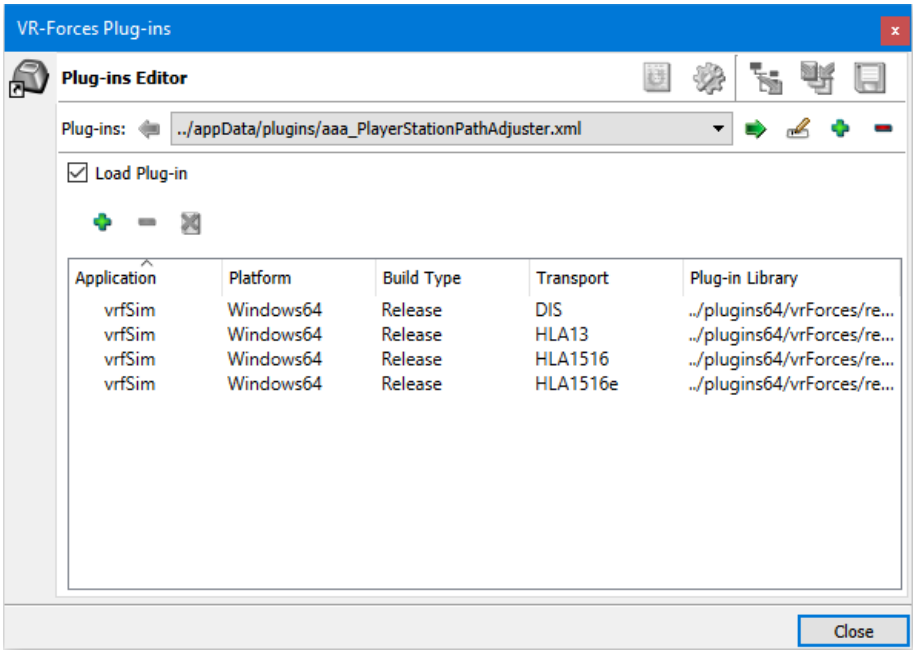
3.14.3 Specifying the DLLs for a Plug-in

Each plug-in configuration that you want to be able to load must specify the DLL to load for that configuration.

➤ **To specify the DLL for a plug-in configuration:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 on the previous page).
2. Select the Plug-ins Editor page (Figure 24).

Figure 24. Plug-ins Editor



3. In the list of plug-ins at the top of the page, select the one that you want to edit.
4. Click the Plug-in Library column for the configuration that you want to edit. The Select Plugin dialog box opens.
5. Select the DLL that you want to load for this configuration.
6. Click Open. The value is changed.

Removing a Plug-in's DLL

You can remove the DLL assignment for a plug-in configuration without removing the configuration.

➤ **To remove the DLL assignment for a plug-in:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 on page 78).
2. Select the Plug-ins Editor page.
3. Select the configuration whose DLL assignment you want to remove.
4. Click the Erase button ( ).

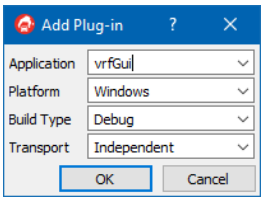
3.14.4 Adding a Plug-in Configuration

➤ **To add a plug-in configuration:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 on page 78).
2. Select the Plug-ins Editor page.
3. In the list of plug-ins at the top of the page, select the one that you want to edit.

4. Click the Add button (+) above the list of configurations (#3 in Figure 23 on page 79). The Add Plug-in dialog box opens (Figure 25).

Figure 25. Add Plug-in dialog box



5. For each parameter (Application, Platform, Build Type, and Transport), select a value from the list.
6. Click OK. The configuration is added to the list.
7. Specify a DLL for the configuration, as described in "3.14.3 Specifying the DLLs for a Plug-in" on page 79.

3.14.5 Deleting a Plug-in Configuration

➤ **To delete a plug-in configuration:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 on page 78).
2. Select the Plug-ins Editor page.
3. In the list of plug-ins at the top of the page, select the one that you want to edit.
4. Select the configuration that you want to delete.
5. Click the Delete button (−) that is above the list of configurations (#4 in Figure 23 on page 79).

3.14.6 Deleting a Plug-in

When you delete a plug-in, you delete the XML configuration file in *./appData/plugins* that specifies the plug-in configurations and whether or not to load it.

➤ **To delete a plug-in:**

1. Choose **Settings > Plug-ins**. The Plug-ins dialog box opens (Figure 22 on page 78).
2. Select the Plug-ins Editor page.
3. In the list of plug-ins at the top of the page, select the one that you want to delete.
4. Click the Delete button (−) to the right of the plug-ins list (#2 in Figure 23 on page 79).



4. Common Player and Entity Features

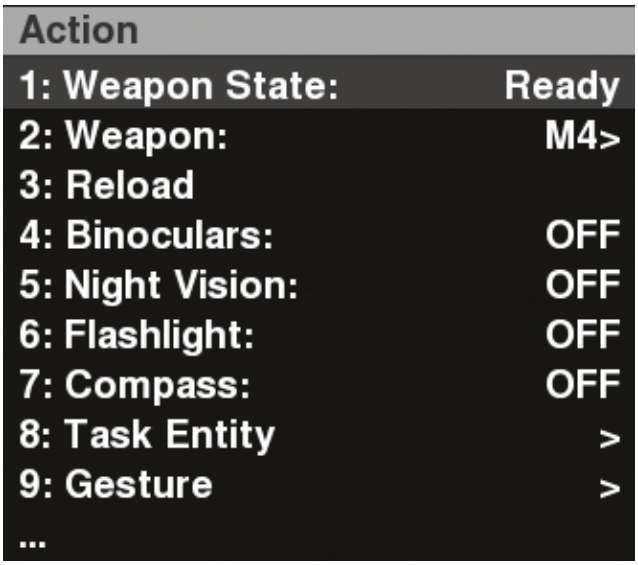
This chapter describes actions that are common to all types of entities in a scenario.

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4.1. The Action Menu

The Action menu lets you turn several features on and off (toggles) and lets you assign tasks to other entities if you are hosting a VR-Forces scenario or connected to a VR-Forces session. The Action menu is context-sensitive.

Figure 26. Action menu for desktop



➤ **To open the Action menu, do either of the following:**

- Press ~.
- Press the menu button on your game controller or head-mounted display (HMD) controller (the Back button on the Logitech Gamepad F310).

The Oculus Rift, HTC Vive, and Varjo HMDs configure the Action menu differently. If the Action menu is displayed upside down, you must change the configuration. For details, please see "3.9.4 Configuration Options for Virtual Reality" on page 61.

4.1.1 Selecting Options on the Action Menu

You can choose options on the Action menu using the keyboard (arrow keys or number keys), the D-pad on a Gamepad or HMD controller, or your mouse.

➤ **To choose an option on the Action menu using the arrow keys or D-pad:**

1. Press the **Up Arrow** and **Down Arrow** keys on your keyboard or the up and down buttons on a Gamepad's D-pad to highlight an option.
2. Press the **Right Arrow** key or the right button on the D-pad to toggle the option on or off or to display a submenu.

When you choose an option with the mouse, if it is a toggle, the state changes immediately. If it displays a submenu, the menu changes immediately. If it is a task, the entity executes that task immediately. Therefore, if a task requires input, such as a location, do not use the mouse to choose it. Use the arrow keys.

➤ To choose an option on the Action menu using a mouse, click the menu option.

Each option on the Action menu has a number. When you choose an option with a number key, if it is a toggle, the state changes immediately. If it displays a submenu, the menu changes immediately. If it is a task, the entity executes that task immediately. Therefore, if a task requires input, such as a location, do not use a number key to choose it. Use the arrow keys.

Numbers are reassigned dynamically if you scroll the Action menu or menu commands are removed due to some change in the state of the character. Therefore, you cannot assume that a particular number always controls the same command.

➤ To choose an option on the Action menu using a number key, press the number associated with the menu option.

4.2. Using the Radio

VR-Engage supports voice communications over radios and intercoms. You can communicate with anyone using the radio application that is in the same exercise. There are 2 radios, each of which has 2 channels. (The radios are configurable. For details, please see "4.2.4 Configuring the MAK Radio" on page 88.) Two applications can communicate only when the radios are tuned to the same frequency and that frequency is not being jammed

Ground vehicles have an intercom, which has one channel. The intercom allows the crew to communicate among themselves. For information about the intercom, please see "4.2.3 Using the Intercom or a VOX Radio" on page 88.

Audio data from the radio system is sent as signal interactions/PDUs on the simulation network. It can be received in other applications that can receive standard signal interactions/PDUs.

Radio communications are perfect. Radio signals are not affected by terrain, weather, distance, or other factors. However, you can use the VR-Forces radio panel or the standalone radio application included with VR-Engage to jam radios. For more information about jamming, see "4.2.6 Jamming Radios" on page 93.

The radio uses the audio devices configured in the Audio Settings dialog box for capture and playback. See"4.6.2 Configuring Sound Effects" on page 95 .

➤ **To use the radio:**

1. Open the Action menu.
2. Choose **Radio** to toggle it to one of the available radios, for example, Radio 1, Radio 2, or Intercom (if one is configured).

3. When you select a radio, the channel and frequency displays. You can toggle that setting to anther channel.
4. To talk, hold down the **T** key or, if you are controlling a human character, press the B button on the Gamepad. To hear others, release the key or button.

You cannot hear other people talking while you are pressing the talk key.

4.2.1 Using MAK Radio in VR-Forces

The MAK Radio feature in VR-Forces allows VR-Forces users to use the radio to talk to VR-Engage players or anyone running the radio application.

To learn more about using the MAK Radio in VR-Forces, please refer to *VR-Forces Users Guide* or online help.

4.2.2 Using the Standalone Radio Application

VR-Engage includes a standalone radio application. It lets you communicate with VR-Engage players without running VR-Engage. The application has different versions for the protocols supported by VR-Engage.

The default key for Push to Talk is **T**, but you can specify other keys in the Audio Settings. See "4.2.5 Audio Settings" on page 92.

➤ **To use the VR-Engage standalone radio:**

1. In a console window or File Explorer, change to *./bin64*.
2. Run the executable for the protocol you are using, as follows:

   DIS:

   `makRadioAppDIS.exe`

   HLA Evolved:

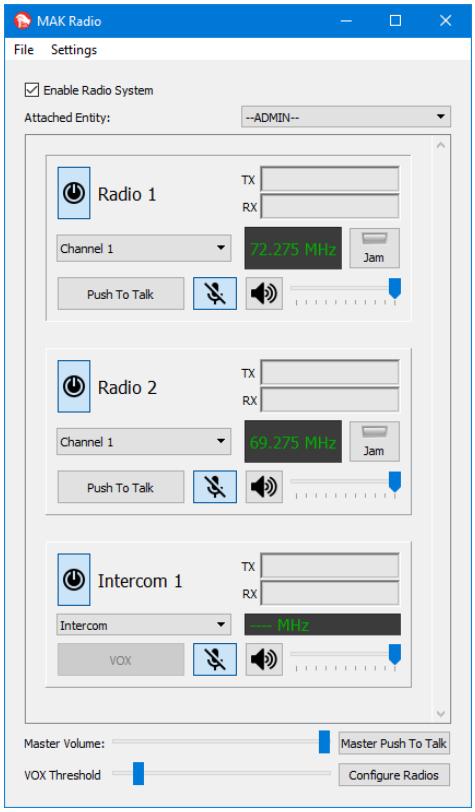
   `makRadioAppHLA1516e.exe`

   HLA13:

   `makRadioAppHLA13.exe`

   MAK Radio opens (Figure 27).

Figure 27. MAK Radio



3. Optionally, adjust the Master Volume slider to adjust the volume of all radios.
4. Optionally, adjust the VOX Threshold slider to adjust the level of sound needed to enable voice activated transmission. (This is usually used for intercoms, not radios.)
5. Optionally, click Master Push to Talk to transmit on all radios that are not muted.
6. Operate a radio head as follows:

    a. Make sure the radio head power button is enabled ().

    b. Optionally, select a channel from the list.

    c. Click Push to Talk or press **T** (or other key) to talk (if this is not a Vox radio).

    d. Click the microphone button () to mute the microphone or enable it.

e. Click the speaker button () to mute the speaker or enable it.

f. Adjust the slider to change the radio's volume.

g. Click the Jam button (

) to jam the radio frequency.

7. Click Configure Radios to edit the radio configuration. Please see "4.2.4 Configuring the MAK Radio" below for details.

8. Optionally, choose **Settings > Audio Settings** to select the Playback Device (speaker) and Recording Device (microphone).

4.2.3 Using the Intercom or a VOX Radio

The intercom and VOX radios are voice activated and transmit any sound greater than the VOX threshold.

➤ **To use the intercom or a Vox radio:**

1. In the MAK Radio Application, select the Attached Entity.

   In the dialog box or application, make sure the power button is enabled ().

2. In the toolbar, select the intercom or the VOX radio from the list. The PTT button is disabled.

3. Make sure that the microphone is not muted.

4. If you are using a Vox radio, you can select a channel.

5. Start talking.

4.2.4 Configuring the MAK Radio

You can configure the number of radios and channels, the channel frequencies, the sample rate, and the format. The Modulation and Crypto settings for radios are as defined for the Transmitter PDU in the IEEE DIS standard, IEEE Std 1278.1-2012.

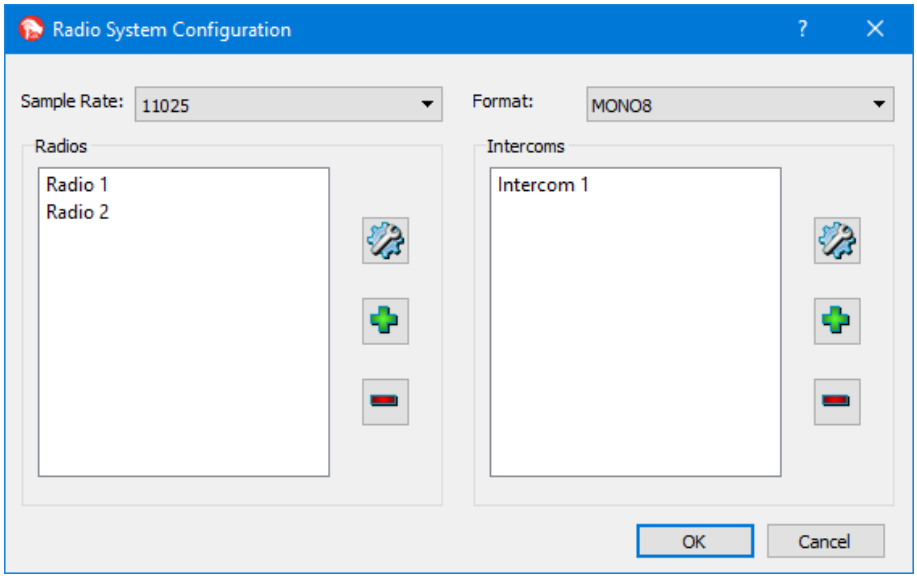
If there is a mismatch between two or more radios in the Transmission, Modulation, and Crypto settings, they cannot talk to each other. The settings must match between communicating radios for the signals to be processed and the transmissions to be heard.

Changes that you make persist from one session of VR-Engage and MAK Radio to another, and the settings are the same for both.

➤ **To configure the MAK Radios:**

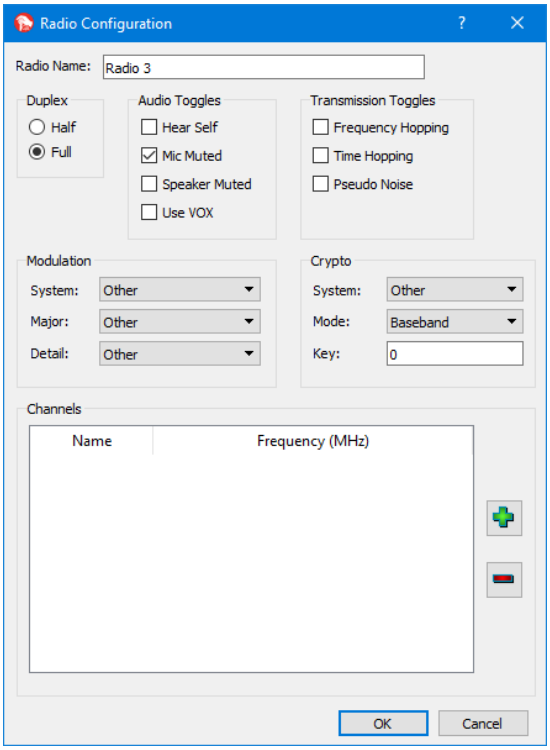
1. In the MAK Radio application, click Configure Radios. The Radio System Configuration dialog box opens (Figure 28).

Figure 28. Radio System Configuration



2. To change the sample rate for all radios, select the rate from the list.
3. To change the format for all radios, select the format from the list.
4. To add or edit a radio:
    a. Click the Add Radio ( ) or Edit button ( ) next to the list of radios. The Radio Configuration dialog box opens.
    b. Configure the radio as needed. Table 3 describes the settings.

Figure 29. Radio Configuration



c. Click OK.

5. To add or edit an intercom:

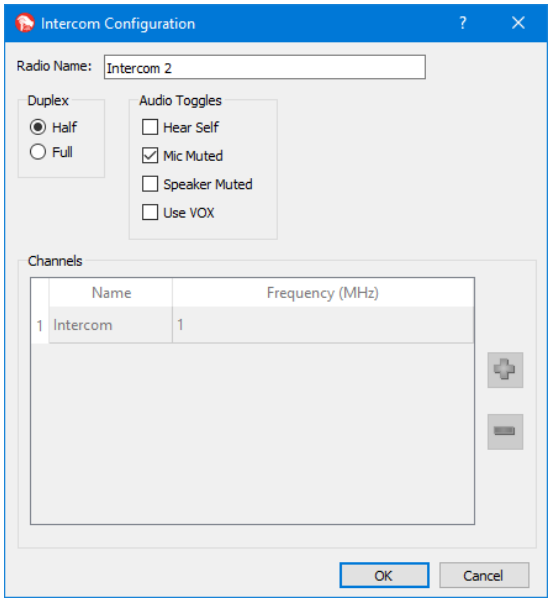
   a. Click the Add Intercom () or Edit button () next to the intercom list. A row is added.

   b. To edit a new or existing intercom, select the row and then click the Edit button next to the intercom list. The Intercom Configuration dialog box opens.

   c. If desired, edit the name of the intercom.

   d. Configure the intercom as needed. Table 3 provides information about the settings. Note that only Duplex and Audio Toggles settings are available for intercoms.

Figure 30. Intercom Configuration



e. Click OK.

6. When you are finished, click OK in the Radio System Configuration dialog box. You return to the Radio Communications dialog box. If you added or removed a radio or intercom, the list updates.

Table 3. Radio and Intercom settings

Setting	Options
Duplex	Radios and Intercoms — Half. Only one user can talk at a time. — Full. All users can speak simultaneously.
Audio Toggles	Radios and Intercoms — Hear Self. Users can hear themselves over the speaker. — Mic Muted. Microphone defaults to muted. — Speaker Muted. Speaker defaults to muted. — Use Vox. Radio is voice-activated.

Table 3. Radio and Intercom settings (continued)

Setting	Options
Transmission Toggles	Radios only — Frequency Hopping. Switches frequencies during transmission to reduce interference and avoid interception. — Time Hopping. Varies the period and duty cycle to achieve anti-jamming or low probability of intercept. — Pseudo Noise. Introduces a deterministically generated random sequence of bits.
Modulation	Radios only — System. Radio system type: Generic, SINGCGARS, and so on. — Major. Modulation type: Amplitude, Pulse, and so on. — Detail. Additional information about the modulation type (options based on the Major setting).
Crypto	Radios only — System. Cryptographic system for the radio: VINSON, KY-100, and so on. — Mode. Crypto mode: Baseband, Diphase, and so on. — Key. A simulated cryptographic key. This key is a non-zero integer value for simulating secured communication. Set to 0 when simulating plain communications.
Channels	Radios only — Use the Add or Delete buttons to manage the radio's channels. — In the rows, double-click to edit each channel's name and frequency as needed.

4.2.5 Audio Settings

In the MAK Radio standalone application, you can access the Audio Settings. These settings allow you to specify the Playback Device (speaker), Recording Device (microphone), and one or more push-to-talk buttons.

The options are saved in *./appData/settings/makRadio/radioAudioSettings.csv*. You can copy the CSV file to other workstations that should have the same settings.

➤ To choose a Playback Device or Recording Device, choose the speaker or microphone from the appropriate list.

➤ **To set the default push-to-talk key:**

1. In the MAK Radio standalone application, choose **Settings > Audio Settings**. The Audio Settings dialog box opens.
2. Click on the Push To Talk Keys box to give it focus.
3. Press the desired key. If you want to use more than one key, continue pressing keys.
4. Click OK.

4.2.6 Jamming Radios

The MAK Radio Application allows you to jam radio frequencies. When you click the Jam button on a radio head, it creates another radio that jams the frequency of the currently selected channel. The users will not be able to hear the radio communications, and will not see an indication that their radio is jammed.

➤ To jam a radio frequency, click the Jam button (

).

4.3. Changing the View Mode

By default, when you assume a role, you are in first person mode. That is, the eyepoint is placed as if you were looking out of the eyes of a human character or from the appropriate position of a character in a vehicle, such as the driver or pilot. You can switch to third person mode so that you can see the character you are playing in its context in the terrain.

If you are driving a vehicle, you may have several views of the vehicle from different angles available.

➤ **To change the view mode, do one of the following:**

- For human characters and aircraft, press **V**.
- For ground vehicles, press the Y button on the Gamepad.

4.4. Resetting Entities

You can reset entities. When you reset an entity, it returns to full health and restores all resources, such as ammunition or fuel. There are two types of reset, as follows:

- Reset. Restores the entity and returns it to the location it had when you took control. If you are controlling a human entity that disembarked from a vehicle role, it resets to the location at which it disembarked.
- Reset in Place. Restore the entity at its current location.

When you reset an entity to the location it had when you took control, none of the other entities in the scenario get reset, so the location might no longer make sense in the context of the overall scenario.

➤ **To reset an entity, do one of the following:**

- Open the Action menu and choose **Reset** or **Reset in Place**. This applies to humans, ground vehicles, and aircraft.
- For humans only, on the keyboard, press **F5** (Reset) or **Ctrl**+**F5** (Reset in Place).

4.5. Starting VR-Forces Events

VR-Forces scenarios can include scenario events, which can consist of text, audio, video, graphics, or some combination of these. A scenario event represents an incident or condition that exercise participants can respond to, for example a political event, a natural disaster, or some other novel event that might require a participant to respond. Events can also be used to satisfy the conditions in a trigger.

If you are controlling a character in a VR-Forces scenario and the scenario has scenario events, you can trigger them. The scenario events are displayed in the VR-Forces front-end. They are not displayed in the VR-Engage window. If VR-Engage is hosting a scenario (and there are no VR-Forces front-ends in the exercise), the events are listed on the Action menu, but triggering them may have no visible effect.

The Action menu lists all of the events that have been created for the scenario, but does not indicate their status. A VR-Engage character can only start an event. If an event is active, you cannot stop it from VR-Engage.

➤ **To start a scenario event:**

1. Open the Action menu.
2. Choose **Trigger Event**.
3. Choose the event you want to trigger.

4.6. Introduction to Sound Effects

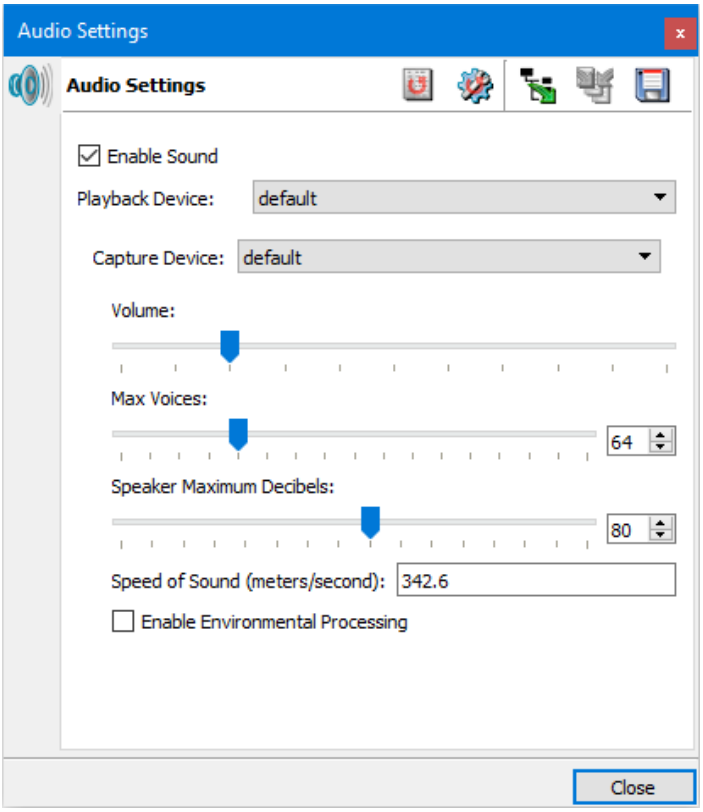
VR-Engage can associate sound effects with entities, fire events, and detonation events. You can enable and disable use of sound effects and you can specify that the player will hear sounds only when their character is within a certain distance of the entity or event that generates them.

4.6.1 Enabling Sound Effects

➤ **To enable sound effects:**

1. Choose **Settings > Audio Settings.** The Audio Settings dialog box opens (Figure 31).

Figure 31. Audio Settings page



2. Select the Enable Sound check box.
3. Optionally, specify the playback device (speaker) and capture device (microphone).

4.6.2 Configuring Sound Effects

You can configure the following sound settings:

- Volume. This is the volume of the system.
- Max Voices. You can have from 1 to 256 voices, or maximum simultaneous playing sounds. Sounds that play at the same time are mixed into a single sound wave prior to being sent to the speaker. This mixing has a CPU cost. A high number of allowable voices can affect performance when there are many audio sounds trying to play.
- Speaker Maximum Decibels. Calibrates the audio system for the speakers that the system is played on. This affects how sounds at a distance fall off so that the sound loudness is realistically replicated. The default setting of 80db represents

headphones or a desktop PC's speakers.

- Speed of Sound. This is the speed of sound in the atmosphere in meters/second. The default value is derived by using a standard day as parameters (20 C, 50% relative humidity, 1013.25 mbar/29.92 inHg). This affects the delay in playing sounds at a distance. For example, an explosion 2km away has a several second delay from the time you can see the visual effect to when you can hear the audio effect.
- Enable Environmental Processing. Enables low pass filtering. As sound propagates through air, higher frequency sounds get absorbed more the further you move from the source of the sound. This setting lets you replicate air absorption of a sound based on the distance the sound is from the listener.

➤ **To configure sound settings:**

1. Choose **Settings > Audio Settings**. The Audio Settings dialog box opens (Figure 31 on the previous page).
2. To set the volume, adjust the Volume slider.
3. To specify the maximum number of voices, adjust the Max Voices slider or change the value in the text box.
4. To set the speaker maximum decibels, adjust the Speaker Maximum Decibels slider or change the value in the text box.
5. To set the speed of sound, type a value in the Speed of Sound box.
6. To enable lowpass filtering, select the Enable Environmental Processing check box.

4.6.3 Associating Sound Files with Entities and Events

VR-Engage includes a set of sound files (WAV format) for generic entity platforms and for fire and detonation events. The files are in *./data/Audio/Sounds*. You add and edit mappings between entity types, fire events, or detonation events and sound files in the Visual Models Editor. Sound files are associated with model definitions. For example, the **filename** parameter for the heli_blades model definition specifies *$(DATA_DIR)/Audio/Sounds/heli_blades.wav*. The Rotary Wing element definition has a parameter called **Entity Sound**. The value for the **model definition** attribute is **heli_blades**.

You can quickly see which model definitions are available for sounds by filtering the list of the Visual Model Editors, Model Definitions Editor page for the Sound schema.



5. Controlling People

This chapter describes how to control human characters and interact with the environment and other characters.

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5.1. Introduction

VR-Engage and VR-Engage Ground let you control individual human characters. VR-Engage includes models for several types of dismounted infantry and civilian characters, including:

- Dismounted infantry
- Dismounted infantry with lasing capability
- Dismounted infantry with missile launchers
- Paratroopers
- Police officers

5.1.1 Enabling and Disabling Mouse Control

When mouse control is enabled, you can use the mouse to turn a character, fire, and other actions. When it is disabled, you can access menus (in windowed mode) and do other typical mouse actions.

When you take control of a character, mouse control is automatically enabled. When you switch to windowed mode, it is automatically disabled. You can toggle mouse control on and off at any time in both full-screen mode and windowed mode.

➤ To enable or disable mouse control, press **Ctrl**. You can also enable mouse control by double-clicking in the screen.

5.2. Basic Movements

As a player, you can move your character around and perform gestures.

5.2.1 Moving Your Character Around the Terrain

You can move your character around the terrain using the keyboard, game controller, or head-mounted display (HMD) controller. You can look around using the keyboard, game controller, HMD controller, or mouse. You can increase and decrease the speed at which you move.

5.2.2 Changing Your Character's Posture

You can change your character's posture. The default is to be standing upright, but you can also crouch or lie prone. Crouching helps you move into spaces with a low clearance or hide behind obstacles. Lying prone makes you less of a target for enemies and improves your accuracy when aiming a weapon.

An icon indicates your character's posture.

➤ **To change your character's posture:**

- Press **E** to move down to a crouching or prone position.
- Press **Q** to move up to a crouching or standing position.
- Press **Z** to lay prone from any position.
- Press **C** to stand from any position.
- Press the Y button on the Gamepad to cycle between standing, crouching, and lying prone.

5.2.3 Looking Around

You can look around by turning only your character's head, instead of turning the entire body. While you are looking, you cannot fire a weapon.

➤ **To look without moving your body:**

1. Press **.** (period).
2. Use the mouse, the arrow keys, or the right thumbstick to look around you.

5.2.4 Gesturing and Signaling

Your character can perform a gesture or signal, such as pointing or surrendering. Some signals have military meanings, which are only available to military characters.

➤ **To make a gesture:**

1. Open the Action menu.
2. On the Action menu, choose **Gesture**.
3. Use an Action menu control to show the submenu. The Gesture menu opens.
4. Choose a gesture.

Your character performs the gesture. People looking at your character will see the gesture. (If you are in the first-person view, you will not see yourself performing the gesture.)

5.2.5 Climbing Ladders

If there are ladders in the terrain, you can climb them.

➤ **To climb a ladder:**

1. Move your character to the base or top of the ladder. When your character mounts the ladder, the ladder fills the view.
2. Climb up or down the ladder:
   - To climb up the ladder, move forward.
   - To climb down the ladder, move backward.

5.3. Navigation

While playing a human character, you can use the compass and the minimap to help you navigate the terrain.

5.3.1 Using the Compass

The compass at the top allows you to see which direction your character is facing.

The compass is horizontal and shows the direction where your character is looking. This uses either true or magnetic north, based on the Heading specified in the Display Units Settings; see Section 36.6, *"Specifying Display Units,"* in the *VR-Vantage Users Guide*.



➤ **To enable or disable the compass:**

1. Open the Action menu (Figure 26 on page 84).
2. On the Action menu, choose **Compass**.
3. Use an Action menu control method to toggle the compass on or off.

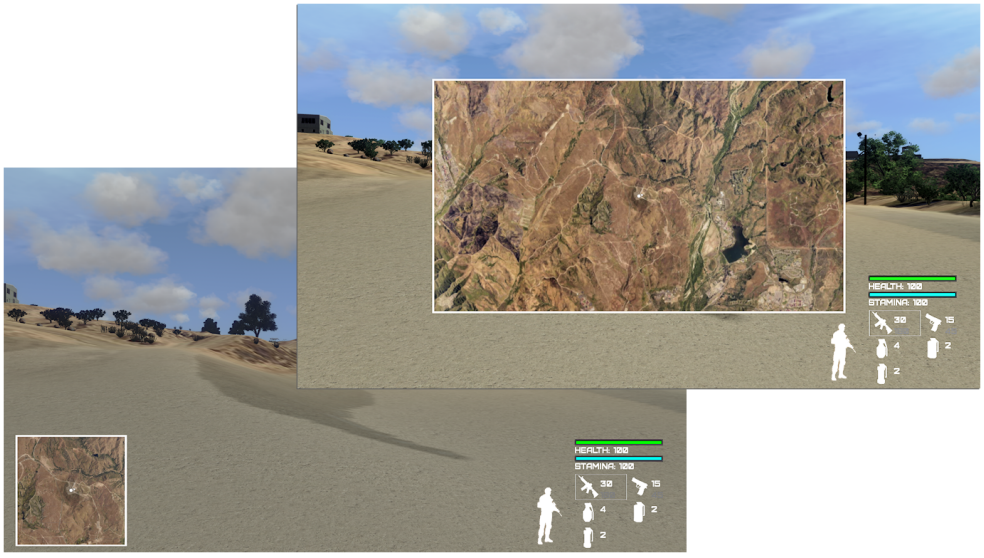
5.3.2 Using the Minimap

You can open a minimap that shows where your character is in relation to the terrain.

The minimap is hidden by default. Use the Action menu or the keyboard to select the display format. Using the keyboard, you can also zoom in or out of the minimap.

You can configure the available map sizes and the minimap's border in *./appData/scripts/playerDefinitions/devices/minimap.lua*.

Figure 32. Minimap - corner and center



➤ **To change the minimap display using the Action menu:**

1. Open the Action menu (Figure 26 on page 84).
2. On the Action menu, choose **Minimap**.
3. Use an Action menu control method to toggle the setting: hidden, corner, or center.

➤ **To change the minimap display using the keyboard:**

- Press **M** to cycle through the corner, center, and hidden views.
- Press **+** on the number pad to zoom in on the minimap.
- Press **-** on the number pad to zoom out of the minimap.
- Press **0** on the number pad to reset the minimap to the default zoom.

5.4. Health and Stamina

The human entity overlay includes bars that indicate the current health and stamina for your character (Figure 33). Health and stamina are depleted as your character sustains damage and experiences fatigue. Tracking human entities' health and stamina adds realism to your simulation.

You can customize the impact of losing stamina. For more information, see "14.1.1 Fatigue Settings" on page 254.

Figure 33. Health and stamina bars



5.4.1 Sustaining Damage to Health

Unless your character is set to be invulnerable, you will sustain damage when other characters attack you. The health bar indicates the state of your health (Figure 33 above). As you take damage and your health is depleted, you will have trouble moving around and aiming weapons. After a certain amount of damage, you fall to the ground in pain. At that point, your view lowers to ground level, and you cannot move or aim a weapon. Other characters in the scenario also sustain damage and experience the same effects (if they are not invulnerable).

The location on the body where a character is injured determines how much damage a character sustains. For example, a shot in the leg or arm is less lethal than a shot to the torso or head.

As you take damage, the screen shows some red. When you are hit from the side, the corners of that side of the screen are highlighted in red. If you are shot from the front or the back, all corners of the screen are highlighted. In addition, as your health is depleted, the screen takes on a red tint and your aiming will be less accurate.

5.4.2 Experiencing Fatigue and Losing Stamina

Spinting, crawling, and walking in a crouched position cause you to use your stamina and thereby experience fatigue. The stamina bar displays your current level of stamina (Figure 33 above). As you grow fatigued and your stamina reserves are reduced, you cannot move quickly and you will also see a greater margin of error when you fire a weapon.

When you walk or stop moving, you regain your stamina. You recover faster if you stop moving than if you walk.

5.5. Weapons

Infantry characters have a rifle, a handgun, and several types of grenades. The name indicates a character's primary weapon; for example, characters with an M4 in their name have an M4 rifle. A graphic in the lower right corner of the screen shows the current weapon (Figure 34).

Figure 34. Weapon overlay for humans



You can configure whether the ammunition counts display next to the weapons. See "14.2.1 Ammunition Count Display" on page 256.

5.5.1 Choosing a Weapon

➤ **To choose a weapon:**

1. Open the Action menu (Figure 26 on page 84).
2. On the Action menu, choose **Weapon**.
3. Use an Action menu control method to show the submenu. The Weapons menu opens.
4. Choose a weapon.

You can also cycle through the weapon list using the Select Weapon button on your game controller.

5.5.2 Aiming a Weapon

You can aim a weapon using the reticle or the sight (Figure 35 and Figure 36).

The reticle indicates the accuracy of your shots. If you are moving, fatigued, or wounded, there is a greater margin of error in your accuracy and the reticle increases in size. To improve your accuracy, you can hold still or change to a prone position. The reticle shrinks to indicate a lesser margin of error.

You can customize the margin of error. For details, see "14.1.2 Aim Settings" on page 254.

Figure 35. Aiming with the reticle



Figure 36. Aiming with sight



➤ To aim a weapon using the reticle, move the reticle using the arrow keys, the mouse (in mouse-look mode), or the right thumbstick on the Gamepad.

➤ **To aim a weapon using the sight:**

1. Hold down **,** (comma) on the keyboard, the right button on your mouse (in mouse-look mode), or the Aim button on your game controller.
2. Use the arrow keys, the mouse, or the right thumbstick on your game controller to move the sight.

5.5.3 Firing a Weapon

Most guns shoot once each time you fire the weapon. The AK-47 fires in three-shot bursts.

➤ **To fire a weapon, do one of the following:**

- Click the left mouse button (in mouse-look mode).
- Press the fire button on your game controller.

5.5.4 Firing Weapons with an HMD Controller

If you are using a head-mounted display (HMD) with hand controllers, you can fire weapons using your controller. By default, the right hand controller is the dominant controller. You can change this by changing the **rightHanded** parameter in *./appData/scripts/playerDefinitions/human.lua* from true to false.

- If you have a pistol, hold the controller in front of you to aim. Press the trigger to fire. The pistol only tracks the position of the dominant hand.
- If you have a rifle, align the two controllers as if you were holding a rifle, with the dominant hand closer to your body. Aim the rifle and fire.

Figure 37. Firing a rifle using HMD hand controllers



5.5.5 Throwing a Hand Grenade

Soldiers can throw fragmentation grenades, smoke grenades, and flash bang grenades. Grenades are thrown at a target point. (If the soldier is aiming towards an area with a light background, the target point may be hard to see.)

Figure 38. Grenade target point



➤ **To throw a grenade:**

1. Use the arrow keys or right thumbstick on the game controller to aim the grenade.
2. Click the left mouse button (in mouse-look mode) or press the fire button on your game controller.

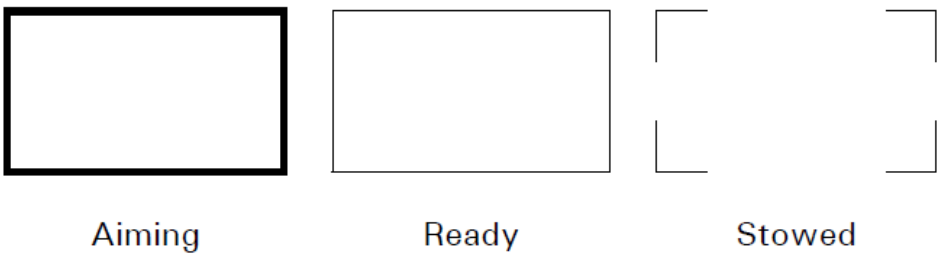
5.5.6 Deploying and Stowing Weapons

When a weapon is deployed, you see it in first-person mode and you can fire it. When it is stowed or ready, you cannot see it in first-person mode and you cannot fire it.

The weapon overlay indicates the status of the weapon, as follows and as illustrated in Figure 39:

- Aiming. Weapon icon has a thick rectangle around it.
- Ready. Weapon has a thin rectangle.
- Stowed. Weapon has a bracketed rectangle.

Figure 39. Weapon status



➤ **To deploy or stow a weapon:**

1. Open the Action menu.
2. On the Action menu, choose **Weapon State**.
3. Use an Action menu control method to toggle between states.

You can also toggle the weapon state by pressing ' (apstrophe) or pressing and holding the weapon selection button on your Gamepad.

5.5.7 Reloading a Weapon

As you fire a weapon, the system tracks the amount of ammunition left in the magazine. When the magazine is depleted, your character automatically pauses to reload. At any point, you can also press **R** to reload. The character reloads a magazine's worth of ammunition. Weapons have a default magazine capacity, which you can customize as needed. For details, see "14.2.2 Magazine Capacity" on page 256.

Please note that the ammunition counts do not display on the screen if **showAmmoCounts** in *humanLayouts.lua* is set to **false**. See "14.2.1 Ammunition Count Display" on page 256.

Figure 40. Magazine and ammunition counts



➤ To reload your weapon with a fresh magazine, press **R**.

5.6. Using the Javelin Missile Launcher

VR-Engage has a character with a shoulder-mounted javelin missile launcher (US Army Javelin) and one that can deploy a tripod-mounted javelin (US Army Javelin (Tripod)).

5.6.1 Using the Shoulder-Mounted Missile Launcher

➤ **To use the shoulder-mounted missile launcher:**

1. Add or select a US Army Javelin character.
2. Engage the character.
3. On the Action menu, set the Missile Launcher option to Aiming. The display changes to show the soldier in third person view, an aiming reticle is added, and a view finder display is added to the screen.

Figure 41. Shoulder-mounted javelin



4. Optionally, press **B** or the X button on your Gamepad to expand the viewfinder to cover the entire screen.
5. Fire the weapon using the standard weapon firing methods.

The character can walk around with the weapon in the Aiming state (third person view). You can also change the Missile Launcher state to Deployed and walk around in first person view. In first person view, the missile launcher is not visible.

5.6.2 Using the Tripod-Mounted Missile Launcher

The tripod-mounted missile launcher is an object that the US Army Javelin (Tripod) character can deploy. Until it is deployed it is not part of the scenario. Once it is deployed it is an independent entity in the scenario. Other characters can fire it. Only the character that originally deployed it can recover it, that is, remove it from the scenario.

A tripod-mounted missile launcher has an azimuth (horizontal range) of 45 degrees to the left and right. It has an elevation (vertical range) of 30 degrees. When a tripod-mounted missile launcher is deployed, it faces in the direction of the entity that deployed it. Once it is deployed, you cannot change its heading.

➤ **To deploy the tripod-mounted javelin:**

1. Add or select the US Army Javelin (Tripod) character.
2. Engage the character. The default presentation is that of a US Army M4 character.
3. Walk to the location where you want to deploy the missile launcher.
4. Face the heading that you want the missile launcher to be deployed to.
5. Optionally, stow your rifle.
6. On the Action menu, choose **Deployable Objects > Deploy Javelin Launcher**. The Javelin Missile Launcher is added to the scenario. The Action menu changes to show Javelin Launcher menu options.

Figure 42. Tripod-mounted javelin



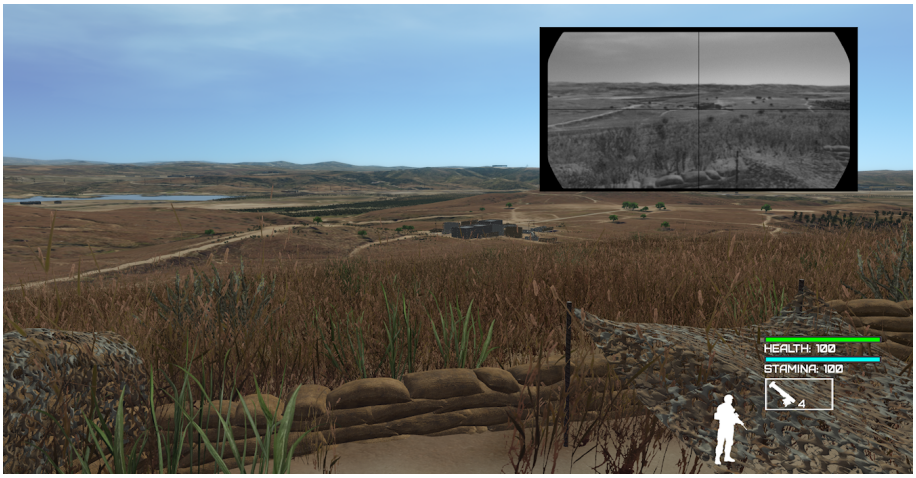
Firing a Tripod-Mounted Missile Launcher

Once a missile launcher is deployed, any character can fire it.

➤ **To fire the missile launcher:**

1. If your character is close to the missile launcher, on the Action menu, choose **Javelin Launcher > Use Launcher**. If your character is not close the missile launcher, walk towards it until the Javelin Launcher menu is displayed. Then, choose **Use Launcher**. The display changes to show the view finder and reticle for the launcher. You are now in direct control of the missile launcher instead of the character you were controlling.

Figure 43. Javelin tripod - aiming



2. Optionally, press **B** or the X button on your Gamepad to expand the viewfinder to cover the entire screen.
3. Aim the javelin and fire it.
4. To give up control of the javelin, on the Action menu, choose **Exit Launcher**. You are now in control of your character again. Your weapon is stowed.

Recovering a Tripod-Mounted Missile Launcher

When you recover a tripod-mounted javelin, you remove it from the scenario. It is not available for use until it is deployed again. Only the character that deployed the javelin can recover it.

➤ To recover the missile launcher, choose **Javelin Launcher > Recover Launcher**. If you are not within a few feet of the missile launcher, the Javelin Launcher menu option is not available. If you walk towards the missile launcher it opens automatically.

5.7. Embarking on a Vehicle

If a vehicle supports embarkation, characters can embark on it and move with it as it moves. If the vehicle has interior geometry, your character can look around and walk around on the floor of the vehicle. Among the vehicles provided with VR-Engage, the 5-ton truck, the Stryker, the police car, and the CH-47 Chinook and CH-149 Cormorant helicopters have interior geometry. Other vehicles, such as the LAV and M1A2, support embarkation but do not have interior geometry.

➤ **To embark on a vehicle:**

1. Have your character walk up to the vehicle. When the character is within a meter or so of the vehicle, the embarkation menu for the vehicle displays.

Figure 44. Embark menu



2. Select a role or seat.
3. Press the **Right Arrow** key or right D-pad button to initiate the action. The character is placed on the vehicle.

5.7.1 Embarking on the Stryker's Interior

The M1126 Stryker has an interior that allows you to board and choose an available seat.

➤ **To embark on the Stryker from the interior:**

1. Have your character walk up to the back of the vehicle. When the character is within a meter or so of the vehicle, the Stryker menu displays.
2. If the door is not open, select **Door**. The door opens, providing a ramp into the Stryker.
3. Walk your character up the ramp and into the interior. Your character automatically shifts to a crouching posture.

   As you navigate the interior, the seat closest to your character displays in the Stryker menu. Different seats display in the menu based on your position.
4. Choose the seat from the menu. This can be a seat in the back, the Driver Seat, or the Commander seat. (You can also embark as the driver or commander directly from the Stryker menu as described in "5.7. Embarking on a Vehicle" on the previous page.)

5.7.2 Disembarking from a Vehicle

There are a couple of ways that you can disembark a vehicle.

➤ **To disembark from a vehicle, do one of the following:**

- Have the character walk off the back of the vehicle.
- On the Action menu, choose Disembark. The character is placed off the back of the vehicle.

5.8. Parachuting

The paratrooper character can parachute out of aircraft. The descent starts in free fall. The paratrooper's weapon is hidden. After the parachute is deployed, the drift of the paratrooper is affected by wind speed and direction. You can turn the parachute to the left or right and you can slow the rate of descent. When the paratrooper lands, the parachute is hidden and the paratrooper's weapon is again available. It returns to whichever view mode it was in before it jumped.

Figure 45. Parachute deployed



If a paratrooper disembarks from a helicopter while it is in the air, the entity is ground-clamped. It does not enter free fall.

➤ To jump from an aircraft, walk out of an open cargo door.

➤ To deploy a parachute, press the **Spacebar** or the left thumbstick on your Gamepad.

➤ To turn left or right while the parachute is deployed, press **A** or **D**, or buttons 5 or 6 on your Gamepad.

➤ To slow the rate of descent while the parachute is deployed, press **A** and **D**, or buttons 5 and 6 at the same time.

5.9. Tasking Other Entities

While you are playing a character, you can assign tasks to other entities in the scenario.

When you assign a task, you are assigning what VR-Forces calls an independent task. If the entity to which you are assigning the task is currently executing a task either as an independent task or as part of a plan, when you assign the new independent task, it abandons the old task or plan.

5.9.1 Disembark Entity

The Disembark Entity task causes the selected entity to disembark from the vehicle that it is on.

➤ **To issue the Disembark Entity task:**

1. Open the Action menu.
2. Choose **Task Entity**.
3. Use an Action menu control method to show the submenu. The Select Entity menu opens.
4. Select the entity that you want to give a task to.
5. Use an Action menu control method to show the submenu. The Task Entity menu opens.
6. Choose **Disembark Entity**.
7. Use an Action menu control method to initiate the action.

5.9.2 Follow Me

The Follow Me task causes the selected entity to follow your character.

If you task an entity to follow you, it will do so indefinitely. To get it to stop following, task the entity to move to a location.

➤ **To issue the Follow Me task:**

1. Open the Action menu.
2. Choose **Task Entity**.
3. Use an Action menu control method to show the submenu. The Select Entity menu opens.
4. Select the entity that you want to give a task to.

5. Use an Action menu control method to show the submenu. The Task Entity menu opens.
6. Choose **Follow Me**.
7. Use an Action menu control method to initiate the action. The entity moves to a location behind your character.

5.9.3 Move to Location

The Move to Location task causes the selected entity to move to the specified location.

➤ **To issue the Move to Location task:**

1. Open the Action menu.
2. Choose **Task Entity**.
3. Use an Action menu control method to show the submenu. The Select Entity menu opens.
4. Select the entity that you want to give a task to.
5. Use an Action menu control method to show the submenu. The Task Entity menu opens.
6. Choose **Move to Location**. VR-Engage places a waypoint symbol at the point your character is looking at.
7. Press and hold the right mouse button or use the right thumbstick on your Gamepad to move the waypoint to the location you want the other entity to move to.
8. Use an Action menu control method to initiate the task. The tasked entity moves to the location.

5.9.4 Move to My Location

The Move to My Location task causes the selected entity to move so that it is standing next to your character.

➤ **To issue the Move to My Location task:**

1. Open the Action menu.
2. Choose **Task Entity**.
3. Use an Action menu control method to show the submenu. The Select Entity menu opens.
4. Select the entity that you want to give a task to.
5. Use an Action menu control method to show the submenu. The Task Entity menu opens.
6. Choose **Move to My Location**.
7. Use an Action menu control method to initiate the action. The selected entity moves to a position next to your character.

5.9.5 Suppress Location

The Suppress Location task causes the selected entity to fire on the specified location to suppress any entities at that location.

➤ **To issue the Suppress Location task:**

1. Open the Action menu.
2. Choose **Task Entity**.
3. Use an Action menu control method to show the submenu. The Select Entity menu opens.
4. Select the entity that you want to give a task to.
5. Use an Action menu control method to show the submenu. The Task Entity menu opens.
6. Choose **Suppress Location**. VR-Engage places a waypoint symbol at the point your character is looking at.
7. Press and hold the right mouse button or use the right thumbstick on your Gamepad to move the waypoint to the location you want the other entity to suppress.
8. Use an Action menu control method to initiate the task. The tasked entity fires at the location.

5.10. Turning on Your Flashlight

The flashlight casts a circle of light on the terrain.

➤ **To turn on the flashlight:**

1. Open the Action menu.
2. Choose **Flashlight**.
3. Use an Action menu control method to toggle the flashlight on or off.



You can also toggle the flashlight on and off by pressing **F**.

5.11. Using the Binoculars

You can zoom in and out in five fixed steps. At the highest zoom level (binoculars), VR-Engage displays a range finder graphic.

➤ **To zoom the view in and out, do any of the following:**

- Scroll the mouse wheel forward and back.
- Press **=** to zoom in, **–** to zoom out. The view zooms one step for each key press.

- Press **B** (for binoculars view). Binoculars goes immediately to the highest zoom level.
- On the Action menu, choose **Binoculars** and change the status. Binoculars goes immediately to the highest zoom level.

You cannot fire a weapon when the binoculars are in use. If you are controlling a character that has lasing capability, pressing the Fire button lases the target.

5.12. Changing Visual Sensors

Human characters can simulate the effect of wearing night vision goggles (NVG).

The default visual sensors use CameraFX, which just applies a filter to the scene. It does not take into account the materials of the viewed objects. For details, please see *VR-Vantage Users Guide*.

If you want a visual sensor capability that takes into account the materials of the viewed objects, you can install SensorFX. SensorFX is an extra cost option. Please contact info@mak.com for details.

➤ **To turn on the night vision goggles for human characters:**

1. Open the Action menu.
2. Choose **Night Vision**.
3. Use an Action menu control method to toggle night vision on or off.

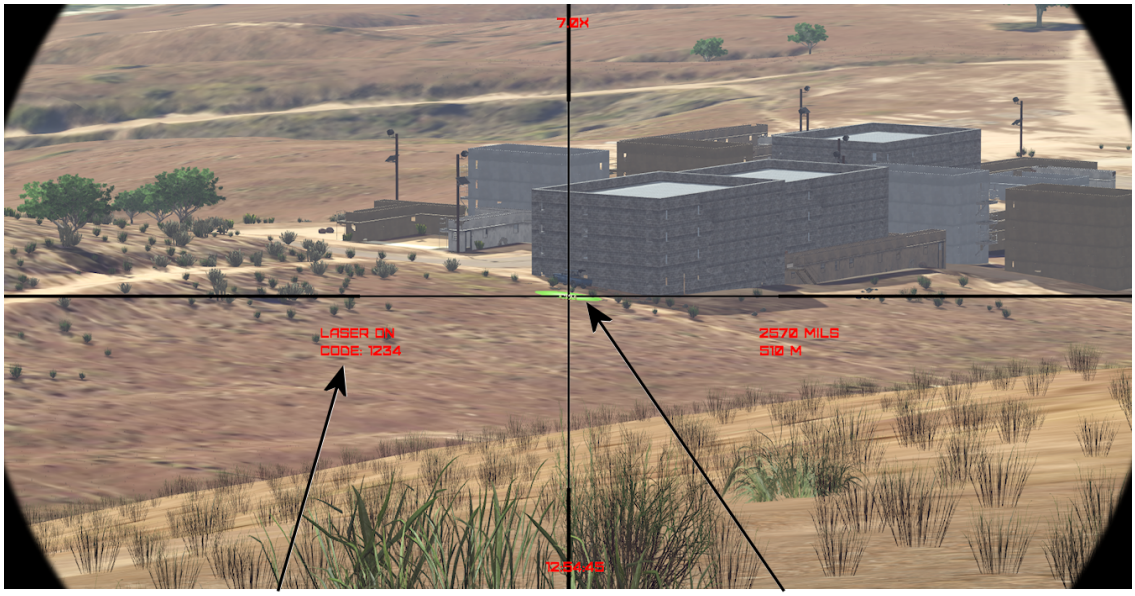
You can also toggle night vision by pressing **N** or the A button on a Gamepad. You do not need to open the Action menu.

5.13. Lasing Targets

Soldiers that have a lasing capability can lase targets. VR-Engage includes two characters with lasing capability – DI Lasing (US) and DI Lasing (CIS).

When you lase a target, the display shows that the laser is on and displays the laser code. If you enable laser designators, a green circle displays on the lased location.

Figure 46. Lasing a target



Laser status and code

Laser designator

You cannot lase entities. You can only lase locations on the terrain.

➤ **To lase a target:**

1. On the Action menu, toggle **Binoculars** to On, or press **B**.
2. Point the cross-hairs of the binoculars at the point you want to lase.
3. Hold down the Fire button on a game controller or the left mouse button.

5.13.1 Defining the Laser Code

You can define the laser code used when you lase a target. Laser codes can be up to four digits long. When you lase a target, that code is used.

➤ **To define the laser code:**

1. On the Action menu, choose **Forward Air Control**.
2. In the Forward Air Control menu, choose **Laser Code**. The Set Laser Code dialog box opens.
3. Enter a laser code and then press **Enter**.

5.13.2 Displaying a Gimbaled Sensor's View

You can display the sensor view for gimbaled sensors in the scenario. You cannot control the view, only see it.

➤ **To view the sensor on another entity:**

1. On the Action menu, choose **Forward Air Control**.
2. On the Forward Air Control menu, choose the entity whose sensor view you want to display.

5.13.3 Enabling Laser Designators

A laser designator is a green circle that shows where a laser is being pointed. It includes the laser code. Laser designators are disabled by default.

➤ **To enable or disable laser designators:**

1. If you are currently controlling a character, press **Esc** to exit to the VR-Engage window.
2. Choose **Settings > Laser Designators**.

5.14. Opening and Closing Doors and Windows

If a terrain has doors and windows that can open and close, when a human character approaches within about a meter of an opening, a menu is displayed that lets you choose to open or close the opening.

Figure 47. Door menu





The ability to open and close doors requires a dynamic terrain server. Therefore it only works if you are connected to a VR-Forces session.

➤ To open or close a door or window, when the appropriate menu is displayed, make a selection from the menu.



6. Controlling Ground Vehicles

This chapter explains how to drive ground vehicles.

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6.1. Introduction

VR-Engage and VR-Engage Ground let you control ground vehicles that use the Vortex physics libraries to provide high-fidelity movement behaviors.

For a list of vehicles included with VR-Engage, please see "Chapter 12. Controllable Entities" on page 211*VR-Engage Users Guide*. You can add more ground vehicles. For details, see "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247.

6.1.1 Ground Vehicle Roles

All ground vehicles support the Driver role, and some vehicles support other roles that you can select from the Choose Role Panel.

Some vehicles also allow you to embark as a passenger in a particular seat when you walk up to them as a human character, but not from the Choose Role Panel. Please see "5.7. Embarking on a Vehicle" on page 110 for details.

To learn what roles are available for each vehicle, please see "Chapter 12. Controllable Entities" on page 211*VR-Engage Users Guide*.

The driver role allows you to:

- Drive the vehicle, which involves:
  - Starting the engine.
  - Engaging gears.
  - Increasing and decreasing throttle.
  - Steering.
- Manage headlights.
- Rotate the turret. (LAV and M1A2 only. You cannot see this happen in first person mode.)
- Fire weapons that are configured on the vehicle. (LAV and M1A2 only. For details, please see "6.3.1 Firing a Vehicle's Gun" on page 125.)

The gunner role allows you to:

- Fire weapons that are configured on the vehicle.
- Rotate a turret and raise and lower the gun. (The M2A3 Bradley IFV and GTK Boxer allow you do perform these actions while VR-Forces drives the vehicle.)
- Stabilize the gun.

The commander role allows you to:

- Look around.
- Change the sensor view.
- Zoom in and out.
- Slew or take full control of the gun (RWS only).
- Designate a target with a laser (RWS only).

6.1.2 Ground Vehicle Display Options

Most ground vehicles are designed for a single screen display. Some vehicles have support for a 3D interior or VR headsets.

- 1 Screen Horizontal. This is the standard interface for most ground vehicles.
- 3D Interior. This display shows a more detailed view of the interior for some roles.
- VR Headset. Select this option if you are using a head-mounted display and have chosen to engage one of the vehicles that supports VR. (This is relevant only if you have an HMD connected.)

➤ **To choose a display option for vehicles with multiple displays:**

1. In the Choose Role Panel, select the vehicle you want to control.
2. Choose the Role.
3. In the Display(s) list, select the display option. Different displays are available only on some vehicles and only for particular roles.

6.2. Driving Ground Vehicles

To operate most ground vehicles, you must use a game controller or racing wheel controller. (You can control the LAV from the keyboard in the driver role.)

6.2.1 Starting the Engine

➤ **To start (or stop) the engine, do one of the following:**

- On the Action menu, toggle Engine: On/Off.
- On a Gamepad, press the Start button.
- On a Racing Wheel Controller, press the Engine On button.
- Press **X**.

6.2.2 Putting the Vehicle into Gear

The LAV has eight forward gears and one reverse gear. Automobiles have six forward gears and one reverse gear. The M1A2 tank has two forward and one reverse gear. Vehicles have automatic transmissions. When you set a gear, you are setting the top gear it can use.

➤ **To put the vehicle into gear, do one of the following:**

- Press the Gear Up or Gear Down buttons on your gaming controller.
- Press **Q** (up) or **E** (down).

6.2.3 Controlling the Throttle

If you are driving using a Racing Wheel Controller, use the gas and brake pedals.

➤ **To move the vehicle, do one of the following:**

- Press the throttle control (left thumbstick on the Gamepad) forward on a Gamepad.
- On a Racing Wheel Controller, depress the Throttle.
- Press **W**.

➤ **To brake the vehicle, do one of the following:**

- Pull the throttle control backwards on a Gamepad.
- On a Racing Wheel Controller, depress the Brake.
- Press **S**.

6.2.4 Steering a Vehicle

➤ **To steer the vehicle, do one of the following:**

- Use the right thumbstick on a Gamepad
- Use the steering wheel of a Racing Wheel Controller.
- Press **A** (left) or **D** (right).

6.2.5 Releasing and Engaging the Parking Brake

➤ **To set the parking brake on or off:**

- On the Action menu, toggle Parking Brake: On/Off.
- On a Gamepad, press the left thumbstick.
- On a Racing Wheel Controller, press the Parking Brake button.
- Press **P**.

6.2.6 Locking and Unlocking the Differential (LAV Only)

A differential allows the wheels on an axle to rotate at different speeds. Locking the differential may improve traction under certain terrain conditions.

➤ **To lock or unlock the differential, do one of the following:**

- On the Action menu, toggle Differential Lock: On/Off.
- On a Gamepad F310, press the X button.
- On a Racing Wheel Controller, press the Differential Gear button.
- Press **C**.

6.2.7 Turning the Headlights On and Off

➤ **To turn on headlights, do one of the following:**

- On the Action menu, toggle Headlights: On/Off.
- On a Gamepad F310, press the A button.

- On a Racing Wheel Controller, press the Lights button.
- Press **L**.

6.3. The Gunner Role

The gunner can:

- Fire the gun.
- Rotate and elevate the gun.
- Zoom in and out.
- Change the sensor. (For details, please see "6.6. Changing the Sensor for an LAV, M1A1, or M1A2 Crew Member" on page 127.)

6.3.1 Firing a Vehicle's Gun

Sabot or heat rounds fired from the M1A1 SA tank travel in an arc, not a straight line. The calculation includes the mass of the projectile, air resistance, and the drag coefficient. VR-Engage calculates for collisions in each frame, which can impact performance.

➤ To fire a ground vehicle's gun, press the fire button on your game controller. (You can also press **F**. On the M1A2, you can use the left mouse button.)

6.3.2 Moving the Turret

The turret controls are different for thegunner and driver roles.

➤ To move the turret in the gunner role, use the right thumbstick on your Gamepad. On the M1A2, you can also use the mouse.

➤ To move the turret in the driver role (LAV, M1A1, and M1A2 only), use the D-pad or press the **I**, **J**, **K**, and **L** keys.

6.3.3 Stabilizing a Vehicle's Gun

By default, the LAV, Stryker, GTK Boxer, and the M1A1 and M1A2 tanks allow you to stabilize the guns. This locks the azimuth and elevation to the values they had with respect to the world when the turret was last moved.

If you have VR-Forces with the VR-Engage add-ons, you can configure whether gun stabilization is enabled by default by editing the weapon system in the Simulation Object Editor. See the information on editing a system's properties in the *VR-Forces Users Guide*.

➤ **To enable or disable gun stabilization:**

1. While acting as the gunner, open the Action menu.
2. Choose **Gun Stabilization**.
3. Use an Action menu control method to toggle the setting: **Heading** stabilizes the gun and **Disabled** does not stabilize the gun.

6.4. The Commander Role

Commanders can rotate the camera to look around, zoom in and out, change the sensor view, and trigger events. Commanders can also communicate with other crew members and other players using the intercom or radio. On some vehicles, the commander role is also configured to take over the gunner role, slew the gun to a target, and designate a target with a laser.

- To learn more about triggering events, see "4.5. Starting VR-Forces Events" on page 94.
- To learn about taking over the gunner role, see "6.4.1 Overriding the Gunner" below.
- To learn how to slew to cue, see "6.4.2 Slewing the Gun to Designate a Target" below.
- To learn how to use the laser designator, see "6.4.3 Using the Laser Designator" on the facing page.

6.4.1 Overriding the Gunner

On ground vehicles that are configured for it, the Commander RWS role can take over the gunner role controls to point the gunner at a target.

➤ **To override the gunner controls:**

1. While acting as the Commander RWS, open the Action menu.
2. Choose **Gunner Override**. The view switches to the gunner.
3. Move and fire the gun as needed. See "6.3. The Gunner Role" on the previous page for instructions.
4. When you are finished, open the Action menu and then choose **Exit Gunner Override**.



To enter or exit Gunner Override, you can also press **O** on the keyboard or Y on the Gamepad.

6.4.2 Slewing the Gun to Designate a Target

The Commander RWS role can designate a target for the gunner (slew to cue).

➤ **To slew the gunner's gun to a specific point:**

1. Use the controls to focus your eyepoint on the target.
2. Press **C** on the keyboard or X on the Gamepad. You take temporary control of the gun, slewing it to point at the target.
3. Release the key or button to return control to the gunner.

6.4.3 Using the Laser Designator

The Commander RWS role can use the laser designator to lase a target.

➤ To use the laser designator, press the **L** key or A on the Gamepad.

6.5. Using the Intercom

Players who are embarked on a ground vehicle can communicate using the intercom. The intercom is voice activated and transmits any sound that is greater than the VOX threshold.

➤ **To use the intercom:**

1. Open the Action menu.
2. Choose **Radio**.
3. Cycle through the options to choose **Intercom**.
4. Start talking.

6.6. Changing the Sensor for an LAV, M1A1, or M1A2 Crew Member

Changing the sensor mode is the same for all crew members. The only difference is that the commander and gunner have more sensors to cycle through.

➤ To change the sensor for a crew member, press the right thumbstick until you see the sensor that you want.

6.7. Pivoting a Tank

Tanks can pivot in place.

➤ **To pivot a tank:**

1. Start the engine.
2. Press the X button on the Gamepad. The Gear setting changes to Pivot in the engine information overlay in the lower left corner of the screen.
3. Put the throttle forward to engage the engine.
4. Use the right thumbstick to pivot left or right.



You can also enable or disable Pivot by toggling the setting in the Action menu.

6.8. Emergency Lights and Sirens

The police cruiser and ambulance entities have emergency lights and sirens.

➤ **To turn on emergency lights and sirens:**

1. Open the Action menu.
2. Choose **Emergency Lights** or a specific type of siren.
3. Toggle the option on.

6.9. Configuring Ground Vehicles on Geocentric Terrains

VR-Engage ground vehicles use the Vortex physics libraries for their movement systems. When a vehicle moves on a geocentric terrain, VR-Engage must convert the geocentric coordinates to a flat earth coordinate system. The conversion is based on a user-defined origin that, ideally, represents the location where the majority of simulation activity will take place. As vehicles move further away from the origin, projection errors can occur. When distances from the origin exceed several hundred kilometers, the projection error may be noticeable and vehicles may drift from their expected line of movement.

To resolve this problem, you should set the origin to a location that is close to the location where you are simulating vehicles. For example, by default, VR-Engage sets the origin to Honolulu, Hawaii, USA, the location of the terrain we use for the Test Drive and First Experience scenarios. If you want to simulate in some other location in the world, you should set the origin differently.

To set the origin, specify values for the **coordinateConverterOrigin** parameter in *./appData/scripts/vortexTerrainConfig.lua*. The values are in decimal degrees for latitude and longitude and meters for elevation. If the parameter is not specified, the default values are 0,0,0.

This parameter is only used for geocentric terrains. For projected terrains, the terrain data is used directly and no conversion is needed.



7. Controlling Aircraft

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7.1. Introduction

VR-Engage and VR-Engage Air let you control fixed-wing aircraft and rotary-wing aircraft. VR-Engage uses the RTDynamics RotorLib and FixedWingLib libraries to provide realistic flight dynamics and aircraft controls. VR-Engage includes mappings for the Thrustmaster HOTAS Warthog™ flight controller, the T.Flight Hotas X flight controller, and the Gamepad F310 and F710. See "11.9. Flight Controllers" on page 185. (You can configure VR-Engage to work with other controllers. See "11.12. Configuring Joysticks and Keyboard Control" on page 202.)

When you are flying an aircraft, you have an out-the-window head-up display (HUD) and an instrument panel. VR-Engage also supports a 3D cockpit. For more information about display options, please see "7.1.4 Aircraft Display Options" on page 134.

For a list of aircraft included with VR-Engage, please see "Chapter 12. Controllable Entities" on page 211. You can add more aircraft. For details, see "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247.

7.1.1 Aircraft Roles

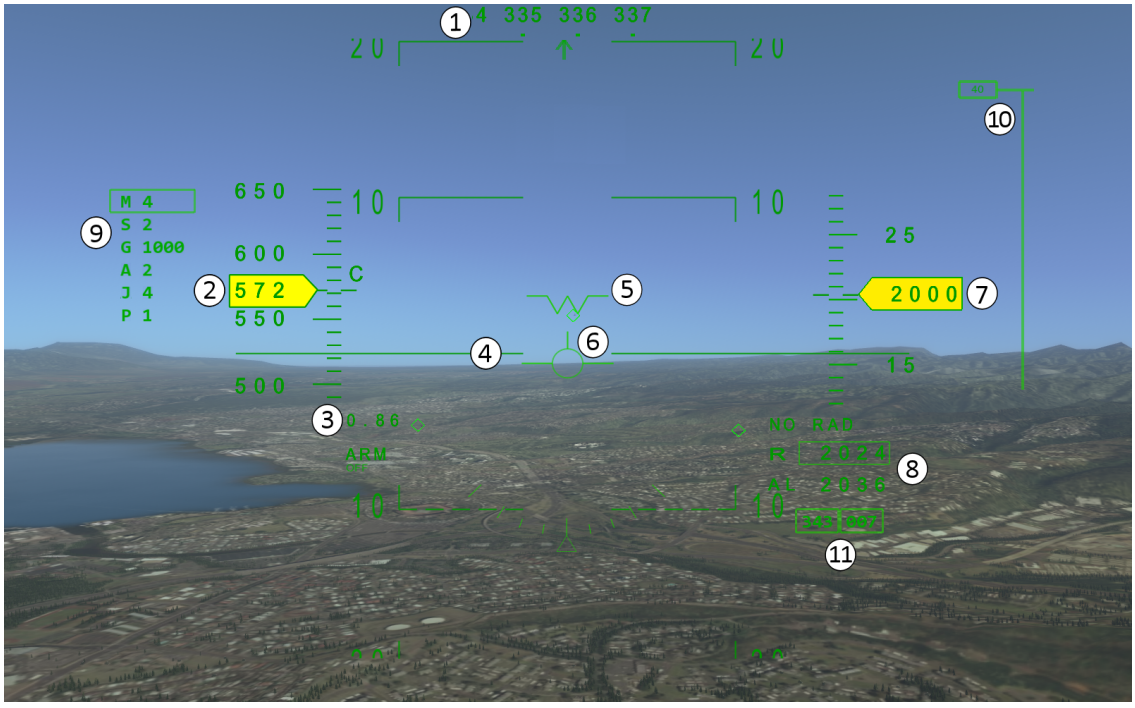
All piloted aircraft support the Pilot role, while UAVs support the Sensor Operator role. Many piloted aircraft also support the Sensor Operator role. Some aircraft support other roles that you can select from the Choose Role Panel.

To learn what roles are available for each aircraft, please see "Chapter 12. Controllable Entities" on page 211.

7.1.2 The Head-Up Display

The head-up display (HUD) provides an out-the-window view with an overlay showing important flight instrument information.

Figure 48. HUD



The information shown includes:

- 1 – Heading Indicator
- 2 – Airspeed Indicator
- 3 – Mach Number (fixed wing only)
- 4 – Attitude Indicator (Artificial Horizon)
- 5 – Flight Path Indicator - direction aircraft is facing
- 6 – Flight Path Indicator - direction of aircraft's movement (fixed wing only)
- 7 – Altimeter
- 8 – Altitude (R = above ground level; AL = above mean sea level)

Aircraft entities with weapons display additional information:

- 9 – Weapon System Counts
- 10 – Launch Success Zone (for selected weapon system)
- 11 – Bearing and Distance to Bullseye

The weapon system counts display only the weapons configured for the entity. The list can include up to seven weapon systems.

The full acronyms or names of the weapon systems are shown in the Weapons and Stores multi-function display in the instrument panel (Figure 49 below) and the Action menu.

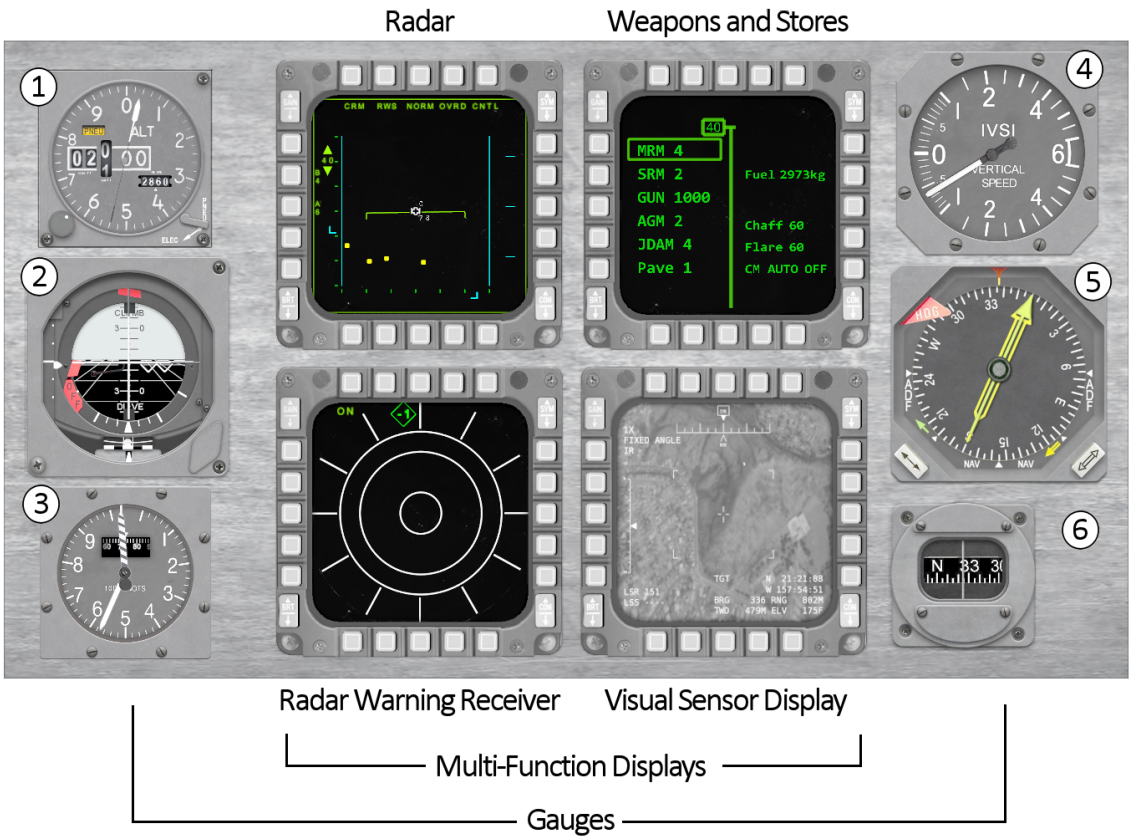
The simple Launch Success Zone shows only the weapon's minimum range, maximum range, and range to the currently selected target. The number indicates the weapon's maximum range in nautical miles.

7.1.3 The Instrument Panel

The instrument panel (Figure 49) has six gauges and four multi-function displays (MFD).

The instrument panel is an independent window. You can minimize and maximize it. If you are using one monitor, it may be hidden behind the HUD. If that happens, press **Alt**+**Tab** to bring it to the front.

Figure 49. Instrument panel



The gauges are:

- 1 – Altimeter
- 2 – Attitude Indicator (Artificial Horizon)
- 3 – Airspeed Indicator
- 4 – Vertical Speed Indicator
- 5 – Heading Indicator
- 6 – Compass

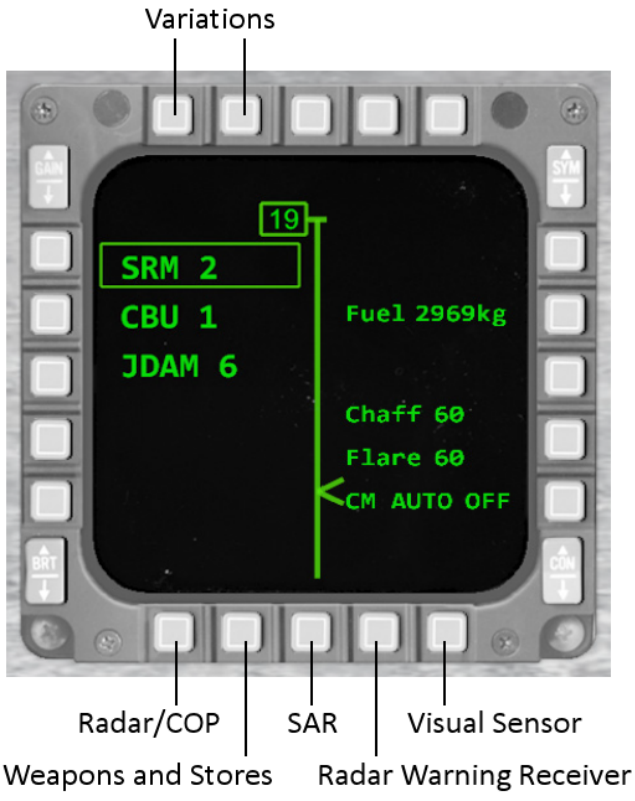
The MFDs are:

- Tactical Situation Display (radar or radar system).
- Weapons/Stores Control Panel.
- Synthetic Aperture Radar (SAR) view.
- Radar Warning Receiver. Shows entities that are detecting you on their radar. The rings show the effective threat range.
- Visual Sensor Display. Displays the view from the gimbaled sensor or a plan view display of the scenario.

Changing the Multi-Function Display

Each MFD window can display any of the possible display types.

Figure 50. Multi-function display



➤ To select a display, click one of the buttons along the bottom of the display.

➤ To view a variation of the display, use either of the first two buttons at the top of the display.

- If the instrument panel does not respond when you click a button, it might not have focus. Click it a few times or expand the window to gain focus.
- You cannot change the multi-function display in a 3D cockpit.

7.1.4 Aircraft Display Options

VR-Engage has the following options for displaying the head-up display (HUD) and instruments panel:

- 1 Screen Horizontal. HUD and instrument panel are integrated in one window, optimized for a single monitor in horizontal (landscape) orientation.
- 1 Screen Vertical. HUD and instrument panel are integrated in one window, optimized for a single monitor in vertical (portrait) orientation.
- 2 Screen. The HUD and instrument panel are in separate windows. If you have two monitors you can move the instrument panel into the second monitor to see both displays at the same time. If you choose this option and are using one monitor, the HUD is full screen and the instrument panel is in a separate window (which might be hidden behind the HUD). You can adjust the size of the HUD; see "14.3.2 Aircraft Instrument Panel Proportions" on page 256.
- Instruments Only. Only the instrument panel displays.
- HUD Only Horizontal. Displays the HUD only, optimized for a monitor in horizontal (landscape) mode.
- HUD Only Vertical. Displays the HUD only, optimized for a monitor in vertical (portrait) mode.
- 3D Cockpit. A 3D cockpit that has the HUD and instruments (Figure 51). In this display option, you cannot change the multi-function display. The 3D cockpit is not available for all aircraft. (In VR-Engage 1.7, it is available for the T38-C Talon jet.)
- VR Headset. Select this option if you are using a head-mounted display. (Available only if an HMD is connected.)
- MR Headset. Select this option if you are using a mixed reality head-mounted display. That is, an HMD with a camera attached so that you can see both the virtual world and real world objects such as your hands and joysticks. (Available only if an HMD is connected.)

Figure 51. 3D cockpit



➤ **To choose an aircraft display option:**

1. In the Choose Role Panel, select the aircraft you want to control.
2. In the Display(s) list, select the display option.

7.2. Taking Control of an Aircraft

To take control of an aircraft, you select it in the Choose Role Panel, just as you would for a human character or a vehicle.

It is beyond the scope of this manual to teach you how to fly a fixed-wing or rotary-wing aircraft. For a brief tutorial on flying the aircraft in VR-Engage, please see the section for fixed-wing aircraft in Chapter 2, *Controlling Entities in VR-Engage*, in *VR-Engage First Experience*.

You can use an HMD while you control an aircraft. Hand controllers are not supported for flying aircraft. You must still control them using a Gamepad or flight controller.

If you take control of an aircraft that is in the air, you must start flying the aircraft as soon as you click Engage. Even though it may take several seconds or longer to display the HUD and instrument panel, the aircraft is already flying. If you take control of an aircraft that is close to the ground, such as a low flying helicopter, there is a risk that it could crash before the HUD is available if you do not immediately maintain its altitude.

7.3. Using Autopilot

You can set an aircraft to use autopilot while still otherwise controlling it. Autopilot has the following modes:

- ALT. Set the altitude and use the current heading and speed. (Equivalent to VR-Forces Fly Altitude task.)
- HDG. Set the heading and use the current altitude and speed. (Equivalent to VR-Forces Fly Heading task.)
- SPD. Set the speed and use the current heading and altitude.
- ALT/HDG/SPD. Fly at the specified altitude, heading, and speed. If no altitude, heading, speed, or any of those are specified, use the aircraft's current settings.
- PATH. Fly along a route that you select. (Equivalent to VR-Forces Move Along Route task.)

If a helicopter is on the ground and you set it to ALT/HDG/SPD without specifying an altitude, it takes off, moves to an altitude of 100 feet and flies at its current heading. If a fixed-wing aircraft is on the ground, it does not take off. For more information about how aircraft respond to ALT/HDG/SPD, please see the Fly Heading and Altitude task in *VR-Forces Users Guide*.

If you are using a Thrustmaster HOTAS Warthog, pressing the Autopilot button when the toggle is set to PATH button causes the plane to fly a pattern hold around a waypoint called PATH, if it exists. Otherwise it flies a pattern hold around the current location.

7.3.1 Setting the Autopilot Mode

➤ **To set the autopilot mode or turn off autopilot:**

1. On the Action menu, choose **Autopilot**. The menu changes to the Autopilot menu.
2. Choose a setting. The Autopilot menu changes as follows based on the autopilot setting you choose:
   - If you choose **ALT**, the **Set Hold Altitude** option is added to the menu.
   - If you choose **HDG**, the **Set Hold Heading** option is added to the menu.
   - If you choose **SPD**, the **Set Hold Speed** option is added to the menu.
   - If you choose **ALT/HDG/SPD**, **Set Hold Altitude**, **Set Hold Heading** and the **Set Hold Speed** options are added to the menu.
   - If you choose **PATH**, you can select from a route in the scenario and the **Set Hold Speed** option is added to the Autopilot menu.
3. Choose the altitude, heading, or speed option that you want to set. An input dialog box opens.

4. Type the value that you want to set.
5. Press **Enter**.

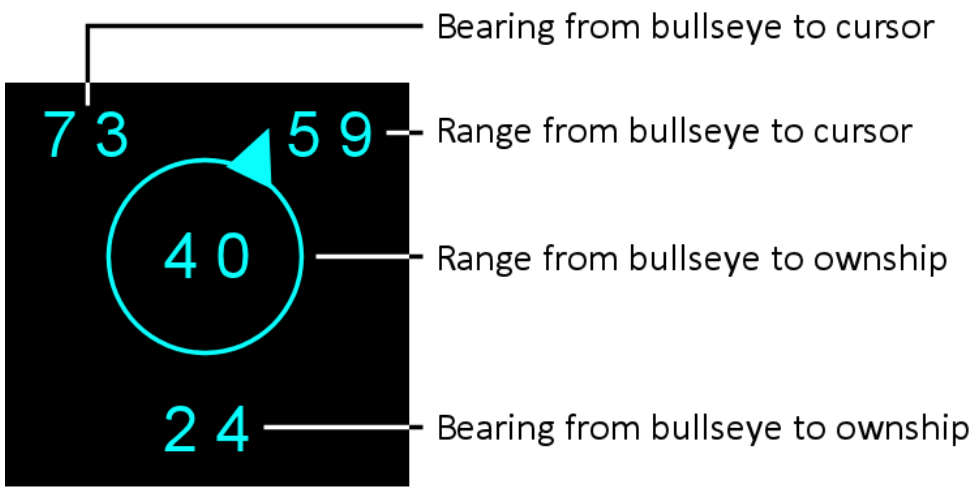
7.4. Selecting a Bullseye

Bullseyes are points that are specified before a pilot flies a mission. While the pilots are on the mission, they report their position—bearing and distance—relative to that bullseye. This allows the pilots to provide an accurate report of their location that opposing forces will not recognize.

If you do not specify a bullseye, the HUD displays the bearing and distance as 000 and 000. After you select a bullseye, the HUD displays the bearing and range of your position relative to the bullseye's coordinates (Figure 48 on page 131). The radar system displays the bearing and range from the bullseye to the cursor, and the bearing and range from the bullseye to the ownship (Figure 52). All ranges are measured in nautical miles, and distances are calculated using the great circle distance.

The bullseyes that you can select when engaged in a pilot role are tactical graphics added to a scenario in VR-Forces.

Figure 52. Bullseye display in radar system



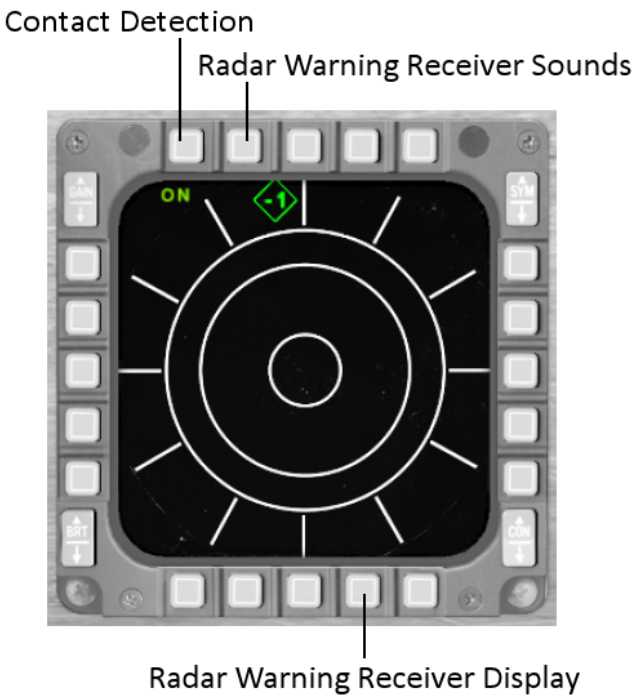
➤ **To set a bullseye:**

1. On the Action menu, choose **Select Bullseye**. The Bullseyes dialog box opens, listing the bullseye tactical graphics defined in the simulation.
2. Use an Action menu control method to select the desired bullseye.

7.5. Using the Radar Warning Receiver

Rotary-wing and fixed-wing entities have a radar warning receiver (RWR). It sounds a warning if it detects radar in addition to displaying the radar contacts. You can enable or disable the RWR and the sound.

Figure 53. Radar Warning Receiver



➤ **To enable or disable the radar warning receiver:**

1. In one of the multi-function displays (MFD) of the instrument panel, click the fourth button at the bottom to show the RWR.
2. Click the first button at the top of the MFD to turn contact detection on or off.

➤ **To enable or disable the radar warning receiver sounds:**

1. Open the Action menu.
2. Choose **RWR Sounds**.
3. Use an Action menu control method to toggle sounds on or off.

You can also toggle the radar warning receiver sounds by pressing **M** or clicking the second button at the top of the multi-function display.

7.6. Controlling Landing Gear

Fixed-wing entities can raise and lower landing gear.

➤ **To control landing gear:**

1. Open the Action menu.
2. Choose **Landing Gear**.
3. Use an Action menu control method to select Up or Down.

You can also toggle landing gear by pressing **G**.

7.7. Controlling Flaps

You can set the flaps on a fixed-wing entity up or down.

➤ **To control flaps:**

1. Open the Action menu.
2. Choose **Flaps**.
3. Use an Action menu control method to toggle the landing gear to Up or Down, MVR (Maneuver).

You can also control flaps using a joystick or Gamepad.

7.8. Launching Countermeasures (Chaff and Flare)

By default, aircraft automatically launch countermeasures (chaff and flare) when they detect a threat. You can disable automatic countermeasures and launch chaff and flare manually.

➤ **To enable or disable countermeasures:**

1. Open the Action menu.
2. Choose **Auto Launch CM**.
3. Use an Action menu control method to toggle automatic countermeasures on or off.

➤ To launch countermeasures manually, press **C** for chaff and **F** for flare.

7.9. Choosing a Weapon

Aircraft have specific loadouts of air-to-ground and air-to-air weapons, which display on the left side of the HUD. You can choose the weapon that you want to use. In the HUD (Figure 48 on page 131) and the Weapons and Stores display (Figure 50 on page 133), a rectangle indicates the selected weapon.

Table 4. Aircraft weapons

Weapon Type	HUD Abbreviation	Action Menu Abbreviation
Air-to-Air		
Long-Range Missiles	L	LRM

Table 4. Aircraft weapons (continued)

Weapon Type	HUD Abbreviation	Action Menu Abbreviation
Medium-Range Missiles	M	MRM
Short-Range Missiles	S	SRM
Air-to-Ground		
Gun	G	GUN
Bombs		
Cluster	C	CBU
JDAM	J	JDAM
KAB	K	KAB
Paveway	P	Pave
Air-to-Ground Missiles	A	AGM

➤ **To select a weapon:**

1. Open the Action menu.
2. Choose **Selected Weapon**.
3. Use an Action menu control method to cycle through the weapons available on your aircraft until the one you want to use is selected.

You can also cycle through the weapon list using the Select Weapon button on your game controller.

The order for cycling weapons is a setting you can adjust; see "14.3.5 Aircraft Weapon Cycle Order" on page 257.

7.10. Air-to-Ground Combat

You can fire air-to-ground bombs or missiles. By default, they try to hit wherever the sensor view is looking. You can specify a target using MGRS coordinates, or you can lase the target and look at the location being lased. (Lasing can be done by a VR-Forces entity or a VR-Engage character.) For lased targets, you can continuously track what the laser is targeting.

7.10.1 Targeting an Air-to-Ground Weapon Using MGRS Coordinates

MGRS coordinates must specify a zone, a grid, and an x, y offset. The x and y offsets must be the same number of digits. For example, a code of 04QFJ190557 would be built from:

- Zone: 04Q
- Grid: FJ

- X offset: 190
- Y offset: 557

In VR-Engage, if you change the coordinate system to MGRS (Display Settings dialog box, Display Units Settings page), the 3D entity label for an entity (windowed mode, 3D view) displays its location in MGRS coordinates. You can then use this value to specify the coordinates for dropping a bomb. To get the MGRS coordinates for a tactical graphic, you can view the state data in VR-Forces.

For more information about MGRS coordinates, please see relevant pages available on the Internet.

➤ **To fire an air-to-ground weapon using MGRS coordinates:**

1. Choose an air-to-ground weapon. See "7.9. Choosing a Weapon" on page 139).
2. On the Action menu, choose **Gimbaled Sensor**. The Gimbaled Sensor menu displays.
3. Choose **Target MGRS Coordinate**. The Input MGRS Coordinate dialog box opens.
4. Type the coordinates you want to target and then press **Enter**. The gimbaled sensor centers on those coordinates.
5. Press the trigger to fire the weapon.

7.10.2 Targeting an Air-to-Ground Weapon Using a Laser Code

You need the laser code to target an air-to-ground weapon with that code. This might be from someone who has the information from the scenario, or another player that is lasing the target as part of the scenario.

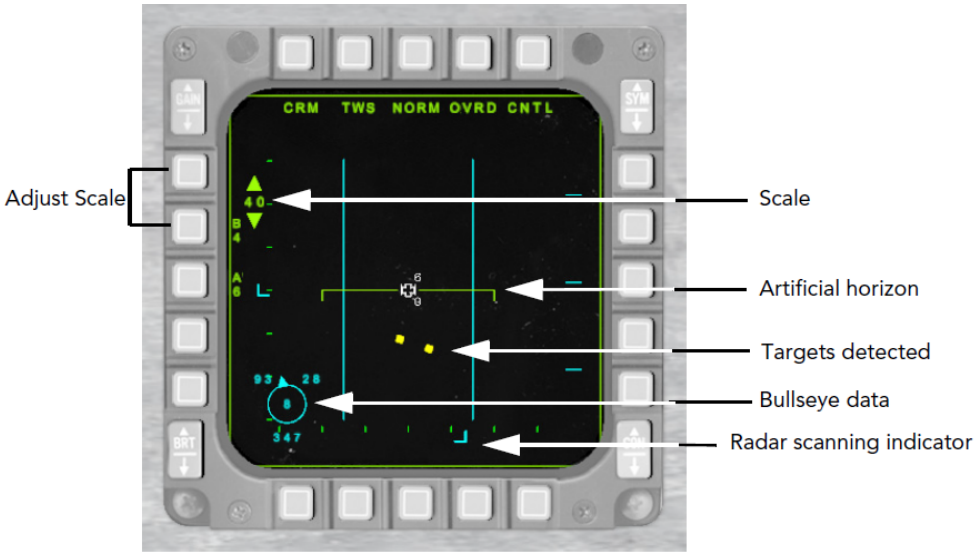
➤ **To target a laser spot:**

1. Choose an air-to-ground weapon.
2. On the Action menu, choose **Gimbaled Sensor**. The Gimbaled Sensor menu displays.
3. Choose **Target Laser Spot**. The Input Laser Code dialog box opens.
4. Type the laser code you are looking for and then press **Enter**. The gimbaled sensor centers on the lased target or location, and the LSS code shows that code and blinks in the Visual Sensor Display (if the display is active in your instrument panel).
5. Press the trigger to fire the weapon.

7.11. Air-to-Air Combat

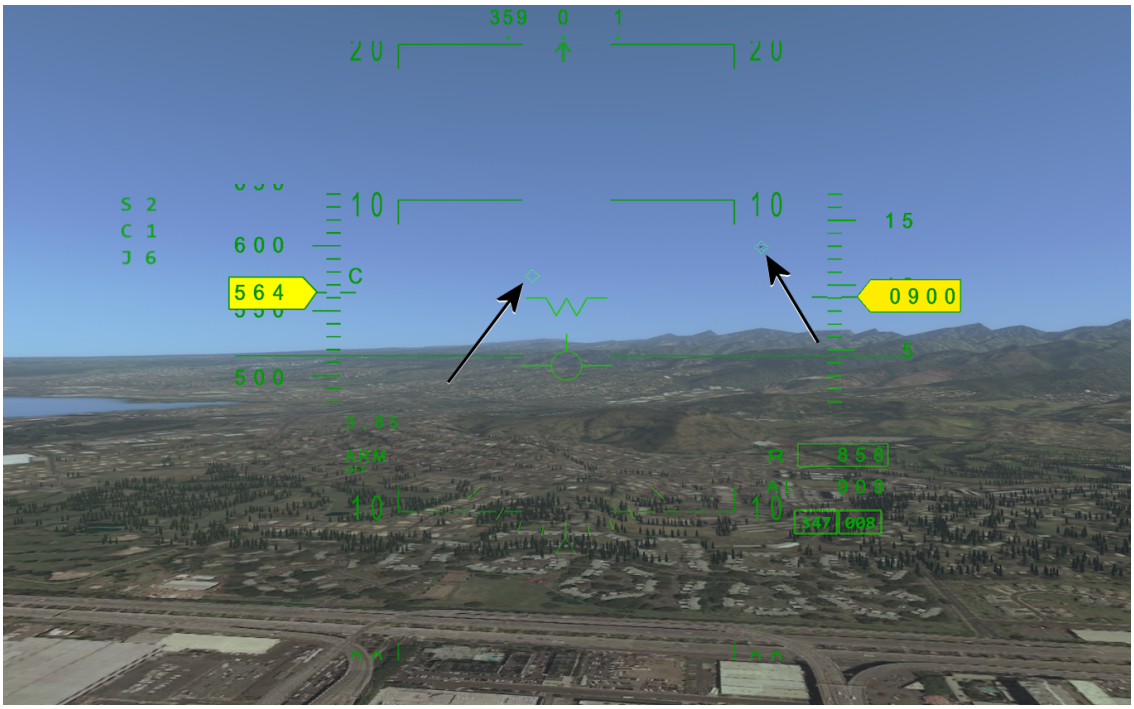
To fire a weapon at another aircraft, you must have a valid target in the Radar System (Figure 54). A blue cursor along the bottom of the Radar System shows when the radar is scanning. Yellow icons indicate detected targets. Detected contacts that are out of the selected range blink (increasing the range may shift their position and cancel the blinking).

Figure 54. Radar System



You can also see targets as green diamonds on the HUD (Figure 55).

Figure 55. Targets in HUD



7.11.1 Selecting Targets

Select a target using the cursor select controls on the joystick or keyboard. Once you have locked on a target (Figure 56), you can fire at it as long as it in range. See "Chapter 11. Mouse, Keypad, and Controller Mappings" on page 171 to learn about the cursor controls.

The Radar System has two modes: Range While Scan (RWS), which is the default setting, and Track While Scan (TWS). TWS, by default, has a narrower antenna sweep and collects more information (such as the target's velocity as well as its range). Both modes allow you to select multiple targets. To learn about targeting more than one entity, see "Selecting and Firing on Multiple Targets" on the next page.

You can see that you have locked on a target when the following things happen in the Radar System:

- The first target icon you select becomes an outline and it is circled to indicate it is the current target. Each subsequent target icon changes to an outline.
- If you select the same target a second time, the radar switches to the Single Track Target (STT) sub-mode and you cannot select another target (other targets no longer appear in the display).
- If the radar is in STT mode, the antenna tracks the designated target instead of sweeping back and forth.
- The Track ID number for the target displays.
- The Track of Interest (TOI) readout line (ROL) displays for the selected target. If you move the cursor to another target, that target's information displays in the TOI ROL. If you have not selected the target, the text is black on white. Once you select the target, the text is white on black.

  The TOI ROL includes:

  - The Track ID
  - Target's bearing and range from bullseye
  - Target altitude
  - Target heading
  - Target speed (Mach number)
  - Target type
  - Target's bearing and range to target from your aircraft

The information for the currently selected target also displays in the HUD, and the selected target blinks (Figure 57).

Figure 56. Radar Lock in the Radar

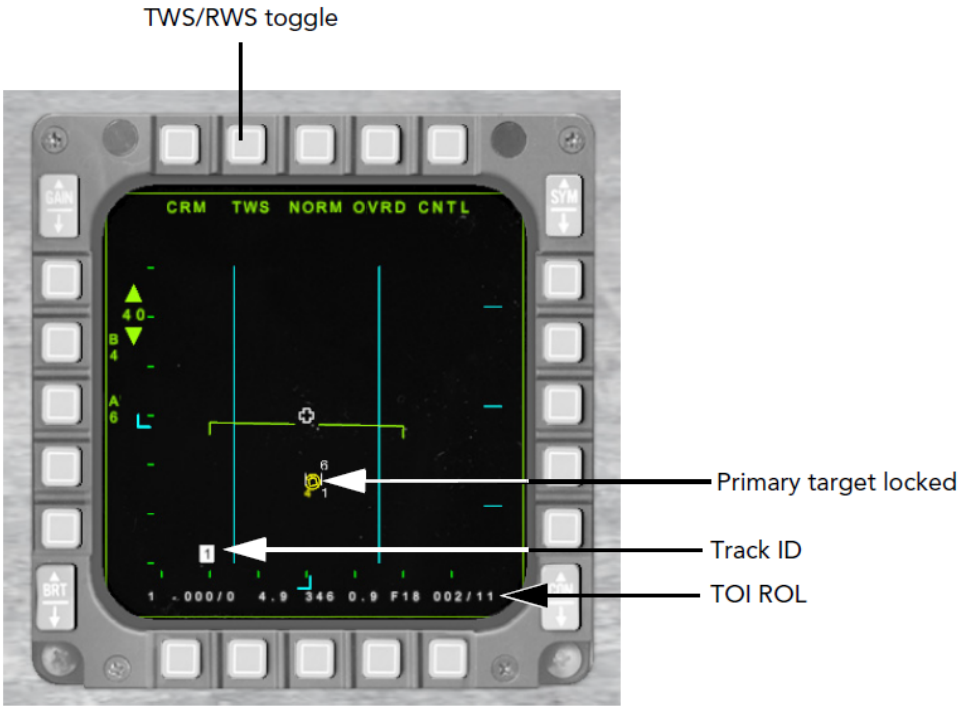
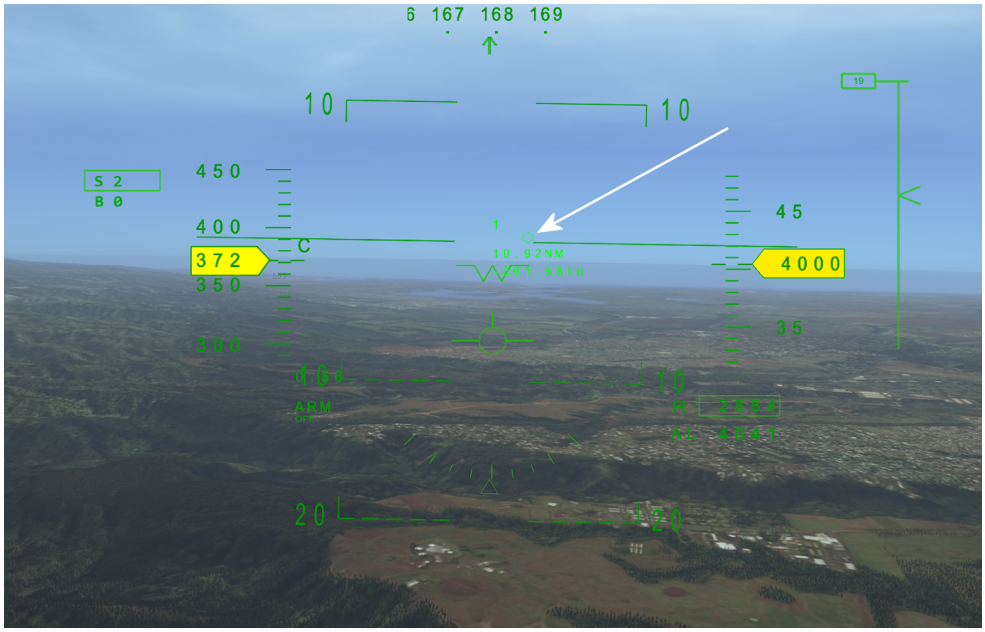


Figure 57. Radar Lock in HUD



Selecting and Firing on Multiple Targets

You can use the cursor controls in the Radar System to select multiple targets, up to six. The targets are added to an air target list in the order that you select them. This list determines the order of attack.

Each time you fire the selected air-to-air weapon, it fires at the next-to-shoot (NTS) target in the list and then cycles the list forward. The NTS target blinks in the HUD, and is circled in the radar. You can also cycle the list forward or backward using the cycling controls. For example, if you have targets 4, 5, 6, and 7, the weapon fires at the targets in order. When you fire the weapon or cycle the list forward, the order of targets becomes 5, 6, 7, and 4. If you cycle the list backward, the order is 7, 4, 5, and 6.

Targets are included in the list until they are destroyed, you unselect a target, or you clear the entire list. Additionally, changing the Radar System mode clears any selected targets and the list. You unselect a target or clear the air target list using the controls on the joystick or keyboard.

7.11.2 Firing an Air-to-Air Weapon

Air-to-air weapons use the radar for targeting.

➤ **To fire an air-to-air weapon:**

1. Choose an air-to-air weapon. See "7.9. Choosing a Weapon" on page 139).
2. Select the target.
3. Press the trigger to fire the weapon.

7.11.3 Focusing the Sensor on the Radar Target

You can set the gimbaled sensor to follow the current radar target.

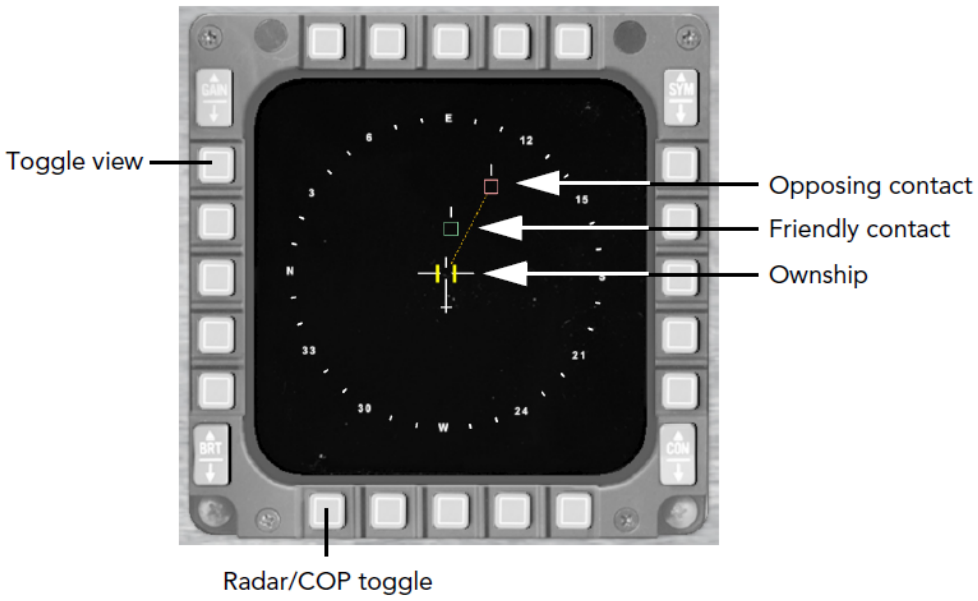
➤ **To focus the sensor on the radar target:**

1. First, target an aircraft. See "7.11.1 Selecting Targets" on page 142.
2. On the Action menu, choose **Gimbaled Sensor > Target Radar Target**. The Visual Sensor focuses on and follows the currently selected target.

7.12. Using the Common Operating Picture

The Tactical Data Link (TDL) Common Operating Picture (COP) is an alternate display to the radar system, displaying surveillance and TDL tracks. Only entities within range of your radar are displayed. In the Radar System, you can use the cursor to select which entity's engagement information to display.

Figure 58. TDL Common Operating Picture



➤ To view the TDL COP, in one of the multi-function displays (MFD) of the instrument panel, click the first button at the bottom to toggle between the Radar System and the COP.

7.12.1 Displaying COP Information for an Entity

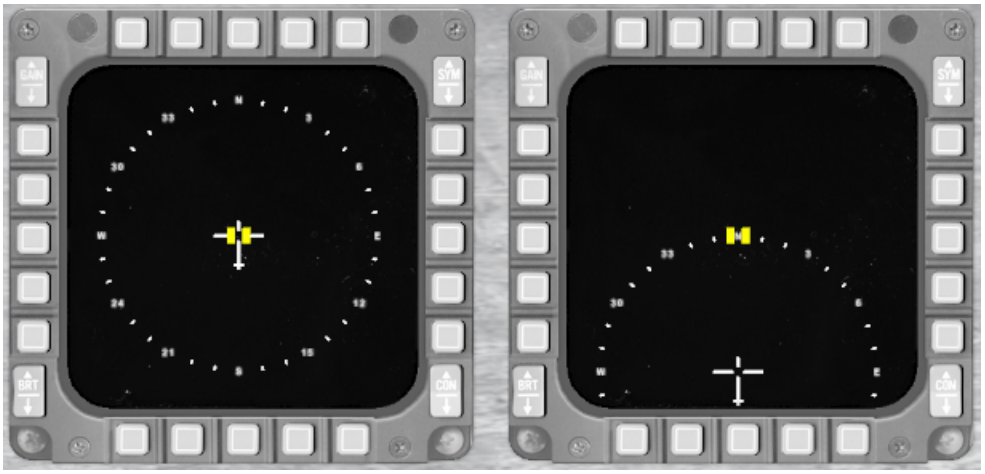
You can see the information about an entity detected by your radar system

➤ To display the information for an entity in the COP, use the controls on the joystick or keyboard to move the cursor over that entity. See "Chapter 11. Mouse, Keypad, and Controller Mappings" on page 171 to learn about the cursor controls.

7.12.2 Toggling the COP Focus Area

By default, the COP centers on the ownship entity. You can shift the focus to a point in front of the entity.

Figure 59. COP Focus Areas - Center and Forward



➤ To toggle the focus between centering on the ownship entity or a point in front of the entity, click the top button on the left side of the MFD.

7.12.3 Selecting an Entity for the COP

You can use the COP to display engagement lines between the aircraft you are flying and entities that you select with the radar.

➤ To select an entity, use the Radar System. See "7.11.1 Selecting Targets" on page 142.

7.13. Requesting SAR Images from RadarFX Server

VR-Engage can request synthetic aperture radar (SAR) images from RadarFX Server. To use this feature, you must install a licensed version of RadarFX Server. For details about using RadarFX Server, please see *RadarFX Users Guide*.

When you request an image, the server returns the image and it is displayed in the multi-function display window of an aircraft's instrument panel.

7.13.1 Requesting a SAR Image

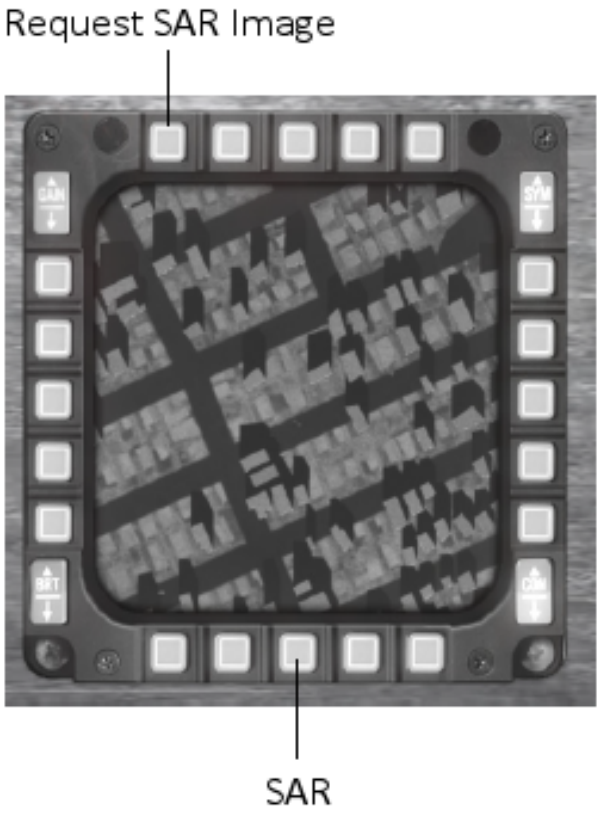
When you request a SAR image, VR-Engage sends the request using the settings configured in the SAR Request Settings dialog box.

RadarFX Server must be running when you request a SAR image.

➤ **To request a SAR image, do one of the following:**

- On the Action menu, choose **Request SAR Image**.
- On the multi-function display, while the SAR image is selected, click the Request SAR Image button (Figure 60).

Figure 60. SAR image



- Press the appropriate button on your joystick.
- Press **S**.

7.13.2 Configuring a SAR Request

When you request a SAR image, you must specify the amount power the SAR system should use.

You can also configure the properties of the image that is returned.

When you request a SAR image as a pilot, the location of the sensor and area of interest are set for you. The image comes from the entity you're flying and focuses on the center of the gimbal view.

Specifying the Power

The power value is the amount of power that the SAR system should use to generate the image. Higher power levels increase the image gain. Lower levels result in a darker image.

➤ **To specify the power**

1. Choose **Settings > SAR Settings.** The SAR Request Settings dialog box opens.
2. Select the Settings tab .
3. In the System Parameters group box, enter a value in the Power box.

Configuring Image Properties

You can specify the properties of the image that the server returns. You can also specify that the image be saved on the server. You can specify the following properties:

- Image size, in pixels.
- Image Rotation. The image can be rotated so that North is up or the sensor's view is up.
- Image Format. Options are PNG, JPG, BMP, Raw, and NITF (National Imagery Transmission Format).
- Image Data Type. Byte, short, or float.

➤ **To specify image properties:**

1. Choose **Settings > SAR Settings**. The SAR Request Settings dialog box opens.
2. Select the Settings tab .
3. In the Image group box, change properties as desired.
4. To save the image on the server, in the Save Options group box, select Save On Server. Specify the directory in which to save images.

Configuring the SAR Connection

To connect to a RadarFX Server, you must specify an IP address and port that matches the port used by the server. The default connection settings on the Connection tab of the SAR Request Settings dialog box match the default settings used by RadarFX Server. If you do not change the settings on the server, you do not have to make any changes in VR-Engage.



8. Controlling Drones

This chapter explains how to deploy and control drones in VR-Engage.

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8.1.2 Video and Images 153
8.1.3 Drone Battery Life 153
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8.1. Introduction

Drone operation is a feature of specific human entities in VR-Engage. It allows you to deploy and fly a quadcopter while playing the role of a human in the scenario.

The three entities that can deploy the quadcopter drone are:

- Civilian Female With Drone.
- Civilian Male With Drone.
- Police Officer With Drone.

After you deploy the drone, it appears and the perspective switches from first person to third person (Figure 61). It also displays the drone's camera view (Figure 62 on the facing page).

The Gamepad controls the drone. VR-Engage includes mappings for the Gamepad F310 and F710. You can use the **W**, **A**, **S**, and **D** keys to move the human entity. As the drone moves, the human character operating it pivots to keep it in the center of the main screen.

Figure 61. Police officer with drone and drone camera view

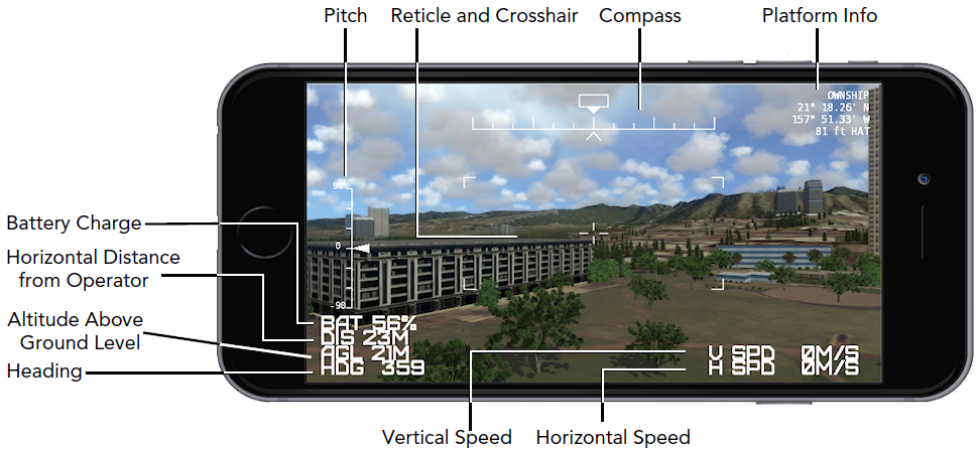


If at any point the drone is destroyed, you can reset the character in place to restore the drone. To learn how to reset entities, please see "4.4. Resetting Entities" on page 93.

8.1.1 Drone Camera Display

The drone camera view shows what the drone can see and also indicates the status of the drone (Figure 62). You can customize the size of the display; see "14.3.4 Drone Camera Display Size" on page 256.

Figure 62. Drone camera view and status indicators



The drone operator can pan the camera up or down, and also zoom in or out.

➤ **To operate the drone's camera:**

1. Add or select a character with a drone.
2. Engage the character.
3. To pan the camera up and down, use the Gamepad's D-pad.
4. To zoom out or in, use the Gamepad's left shoulder button and trigger (buttons 5 and 7).

The default location for the drone camera view is at the top right of the VR-Engage window, but you can configure this.

➤ **To change the camera view in the interface:**

1. Press **F6** one time to change the whole screen to display the camera view instead of the third-person view.
2. Press **F6** a second time to return to the first-person view without the camera view.
3. Press **F6** a third time to return to the default view.

8.1.2 Video and Images

You can use the drone to stream video and capture images. Please see "Chapter 10. Video Stream and Image Capture" on page 167.

8.1.3 Drone Battery Life

The drone has a limited battery life. The current charge status displays in the drone's camera view (Figure 62 above). If the battery charge falls below about 5% while it is in the air, the drone descends to the ground. To restore the drone, open the Action menu and choose **Reset in Place**.

8.2. Operating the Drone

To deploy and operate a quadcopter drone, you must engage as one of the three entities with the drone (Civilian Female With Drone, Civilian Male With Drone, or Police Officer With Drone). The MAK Suite Demo scenario includes a Civilian Male With Drone entity in the neutral (green) force.

You can create one of the drone operator entities to use if you do not want to use the MAK Suite Demo scenario. To learn how to create entities, please see "3.2.2 Creating a New Entity" on page 49.

8.2.1 Deploying and Flying the Drone

When you deploy the drone, the default is to control its movements using the Gamepad and the character's movements with the keyboard.

➤ **To deploy the drone:**

1. Add or select a character with a drone.
2. Engage the character.
3. Open the Action menu and choose **Deployable Objects > Deploy Spark**.
4. Use the Gamepad to control the drone (please see "11.8. Gamepad Mappings for Drones" on page 184). Use the **W**, **A**, **S**, and **D** keys to move the character.

8.2.2 Stopping and Resuming Use of the Drone

While the drone is deployed, you can stop or resume use of the drone.

➤ **To stop or restart using the drone:**

1. Open the Action menu and choose **Drone** to open the Drone submenu.
2. Choose the appropriate option:
   - **Stop Using Drone**. Closes the drone's camera view and leaves the drone in its current location. You can control the human character with the Gamepad.
   - **Use Drone**. Resumes using the drone. The camera view reopens.

8.2.3 Switching Control Between Character and Drone

You can change whether the Gamepad controls the human character or the drone.

➤ **To change what the Gamepad controls:**

1. Open the Action menu and choose **Drone**.
2. Use an Action menu control to toggle the **Gamepad Control**:

- Human: The Gamepad controls the human character.
- Drone: The Gamepad controls the drone.

You can also choose whether the human character's focus is on the drone.

➤ **To change the character's focus:**

1. Open the Action menu and choose **Drone**.
2. Use an Action menu control to toggle the **View Focus**:
   - Human: The human character no longer keeps the drone in the center of the screen.
   - Drone: The human character keeps the drone in his or her sights.

8.2.4 Landing the Drone

You can tell the drone to land itself at its current location.

➤ To land the drone, open the Action menu and choose **Drone > Land**. It descends to the ground.

8.2.5 Returning the Drone to its Starting Position

You can send a command to the drone to have it return from where it is currently located to the starting point where it was first deployed.

➤ To return the drone to its starting location, open the Action menu and choose **Drone > Return to Home**.

The drone camera view closes and the drone flies itself back to its starting position.

8.2.6 Recovering the Drone

When you are finished using the drone, you can command it to return and stow itself.

➤ To recover the drone, open the Action menu and choose **Drone > Recover**.

The drone camera view closes and the drone flies itself to your location from where it was. Afterward, its battery is immediately recharged to full.



If the drone is low on battery power, it cannot fly itself to you. You can reset it in place or move to the drone's location on the ground and then recover it.



9. Sensor Operator Role

This chapter explains the sensor operator role in VR-Engage. The sensor operator is included in the full version of VR-Engage and is also available as an independently licensed capability.

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- 9.1.1 Focusing the Sensor 159
- 9.1.2 Changing the Sensor Mode 160
- 9.1.3 Resetting the Sensor 160
- 9.1.4 Video and Pictures 160
- 9.1.5 Defining a Laser Code 161
- 9.1.6 Lasing Targets 161
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- 9.2.1 Configuring the Location of the Remote Camera 162

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9.1. The Sensor Operator Role

VR-Engage players can control sensors and remote cameras using the sensor operator role. The sensor operator can slew the sensor, zoom in and out, and can focus it on specific locations and entities.

Figure 63. Sensor operator view



You can add remote cameras to a scenario and set their heading and pitch. VR-Engage is also configured to automatically add cameras to remotely simulated (that is, non-VR-Forces) F-18 and UAV entities.

You can expand the remote cameras to other entities by modifying the componentAttachmentTable.mtl in the SMS.

If a sensor is mounted on an entity, the sensor operator does not control the entity. Therefore, you need another player to operate the entity, it must have a VR-Forces plan or task, or it must be mounted on a remote entity.

➤ **To operate a camera:**

1. In the Objects Panel, select a camera or an entity whose sensor you want to control.
2. In the Role list, choose Sensor Operator.
3. Click Engage. The window changes to 3D mode and a sensor overlay is displayed.
4. To zoom in and out, use the Gamepad's right thumbstick, or use your joystick.
5. To slew the sensor, use your joystick or the Gamepad's left thumbstick.

9.1.1 Focusing the Sensor

You can focus the sensor on:

- The center of the screen.
- On a location specified by an MGRS coordinate or laser designation code.

  When you specify an MGRS coordinate or laser designation code, the sensor focuses on that spot. However, if a laser spot moves, the sensor does not follow it. If you specify a laser code for continuous tracking, the sensor follows the laser spot as it moves.
- On a waypoint. If a scenario has waypoints, you can focus on them.
- On a street. If a terrain has shapefiles that have street names, you can focus on a street. The sensor tracks the closest vertex. It must be within five kilometers of the X,Y coordinates of the sensor.

➤ **To set an MGRS target or laser code:**

1. Engage an aircraft as the sensor operator or engage a remote camera.
2. On the Action menu, choose **Gimbaled Sensor**. The Gimbaled Sensor menu opens.
3. Choose **Target MGRS Coordinate** or **Target Laser Spot**. A data entry dialog box opens.
4. Type the code.
5. Press **Enter**.

➤ **To track a laser spot continuously:**

1. Engage an aircraft as the sensor operator or engage a remote camera.
2. On the Action menu, choose **Gimbaled Sensor**.
3. On the Gimbaled Sensor menu, choose **Continuous Track**. A data entry dialog box opens.
4. Type the code.
5. Press **Enter**.

➤ **To track a waypoint:**

1. Engage an aircraft as the sensor operator or engage a remote camera.
2. On the Action menu, choose **Gimbaled Sensor**.
3. On the Gimbaled Sensor menu, choose **Track Waypoint**. A list of waypoints opens.
4. Select the waypoint you want to track.
5. Press **Enter**.

➤ **To track a street:**

1. Engage an aircraft as the sensor operator or engage a remote camera.
2. On the Action menu, choose **Gimbaled Sensor**.

3. On the Gimbaled Sensor menu, choose **Enter Street Name**. A text entry dialog box opens.
4. Type the name of the street you want to track.
5. Press **Enter**.

➤ To focus the sensor on the center of the screen, press the A button on your Gamepad.

9.1.2 Changing the Sensor Mode

A sensor operator can view the scenario in visual mode, NVG mode, or IR mode.

You can set the available modes in *./appData/scripts/playerdefinitions/sensorOperator.lua* by editing the **sensorModes** array. When you change the sensor mode, it cycles through the available modes in the order specified in the array.

➤ **To change the sensor mode:**

1. Engage an aircraft as the sensor operator or engage a remote camera.
2. On the Action menu, choose Gimbaled Sensor.
3. On the Gimbaled Sensor menu, choose **Mode**.
4. Cycle through the modes to choose the one you want.

You can also change the sensor mode by pressing the X button on a Gamepad.

9.1.3 Resetting the Sensor

When you reset the sensor, it returns to a fixed angle at the neutral azimuth and elevation.

➤ **To reset the sensor:**

1. On the Action menu, choose **Gimbaled Sensor**.
2. On the Gimbaled Sensor menu, choose **Reset Sensor**.

You can also reset the sensor by pressing the Y button on a Gamepad.

9.1.4 Video and Pictures

You can use the sensor operator to stream video and capture images. Please see "Chapter 10. Video Stream and Image Capture" on page 167.

9.1.5 Defining a Laser Code

You can define the laser code used when you lase a target. Laser codes can be up to four digits long. See "9.1.6 Lasing Targets" below, to learn how to lase a target.

➤ **To define the laser code:**

1. On the Action menu, choose **Set Laser Code**. Input Laser Code dialog box opens.
2. Enter a laser code and then press **Enter**. The LSR code displays in the sensor view.

Your laser designator uses that code.

9.1.6 Lasing Targets

Sensor operators can lase targets.

When you lase a target, the display shows that the laser is on. If you enable laser designators, a green circle and laser code displays on the lased location. See "5.13.3 Enabling Laser Designators" on page 118.

➤ **To lase a target or turn off lasing:**

1. Focus the sensor on a target or location. See "9.1.1 Focusing the Sensor" on page 159.
2. On the Action menu, choose **Lasing**.
3. Use an Action menu control method to toggle Lasing on or off.

9.1.7 Firing Weapons

When you engaged as a sensor operator, you can use the weapons available on the aircraft. The typical case is to fire at your own laser designator. You can also target a laser spot that another entity is currently lasing.

➤ **To target, select, and fire a weapon:**

1. To fire at your own laser designator:
   a. Define your laser code (see "9.1.5 Defining a Laser Code" above).
   b. Focus the sensor and lase the target (see "9.1.6 Lasing Targets" above).

   To fire at another entity's laser designator, choose **Gimbaled Sensor > Target Laser Spot** and then enter that laser code. The LSS code displays in the sensor view.
2. In the Action menu, choose **Selected Weapon** and then use an Action menu control method to cycle through weapons until the one you want is displayed (Table 4 on page 139).
3. In the Action menu, choose **Fire Selected Weapon**.

9.2. Placing Sensors on Remote Entities

VR-Engage uses the VR-Forces remote component attachment feature to automatically place gimbaled sensors on remotely simulated entities. A remotely simulated entity is an entity that is part of an exercise, but is simulated by an application other than VR-Forces. The sensor is attached to the remote entity and moves with it. You can use the sensor operator role to operate the sensor. You cannot operate the remote entity.

The entities to which VR-Engage automatically attaches sensors are configured in *./data/simulationModelSets/VR-Engage/extra/componentAttachmentTable.mtl*.

The location where the sensor is embarked on the remote entity is configurable in the VR-Forces Simulation Object Editor.

If your scenario uses multiple simulation engines, then by default, the remote sensor is simulated on the first one.

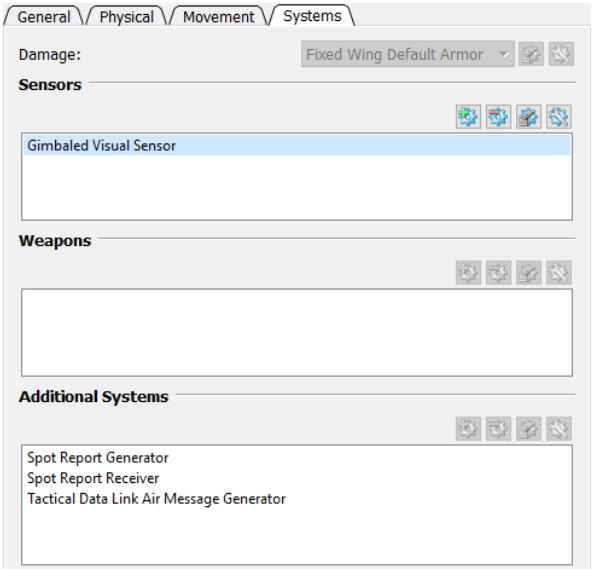
9.2.1 Configuring the Location of the Remote Camera

VR-Engage places a sensor on a remote entity at a location relative to the center of the entity. You can specify an offset from the default location.

➤ **To specify the offset for placing a sensor on a remote entity:**

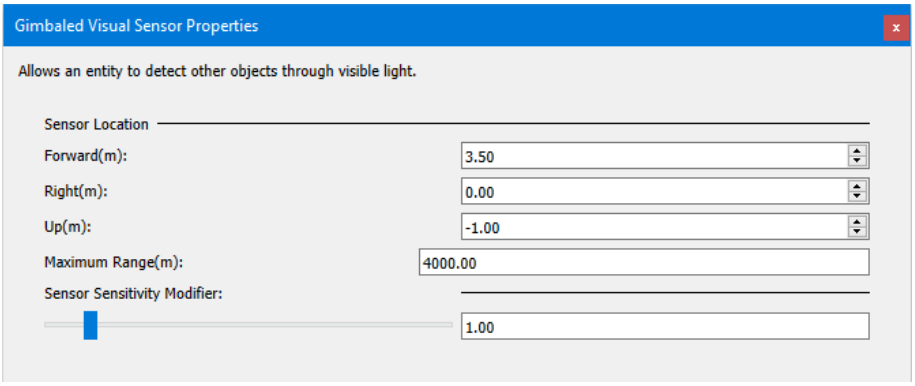
1. In a version of VR-Forces that has the VR-Engage add-ons installed, open the Simulation Object Editor.
2. Open *VR-Engage.sms*.
3. In the list of objects, select the VR-Forces entity that you want to configure to use a remote camera.
4. On the right, select the Systems tab.

Figure 64. Gimbaled Visual Sensor system



5. Select the Gimbaled Visual Sensor System.
6. Click the Properties button (). The Gimbaled Visual Sensor Properties dialog box opens.

Figure 65. Gimbaled Visual Sensor Properties



7. Edit the Sensor Location parameters.
8. Click OK.
9. Save the SMS.
10. Copy the updated SMS to your VR-Engage installation's *./data/simulationModelSets* directory. (Or you can just copy the *./data/simulationModelSets/VR-Engage/vrfSim/Remote Sensor.entity* file.)

9.3. Configuring the Sensor Operator Overlay

The information displayed on the sensor operator overlay is controlled by keywords in the following lines in *./appData/scripts/playerDefinitions/sensorOperator.lua*:

```
includes={
  --include these regardless of entity type
  "devices/menu.lua";
  "devices/radio.pilot.lua";

  --When entering this role, the configuration that best matches
  --the ownship's entity type will be used.
  ["-1:-1:-1:-1:-1:-1:-1"] = {
    components ={
      { componentType = "DtVrvSensorOverlayUpdater";
        priority = 10;
        sections = {"Crosshair", "PlatformInfo", "VreTargetInfo",
             "VreDisplayInfo", "Pitch", "Reticle", "Compass", "Time"};
      };
    };
  };
  ["1:2:-1:-1:-1:-1:-1"] = {
    components ={
      { componentType = "DtVrvSensorOverlayUpdater";
        priority = 10;
        sections = {"Crosshair", "PlatformInfo", "VreMgrsTargetInfo",
             "VreDisplayInfo", "Pitch", "Reticle", "Compass", "Time"};
      };
```

```
    };
  };
  ["5:-1:-1:-1:-1:-1:-1"] = {
    components ={
      { componentType = "DtVrvSensorOverlayUpdater";
        priority = 10;
        sections = {"Rec", "Reticle", "DateTime"};
      };
    };
  };
};
```

The overlay to use is chosen based on the object type enumeration. You can add or remove overlay components by adding or removing keywords. The keywords are as follows, referenced to Figure 66 and Figure 67:

- Crosshair (1).
- VreTargetInfo (2). Show location using latitude/longitude coordinates.
- VreMgrsTargetInfo (2). Show location using MGRS coordinates.
- PlatformInfo (3).
- VreDisplayInfo (4).
- Pitch (5).
- Reticle (6).
- Compass (7).
- Time (8).
- Laser Code and Laser Spot (9). You define the Laser Code (LSR) for lasing a target by choosing **Set Laser Code** from the Action menu. You specify the Laser Spot (LSS) for the weapon by choosing **Gimbaled Sensor > Target Laser Spot** from the Action menu.
- Rec (Record. This is only text. VR-Engage does not record anything.) (10).
- DateTime (11).

Figure 66. Sensor operator overlay for aircraft

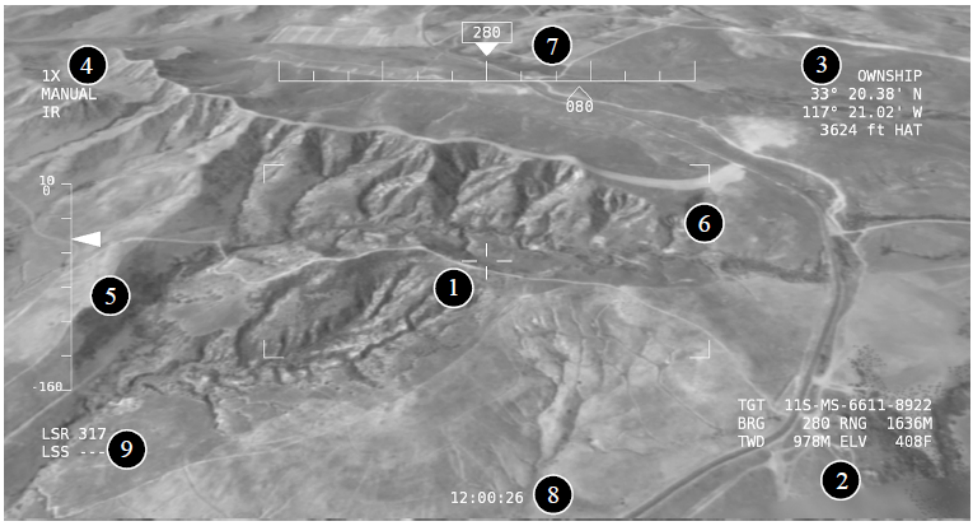
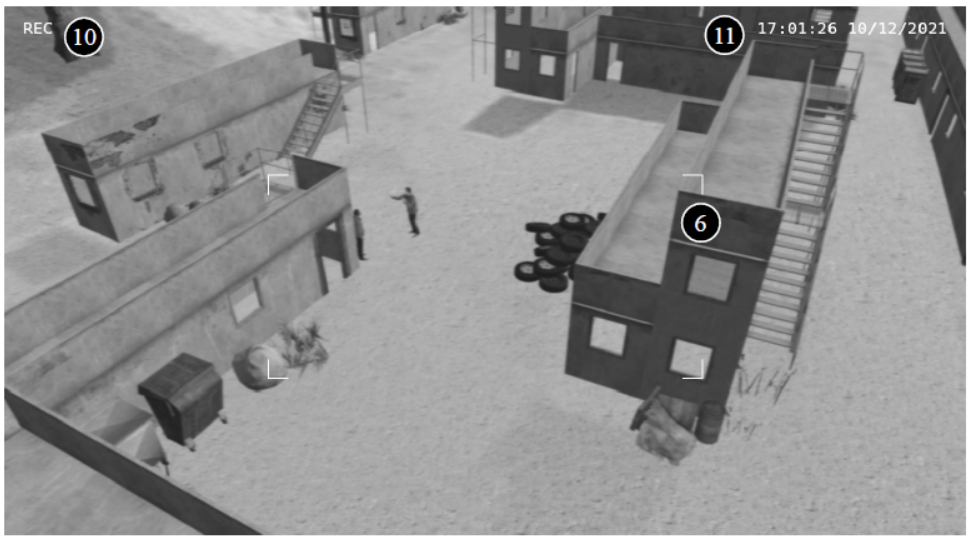


Figure 67. Sensor operator overlay for security camera



You can also write a plug-in to create new overlay elements.



10. Video Stream and Image Capture

This chapter explains how to use the Video Stream and Capture Image features for the Sensor Operator and Drone.

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10.1. Introduction

You can use the sensor operator or the drone to stream video and take pictures.



Please see "Chapter 8. Controlling Drones" on page 151 and "Chapter 9. Sensor Operator Role" on page 157 for more about those features.

10.2. Video Streams

Sensor operators and drones can stream video. The default is to stream to a file. To receive the video stream, you must install a media player that can process the video stream, such as VLC media player.

10.2.1 Streaming Video as a Sensor Operator

The sensor operator streams the camera's video feed.

➤ **To stream video as a sensor operator:**

1. Add or select an entity that has a sensor.
2. Engage as the Sensor Operator.
3. Open the Action menu and choose **Gimbaled Sensor**.
4. Use an Action menu control to toggle **Video Stream** to Started.

A user can then receive the video stream (see"10.2.4 Receiving a Video Stream" on the facing page).

10.2.2 Streaming Video from a Drone

The drone can stream the full VR-Engage window or only the drone's camera view.

➤ **To stream video from a drone:**

1. Add or select an entity with a drone.
2. Engage the character.
3. Open the Action menu and choose **Deployable Objects > Deploy Spark**.
4. From the Drone submenu, choose **Streaming Video** and use an Action menu control to open the submenu. The Streaming Video submenu opens.
5. Use an Action menu control to toggle **Video Stream** to Started.
6. Choose **Video Source** and use an Action menu control to open the submenu. The Video Source menu opens.
7. Select whether the source of the video stream should be the Main Window or the Drone View. A user can then receive the video stream (see "10.2.4 Receiving a Video Stream" on the facing page).

10.2.3 Editing the Video Stream File Settings

The sensor operator and drone video streams default to a file. You can change the stream settings by editing the **DtStreamingVideoUpdater** definition in the *sensorOperator.lua* or *human.lua* file in *./appData/scripts/playerDefinitions*.

10.2.4 Receiving a Video Stream

To receive the video stream, you must have a viewing application installed and have access to the VR-Engage installation where the video is being streamed. For details about configuring the video stream, please see *Chapter 8, Using Streaming Video*, in *VR-Vantage Users Guide*.

The default stream is *H264 HW-MPGTS-FILE*, saved in *./appData/videoStreams*, but you can edit it.

➤ **To receive the video stream:**

1. Launch the viewing application.
2. Select the stream file in the directory where VR-Engage is streaming the video.

As long as the video stream is turned on for the sensor or drone, the video stream displays in the viewing application.

10.3. Capturing Images

The sensor operator and drone have cameras that can take screen shots of the camera view and save them to your computer.

➤ **To take pictures with the sensor operator:**

1. Add or select an entity that has a sensor.
2. Engage as the Sensor Operator.
3. Open the Action menu and choose **Gimbaled Sensor > Capture Image**.

A screen capture of the camera view is saved in *./userData/screenshots* as a *PNG* file.

➤ **To take pictures with the drone:**

1. Add or select a character with a drone.
2. Engage the character.
3. Open the Action menu and choose **Deployable Objects > Deploy Spark**.
4. Fly the drone to the location where you want to take a picture.
5. Open the Action menu and choose **Drone > Capture Image**.

A screen capture of the camera view is saved in *./userData/screenshots* as a *PNG* file.



11. Mouse, Keypad, and Controller Mappings

This chapter describes mouse and keyboard mappings and controller mappings for VR-Engage. For details about configuration additional controllers, please see "11.12. Configuring Joysticks and Keyboard Control" on page 202.

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11.1. Mouse and Keyboard Mappings

Using the mouse and keyboard, you can control human characters, ground vehicles, and navigate the Action menu. You can also perform some aircraft behaviors.

11.1.1 Human Controls

Table 5 lists mouse and keyboard mappings for human players.

Table 5. Human player mouse and keyboard controls

Mouse Mappings	
Turn and move weapon	Mouse move
Fire	Left mouse button
Zoom in	Mouse wheel forward
Zoom out	Mouse wheel backward
Aim	Right mouse button
Keyboard Mappings	
Application Management	
Reset in current position (the scenario continues to run)	Ctrl+F5
Reset to starting position (the scenario continues to run)	F5
Toggle Action menu	~ (tilde)
Toggle full screen	Ctrl+Enter
Disable/enable mouse control	Ctrl
Disengage/change role	Esc
Movement	
Sprint forward	Shift+W
Run forward	W
Walk forward	Alt+W
Walk backward	S
Run backward	Shift+S
Turn left	Left arrow
Turn right	Right arrow
Posture up	Q
Posture down	E
Stand	C
Lay prone	Z

Table 5. Human player mouse and keyboard controls (continued)

Toggle First-person/3rd person mode	V
Parachuting	
Deploy parachute	Spacebar
Turn left or right	A, D
Slow rate of descent	A+D
Engagement	
Aim	, (comma)
Strafe left	A
Strafe right	D
Pitch weapon/look up	Up arrow
Pitch weapon/look down	Down arrow
Toggle Weapon State (Stowed, Ready, Aiming)	‘ (apostrophe)
Cycle weapons	Spacebar
Select weapon	1, 2, 3, and so on (not on number pad)
Reload weapon	R
View and Accessories	
Look (weapons are disabled while looking)	. (period) + arrow keys or mouse
Toggle night vision goggles	N
Toggle binoculars	B
Zoom in	=
Zoom out	- (dash, not on number pad)
Talk on the radio	T
Toggle flashlight	F
Toggle compass	G
Toggle minimap	M
Zoom in on minimap	+ (plus sign on number pad)
Zoom out of minimap	- (minus sign on number pad)

11.1.2 Ground Vehicle Controls

Table 6 lists keyboard controls for ground vehicles.

Table 6. Keyboard mappings for ground vehicles

Function	Key
Movement (driver role)	
Steer left	A
Steer right	D
Throttle	W
Brake	S
Shift gear up	Q
Shift gear down	E
Start/stop engine	X
Differential lock	C
Headlights	L
Parking brake	P
Engagement (gunner role and the LAV driver role)	
Turret left	H
Turret right	K
Turret up	U
Turret down	J
Fire	F
Next weapon	R
Previous weapon	V
Commander RWS role	
Toggle laser designator	L
Slew to cue	C
Gunner override	O
Mouse Mappings (commander and gunner only)	
Look (commander)	Mouse move
Move turret (gunner)	Mouse move
Fire weapon (gunner)	Left mouse button
Zoom in	Mouse wheel forward
Zoom out	Mouse wheel backward

11.1.3 Aircraft Controls

Table 1 lists the keyboard mappings for aircraft. You require another controller to fly the aircraft. See "11.9. Flight Controllers" on page 185.

Table 7. Keyboard mappings for fixed-wing aircraft

Function	Key
Toggle radar warning receiver	M
Observer mode	V
Landing gear	G
Engagement	
Move radar cursor up	I
Move radar cursor down	K
Move radar cursor left	J
Move radar cursor right	L
Select target closest to cursor	Z
Unselect target closest to cursor	X
Cycle target list back	T
Cycle target list forward	Y
Clear air target list	U
Launch chaff	C
Launch flares	F

11.1.4 Action Menu Controls

Table 8 lists keyboard controls for the Action menu.

Table 8. Action menu mouse and keyboard mappings

Mouse Mappings	
Select menu item	Mouse click Number matching menu item
Keyboard Mappings	
Toggle Action menu	~ (tilde)
Next menu item	Up arrow
Previous menu item	Down arrow
Select menu item	Right arrow or Enter
Return to previous menu	Left arrow

11.2. Tips for Logitech Gamepad

The Mode button switches the functions of the D-pad and the left thumbstick. Since it is easy to inadvertently press it, if the D-pad and thumbstick are not working as expected, check the Mode button. It should be off (no green light).

VR-Engage controls use DirectInput. There is a switch on the back of the Gamepad that you can set to either D (DirectInput) or X (XInput). This should be set to D to control VR-Engage entities as described in the following sections.

11.3. Gamepad Mappings for Human Control

Figure 68 illustrates Gamepad mappings for controlling humans.

Figure 68. Human controls

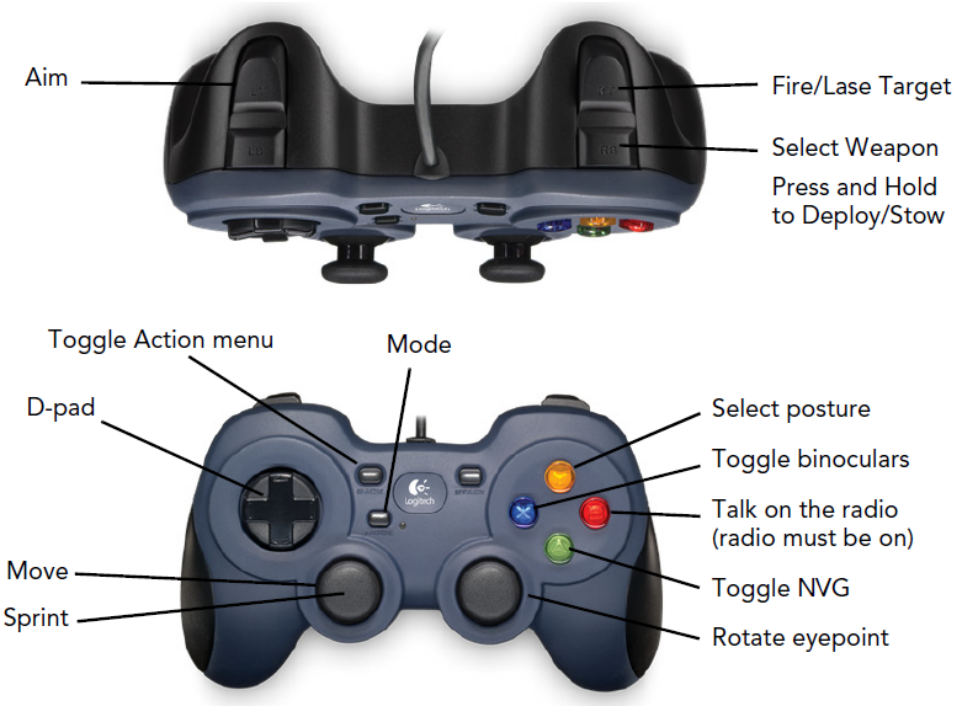


Table 9 lists the Gamepad controls for human characters.

Table 9. Gamepad control mappings - human

Function	Key/Button
Movement	
Move	Axis 1 and Axis 2, or D-pad
Sprint	Button 11 Down Toggle
Rotate Eyepoint	Axis 3 and Axis 4
Posture Select	Button 4 Down Toggle
Toggle Binoculars	Button 1 Down Toggle
Talk on radio	Button 3 Down Toggle
Human Combat	
Aim	Button 7 Down Toggle
Fire/Lase Target	Button 8 Down Toggle
Weapon Cycle	Button 6 Down Toggle

11.4. Gamepad Mappings for Using the Action Menu

Figure 69 illustrates Gamepad mappings for the Action menu.

Figure 69. Gamepad menu controls



Table 10 lists the Gamepad controls for using the Action menu.

Table 10. Gamepad control mappings - Action menu

Function	Key/Button
Move in menu	D-pad
Toggle Action Menu	Button 9 Down Toggle
Select	Button 2 Down Toggle
Cancel	Button 3Down Toggle

11.5. Gamepad Mappings for the LAV and Tanks

Gamepad mappings for controlling the LAV and tanks depend on the role you are playing. They are illustrated as follows:

- Figure 70 illustrates driver controls. These controls also apply to driving tanks, except as noted.
- Figure 71 illustrates commander controls. These controls also apply to tanks with commander roles.
- Figure 72 illustrates gunner controls. The controls also apply to tanks.

Figure 70. Driver controls for LAV and tanks

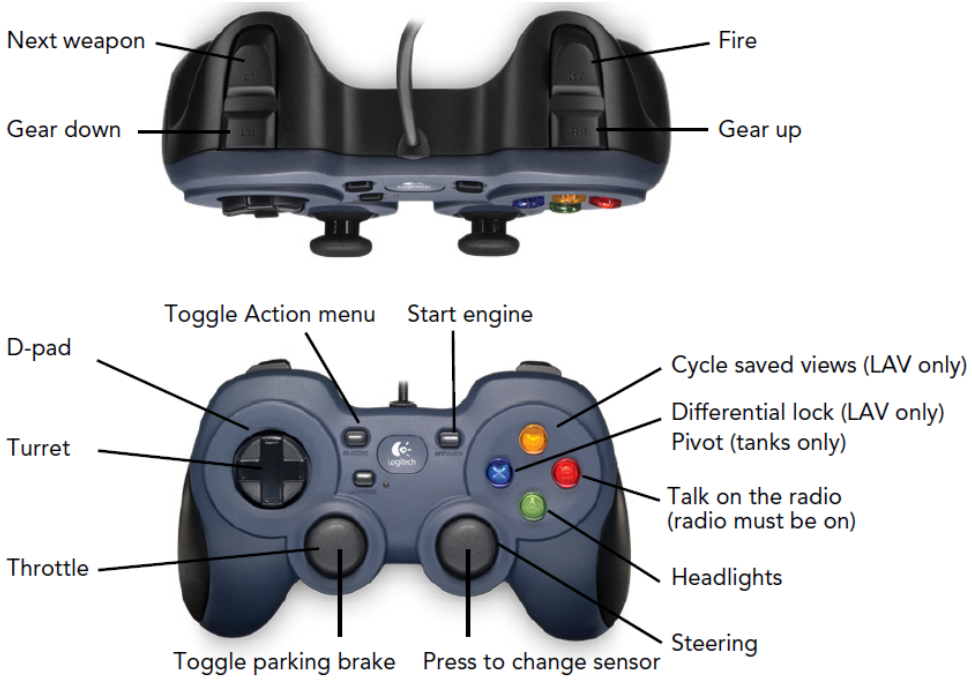


Table 11 lists the driver's Gamepad controls for the LAV and tanks.

Table 11. Driver Gamepad control mappings - LAV and tanks

Function	Key/Button
Vehicle Control	
Start Engine	Button 10 Down Toggle
Throttle	Axis 2
Gear Down	Button 5 Down Toggle
Gear Up	Button 6 Down Toggle
Parking Brake	Button 11 Down Toggle
Steering	Axis 3
Differential Lock (LAV)	Button 1 Down Toggle
Pivot (tanks only)	Button 1 Down Toggle
Headlights	Button 2 Down Toggle
Talk on radio	Button 3 Down Toggle
Cycle saved views (LAV)	Button 4 Down Toggle
Change sensor	Button 12 Down Toggle
Engagement	
Turret	D-pad

Table 11. Driver Gamepad control mappings - LAV and tanks (continued)

Function	Key/Button
Cycle Weapon	Button 7 Down Toggle
Fire Weapon	Button 8 Down Toggle

Figure 71. Commander controls - LAV and tanks

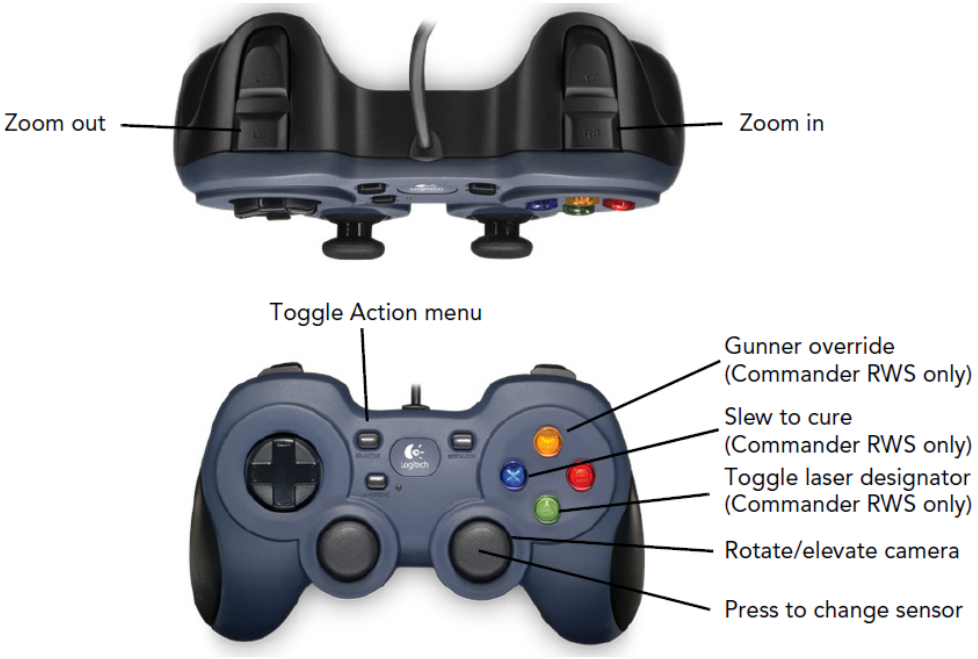


Table 12 lists the commander's Gamepad controls for the LAV and tanks. (Not all tanks are configured with commander roles.)

Table 12. Commander Gamepad control mappings - LAV and tanks

Function	Key/Button
Rotate/elevate camera	Axis 3 and Axis 4
Change sensor	Button 12 Down Toggle
Zoom out	Button 5 Down Toggle
Zoom in	Button 6 Down Toggle
Slew to cue	Button 1 Down Toggle (Commander RWS only)
Gunner override	Button 4 Down Toggle (Commander RWS only)
Toggle Laser Designator	Button 2 Down Toggle (Commander RWS only)

Figure 72. Gunner controls for LAV and tanks



Table 13 lists the gunner's Gamepad controls for the LAV and tanks.

Table 13. Gunner Gamepad control mappings - LAV and tanks

Function	Key/Button
Rotate/elevate gun	Axis 3 and Axis 4
Change sensor	Button 12 Down Toggle
Zoom out	Button 5 Down Toggle
Zoom in	Button 6 Down Toggle
Cycle Weapon	Button 7 Down Toggle
Fire Weapon	Button 8 Down Toggle
Talk on radio	Button 3 Down Toggle

11.6. Racing Wheel Controllers

VR-Engage supports the Logitech G27 and G29 racing wheel controllers.

If your racing wheel is not working as expected, make sure you are using the latest drivers.

Figure 73 illustrates the mappings of the G27 racing wheel.

Figure 73. G27 racing wheel controls



Table 14 lists the G27 racing wheel controls.

Table 14. G27 Racing Wheel control mappings

Function	Key/Button
Next View	Button 4 Down Toggle
Previous View	Button 3 Down Toggle
Cycle Sensor	Button 16 Down Toggle
Brake	Axis 3
Differential Lock	Button 7 Down Toggle
Engine Enable	Button 8 Down Toggle
Gear Down	Button 6 down Toggle
Gear Up	Button 5 Down Toggle
Headlights	Button 20 Down Toggle
Parking Brake	Button 22 Down Toggle
Reset	Button 23 Down Toggle
Steering	Axis 1
Throttle	Axis 2

Figure 74 illustrates the mappings of the G29 racing wheel.

Figure 74. G29 racing wheel controls

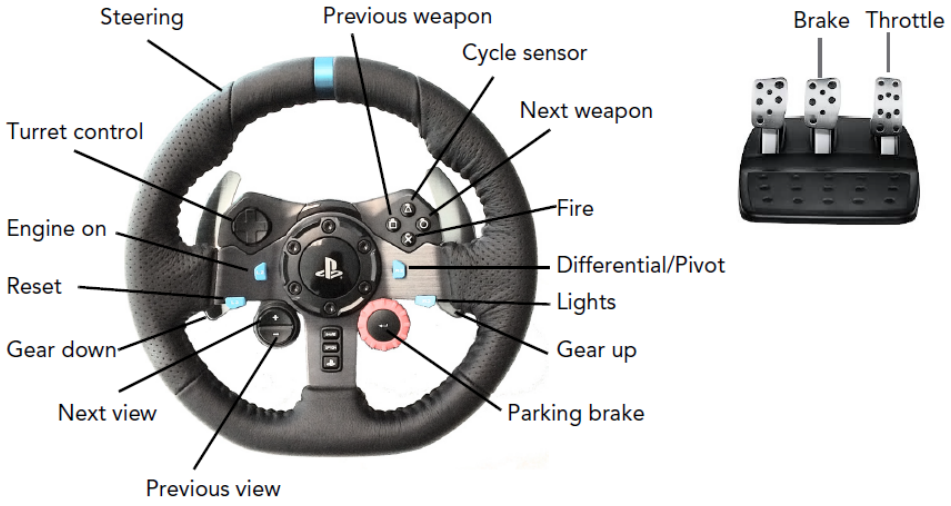


Table 15 lists the G29 racing wheel controls.

Table 15. G29 racing wheel control mappings

Function	Key/Button
Next View	Button 20 Down Toggle
Previous View	Button 21 Down Toggle
Cycle Sensor	Button 4 Down Toggle
Brake	Axis 3
Differential Lock	Button 7 Down Toggle
Engine Enable	Button 8 Down Toggle
Gear Down	Button 6 down Toggle
Gear Up	Button 5 Down Toggle
Headlights	Button 11 Down Toggle
Parking Brake	Button 24 Down Toggle
Reset	Button 12 Down Toggle
Steering	Axis 1
Throttle	Axis 2
Differential Lock	Button 7 Down Toggle

11.7. Gamepad Mappings for Cars and Trucks

This section describes Gamepad mapping for cars and trucks. These vehicles have a driver role, but for the most part do not have weapons.

Figure 75. Driver controls for cars and trucks



Table 16 lists the driver's Gamepad controls for cars and trucks.

Table 16. Driver Gamepad control mappings - cars and trucks

Function	Key/Button
Vehicle Control	
Start Engine	Button 10 Down Toggle
Throttle	Axis 2
Gear Down	Button 5 Down Toggle
Gear Up	Button 6 Down Toggle
Parking Brake	Button 11 Down Toggle
Steering	Axis 3
Headlights	Button 2 Down Toggle

11.8. Gamepad Mappings for Drones

Figure 76 illustrates the drone controls for Gamepads. These are for the drone that can be deployed by human characters: Civilian Female With Drone, Civilian Male With Drone, and Police Office With Drone.

Figure 76. Drone controls



Table 17 lists the Gamepad controls for the drone.

Table 17. Gamepad control mappings - drone

Function	Key/Button
Drone Flight Controls	
Altitude	Left thumbstick, forward/back
Direction	Left thumbstick, left/right
Movement	Right thumbstick, forward/backward/left/right
Drone Camera Controls	
Zoom in	Button 7
Zoom out	Button 5
Pan up or down	D-pad, up/down

11.9. Flight Controllers

VR-Engage includes mappings for the Thrustmaster HOTAS Warthog flight (Joystick-HOTAS Warthog) controller, the T.Flight Hotas X (T.Flight Hotas X) flight controller, and the Gamepad F310 and F710 (Logitech Dual Action).

11.9.1 HOTAS Warthog Mappings for Fixed-Wing Entities

Figure 77 and Figure 78 show the mappings for the Thrustmaster Warthog flight controller for fixed-wing entities.

Figure 77. Thrustmaster HOTAS Warthog joystick mappings - fixed-wing



Figure 78. Thrustmaster HOTAS Warthog throttle mappings - fixed-wing

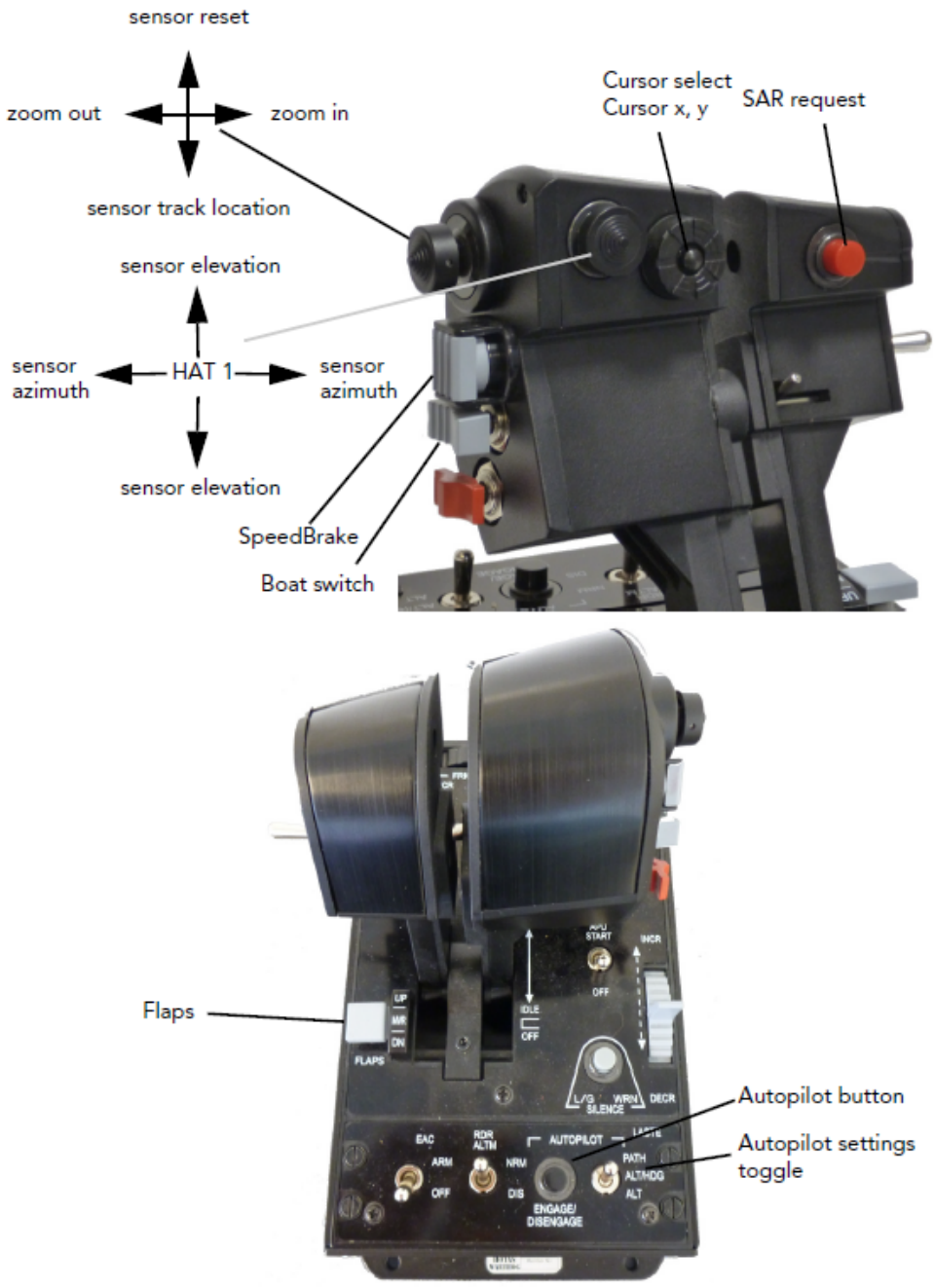


Table 18 lists the flight controls for the Thrustmaster HOTAS Warthog controller for fixed-wing entities.

Table 18. Thrustmaster HOTAS Warthog mappings - fixed-wing

Function	Key/Button
Extended Flight Controls	
AutopilotMode1	Throttle Button 27 Down Toggle
AutopilotMode2	Throttle Button 28 Down Toggle
AutopilotToggle	Throttle Button 26 Down Toggle
Flap 1	Throttle Button 22 Down Toggle. Toggle states match joystick up, maneuver, down.
Flap 2	Throttle Button 23 Down Toggle. Toggle states match joystick up, maneuver, down.
NoseWheelSteering	Button 3 Down Toggle
ToggleLandingGear	G Toggle
Engagement	
cycle weapon	Throttle Button 5 Down Toggle
fire selected weapon	Throttle Button 1 Down Toggle
replenish fuel and ordnance	Throttle Button 4 Down Toggle
FixedWingLib CGF Flight Controls	
air brake	Boat Switch (Button 10) Down. This causes excess drag and the plane's speed drops quickly.
pitch	Joystick forward and back (Axis 2)
roll	Joystick left and right (Axis 1)
throttle	Throttle lever (Axis 3)
wheel brake	SpeedBrake (Button 7) Down, button 8 Down. If you pull back and release, it re-centers. If you push forward, it locks in place. Both directions activate full brakes.
Gimbaled Sensor	
sensor-azimuth	Throttle HAT 1 Right (Up), HAT 1 Left (Down)
sensor-cycle	Joystick Button 7 Down Toggle
sensor-elevation	Throttle HAT 1 Up (Up), HAT 1 Down (Down)
sensor-reset	Throttle Button 3 Down
sensor-track-location	Throttle Button 5 Down
sensor-zoom	Throttle Button 4 (Down), Button 6 (Up)
Observer Control	
ObserverAttachMode	V (on the keyboard)
Radar Scope	
cursor-select	Button 1 (also clears the selection from the air target list)

Table 18. Thrustmaster HOTAS Warthog mappings - fixed-wing (continued)

Function	Key/Button
cursor-x	Axis 1
cursor-y	Axis 2
Clear air target list	U (on the keyboard)
SAR	
request	Throttle Button 15

11.9.2 HOTAS Warthog Mappings for Rotary-Wing Entities

Figure 79 and Figure 80 show the mappings for the Thrustmaster Warthog flight controller for rotary-wing entities.

Figure 79. Thrustmaster HOTAS Warthog joystick mappings - rotary-wing



Figure 80. Thrustmaster HOTAS Warthog throttle mappings - rotary-wing

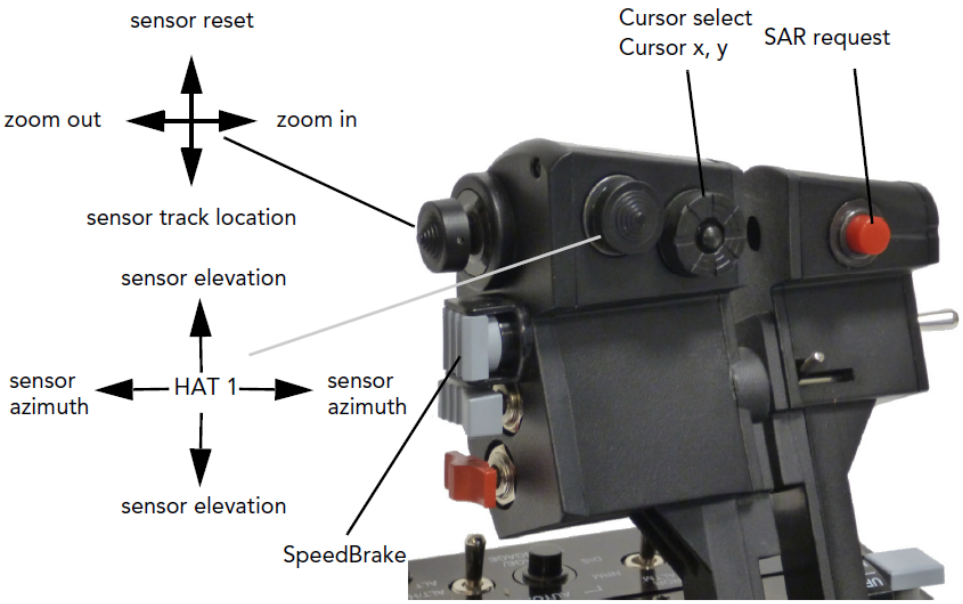


Table 19 lists the flight controls for the Thrustmaster HOTAS Warthog controller for rotary-wing entities.

Table 19. Thrustmaster HOTAS Warthog mappings - rotary-wing

Function	Key/Button
Engagement	
fire selected weapon	Button 1 Down Toggle
cycle weapon	Button 5 Down Toggle
replenish fuel and ordnance	Button 4 Down Toggle
Gimbaled Sensor	
sensor-azimuth	Throttle HAT 1 Right (Up), HAT 1 Left (Down)
sensor-cycle	Joystick Button 7 Down Toggle
sensor-elevation	Throttle HAT 1 Up (Up), HAT 1 Down (Down)
sensor-reset	Throttle Button 3 Down

Table 19. Thrustmaster HOTAS Warthog mappings - rotary-wing (continued)

Function	Key/Button
sensor-track-location	Throttle Button 5 Down
sensor-zoom	Throttle Button 4 (Down), Button 6 (Up)
Radar Scope	
cursor-select	Button 1 (also removes selection from the air target list)
cursor-x	Axis 1
cursor-y	Axis 2
Clear air target list	U (on keyboard)
RotorLib CGF Rotary Wing Controls	
collective	Axis 3, <UP>, <DOWN>
pedal	HAT 1 Up, HAT 1 Left
pitch	Axis 2, W
roll	Axis 1, D (Up), A (Down)
wheel brake	SpeedBrake (Button 7) Down, button 8 Down. If you pull back and release, it recenters. If you push forward, it locks in place. Both directions activate full brakes.
SAR	
request	Button 15

11.9.3 T.Flight Hotas X Mappings for Fixed-Wing Entities

Figure 81 shows the joystick controls for the T.Flight Hotas X flight controller for fixed-wing entities.

VR-Engage also supports the T.Flight Hotas 4 controller. The button layout is similar to the T.Flight Hotas X.

Figure 81. T.Flight Hotas X joystick - fixed wing



Figure 82 shows the throttle controls for the T.Flight Hotas X flight controller for fixed-wing entities.

Figure 82. T.Flight Hotas X throttle - fixed-wing

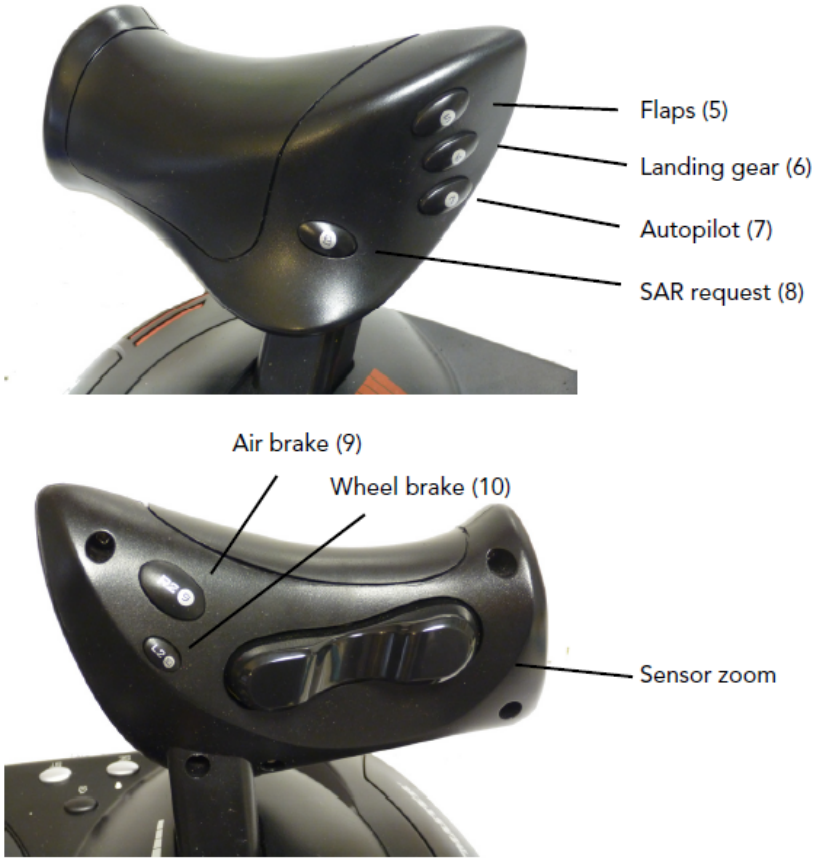


Table 20 lists the flight controls for the T.Flight Hotas X controller for fixed-wing entities.

Table 20. T.Flight Hotas X mappings - fixed-wing

Function	Key/Button
Engagement	
cycle weapon	Button 5 Down Toggle
fire selected weapon	Button 1 Down Toggle
cursor select target	Button 3 Down Toggle
FixedWingLib CGF Flight Controls	
pedal	Joystick twist left and right (Axis 4)
pitch	Joystick forward and back (Axis 2)
roll	Joystick left and right (Axis 1)
throttle	Throttle forward and back (Axis 3)
autopilot	Button 7
air brake	Button 9 Down

Table 20. T.Flight Hotas X mappings - fixed-wing (continued)

Function	Key/Button
landing gear	Button 6
flaps	Button 5
wheel brake	Button 10 Down
Menu	
Action menu	Button 4 Down
down	HAT 1 Down, <DOWN>
left	HAT 1 Left, <LEFT>
right	HAT 1 Right, <RIGHT>
up	HAT 1 Up, <UP>
Observer Control	
Attach mode	V (on keyboard)
Radar Scope	
down	HAT 1 Down, <DOWN>
left	HAT 1 Left, <LEFT>
right	HAT 1 Right, <RIGHT>
up	HAT 1 Up, <UP>
select target closest to cursor	Z (on keyboard)
clear current radar selection	X (on keyboard)
Release Bomb	
release	Button 1 Down
SAR	
request	S, Button 8 Down

11.9.4 T.Flight Hotas X Mappings for Rotary-Wing Entities

Figure 83 shows the joystick controls for the T.Flight Hotas X flight controller for rotary-wing entities.

VR-Engage also supports the T.Flight Hotas 4 controller. The button layout is similar to the T.Flight Hotas X.

Figure 83. T.Flight Hotas X joystick - rotary-wing



Figure 84 shows the throttle controls for the T.Flight Hotas X flight controller for rotary-wing entities.

Figure 84. T.Flight Hotas X throttle - rotary-wing



Table 21 lists the flight controls for the T.Flight Hotas X controller for rotary-wing entities.

Table 21. T.Flight Hotas X mappings - rotary-wing

Function	Key/Button
Engagement	
cycle weapon	Button 5 Down Toggle
fire selected weapon	Button 1 Down Toggle
cursor select target	Button 3 Down Toggle
Menu	
Action menu	Button 4 Down
down	HAT 1 Down, <DOWN>
left	HAT 1 Left, <LEFT>
right	HAT 1 Right, <RIGHT>
up	HAT 1 Up, <UP>

Table 21. T.Flight Hotas X mappings - rotary-wing (continued)

Function	Key/Button
Radar Scope	
down	HAT 1 Down, <DOWN>
left	HAT 1 Left, <LEFT>
right	HAT 1 Right, <RIGHT>
up	HAT 1 Up, <UP>
select target closest to cursor	Z (on keyboard)
clear current radar selection	X (on keyboard)
RotorLib CGF Rotary Wing Controls	
collective	Throttle forward and back (Axis 3)
pedal	Joystick twist left and right (Axis 4)
pitch	Joystick forward and back (Axis 2)
roll	Joystick left and right (Axis 1)
wheel brake	Button 10 Down
SAR	
request	S, Button 8

11.9.5 Gamepad Flight Control Mappings for Fixed-Wing Entities

Figure 85 illustrates the fixed-wing flight controls for Gamepads.

Figure 85. Fixed-wing flight controls



Table 22 lists the flight controls for Gamepads for fixed-wing entities.

Table 22. Gamepad flight control mappings - fixed-wing

Function	Key/Button
Engagement	
cycle weapon	Button 7
fire selected weapon	Button 8
FixedWingLib CGF Flight Controls	
pedal	Axis 1 (Left thumbstick, left/right)
pitch	Axis 4 (Right thumbstick, forward/back)
roll	Axis 3 (Right thumbstick, left/right)
throttle	Axis 2 (Left thumbstick, forward/back)
air brake	Button 2
wheel brake	Button 1
flaps	Button 4

11.9.6 Gamepad Flight Control Mappings for Rotary-Wing Entities

Figure 86 shows the buttons for the F310 Gamepad for rotary-wing control.

Figure 86. Gamepad rotary-wing flight controls



Table 23 lists the flight controls for Gamepads. for rotary-wing entities

Table 23. Gamepad flight control mappings - rotary-wing

Function	Key/Button
Engagement	
cycle weapon	Button 7
fire selected weapon	Button 8
RotorLib CGF Rotary Wing Controls	
collective	Axis 2
pedal	Axis 1
pitch	Axis 4
roll	Axis 3
SAR	
request	S

11.9.7 Gamepad Flight Control Mappings for the Sensor Operator

Figure 87 shows the buttons for the F310 Gamepad for the sensor operator role.

Figure 87. Gamepad sensor operator controls



Table 24 lists the controls for Gamepads for the sensor operator

Table 24. Gamepad mappings - sensor operator

Function	Key/Button
Sensor orientation	Left thumbstick
Sensor mode	Button 1
Track location	Button 2
Track the entity closest to the center of the screen	Button 3

Table 24. Gamepad mappings - sensor operator (continued)

Function	Key/Button
Reset sensor	Button 4
Zoom	Right thumbstick (up and down)

11.10. Head-Mounted Display Controllers

The Oculus Rift and HTC Vive head-mounted displays support hand controllers. This section shows the mappings for these controllers, which can be used for soldier roles. If you do not have hand controllers, you can use the keyboard and Gamepad controls. (HMD hand controllers are not mapped in joystick settings.)

Figure 88 illustrates the controls on the Oculus Rift touch controller.

Figure 88. Oculus Rift touch controller

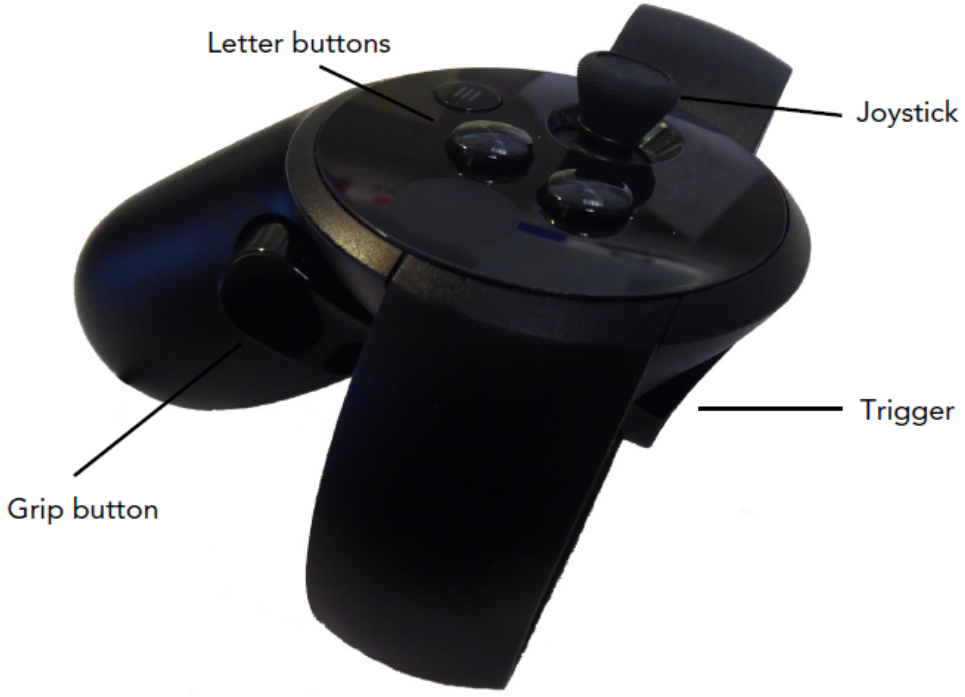
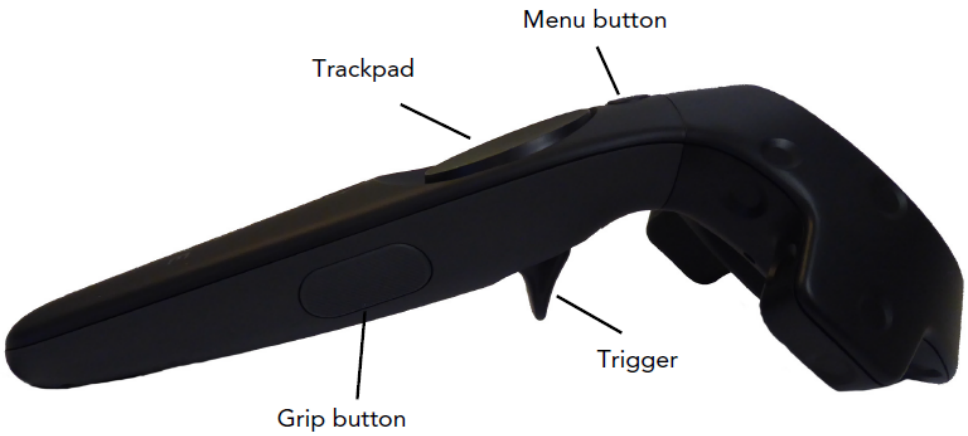


Figure 89 illustrates the controls on the Oculus Rift touch controller.

Figure 89. HTC Vive controller

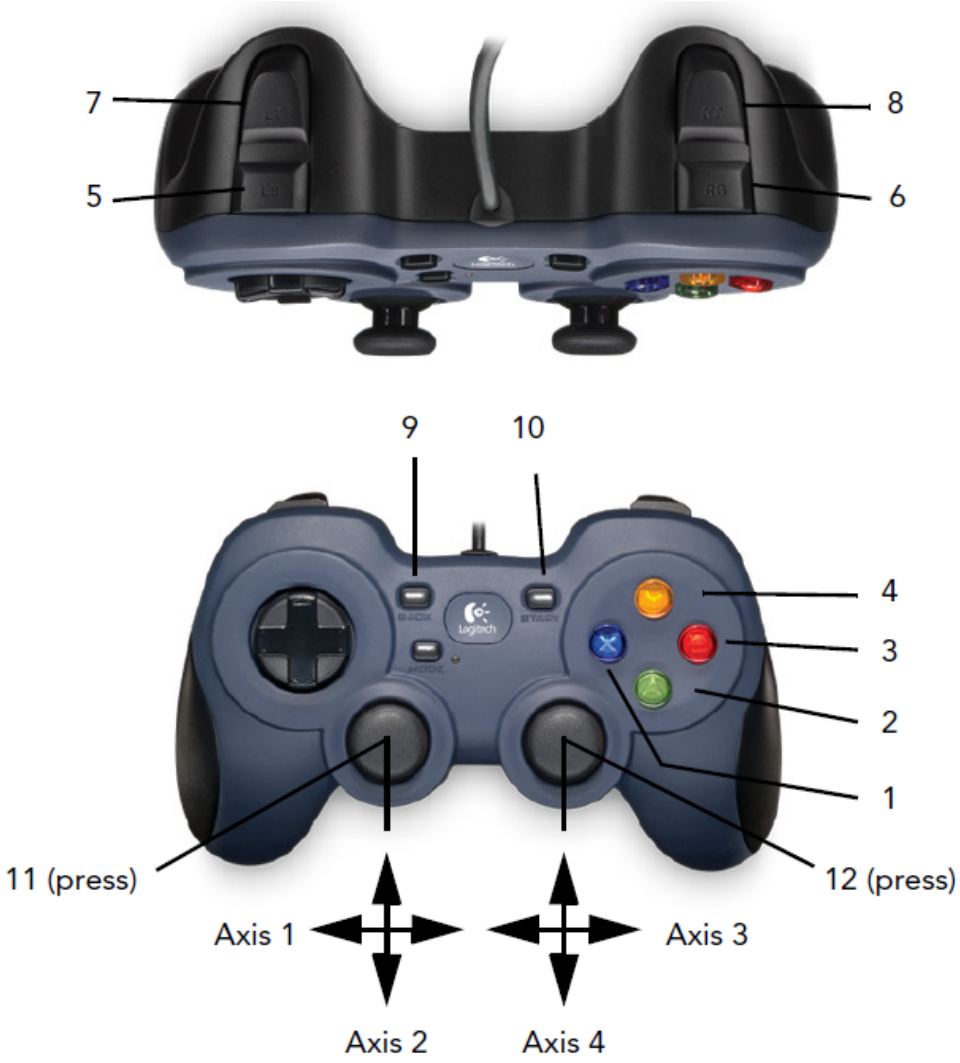


The controls work as follows:

- Fire. Press the trigger on the dominant hand to fire the weapon.
- Aim. Press the grip button to raise the weapon to the aim-down-sights position.
- Move. Movement is controlled by the right hand joystick (Oculus Rift) or trackpad (HTC Vive), as follows:
  - Walk forward. Push/touch forward. Movement is based on the orientation of the entity, not the direction it is looking or aiming.
  - Walk backwards. Pull/touch backward.
  - Walk sideways. Push/touch left and right
  - Sprint. Push down while pressing forward.
- Turn. Press/touch the left hand joystick or trackpad to the left or right.
- Change posture. Press the trigger on the non-dominant hand for Posture Up. Press the grip button on the non-dominant hand for Posture Down.
- Action menu. To open, press Y on the non-dominant hand Oculus touch controller. Press the menu button on the non-dominant hand HTC Vive controller. While the menu is open, the joystick or trackpad acts as a D-pad.

11.11. Generic Gamepad Button Numbering

Figure 90. Logitech Gamepad button and axis numbering



Game controllers are mapped in the Joystick Configuration page of the Application Settings dialog box. (For details, please see "11.12. Configuring Joysticks and Keyboard Control" below.) The mappings are identified by button and axis numbers. Figure 90 identifies the button and axis numbering scheme.

11.12. Configuring Joysticks and Keyboard Control

You can control entity movement and weapon fire using a joystick, the keyboard, or both. You can attach multiple joysticks and can use a mix of joystick and keyboard control at the same time. You configure joystick and keyboard mappings on the Application Settings dialog box, Joystick Configuration page. You must add a new configuration for each controller that you want to use.

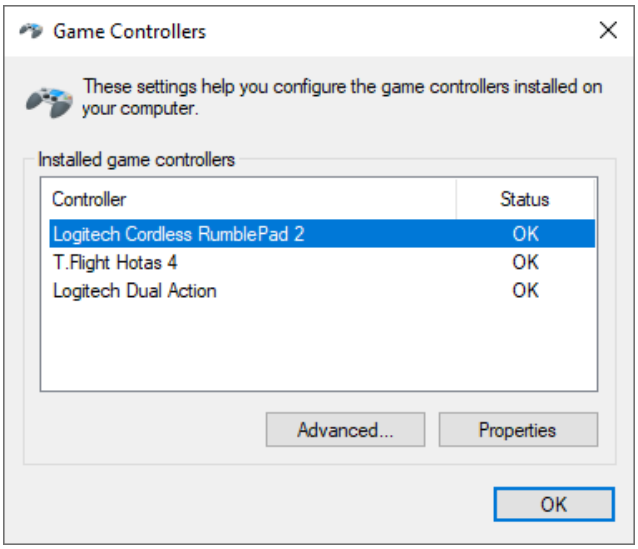
You can configure Xbox controllers to use with VR-Engage. See Mapping Xbox Controllers.

11.12.1 Windows Game Controllers

VR-Engage requires that devices be a USB Windows Game Controller (as opposed to a USB human interface device) You can verify that a USB device is a game controller with the Game Controllers dialog. If the device is a game controller, you will see an entry for the device in that dialog when the device is connected (Figure 91).

➤ To open the Game Controllers dialog, in the Windows 10 search bar, enter Set Up USB Game Controllers and then select the entry.

Figure 91. Game Controllers dialog box



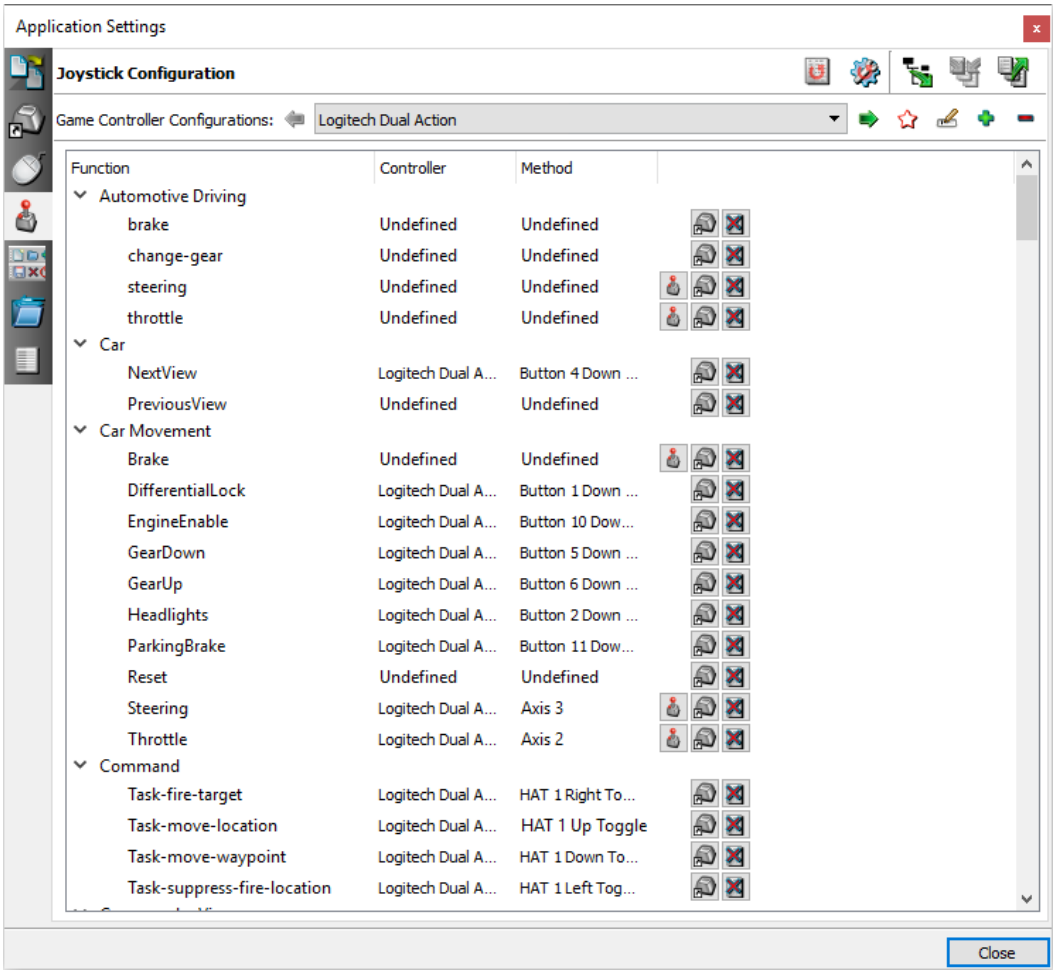
11.12.2 Creating a Joystick Configuration

A joystick configuration contains the joystick mappings and, optionally, keyboard mappings that you can use to control an entity. VR-Engage includes default configurations for several game controllers.

➤ **To create a joystick configuration:**

1. Choose **Settings > Application**. The Application Settings dialog box opens.
2. Select the Joystick Configuration page (Figure 92).

Figure 92. Joystick Configuration page



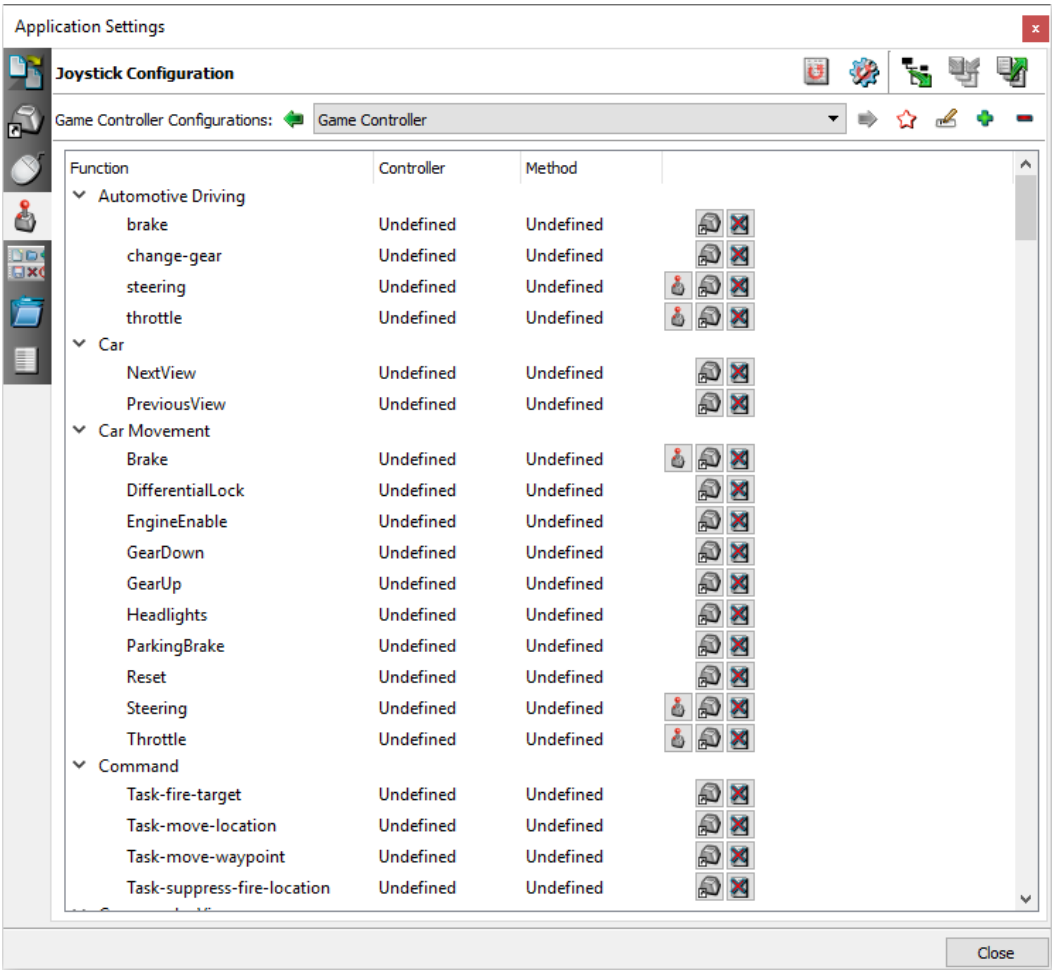
3. Click the Add button ( ). The New Configuration dialog box opens.
4. Type a name for the configuration.

! The name you give the configuration must match the name that the controller identifies itself as when it connects to the computer.

---

5. Click OK. The window redisplays to show the functions that this device can control (Figure 93).

Figure 93. Joystick configuration



6. Edit the joystick and keyboard mappings as described in "11.12.3 Mapping the Joystick Stick" below and "11.12.4 Mapping Joystick Buttons and Keyboard Keys" on the next page.

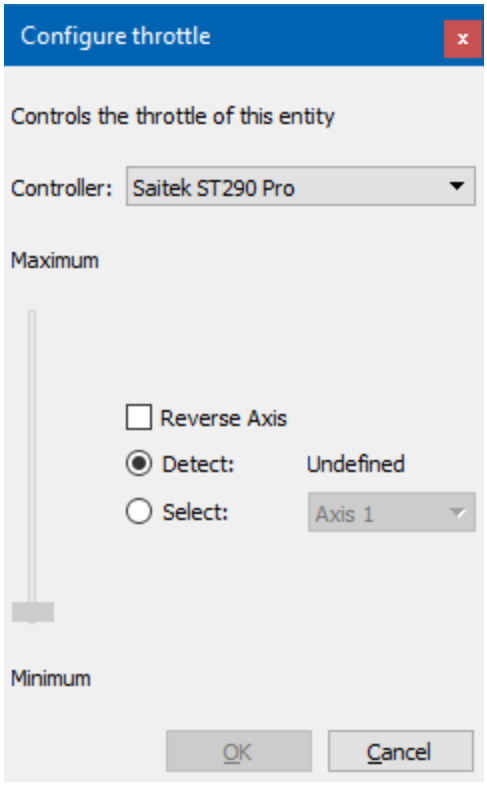
11.12.3 Mapping the Joystick Stick

To control an entity with a joystick (or other axis control), you map the joystick controls to specific entity movement components and weapons.

➤ **To map joystick controls:**

1. Create a joystick configuration, as described in "11.12.2 Creating a Joystick Configuration" on page 203.
2. On the Joystick Configuration page (Figure 93 above), click the Joystick button ( ) for the function you want to map. A joystick configuration dialog box opens (Figure 94).

Figure 94. Joystick configuration dialog box



3. In the Controller list, select the controller you want to configure.
4. Configure each axis as follows:
    a. To let VR-Engage select the axis, select the Detect option and move the joystick in the axis you want to use for this control.
    b. To choose the axis, select the Select option and select an Axis from the list.
    c. Move the joystick in the axis you are configuring. If the Maximum/Minimum slider moves in the direction that you expect, you are finished. If the slider moves opposite to what you expect, select the Reverse Axis check box. It should now move as expected.
5. Click OK.
6. Repeat this process for each function you want to control with the joystick.

11.12.4 Mapping Joystick Buttons and Keyboard Keys

You can map joystick buttons and keyboard keys to entity movement control and weapon control. When entity control is enabled, the entity control key mappings override any other key mappings, such as observer control mappings.

➤ **To map joystick buttons and keyboard keys to entity control:**

1. Create a joystick configuration, as described in "11.12.2 Creating a Joystick Configuration" on page 203.
2. On the Joystick Configuration page (Figure 92 on page 204), click the Key Mapping button ( ) for the control you want to map. A configuration dialog box opens. It may call for a range of values (Figure 95), or just be a toggle (Figure 96).

Figure 95. Key mapping configuration dialog box

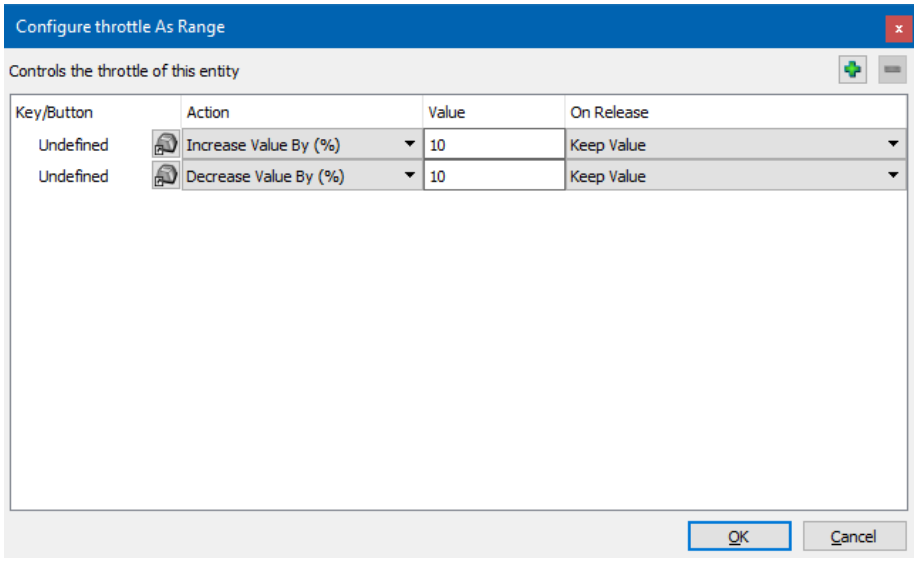
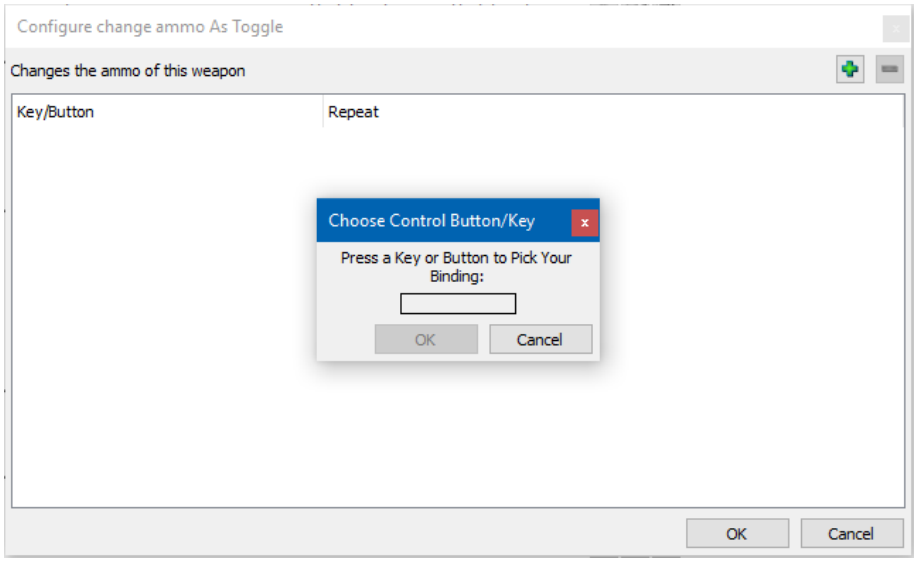


Figure 96. Key mapping configuration as toggle dialog box

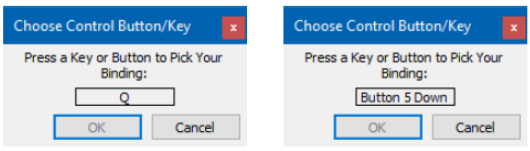


3. If the mapping requires a range, for each row in the dialog box, do the following:

a. Click the Key Mapping button (). The Choose Control Button/Key dialog box opens (Figure 96).

b. Press the joystick button or keyboard key that you want to use to activate this control. It is displayed in the dialog box (Figure 97). (If a key binding is not available, the OK button does not become activated.)

Figure 97. Choose Control Button/Key dialog box with selection



Key Joystick button

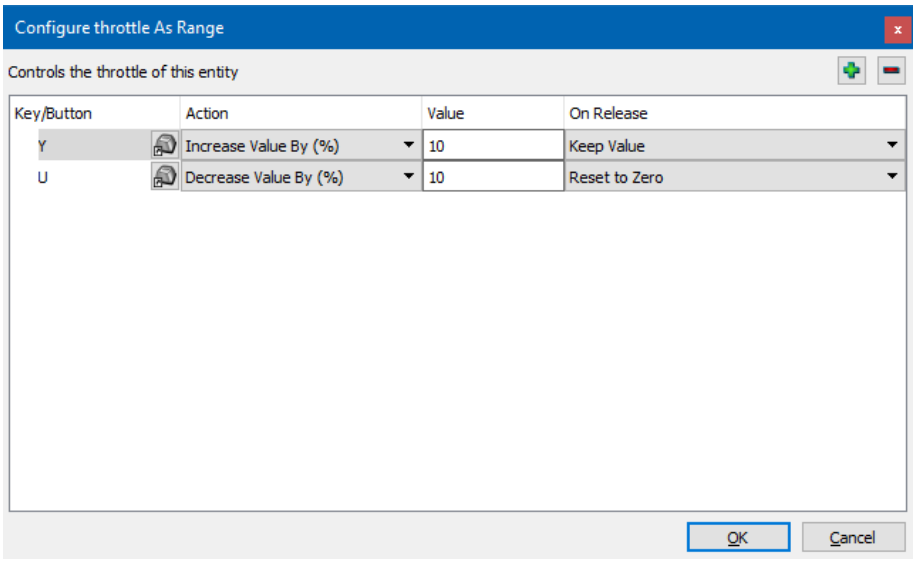
c. Click OK.

d. In the Action column, select an option from the list.

e. In the Value column, enter an appropriate value for the Action option.

f. In the On Release column, select an option from the list. (This is what happens when you release the key.) A complete dialog box looks similar to Figure 98.

Figure 98. Key mapping configuration dialog box



4. If the keyboard mapping is a toggle, the Choose Control Button/Key dialog box opens automatically. Do the following:

   a. Press the key or joystick button that you want to use.
   b. Click OK.
   c. In the Repeat column, select Yes or No. Yes means that the action repeats if you hold down the key. No means it happens one time for each key press.
5. Click OK.
6. Repeat this process for each function you want to configure.



12. Controllable Entities

This chapter lists the VR-Forces entity types that are controllable from VR-Engage out of the box. You can configure other entities to be controllable, as described in "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247.

12.1. VR-Forces Entities that VR-Engage Can Control 212

12.1. VR-Forces Entities that VR-Engage Can Control

The VR-Engage SMS includes the following entities that you can control in VR-Forces from VR-Engage if VR-Forces is running a scenario that uses the VR-Engage SMS. Each entity lists the roles that are available for that entity.

- AH-64D Apache Longbow: Pilot, Copilot/Gunner, Sensor Operator



- AH-64E Apache Guardian with FCR: Pilot, Copilot/Gunner, Sensor Operator



- Afghan Police Officer: Human Player



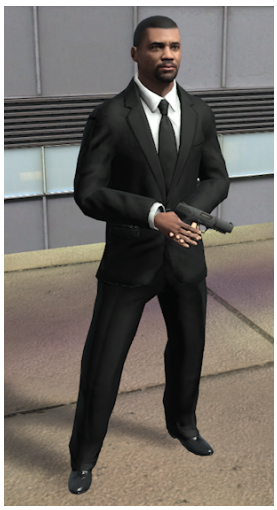
- Afghan Soldier: Human Player



- African Insurgent: Human Player



- Agent M9: Human Player



- Ambulance (Vortex): Driver



- Australian Soldier EF88: Human Player



- Australian Soldier XM107: Human Player



- BMP-3_AFV: Driver, Gunner, Commander



- Beechcraft MC-12 King Air Single Seater: Pilot, Sensor Operator



- Beechcraft MC-12 King Air: Pilot, Sensor Operator



- Brazilian Soldier: Human Player



- CH-149 Cormorant: Pilot, Sensor Operator



- CH-47 Chinook: Pilot, Copilot, Sling Load Operator



- Chilean M16-M203: Human Player



- Chilean M16: Human Player



- Chilean M4: Human Player



- Civilian Female With Drone: Human Player



- Civilian Male With Drone: Human Player



- Colombian Police Officer: Human Player



- Colombian Soldier: Human Player



- DI AK-47: Human Player



- DI Lasing (CIS): Human Player



- DI Lasing (US): Human Player



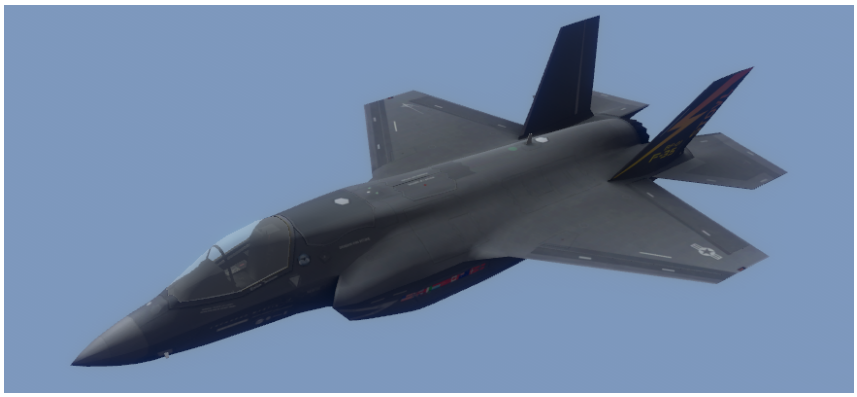
- Eurofighter Typhoon: Pilot, Sensor Operator



- F-16A Fighting Falcon: Pilot, Sensor Operator



- F-35 Lightning II: Pilot, Sensor Operator



- F/A-18 Hornet: Pilot, Sensor Operator



- Farmer M9: Human Player



- Fiat 124 (Vortex): Driver



- GTK Boxer APC: Driver, Commander RWS



- GTK Boxer CRV: Driver, Gunner, Commander RWS, Commander Hatch



- HMMWV Utility Vehicle: Driver



- ISIS Fighter: Human Player



- Insurgent M9: Human Player



- Insurgent: Human Player



- Iranian Soldier: Human Player



- Iraqi Police Officer: Human Player



- Iraqi Soldier: Human Player



- Israeli Soldier M4: Human Player



- Israeli Soldier: Human Player



- Kurdish Fighter: Human Player



- LAV III APC (Vortex): Driver, Gunner, Commander



- Libyan Police Officer: Human Player



- Libyan Soldier: Human Player



- M1120A4 HEMTT LHS: Driver



- M1126 Stryker ICV with M2: Driver, Commander



- M1151 ECAC with M240: Driver, Gunner



- M1151 ECAC with M240B: Driver, Gunner



- M1151 ECAC with M2: Driver, Gunner



- M1151 ECAC with MK 19: Driver, Gunner



- M1151 Expanded Capacity Armament Carrier (ECAC): Driver



- M1A1 AIM (AUS) Mineplow: Driver, Gunner, Commander Hatch



- M1A1 AIM (AUS): Driver, Gunner, Machine Gun, Commander Views, Commander Hatch



- M1A1 SA: Driver, Gunner



- M1A2 Abrams MBT (Vortex): Driver, Gunner



- M1A2 SEP Abrams: Driver, Gunner



- M2A3 Bradley IFV: Driver, Gunner, Commander



- M915 Tractor Truck: Driver



- M977 HEMTT Cargo Truck: Driver



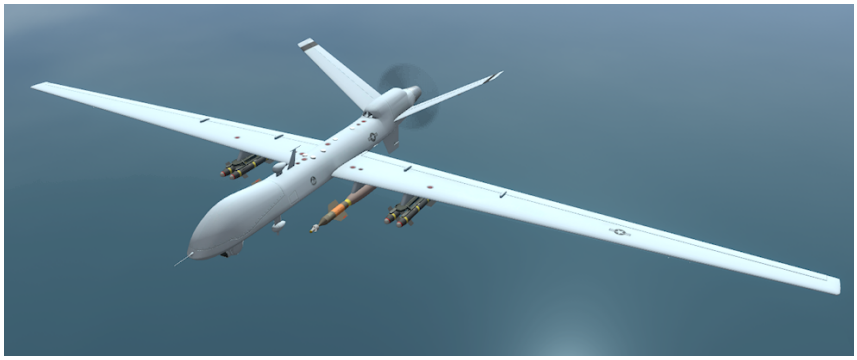
- MH-60 Black Hawk: Pilot, Sensor Operator



- MQ-8B Fire Scout: Sensor Operator



- MQ-9 Reaper UAV: Sensor Operator



- MiG-29 Fulcrum: Pilot, Sensor Operator



- Mideast Combatant: Human Player



- Pakistani Police Officer: Human Player



- Pakistani Soldier: Human Player



- Paratrooper M9: Human Player



- Paratrooper: Human Player



- Police Cruiser (Vortex): Driver



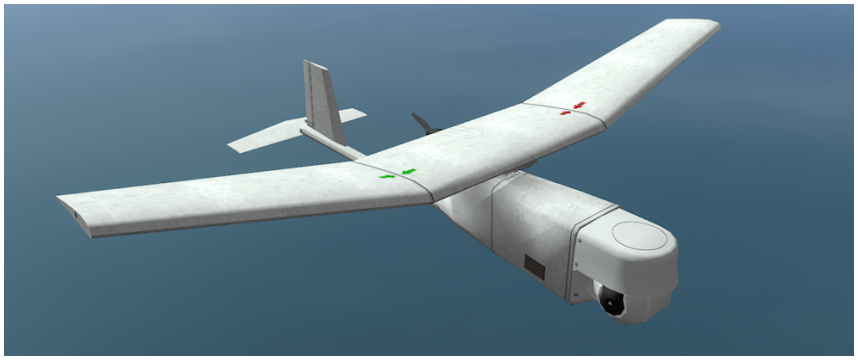
- Police Officer With Drone: Human Player



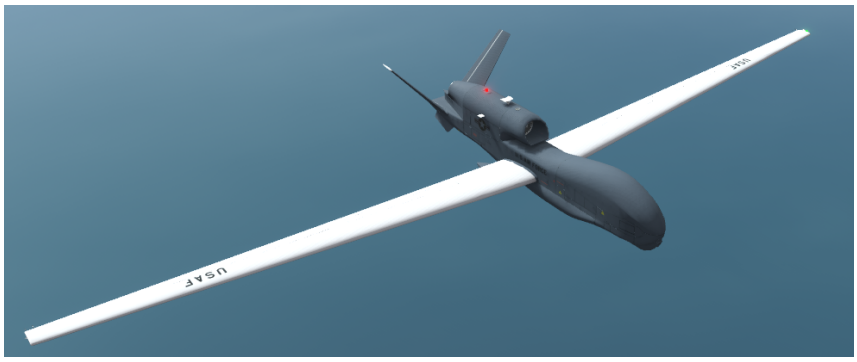
- Policeman M9: Human Player



- RQ-11 Raven UAV: Sensor Operator



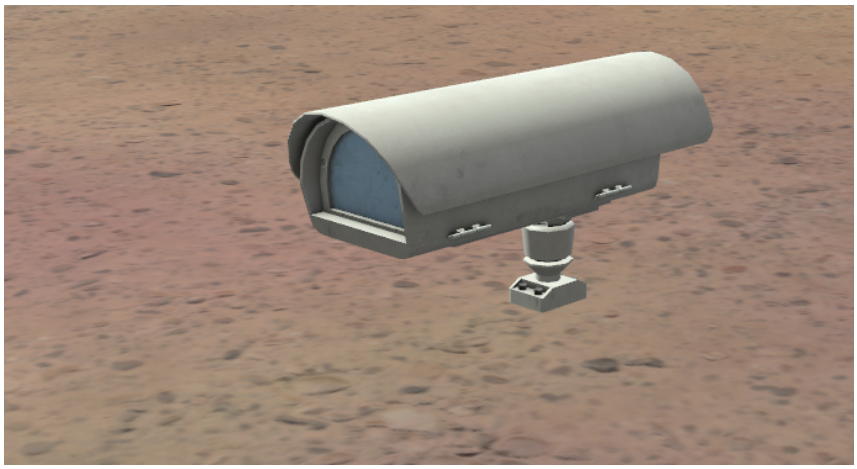
- RQ-4 Global Hawk UAV: Sensor Operator



- RQ-7 Shadow UAV: Sensor Operator



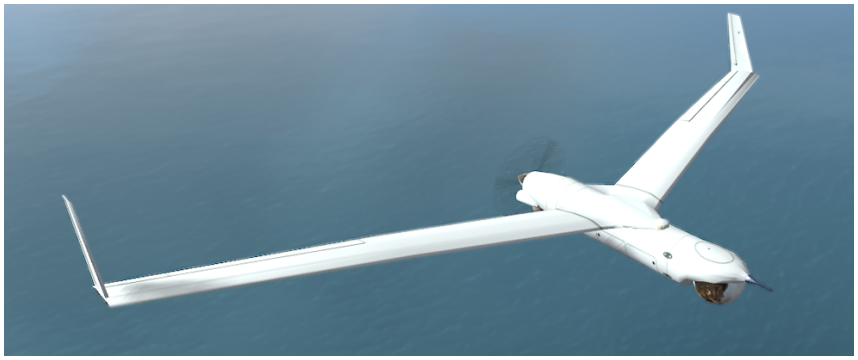
- Remote Camera: Sensor Operator



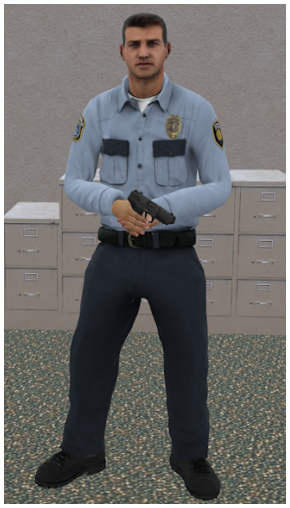
- Russian Rebels: Human Player



- ScanEagle UAV: Sensor Operator



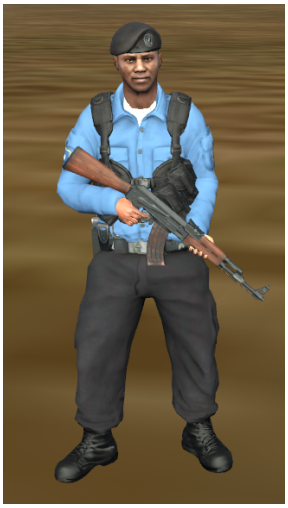
- Security Guard M9: Human Player



- Singaporean Soldier: Human Player



- Somali Police Officer: Human Player



- Somali Soldier: Human Player



- Sport Hatchback Coupe: Driver



- Sport Standard Size Sedan: Driver



- Standard MidSize Sedan: Driver



- Sudanese Police Officer: Human Player



- Sudanese Soldier: Human Player



- Suspect M9: Human Player



- Syrian Police Officer: Human Player



- Syrian Soldier: Human Player



- T-38C Talon: Pilot, Sensor Operator



- Taliban: Human Player



- Technical Truck: Driver



- UH-60M Blackhawk: Pilot, Copilot, Gunner



- US Army Javelin (Tripod): Human Player



- US Army Javelin: Human Player



- US Army M16-M203: Human Player



- US Army M16: Human Player



- US Army M4: Human Player



- US Army M9: Human Player



- US Border Patrol M9: Human Player



- USMC M16-M203: Human Player



- USMC M16: Human Player



- USMC M4: Human Player



- Ugandan Police Officer: Human Player



- Ugandan Soldier: Human Player





13. Adding and Editing VR-Engage Entity Models

This chapter explains how to edit the VR-Engage simulation model set to add or edit models that you can control from VR-Engage. If you want to make other customizations to entities using Lua scripts or editing sysdef files, see

13.1. The VR-Engage Simulation Model Set 248
13.2. Extending VR-Engage.sms 248
13.2.1 Creating a New Simulation Model Set 249
13.2.2 Creating a New VR-Engage-Controllable Entity 249
13.2.3 Editing a VR-Engage-Controllable Entity 250
13.2.4 Deploying the SMS to VR-Engage 250

13.1. The VR-Engage Simulation Model Set

The entity models that VR-Engage simulates are defined in a set of files called a simulation model set (SMS). VR-Engage includes an SMS called *VR-Engage.sms*. The example scenarios included with VR-Engage all use this SMS. If you create an unhosted session, the list of entities available to you is drawn from *VR-Engage.sms*. If you install the VR-Forces Add-on package, *VR-Engage.sms* is installed into VR-Forces.

VR-Engage.sms includes all of the simulation objects in the default VR-Forces SMS, *EntityLevel.sms*. A subset of human, ground, and air entities are modified so that they can be controlled by a human player using VR-Engage. When you create a scenario in VR-Forces for use with VR-Engage, you can use any of the simulation objects in the SMS. The extended *VR-Engage.sms* entities function in the scenario as they normally would (that is, as they do in *EntityLevel.sms*) when they are controlled by VR-Forces. However they can also be controlled at any time by a VR-Engage user.

VR-Engage ships with a set of entities that you can control, listed in "Chapter 12. Controllable Entities" on page 211. You can edit the entity models in *VR-Engage.sms* and add new ones. You add and edit models using the VR-Forces Simulation Object Editor, an application included with VR-Forces. If you do not have VR-Forces, please contact your MAK Technologies salesperson for information about obtaining VR-Forces.



This chapter assumes that you understand the concepts of SMSs and how to use the Simulation Object Editor. For details, please see relevant chapters in Section XI, “Creating and Editing Simulation Models,” in *VR-Forces Users Guide*.

13.2. Extending VR-Engage.sms

You may want to edit simulation models or add new ones for any of the following reasons:

- Create an entity similar to an existing one (for example, a new type of car or aircraft).
- Change the performance characteristics of an existing entity.
- Replace the 3D model associated with an entity.
- Replace or modify the first person model.

The first three modifications can typically be done using the Simulation Object Editor. Replacing or changing the first person model requires different tools and a different skill set. Contact MAK Technologies for more information about changing the first person model.

The overall approach to extending *VR-Engage.sms* is:

1. Create a new SMS that includes *VR-Engage.sms*.
2. Make the desired changes to the SMS.
3. Copy the new SMS to your VR-Engage installation.
4. Configure VR-Engage to use the new SMS by default when starting an unhosted session or creating a new scenario in a hosted session.

This chapter covers some of the basics of working in the SMS. For more information, such as changing the 3D model, please refer to *VR-Forces Users Guide*.

13.2.1 Creating a New Simulation Model Set

If you want to modify or extend the VR-Engage simulation model set, we recommend you create a new simulation model set that includes *VR-Engage.sms*. This makes the differences between your customizations and the installed SMS clear. It also makes it easier to revert to the installed SMS if your new SMS has problems.

For information about other ways to create an SMS, please see *VR-Forces Users Guide*.

➤ **To create a new simulation model set:**

1. Open the Simulation Object Editor.
2. Choose **File > New Simulation Model Set**. The New Simulation Model Set dialog box opens.
3. Select New Simulation Model Set.
4. Click Next. The Simulation Model Set Type page displays.
5. Select Extend Existing Simulation Model Set.
6. Click Next. The Extend Existing Simulation Model Set page displays.
7. Select *VR-Engage.sms*.
8. Click Next. The New Model Set Name page displays.
9. In the File Name box, type a name for the new model set.
10. Click Finish. The Simulation Object Editor loads systems information from the included model sets and displays the new SMS. Since all of the simulation objects are included from other SMSs, none of them are currently editable. They are listed in the Objects List using gray text.
11. Choose **File > Save Simulation Model Set**.

13.2.2 Creating a New VR-Engage-Controllable Entity

The recommended way to create a new entity that can be controlled by a VR-Engage player is to base it on an existing entity of the type you want to create. To control an

entity in VR-Engage, it must be one of the entities that was included from *VR-Engage.sms*. Entities that are included from *EntityLevel.sms* cannot be controlled from VR-Engage.

➤ **To create a new entity that can be controlled by a VR-Engage player:**

1. In the Simulation Object Editor, load your new SMS.
2. In the Tags list, select VR-Engage. The Objects List is filtered to show only models that are included from *VR-Engage.sms*.
3. Select an entity similar to the one you want to create. (A yellow bar is added to the window. It displays the SMS where the selected entity is originally included.)
4. Choose **Model > New Model from Existing**. The Create New Model dialog box opens.
5. Type a name for the new model.
6. Optionally, edit the Entity Type.
7. Click OK.
8. Edit the new entity.
9. Save the SMS.

13.2.3 Editing a VR-Engage-Controllable Entity

You can only edit models that are part of the loaded SMS. You cannot edit models that are included from another SMS. Therefore, if you want to edit one of the models included from *VR-Engage.sms*, you must promote it to your SMS. (You can always edit any of the models you created using the procedure in "13.2.2 Creating a New VR-Engage-Controllable Entity" on the previous page.)

1. In the Simulation Object Editor, load your SMS.
2. In the Tags list, select VR-Engage. The Objects List is filtered to show only models that are included from *VR-Engage.sms*.
3. Select the entity you want to edit. If the entity is not part of the main SMS, a yellow bar is added to the window. It displays the SMS where the selected entity is currently included.
4. If the entity is not part of the main SMS, choose **Model > Promote to Main Simulation Model Set** or click the Promote button in the yellow bar. The model is promoted. It is now shown in dark text at the top of the Objects List.
5. Edit the model as desired.
6. Save the SMS.

13.2.4 Deploying the SMS to VR-Engage

After you create the new SMS, you must copy it to VR-Engage. This allows you to run scenarios that were created in VR-Forces using the new SMS. You can also specify that the new SMS be used by default when you create an unhosted session or create a new scenario in a hosted session in VR-Engage.

1. Copy the SMS file and associated data folder to your VR-Engage installation, preserving the path. The path to your SMS will look something like this:

   ./data/simulationModelSets/<your SMS name>.sms

   ./data/simulationModelSets/<your SMS name>

2. Configure VR-Engage to use the new SMS by default:

   a. In a text editor, open *./appData/scripts/playerStation.lua*.

   b. Set the variable **defaultSimulationModelSets** to point to your new SMS, for example:

```
-- Default simulation model set to use when launching the
simulation engine.
defaultSimulationModelSets = {
      "../data/simulationModelSets/<your SMS name>.sms"
};
```



14. Adjusting Entity Settings

VR-Engage entities ship with certain default settings. This chapter explains how to make adjustments to some of the available settings for VR-Engage entities so that they behave as required.

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14.1. Human Settings

You can adjust the player settings for human characters.

14.1.1 Fatigue Settings

The fatigue settings affect human characters' stamina. You can adjust the impact of fatigue on a human player's aim and movement by editing the "fatigue" values in *./data/SimulationModelSets/VR-Engage/vrfSim/systems/movement/human.sysdef*, in the **human-movement** component. See "5.4.2 Experiencing Fatigue and Losing Stamina" on page 102, for information on how it affects players.

The **fatigue-increase-rate-low**, **fatigue-increase-rate-medium**, and **fatigue-increase-rate-high** values specify the increase to fatigue every second while a character is running. These values are for different activities, running (high) and crawling (medium). Walking is low, with no impact on the character's stamina.

The **max-fatigue-affect-on-movement** specifies the maximum fatigue value that movement uses for modifying the character's speed. If this is set to 100, the human character cannot move when their stamina is at 0.

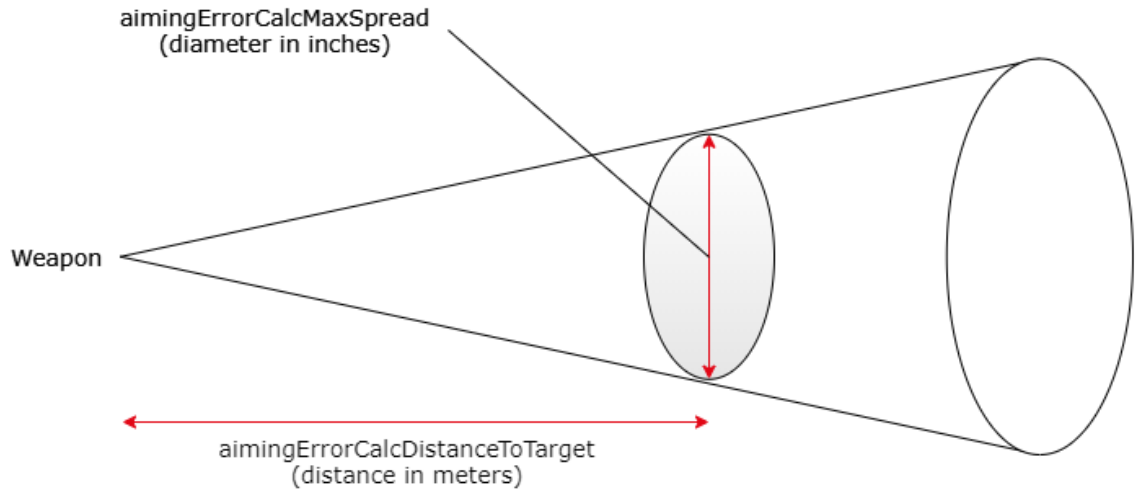
The **fatigue-threshold-percent** value specifies the percentage of maximum speed that fatigue will affect movement. With this value set to 0.7, it means that fatigue will increase when speed is 70% of maximum speed. If a human character is moving at about 70% of their maximum speed, then the human is running. Otherwise, it is walking. Maximum speed varies based on mobility health and overall health.

14.1.2 Aim Settings

When a player uses the Aim feature to focus on a target (instead of "shooting from the hip"), this improves the likelihood that they will hit the target. Lying prone provides additional stability. You can adjust the degree to which aiming helps their chances by editing the "aiming" values in *./appData/scripts/playerDefinitions/human.lua*.

There are two values used to calculate the maximum aiming error: **aimingErrorCalcMaxSpread** and **aimingErrorCalcDistanceToTarget**. The **aimingErrorCalcMaxSpread** specifies the size of the shot spread in inches at the distances specified by **aimingErrorCalcDistanceToTarget**. The **aimingErrorCalcDistanceToTarget** specifies in meters the distance for the shot spread. With **aimingErrorCalcMaxSpread** set to 96 and **aimingErrorCalcDistanceToTarget** 50, shots at the worst aiming error have a 96-inch spread at 50 meters. The maximum spread decreases at closer distances and increases at longer distances because the spread is based on a cone (Figure 99).

Figure 99. Aiming error spread



The **requiredAimingErrorPercent** value sets the amount of aiming error that is always present. Aiming error never drops below this value. This aiming error varies all shots slightly so that bullets do not all hit the same point. This value is a percentage. For example, a value of **0.07** means that the minimum aiming error that will always exist is 7% of the maximum error computed with **aimingErrorCalcMaxSpread** and **aimingErrorCalcDistanceToTarget**.

The **proneAimingImprovementPercent** value sets the amount that aiming will improve when a character is lying prone. This value is also a percentage. For example, a value of **0.2** means that aim improves by 20% when in the prone position.

The **aimingImprovementPercent** value sets the amount that aiming improves when a player aims the weapon. As with the other settings, this value is a percentage. A value of **0.2** means that aim improves by 20% when aiming the weapon.

14.1.3 Observer Controls

By default, the observer controls inherited from VR-Vantage are enabled. These controls are described in Section 15.3, *"Moving the Observer from the Keyboard in the 3D Projection,"*the chapter on moving the observer in *VR-Vantage Users Guide*.

You can disable these controls by editing *./appData/scripts/playerStation.lua* and setting **enableVRVControls** to **false**. You might want to do this for stations that will be used for player training. If these controls remain enabled, a player can inadvertently move their eyepoint, making it difficult to control the entity.

14.2. Weapon Settings

You can adjust various settings for weapons that VR-Engage characters can use by editing the weapon's sysdef file. You can also adjust weapon configuration for players.

14.2.1 Ammunition Count Display

You can configure whether the ammunition counts display next to the weapons by editing *./appData/scripts/playerDefinitions/displayLayouts/humanLayouts.lua* and setting **showAmmoCounts** to either **true** or **false**.

14.2.2 Magazine Capacity

The magazine capacity determines the number of bullets that a player can fire before reloading the weapon. It is defined by the **rounds-per-magazine** value in the weapon's sysdef file (*./data/simulationModelSets/VR-Engage/vrfSim/systems/weapons*).

14.3. Vehicle, Sensor Operator, and Drone Settings

You can customize some vehicle features by editing the relevant *.lua* files, and these available customizations are covered here. Other edits to entities require you to update the Simulation Model Set. See "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247for more information.

14.3.1 Ground Vehicle Collisions

By default, the Vortex collision manager handles collisions between Vortex and non-Vortex platform-level entities. It can also support collisions with other simulation objects. Edit the **vortexSettings** in *./appData/scripts/vortexConfig.lua* to support collisions with other entities. There are comments in the file that provide examples.

14.3.2 Aircraft Instrument Panel Proportions

You can configure the size of the instrument panel window, including setting it to be full screen, by editing the instrumentPanels block in *./appData/scripts/playerDefinitions/pilot.lua*.)

14.3.3 Sensor Operator Modes

Sensor operators can have access to different modes. You can set the order for the modes and specify which ones are available by editing the **sensorModes** array in *./appData/scripts/playerdefinitions/sensorOperator.lua*.

Available modes:

- IR. Infrared (white hot).
- NVG. Night vision.
- Visual Camera.

14.3.4 Drone Camera Display Size

When players operate a drone, a view displays what the drone's camera sees. To change the size of the drone camera view, edit **viewportConfigurations** in the *./appData/scripts/playerDefinitions/human.lua* file.

14.3.5 Aircraft Weapon Cycle Order

Pilots can cycle through the selected weapon using the Select Weapon button on their controller. The order for cycling the weapons is specified in the **weapon-cycle-order** parameter in *./vrfSim/platforms/FWL_Fixed_Wing_Aircraft.ope* and *./vrfSim/platforms/RL_Rotary_Wing_Aircraft.ope*. The default order is: NONE (no weapon selected), LRM (long-range missiles), MRM (medium-range missiles), SRM (short-range missiles), GUN (gun), BOMB (bombs), AGM (air-to-ground missiles), and ROCKET (rockets).



15. Creating VR-Engage Scenarios in VR-Forces

This chapter describes how you can create your own scenarios that include VR-Engage controllable entities. While VR-Engage can load or join a session of any entity-level VR-Forces scenario, players can only choose an entity that is configured as a VR-Engage controllable entity. VR-Engage does not allow you to create and save scenarios. You need to use VR-Forces with the VR-Engage add-ons to create scenarios that include VR-Engage controllable entities.

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15.1. Installing the VR-Forces/VR-Engage Add-ons

Before you can create your own VR-Engage scenarios, you must install the *VR-ForcesVR-EngageAdd-ons.exe* plug-in on a version of VR-Forces that is compatible with your copy of VR-Engage. In addition to other features, the installer extended VR-Forces with the *VR-Engage.SMS*, which includes entities that a VR-Engage user can control. These entities also have all of the built-in capabilities of the corresponding entity from the VR-Forces *EntityLevel.SMS*.

For more information see, *“Installing the VR-Forces Plug-in,”* .

15.2. Creating a VR-Engage Scenario in VR-Forces

You can use VR-Forces to create scenarios. If you want to include entities that can be controlled by VR-Engage players, you must use the *VR-Engage.sms* (or an SMS that is an extension of the VR-Engage SMS) and include entities that have been configured as controllable entities. "Chapter 12. Controllable Entities" on page 211 lists the entities that are included with VR-Engage. "Chapter 13. Adding and Editing VR-Engage Entity Models" on page 247 explains how to configure other models to be controlled by VR-Engage players. When you use the VR-Engage filter in the Simulation Objects Palette (Figure 101), you see a list of VR-Engage controllable entities.

Your scenario can include other entities that are not VR-Engage controllable and players can interact with them. The VR-Engage SMS is an extension of VR-Forces’s Entity Level SMS, including all of the simulation objects, which allows you to add them to VR-Engage scenarios. (Non-controllable entities are not listed in the Choose Role panel.)

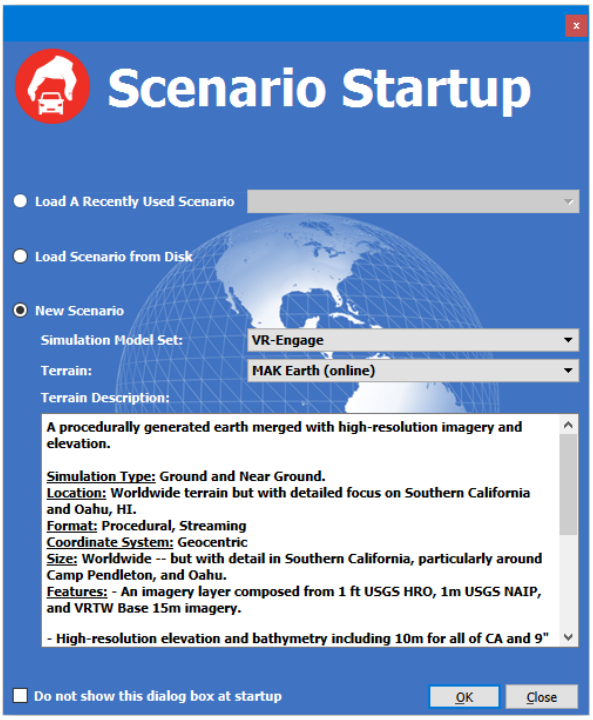
You can assign tasks and plans to all entities in the scenario. If a player engages as a controllable entity, its plan or task is suspended while the player is engaged. That entity then resumes its assigned behaviors when the player disengages. You can also use plan triggers to give entities responses to players’ actions.

Before creating the scenario, ensure that you are using a version of VR-Forces that is compatible with the version of VR-Engage that you want to use and also has the add-ons plug-in for that version of VR-Engage. To check for compatibility, see the “New Features and Updates” in the *VR-Engage Release Notes*.

➤ **To create a scenario that is compatible with VR-Engage:**

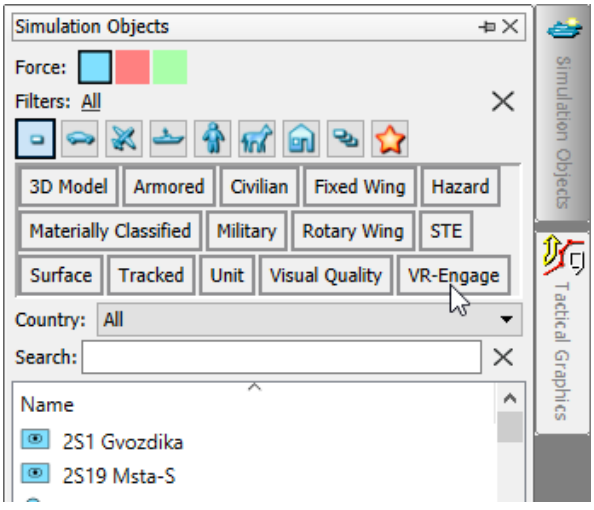
1. Open VR-Forces.
2. In the Scenario Startup dialog box, specify VR-Engage as your Simulation Model Set (Figure 101). You should also use a terrain that is available in both your VR-Forces and VR-Engage directories.

Figure 100. New scenario in VR-Forces Scenario Startup



3. You can add any simulation objects or tactical graphics included in those palettes, not only VR-Engage controllable entities.
4. To filter the list of simulation objects to those that can be controlled by VR-Engage players, use the VR-Engage filter (Figure 101).

Figure 101. VR-Engage filter in Simulation Objects palette



5. Add entities, tasks, and plans as described in the *VR-Forces Users Guide*.
6. Save your scenario.

15.3. Running Your Scenario

When hosting a scenario, you can host it in either VR-Forces or VR-Engage. Use the application that best suits your needs.

VR-Engage performs better when it is hosting only the ownship in a scenario. If you have multiple users connecting different instances of VR-Engage to a scenario hosted in VR-Engage, or even if you have one user running a large scenario, performance and frame rate can deteriorate. Some entities, such as Vortex-based ground vehicles, require a minimum frame rate (approximately 20 FPS) to remain stable. You should use VR-Engage to host only simpler scenarios or for basic testing.

VR-Forces is the preferred choice when hosting a session where there will be multiple players or there are a number of entities in the scenario. Depending on the complexity of your scenario, you may want to host the simulation on one or more dedicated simulation engines. You can host these engines on one or more machines as needed to distribute the workload.

Regardless of where the scenario is hosted, VR-Engage instances can join the scenario and the players can choose a role for a controllable entity; see "3.2.1 Choosing an Existing Role" on page 48. If the scenario is hosted by VR-Forces, you can also assign roles to players as described in "3.2.4 Assigning Roles from VR-Forces" on page 52.

15.3.1 Hosting a Scenario in VR-Forces

When you host a scenario using one or more instances of VR-Forces, you would load the scenario and then have the VR-Engage stations connect to it. This works only when the connection information is the same in all instances of VR-Forces and VR-Engage.

For more information, see "3.3. Connecting to VR-Forces" on page 54



While VR-Engage can join any entity-level scenario, players can only participate in scenarios that include VR-Engage controllable entities.

15.3.2 Hosting a Scenario in VR-Engage

If you want to host your scenario in VR-Engage, such as a simple scenario for one player or for testing purposes, you simply need to copy your scenario to the *./userData/scenarios* directory. When you launch VR-Engage and choose to Host VR-Forces Session, your scenario is included in the list of available scenarios.

For more information, see "3.1.1 Hosting a VR-Forces Session" on page 45.



16. Customizing Overlays

This chapter provides examples of how you can customize the overlay for an entity.

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16.1. Overview of Custom Overlays

There are several ways to customize the overlays for an entity's role. Depending on the complexity of the overlay, you may need to modify a configuration script, write code, or use GL Studio.

This chapter provides typical examples of customizing overlays. It does not cover overlays that involve extensive development. If you need a complex overlay that requires C++ development, such as those used in 3D cockpits or those used with VR, AR, or MR displays, please contact support@mak.com for assistance.

16.1.1 Types of Overlays

The types of overlays covered in this chapter are:

- Simple scripted overlays, which are defined in the role configuration scripts. These overlays can display dynamic text objects, lines, and graphical images placed on the screen. This requires some familiarity with the Lua scripting language; please refer to https://www.lua.org/docs.html.
- Sensor overlays, which use the built-in capabilities of VR-Vantage and are further customized by allowing you to declare which elements you want to make visible. This also requires you to edit the Lua configuration files.
- GL Studio overlays, which are dynamic overlays that require some C++ development. These provide the most flexibility. This requires using the GL Studio editor from DiSTI to create an RSO. To use your own RSO, you must have a GL Studio runtime license from DiSTI. Please contact support@mak.com for assistance with licenses.

16.1.2 Examples of Each Type of Overlay

Scripted overlays allow you to display:

- Text on the screen to reflect the state attribute of the entity.
- Lines, such as simple cross-hairs.
- Simple, static graphics.

Sensor overlays allow you to have a dynamic UAV-style overlay that display:

- Target information.
- Location data.
- Reticle or cross-hairs.
- Heading, pitch, or roll information.
- Compass elements.

GL Studio overlays can be dynamic and include:

- Rich graphics.
- User interaction.

16.2. Adding a Simple Scripted Overlay

Using Lua script, you can add a simple, scripted overlay by adding a `DtOverlayComponent` to the role definition. There is an example of a role using the `DtOverlayComponent` in the *carDriver.lua* definition file, found in *./appData/scripts/playerDefinitions*:

```
{ componentType = "DtOverlayComponent";
   priority = 10;
   elements = {
       {type = "text"; text = "Speed: $(speed)"; position =
                   {x = 0.01, y = 0.08}};
       {type = "text"; text = "RPM: $(rpm)"; position =
                   {x = 0.01, y = 0.06}};
       {type = "text"; text = "Gear: $(set-gear)"; position =
                   {x = 0.01, y = 0.04}};
       {type = "text"; text = "Fuel: $(resource:movement|fuel)";
                   position = {x = 0.9, y = 0.08}};
   };
};
```

Figure 102. Car driver overlay



The `DtOverlayComponent` has an element list. Each element can be one of three types of elements: text, line, and quad.

Colors can be defined as a string in quotes or as an RGBA color value. If you want to use a color name, the syntax is `color = "white"` and you can specify white, black, blue, green, red, orange, or yellow. If you want to use RGBA values, the syntax is `color = {r=RR, g=GG, b=BB [, a=AA]}`. `A` is optional and allows you to specify the alpha channel (opacity) in addition to the red, green, and blue channels.

16.2.1 Text

The `text` element includes a text field, position in normalized screen coordinates, color, font, and font size. The `color`, `font`, and `fontSize` are optional, and default to white text that is sixteen pixels high in the default VR-Engage font.

```
{type = "text"; text = "Speed: $(speed)"; position =
       {x = 0.01, y = 0.08}};
```

The `text` element can reference any VR-Engage state attribute using the `$(attribute_name)` syntax. The available attributes are covered in comments in the corresponding *.lua* file.



Normalized screen coordinates convert the value between 0 and 1.0 to a pixel value to place the element on the screen.

16.2.2 Line

The `line` element has a start point and an end point, a color, and a line width. The color and line width are optional; the default color is white and the line width is 1 pixel wide.

```
{type = "line"; startPoint = {x = 0; y = 0.01};
       endPoint = {x = 1; y = 0.01}};
```

16.2.3 Quad

The `quad` element places a textured image on the screen. The position and size are in normalized screen coordinates.

```
{type = "quad"; texture= "$(DATA_DIR)/overlays/m9_icon.png";
       position = {x = 0.1; y = 0.2}; size= {x = 0.1; y= 0.1}};
```

16.3. Adding a Custom Sensor Overlay

If you need an overlay that is similar to the VR-Vantage sensor overlay (Figure 103), you can configure it by adding a `DtVrvSensorOverlayUpdater` component to a sensor operator's role definition Lua script and indicating which sections of the built-in overlay should be seen in your version.

Figure 103. Sensor overlay



For details on customizing the overlay for sensor operator roles, see "9.3. Configuring the Sensor Operator Overlay" on page 163.

Sensor overlays pull data from the current observer. If you need sensor overlay sections in addition to those in the built-in overlay, you must use the VR-Vantage API to build a plug-in and add the section.

16.4. Adding a GL Studio Overlay

VR-Engage supports overlays created with DiSTI's GL Studio. VR-Engage uses VR-Vantage's GL Studio integration to configure and update any loaded RSOs. You must have a GL Studio license to develop a GL Studio RSO.

To add a new GL Studio overlay, you need to complete a series of procedures:

1. Create the new RSO using DiSTI's GL Studio editor.
2. Create VR-Vantage GL Studio updaters as needed.
3. Create a new VR-Vantage GL Studio model definition.
4. Modify the role configuration scripts to use the new model definition.

Please refer to DiSTI's documentation on GL Studio for details on creating an RSO.

Figure 104. GL Studio overlay



16.4.1 Creating a GL Studio RSO

To create a new GL Studio RSO, use DiSTI's GL Studio application. You can create the overlay and its properties. The properties provide a way to update values seen on the overlay or drive the dynamic components in the overlay.

The output from GL Studio is source code that is compiled into a DLL file. Save the DLL file in *./data/huds64*.

16.4.2 Creating VR-Vantage GL Studio Updaters

To update the RSO with data, you must configure the RSO's model definition with the list of VR-Vantage GL Studio updaters to provide data to the RSO.

For a list of available updaters, please see Section 17.2.2, *"Creating a Model Definition for a Cockpit,"* in *Adding Content to MAK Applications Reference Manual*.

16.4.3 Configuring the VR-Vantage GL Studio Model Definition

VR-Engage includes the Model Definition Editor in the Visual Model Editors dialog, which allows you to configure model definitions for GL Studio RSOs.

For more information, please see Chapter 14, *Model Definitions*, in *Adding Content to MAK Applications Reference Manual*.

16.4.4 Modifying Role Configuration Scripts

VR-Engage entity roles are defined with Lua scripts in *./appData/scripts/playerDefinitions*. To use your new GL Studio model definition when a role is activated, you need to add a `DtGlStudioHudMapperLogic` component to the role definition. In this example, we are using our `vreHUDPlusMFDs` model:

```
{ componentType = "DtGlStudioHudMapperLogic";
       priority = 10;
       modelDefinitions = {"vreHUDPlusMFDs"};
}
```

This component overrides the entity type mapping of VR-Vantage with the declared mapping.



17. Activating Scripts in VR-Forces

Characters in VR-Engage can activate scripts in the VR-Forces simulation engine.

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17.1. Activating Lua Scripts in VR-Forces

VR-Forces lets users add tasks and set data requests by writing Lua scripts. Lua is a scripting language that does not require compilers and software development tools like those required by the VR-Forces C++ toolkit. Also, you do not need a VR-Forces developers license to add Lua scripts.

VR-Engage characters can trigger scripts or activate them in the VR-Forces simulation engine. Once a script is triggered, there is no further involvement of the character you are playing. The script must have previously been written in VR-Forces. Then it must be added to the Action menu to be accessible to characters.

For information about how to write a script, please see *VR-Forces Users Guide*. This chapter explains how to add a script to the Action menu and how to execute it.

17.2. Adding a Script to the Action Menu

The Action menu for human characters is configured in the file *.\appData\scripts\playerDefinitions\human.lua*.

The Action menu and the Scripts submenu are configured in the following lines of the file (comments have been removed):

```
updaters={
    DtActionMenuUpdater = {
        menus={
            ["Action"] = {
                parent="";
                size={x = 400, y = 300};
                position={ x= 100, y = 300};
                elements={
                    {label = "Flashlight:", action =
"toggleFlashlight", decorator="$STATE", stateAttribute="flashlight",
stateList={"OFF", "ON"} };
                    {label = "Night Vision:", action =
"toggleNvg",    decorator="$STATE", stateAttribute="NVG", stateList=
{"OFF",    "ON"} };
                    {label = "Radio", action = "cycleRadio",
decorator="$STATE", stateAttribute="currentRadio"};
                    {label = "Task entity", action = "selectMenu",
param = "Select Entity"};
{label = "Execute Script", action = "selectMenu", param = "Scripts"};
                    ...
                };
            };
            ...
            ["Scripts"] ={
parent="Action";
    elements={
```

```
{label = "Script 1", action="scriptedTask",    param="Fire_For_Effect_
on_Location", cursor="selectLocationCursor"};
                };
            };
...
```

The `label = "Execute Script"` line might be commented out. You need to uncomment it for the Execute Script menu command to be enabled.

The Scripts menu option is added as an element of the Action menu. It has an element for each script to be listed on the submenu. In this case, there is one script with the following parameters:

- **label**. The text shown on the menu.
- **action**. Must be scriptedTask.
- **param**. The name of the Lua script.
- **cursor**. A location selected by the player. This is the only input to the script.

The only input that a VR-Engage character can provide to a script is a cursor position.

17.3. Activating a Script

You can tell VR-Forces to activate a script.

➤ **To activate a script:**

1. Open the Action menu.
2. Select Execute Script.
3. Press the **Right Arrow** key, or the right button on the D-pad to show the submenu. The Scripts menu opens.
4. Select the script that you want to activate.
5. Press the **Right Arrow** key or right button on the D-pad.



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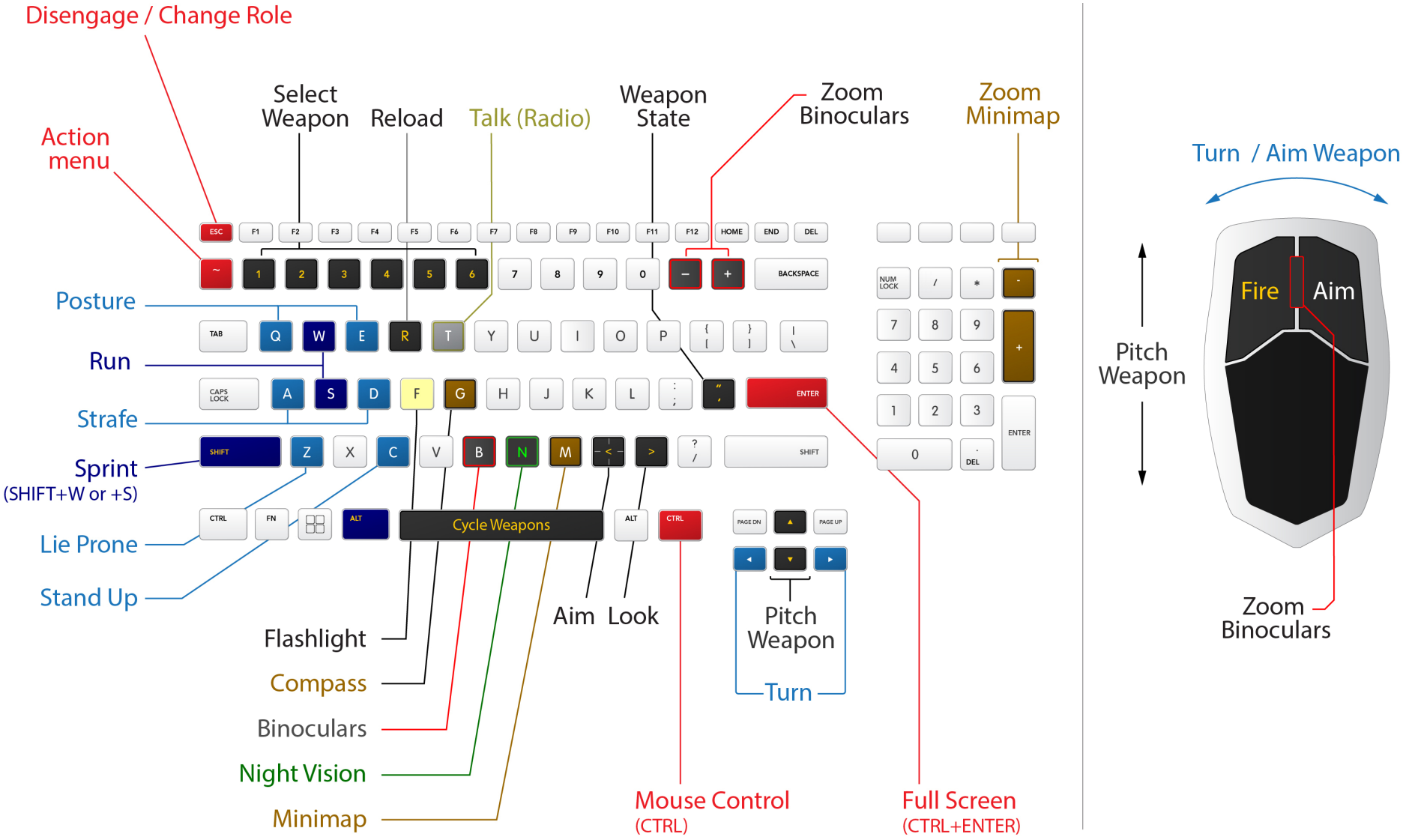
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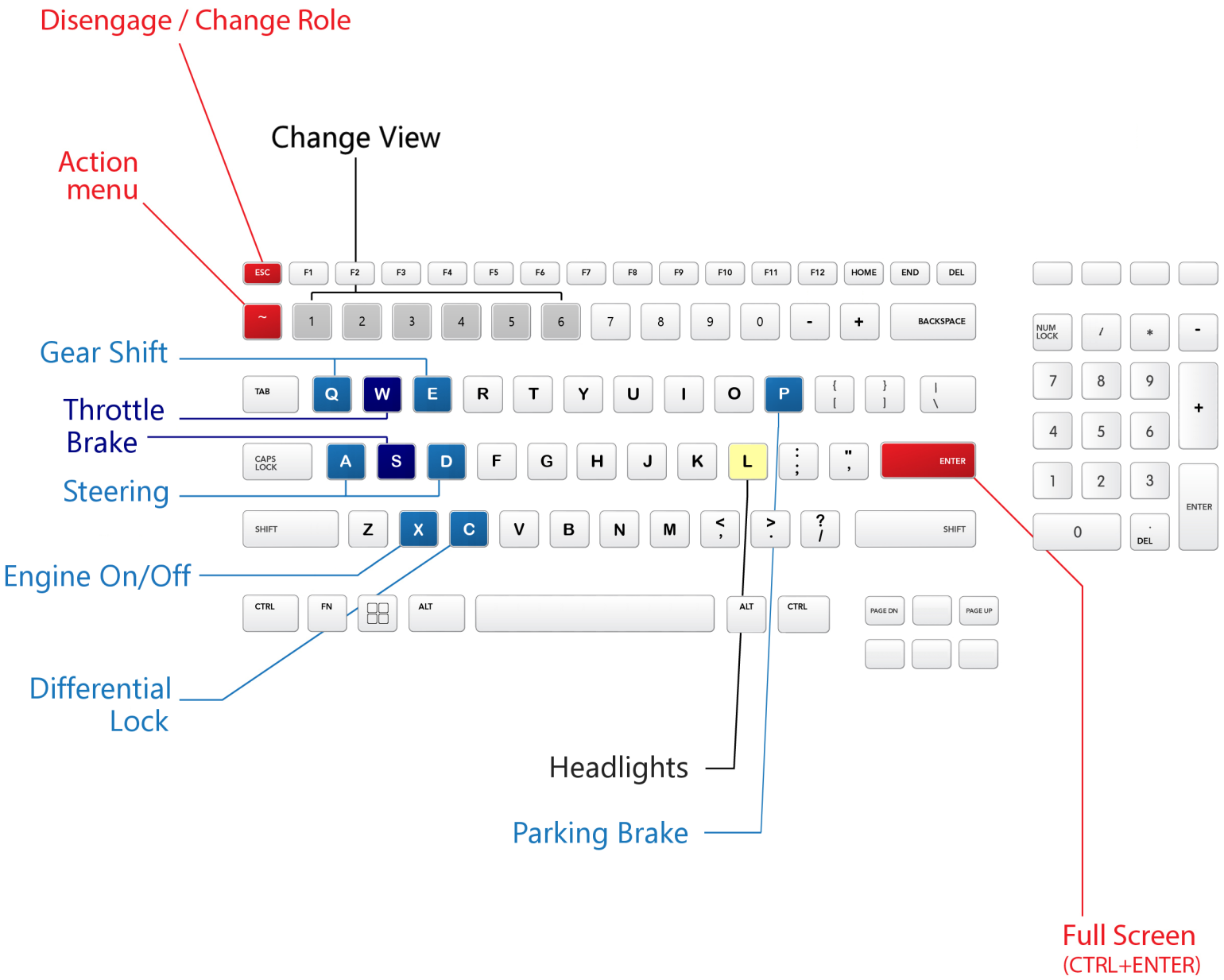
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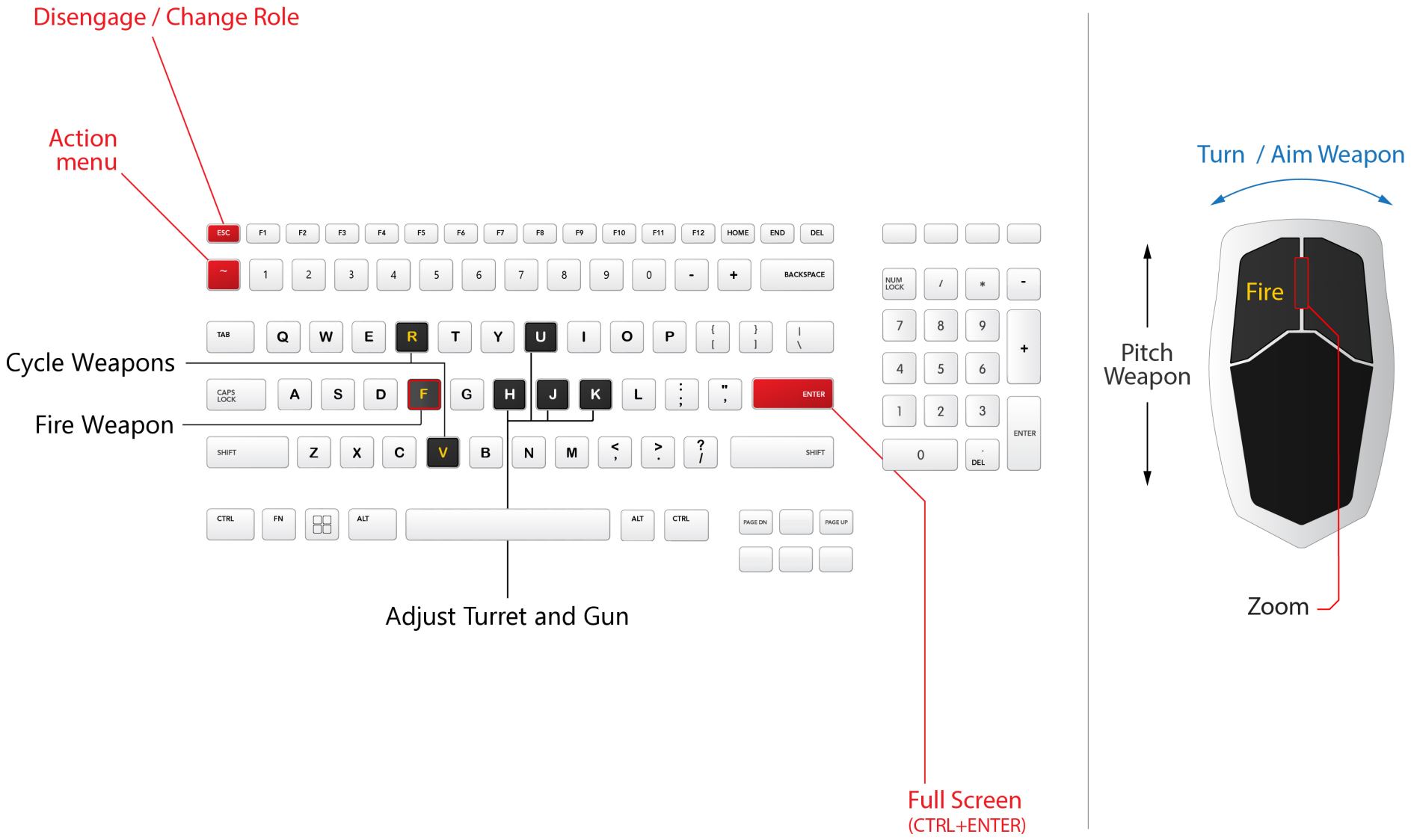
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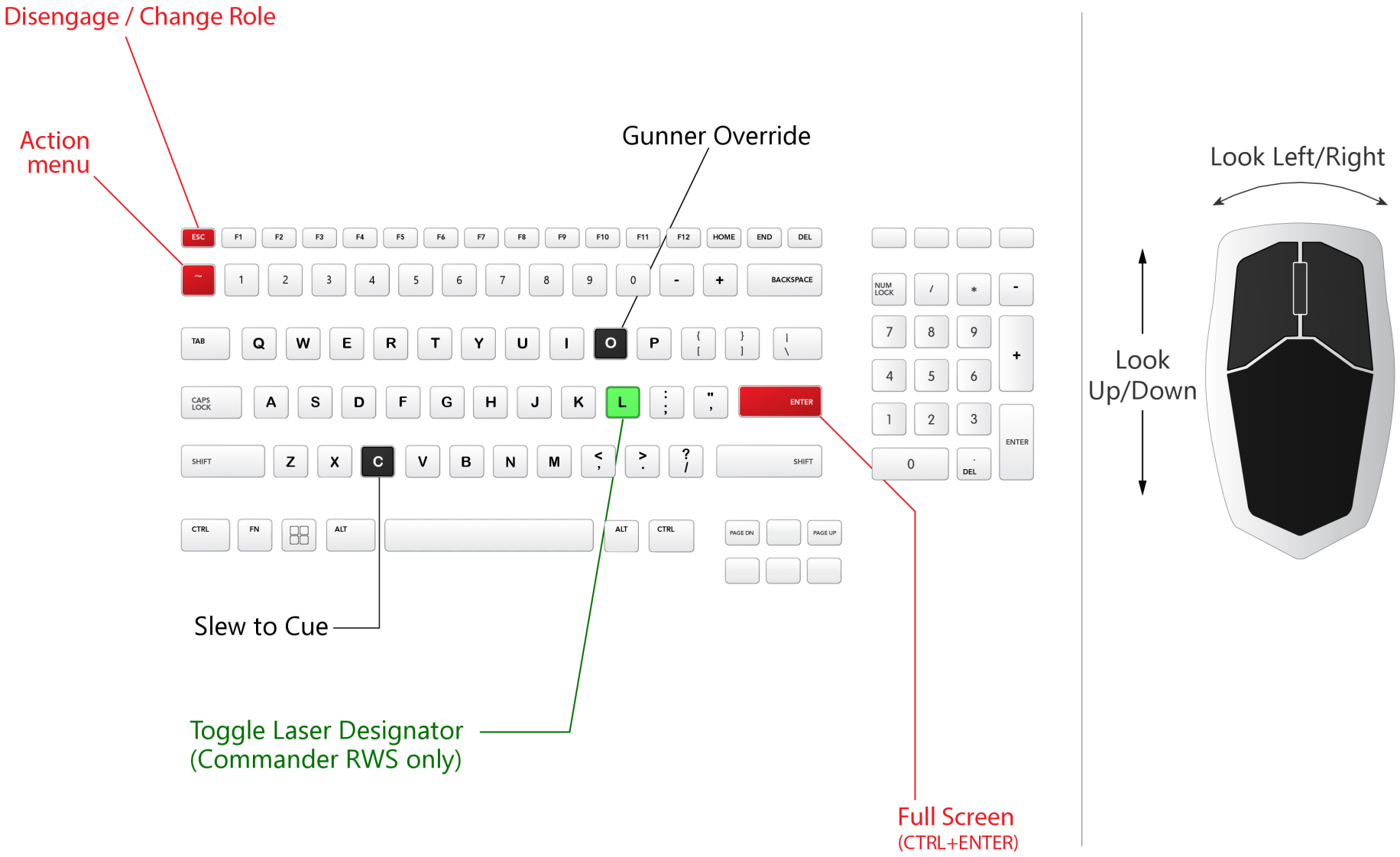
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