



MAK ONE



VR-Engage Capabilities

VR-Engage is MAK's multi-role virtual simulator. VR-Engage lets you play the role of a first-person human character; a vehicle driver, gunner, or commander; an operator of a small drone; or the pilot of an airplane or helicopter. VR-Engage can be deployed as a trainee simulator, a role player station, an instructor aid, a desktop simulation game, even a VR headset experience. Built on mature, proven technologies, VR-Engage gets its simulation engine from VR-Forces and its game-quality 3D graphics from VR-Vantage.

VR-Engage includes:

- A high-fidelity vehicle physics engine that provides accurate vehicle motion.
- Ground vehicles, rotary- and fixed-wing aircraft (manned and unmanned), and a 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, supported by VR-Vantage and VR-Forces. You can use the terrain you have or take advantage of innovative streaming and procedural terrain techniques.
- Support for virtual reality and mixed reality using head-mounted displays, such as Oculus Rift, Varjo, HTC Vive, Valve Index, and XTAL.



Figure 1. VR-Engage UI

VR-Engage Capabilities

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.
- A sensor operator controlling a gimbaled sensor or security camera.
- The pilot of a small drone.

Dismounted Soldiers and Other Human Characters

If you take the role of a dismounted soldier or another 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, crouch, crawl, prone).
- Military gestures for US Army and US Marine Corps entities.
- Interaction with the environment (move, open and close doors or windows, climb ladders).
- Interaction with other characters (occupy different seats in a vehicle, shoot at and be shot at, drag or carry wounded people, task CGF entities, interact with other players).
- Sensors (binoculars and night vision goggles (NVG)).



Figure 2. NVG view

VR-Engage Capabilities

- Weapons (rifles, grenades, hand guns, rocket and missile launchers). You can select any of the weapons your character is carrying. Weapons can be stowed, ready, or aimed.
- A compass that helps you navigate the terrain. The compass can display degrees or NATO-MIL and use true north, magnetic north, or grid north.
- 2D minimap. Use it to orient yourself within the larger terrain ([Figure 5](#)).
- Health and stamina indicators. These show the well-being of your character ([Figure 10](#)). As health and stamina decline, your performance is affected.
- Carried gear, such as a flashlight, range finder, or compass.
- The ability to 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.



Figure 3. Fast roping

VR-Engage Capabilities

- Embark and disembark. Enter and leave vehicles and take on the roles of vehicle crew members.



Figure 4. Embarked entities

- Parachute from an aircraft.



Figure 5. Parachuting

VR-Engage Capabilities

Ground Vehicle Crew

VR-Engage lets you take on the roles of the driver, gunner, commander, or other roles defined for a ground vehicle (one role at a time, of course) that has the following capabilities:

- Physics-based ground vehicle dynamics model.
- Environment interaction (collide, drive over, push, destroy).
- Ground-to-ground engagements:
 - Sensors (EO, IR, NVG).
 - Weapons (main gun, machine gun). VR-Engage models the ballistic trajectory for tank rounds and supports gun stabilization on vehicles that have weapons mounted on them.
 - Signals/countermeasures (smoke grenades).
- Vehicle controls (headlights and taillights, emergency lights and sirens).
- 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 on an M1126 Stryker ICV with M2, VR-Forces can drive that vehicle.

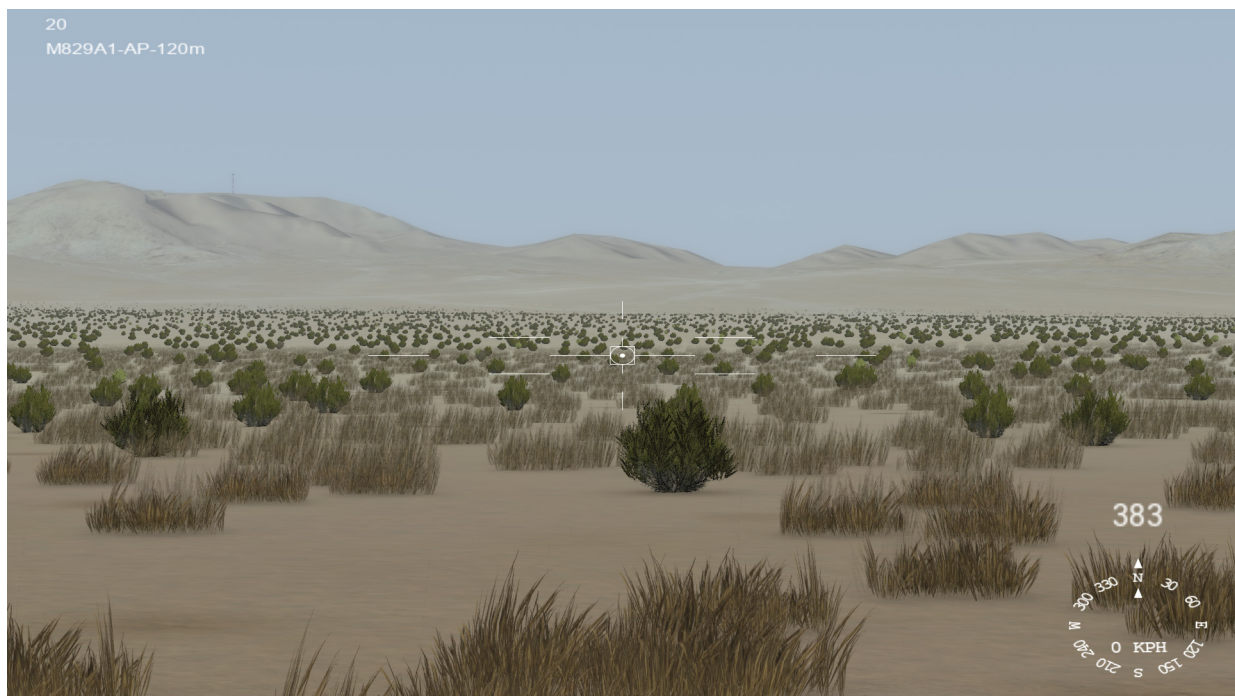


Figure 6. Gunner view

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

VR-Engage Capabilities

Pilot

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

- Physics-based fixed- and rotary-wing dynamics models.
- Take off, flight, autopilot, and landing.
- Head-up display (HUD).

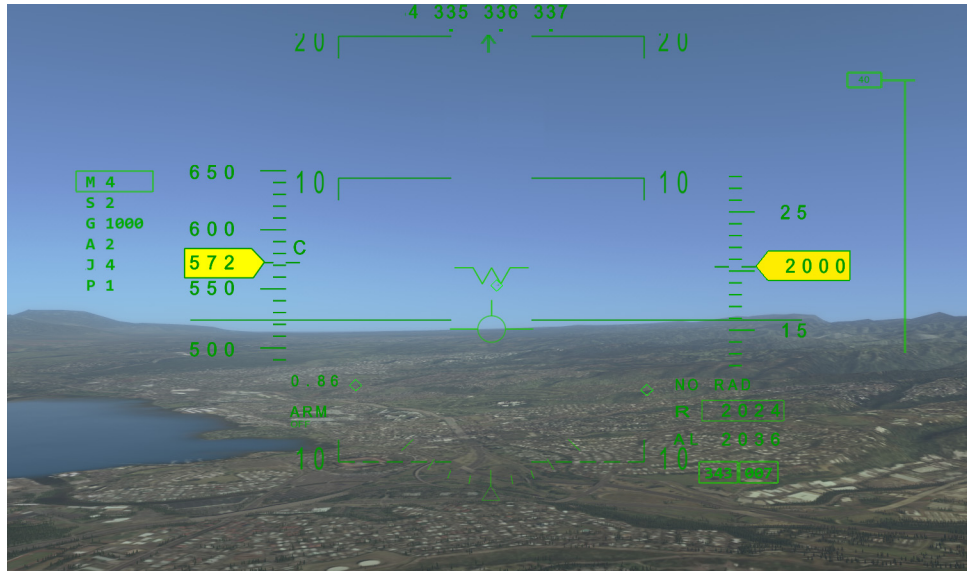


Figure 7. HUD

- Multi-function cockpit display. Flight instruments, map/chart, imagery.

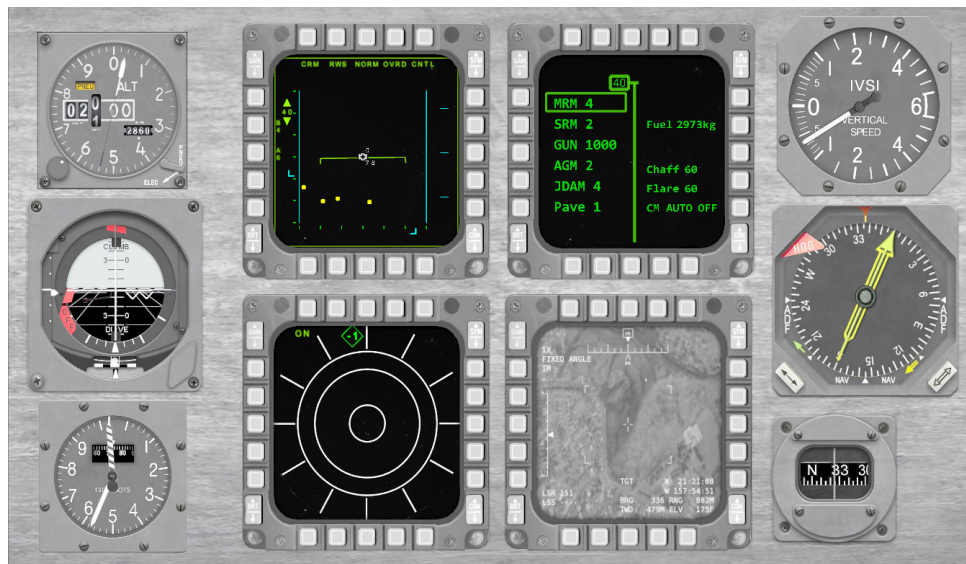


Figure 8. Instrument panel and multi-function display (MFD)

VR-Engage Capabilities

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

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.
- Lase targets and fire weapons.
- Control gimbaled sensors using joysticks or game controllers, or configure VR-Engage to work with sensor-specific hand controller devices.

You can 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.

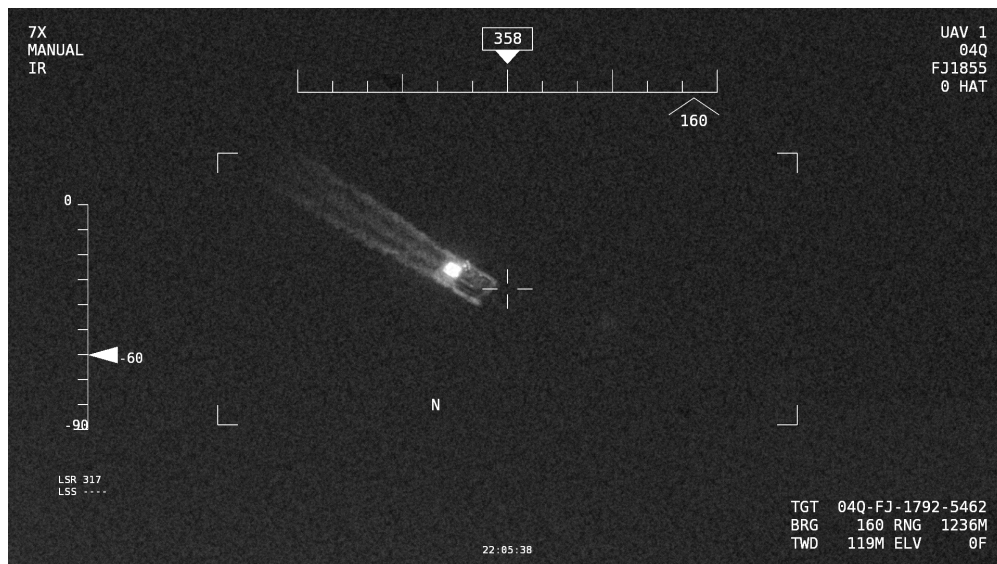


Figure 9. Sensor Operator view

VR-Engage Capabilities

Drone Operator

As a civilian 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 10. Drone operator, drone, and drone camera view.

VR-Engage also includes a light strike vehicle (LSV), which has a drone operator role. The drone is equipped with a camera that has different sensor modes—visual, NVG, and IR black hot or white hot. You can fly the drone even when the vehicle is moving. It can also be set to allow other entities to assign tasks to the drone.

There are other small drones that players can control. One of these includes a munition, and players can fly that drone into small targets to damage or destroy them.

User Interface

You control your character using the keyboard, mouse, and game controllers. The GUI (graphical user interface) provides command menus, as well as cockpit and crew cabin displays.

Other interfaces include:

- Radio (push-to-talk, radio channels, MAK Data Logger support) and text chat with other players and instructors.
- Control with role-specific devices (game controller, driver's steering wheel, pilot's HOTAS).
- Display system support (monitors, projectors, VR and MR devices).
- Audio (engine sounds, environmental noise, event effects, warning tones).
- Sensor and drone information (compass, ownship, drone position, speed, and battery charge)

VR-Engage Capabilities

Image Generator

VR-Engage includes a built-in image generator, based on VR-Vantage, 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 Remote Display Engines. This is an example of the flexibility of MAK's product architecture that enables you to 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, horizon-based ambient occlusion (HBAO)).



Figure 11. Multi-channel display

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, optionally by multiple computers.
- IR and NVG Sensors using the included CameraFX or optional SensorFX.
- On-screen multi-function display (MFD), IR black hot or white hot (latter requires SensorFX).
- Head-mounted displays.

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.

VR-Engage Capabilities

Integration with VR-Forces

When VR-Engage is used with a compatible version of VR-Forces and other MAK ONE 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.
- Role-play multiple entities at a time by switching between manual and CGF control on-the-fly. Take control of VR-Forces-driven entities.
- Manage entity assignments and roles for multiple VR-Engage players from VR-Forces.
- VR-Forces users can talk with VR-Engage players using MAK radio or text chat.
- Configure entities with the VR-Forces Simulation Object Editor.
- Create scenarios in VR-Forces and load them in VR-Engage for standalone use.
- Send scenario events from VR-Engage to VR-Forces-controlled entities.
- Automatic WebLVC integration (tablet-based IOS and so on).
- Publish entity state properties and appearance bits.



Figure 12. VR-Engage and VR-Forces running together

VR-Engage Capabilities

The following sections list the benefits of different configurations of VR-Engage and VR-Forces.

Instructor

The VR-Forces GUI can serve as a common instructor interface to manage both the player-controlled entities and computer generated forces (CGF) entities – including unified laydown, checkpointing, drag and drop, and scenario save and load. The instructor can assign characters and roles to VR-Engage players. Instructors can also communicate via radio between VR-Forces and VR-Engage players, or anyone using the standalone VR-Engage radio application.

Role Player

- One role player can switch between CGF and first-person to control multiple entities. For instruction, players can be limited to playing only the specific role assigned to them.
- CGF Assist lets the player give control to the VR-Forces simulation engine.
- Players can embark on vehicles in the VR-Engage space or those simulated by a compatible VR-Forces scenario.
- Players can task CGF entities.
- Players can initiate scenario events.

Standalone Mode

A role player can play VR-Forces scenarios that were created using the VR-Engage SMS and have been copied to VR-Engage.

Integration with Other MAK ONE Products

Previous sections have discussed VR-Engage's integration with VR-Forces and VR-Vantage. Additionally, like all MAK ONE 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.

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).

Network Interoperability with Other Federates

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

VR-Engage Capabilities

Extensibility

Although VR-Engage comes ready-to-run out of the box, its design is versatile, allowing system integrators to add modules and complementary products, and to customize and extend VR-Engage to meet program-specific requirements:

- VR-Vantage Remote Display engines provide a multi-channel display.
- SensorFX enhances the fidelity of EO/IR sensors using physically accurate modeling based on the material properties of terrain and objects.
- VR-TheWorld Server provides streaming terrain data (elevation, imagery, land use, and feature layers) through open standards.
- WebLVC Server enables web and mobile apps that can be used by exercise support staff to manage and stimulate VR-Engage entities (for example, position entities, change weather, or initiate scenario events from a tablet).
- DiSTI's GL Studio editor can be used to author and edit interactive cockpit instruments.
- Editors from CM Labs and RT Dynamics allow you to author new vehicle types and change the dynamics of existing vehicle types.
- DI-Guy editors and SDK allow you to add new characters and motions.
- And perhaps most important – almost any aspect of the VR-Engage system can be customized or extended by a C++ developer using the VR-Engage, VR-Forces, or VR-Vantage toolkits.

Input/Output Devices

You can configure different user interface control devices (such as flight controllers) using mapping files.

You can configure output devices using VR-Forces simulation engine plug-ins (or MAK could help you to get at the Vortex integration with DBOX). For example, stimulate my altimeter in my physical cockpit, or stimulate my motion platform.

New Characters

VR-Engage can take control of any type of VR-Forces human character entity. However, there are a limited number of characters used in the first-person POV. As a result, the hands and sleeves won't change to match the chosen character.

MAK engineering is required to rig another character for first-person POV (the tools you'll need are available with the VR-Vantage SDK and DI-Guy SDK, but the process is difficult). This is the same as in VR-Vantage.

MAK engineering is required to rig new weapon types.

VR-Engage Capabilities

New Ground Vehicles

Users can rig new vehicle models to use one of the vehicle types provided by MAK (for example, 4-wheel truck, multi-wheel truck, tracked vehicle). VR-Engage includes systems and archetypes that you can use to add vehicles. The documentation includes examples. For more advanced configuration, such as changes to the underlying Vortex vehicle mechanism file, the CM Labs Vortex editor may be required.

New Air Vehicles

The VR-Engage User Guide and help explain how to use the VR-Forces Simulation Object Editor to configure aircraft to use the RotorLib or FixedWingLib libraries for their movement dynamics. You can use the RT Dynamics editor to alter the parameters of flight dynamics models.

If you want to add any new vehicle behavior, MAK engineering is required.

Custom Cockpit/Cabin Instruments

You can change the look/feel/arrangement of cockpit instruments with the GL Studio editor, as long as the changes are compatible with the interface that our widgets already use.

Interfaces to new capabilities require MAK engineering.

Simulation and IG Customization

You can add many IG and simulation capabilities with the VR-Engage, VR-Forces, and VR-Vantage toolkits.

Changing the way a vehicle takes damage could be done by configuring VR-Forces parameters or by adding a VR-Forces plug-in.

Want to add a red dot (like a laser sight spot) to indicate where the player is pointing the gun? You can do that with a VR-Vantage plug-in. You could also add or change particle system effects and other scene representation details.

MAK engineering is required to alter VR-Engage behavior.

New Sensors

You can configure EO/IR/NVG/SAR sensors using VR-Engage display settings options.

If you want to make a new type of sensor, you could do it with SigSim and SenSim tools and plug it into VR-Engage.

VR-Engage Capabilities

Documentation

VR-Engage comes with a complete documentation set.

- **First Experience Guide.** Instructions for seeing results in the first five minutes of use.
- **VR-Engage User Guide.** A comprehensive manual that covers all aspects of running and participating in scenarios, using various controllers, creating VR-Forces scenarios, and configuring both visual models and simulation models.
- **VR-Vantage User Guide.** Provides 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.** Instructions for how you can add your own simulation objects models and terrains to MAK applications.
- **HTML5 help.** A locally installed, HTML5 version of the VR-Engage User Guide, Adding Content to MAK Applications manual, and other select topics.

Superior Technical Support

At MAK, technical support is not just an afterthought. Our reputation for supporting our customers is one of the key reasons that people choose our products. When you submit a support ticket with questions, you work directly with our product developers who know the software inside and out. When you buy MAK's products, you can be sure that MAK will be in your corner as you work towards successful completion of your HLA/DIS project. We've even been known to be on the phone with customers during key events.

When someone reports a bug, our engineers are quick to provide a patch or workaround, meaning you will not have to wait for the next release to have your problem addressed.

With maintenance, you are entitled to upgrades when they are released. Typically, new releases not only add support for the latest versions of RTIs, the RPR FOM, HLA Specifications, and so on, but also try to maintain compatibility with older versions as well. For example, our current release supports many versions of the MAK RTI, includes FOM Mappers for RPR FOMs 0.5, 0.7, 0.8, 1.0, and 2.0, and continues to support DIS 7.



MAK ONE

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