



VR-Forces 5.0 Release Notes

This release note contains the following release-specific information for VR-Forces 5.0.

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Systems Supported and System Requirements

This section describes platform support and system requirements for VR-Forces. To take full advantage of VR-Forces's visualization capabilities and optimize performance, you must use a modern game computer with a high quality NVIDIA graphics card.

For the most up-to-date information about systems supported, see the Product Versions page on the MAK web site at: <https://www.mak.com/support/product-versions>. For hardware requirements, see <https://www.mak.com/support/hardware-recommendations>.

VR-Forces 5.0 is available for the platforms listed in Table 1. For toolkit users, application code must be built with the indicated compilers in order to link to VR-Forces libraries.

Table 1. Platforms supported

Operating System	Compiler
Windows 10	Microsoft Visual C++ 15.0 (64-bit)
Red Hat Enterprise Linux 8.0 (64-bit libraries)	default compiler

3D Video Cards Supported

VR-Forces 5.0 supports NVIDIA graphics cards that support OpenGL 4.5 or above. While we support NVIDIA Quadro cards, we strongly recommend GeForce cards. If you use a Kepler Series Quadro card, read the instructions in "Using Kepler Series Quadro Cards" on the facing page. VR-Forces does not support AMD (formerly ATI) graphics hardware.

 VR-Forces strives to provide the best 3D scene quality possible and cutting edge visualization effects. To provide this functionality, VR-Forces takes advantage of OpenGL features that may not be supported on older video cards. When this is the case, you can disable these features, allowing VR-Forces to run in 3D modes. OpenGL 4.5 is the minimum requirement for rendering a 3D scene in VR-Forces. For the best visual quality and highest performance, you should use the most recent NVIDIA GeForce card. The minimum recommended card is 2070 or better.

Some laptops have an NVIDIA graphics card and an Intel graphics card. You must configure your computer to use the NVIDIA card. To do so:

1. Open the NVIDIA Control Panel (in the System Tray).
2. Select Manage 3D Settings.
3. Select Global Settings.
4. Select Preferred Graphics Processor.
5. Select High-performance NVIDIA Processor.

 You should always try to use the latest drivers available for your video card.

 If you use an external monitor with your laptop and your laptop is not using the NVIDIA graphics card when running VR-Forces, try setting the main display to be the laptop's built-in monitor instead of an external monitor.

Using Kepler Series Quadro Cards

There is a known issue with the Quadro drivers on Kepler series Quadro cards. NVIDIA says it's related to the fact that the default profile optimizes for a fixed eyepoint (for applications like CAD). To run on these cards, you must change the global profile for the driver, as follows:

1. Open the NVIDIA Control Panel.
2. Select the Manage 3D Settings page.
3. Select the Global Settings tab.
4. In the list of driver profiles, select Workstation App - Dynamic Streaming.

We are working with NVIDIA to have their drivers recognize our applications and apply this profile automatically. In the meantime, for Kepler series Quadro you must make this change manually.

Compiler Compatibility on Windows

MAK provides versions of product releases that have been compiled with different versions of Microsoft Visual C++ (for example, 12.0 and 15.0). When you run MAK products together on the same computer, for example, VR-Forces and VR-Vantage Stealth, we strongly recommend that you run versions compiled with the same

compiler. Mixing products compiled with different versions of the compiler can result in program instability. The exception to this is that products built with VC 14 and VC 15 are binary compatible.

Required Software for Toolkit Users

If you plan to build VR-Forces applications using the VR-Forces Toolkit, you must download and install VR-Link 5.8.

If you plan to build the VR-Forces GUI, you must download and install Qt 5.15.2 (Windows VC 15 and Linux Red Hat 8). You can download it at:
<http://www.mak.com/support/bonus-material>.

Qt is also available as a free download under the LGPL version 2.1 license at <https://www.qt.io>. This version should be satisfactory for most VR-Forces customers. If you need a Qt commercial license, you must purchase the license from Qt.

MAK Product Compatibility

To build VR-Forces applications, you must link with VR-Link 5.8. If you are building for HLA and want to link with the MAK RTI, use MAK RTI 3.x or later, although we recommend use of the latest release. If you are building for HLA Evolved, you must use MAK RTI 4.0.4 or later.

License Manager

VR-Forces 5.0 uses FLEXlm 11.17.1. You must install the license management software to run VR-Forces. If you are upgrading from a version of VR-Forces that used an older version of FLEXlm, you must upgrade your license management files. You do not need a new license. Licenses are forward compatible.

The License Manager files are not part of the VR-Forces installer. You can download them at:

- Windows: <http://ftp.mak.com/out/MAKLicenseManager-win64-setup.exe>
- Linux: <http://ftp.mak.com/out/MAKLicenseManager-linux64-setup.tar.gz>

A license manager FAQ is available at <https://www.mak.com/support/license-support>.

Third-Party Libraries Supported

VR-Forces 5.0 uses the indicated versions of the following libraries:

- VR-Link 5.8
- Qt 5.15.2 (VC 15 and Red Hat 8)
- OpenSceneGraph 3.6.4
- Boost 1.63.0
- FreeGlut 2.4.0 (Windows), 2.6.0 (Linux)
- GL-Studio 7.0 (VC 15)
- DI-Guy 13.6 (development version)

- Triton 4.43
- Silverlining 6.20
- SpeedTree 6.3.2
- CDB API 2.2 (Windows), 2.1 (Linux)
- osgEarth 3.2
- CUDA 9.2 (Windows), 10.2 (Linux)

Using MAK Products on Virtual Machines

You can run MAK products on virtual machines. For more information, see the Cloud & Virtualization page on our website at <https://www.mak.com/learn/cloud-virtualization>.

The makData Package

As of this release, the data installation is separate from the product installation. MAK applications can share the same data package, so you no longer need to install it separately for each product. For instructions on installing the data, see "[Installing the makData Package](#)" in the *VR-Forces Users Guide*.

Network Compatibility

VR-Forces 5.0 is compliant with RPR FOM 1.0 and RPR FOM 2.0 and includes FOM mappers for many draft versions of the RPR FOM. It is compliant with RTIs that support the HLA 1.3 specification, the SISO DLC HLA API 1516 version of the IEEE 1516 specification (SISO-STD-004.1-2004), or HLA Evolved. MAK recommends HLA Evolved.

To use an RTI with VR-Forces, it must use the same operating system and be built with the same compiler.

VR-Forces 5.0 supports DIS 4, 5, 6, and 7, and can therefore interoperate with DIS applications of any of these versions. MAK recommends DIS 7.

Backward Compatibility

The VR-Forces 5.0 APIs are largely compatible with earlier VR-Forces 4.x versions, however some changes are required to migrate to 5.0. See the *VR-Forces Migration Guide* for more information.

Scenarios created with recent releases should be forward compatible. Updates to tasks, systems, and terrain reasoning may change how simulation objects behave. See "New Features and Updates" to learn whether there are any changes that might impact scenarios created in previous versions.

Support for MAK Data Logger Recordings

While VR-Forces 5.0 works with all recent versions of the MAK Data Logger, please know:

- Versions of the MAK Data older than 5.5.1 (released in May 2018) have known problems with the encoding of DIS 7 Attributes, which can cause crashes in MAK products.
- VR-Forces 5.0 default HLA configurations use updates to various default FOM modules since VR-Forces 4.10. To record logger files, ensure that the MAK Data Logger instance you are using is configured to use the updated FOM Modules. In MAK Data Logger 5.9 and earlier, those FOM Files must be copied from the VR-Forces 5.0 install into the MAK Data Logger install and configured correctly. Refer to the *MAK Data Logger Users Guide* for details.

To play logger files recorded with an earlier version of VR-Forces, you must insure that your VR-Forces 5.0 version is configured to correctly use the FOM files distributed with the MAK Data Logger and used to record the Logger file. Refer to the *VR-Forces Users Guide* for details.

RPR FOM Versions Supported

VR-Forces 5.0 has built-in support for versions 1.0 and 2.0 (drafts 6, 17, and 20) of the RPR FOM and RPR FOM 2.0, draft 17 with DI-Guy extensions. It also supports VR-Link's ability to support alternative FOMs through the FOM Mapper. By default, VR-Forces 5.0 uses RPR FOM 2.0.

If you are building an application with the VR-Forces toolkit and you want to specify a version of the RPR FOM through code, pass the version number (for example, 2.0006) to the `DtFedAmbWrapper` constructor and pass the resulting object to the `DtExerciseConn` constructor. Also, make sure you are using a federation execution name that corresponds to the right FED file. For example:

```
DtExerciseConn conn("VR-Link20006", "MyApp", new DtRprFomMapper(2.0006));
```

In order to support RPR FOM 1.0, we have added the following extensions (which are supported in later versions of the RPR FOM):

- `EnvironmentProcess`
- `GriddedData`
- `EmbeddedSystem.IFF`
- `EmbeddedSystem.IFF.NatoIFF`
- `EmbeddedSystem.IFF.NatoIFF.NatoIFFTransponder`
- `EmbeddedSystem.IFF.NatoIFF.NatoIFFInterrogator`
- `EmbeddedSystem.IFF.SovietIFF`
- `EmbeddedSystem.IFF.SovietIFF.SovietIFFTransponder`
- `EmbeddedSystem.IFF.SovietIFF.SovietIFFInterrogator`
- `EmbeddedSystem.IFF.RRB`

- BaseEntity.AggregateEntity
- ObjectRoot.BaseEntity.PhysicalEntity.Lifeform

For both RPR FOM 1.0 and 2.0, VR-Forces 5.0 relies on the Controlling and ViewControl custom MAK extensions.

New Features and Updates

VR-Forces 5.0 has the following new features and updates.



When you uninstall VR-Forces, it now uninstalls the entire directory. Be sure to copy any files you created, such as scenarios or SMSs, to another folder before you uninstall VR-Forces 5.0.

Data

- The MAK data package is now installed in a central location separate from the product installation, allowing MAK products to share data. You no longer install the data separately for each product. Instead, you can install the data packages in a common location—on a machine where multiple products are installed, or on a network share—to supply 3D models, 2D icons, audio files, terrain configurations, HUDs, overlays, particle systems, and more. This significantly reduces the disk space required when running multiple MAK ONE applications. See "The makData Package" on page 5.
- Entity and other files are now located in the shared data directory. Refer to the *VR-Forces Migration Guide* for more information.

Scenarios

- The HawaiiAir scenario now has a box around the refueling area, the aircraft that receives fuel starts with a lower fuel level, the Honolulu airport is a proper aerodrome with runway objects, and the commercial aircraft perform takeoff and landing tasks using the aerodrome's runways.
- The Create Detonation dialog box has more options for Munition Type.
- You can now load object tags into a scenario to use in the palettes without adding them to the SMS. See "[Loading Object Tags](#)" in the *VR-Forces Users Guide*.

Visuals

- VR-Forces now supports horizon-based ambient occlusion (HBAO). This is enabled by default. See "[Using the Ambient Occlusion Effect](#)" and "[Configuring Ambient Occlusion](#)" in the *VR-Forces Users Guide*.
- Height above terrain (HAT) lines now indicate that the height is above ground level (AGL).

Simulation Objects

- You can now configure multiple countermeasure systems in terms of relative position and orientation on a aircraft entity.
- Tank treads now move realistically when tanks turn. When a tank turns right, for example, then the right tread locks up or slows down, depending on the forward motion.
- Field artillery units in entity-level scenarios are now aware of the subordinates and the weapons in the unit, knowing their capabilities and remaining munition rounds. This allows the unit to determine which subordinates can be tasked in an attack.
- Artillery entities can fire smoke rounds.
- DIS has the concept of station names (an enumeration) in their IsPartOfPdu. VR-Forces now supports this to allow for an entity to indicate the relative position of one entity to another not by an x,y,z offset but by an identified position.
- There are new and updated entities. For a complete list of simulation objects, see the *VR-Forces Entity Model Catalog*. New entities include:
 - Humans: Background Civilian (Mideast Female), Background Civilian (Mideast Male), Background Civilian (Western Female), Background Civilian (Western Male), Belgian Soldier, Dutch Soldier, Sergeant M16, UK Soldier L85A2 NLAW, US Sergeant M4.
 - Ground vehicles: 2S35 Kolitsiya SV, ASLAV-25, BMD-2 IFV, BMD-3 IFV, Buffalo ARV, Coyote TSV 6x6, Ford Escape SUV, GAZ-2330 SPM Tigr-M, GAZ-233114 AMN Tigr-M, GAZ-233115 Tigr-M, HQ-2 Launcher, HQ-9 Self Propelled TEL, K-17 Bumerang IFV, LAV I AVGP Grizzly, LAV I AVGP Husky, M1000 Heavy Equipment Trailer, M104 Wolverine, M1068 Command Post, M1068 SICPS, M1070 HET Truck, M1126 Stryker w/ M2, M1126 Stryker w/ MK19, M113 Armored Ambulance, M1134 Stryker ATGM, M1140 HIMARS ATACMS, M1231 Husky Mk III VMMD, M142 HIMARS, M577 Armored Treatment Vehicle, M60T Sabra MBT, M992A2 FAASV, MAZ 543, MEP 1050 Generator Trailer, MRAP M-ATV, MRAP Ridgeback PPV, MSVS 8x8 Truck, MTRV Close Support Tanker, MTRV Truck, Medium Box Truck, Mercedes-Benz Actros Truck, PHL 03 (Type 03) MLRS, PHZ 89, Pandur II 6x6, Pandur II 8x8, RG-31 Charger MRAP, RG-31 Nyala MRAP, RG-32 Galten MRAP, RG-33 MRAP, Roland 2 AMX-30R, SA-10B SP TEL (5P85S), SA-12 Giant TELAR (9A82), SA-12 Gladiator TELAR (9A83-1), SA-12 Grill Pan Engagement Radar (9S32), SA-17 Grizzly BUK-M2 TELAR (9K317E), SA-17 Grizzly Launcher/Loader TEL (9A316), SA-22 Pantsir-S1 Tracked, SA-22 Pantsir-S1 Truck, SA-5 Gammon Square Pair Radar (5N62), Scud-B, T-155 Firtina, T-90M MBT, TOS-1 Buratino, Technical Truck w/ Mortar, Terrier AEV, Titan AVLB, Toyota Land Cruiser M240, Trojan AVRE, Ural 4320 Tanker, Ural 43203 R330Zh Jammer, Ural 4320, Ural 43206, Ural 5323, ZSU-57-2.

- Fixed-wing aircraft: ATR 72-600, Antonov AN-72 Coaler, BAE Hawk T2, Boeing E-4, Bombardier CRJ 700, BTT-3 Banshee Jet 80, Beechcraft T-6 Texan II, Beriev A-50 Mainstay, CASA CN-235, CL-415 Superscooper, Cessna F406 Caravan II, E-7 AEW&C Wedgetail, Embraer ERJ135, Embraer Phenom 100, Embraer R/E-99, F-4E 2020 Terminator, Gulfstream G400, Gulfstream III, IL-38 Dolphin, JF-17 Thunder, MQ-1C Gray Eagle, MiG-31 Foxhound, Nanchang Q-5 Fantan, Sentinel R1, Shenyang J-31 Gyrfalcon, SU-22M-4 Fitter-K, SU-24M Fencer D, SU-34 Fullback, SU-57 Felon, Shaanxi KJ-500, Tu-22M Backfire, Tu-95 Bear E, Yak-130 Mitten.
- Rotary-wing aircraft: AS-355 Ecureuil 2, Bell 212, Bell 407, EC-120 Eurocopter Colibri, Harbin Z-9, MD-500, UH-3H Sea King.
- Subsurface watercraft: Type 039A (Yuan Class) Submarine, Virginia Class Submarine.
- Surface watercraft: Albion-class LPD, America Class Amphibious Assault Ship, Archer Class Patrol Boat, Buyan M Class Corvettet, Defender Class B Patrol Boat, Jiangkai II Type 054A Frigate, Lafayette-class Frigate, Ropucha Class Landing Ship, Skjold Class Corvette, Type 001 Liaoning Class Carrier, Type 23 Duke Class Frigate, Type 26 City Class Frigate, Type 42 Sheffield Class Destroyer.
- Weapons and Munitions: FGM-148 Javelin Tripod, RH-202 AA Gun, M1064 IR Illumination Round, M1066 IR Illumination Round. M1123 IR Illumination Round, M825 155mm WP, M992 IR Illumination Round, SA-23B Giant (9M82M).
- Vehicle and Human Units: Air Defense Artillery Platoon (RUS) SA-9, Air Defense Artillery Platoon (USA) Avenger, Antitank Team (USA Army) Javelin, Armored Recon Platoon (RUS) BMP2, Armor Breach Co (US), Armor Plt with Plows (US), BM-21 2B17, BTR-90 APC, COLT Team (RUS), COLT Team (USA), Combat Service Support Platoon (RUS), Combat Service Support Platoon (USA), Combat Service Support Section (USA), Field Artillery Battery (USA) M109, Field Artillery Battery (USA) M777, Field Artillery Headquarters Section (USA), Field Artillery Platoon (USA) M109, Field Artillery Platoon (USA) M777, Field Artillery Section (USA) M109, Field Artillery Section (USA) M777, Fire Support Team (USA), Infantry Headquarters Section (RUS Army), Infantry Headquarters Team (USA Army), Infantry Platoon (USA Army), Machinegun Team (USA Army) M240, Mechanized Fire Team (USA Army) Javelin, Mechanized Fire Team (USA Army), Mechanized Squad (USA Army), Motorized Squad (Irregular Technical), Motorized Squad (Irregular), Paratrooper Fire Team (USA), Rifle Fire Team (Insurgent) AR, Rifle Fire Team (Insurgent) RPG, Rifle Fire Team (USA Army), Rifle Squad (Insurgent), Rifle Squad (USA Army), Rifle Squad (USA Marines), Strkyer Rifle Squad (USA Army), Stryker Rifle Headquarters Section (USA Army).png, Stryker Rifle Platoon (USA Army), Stryker Weapons Squad (USA Army), Supply Section (US), Tank Company (RUS), Tank Company (USA) Mine Plows, Tank Company (USA), Tank Headquarters Section (RUS), Tank Headquarters Section (USA), Tank Platoon (RUS), Tank Platoon (USA) Mine Plows, Tank Platoon (USA),

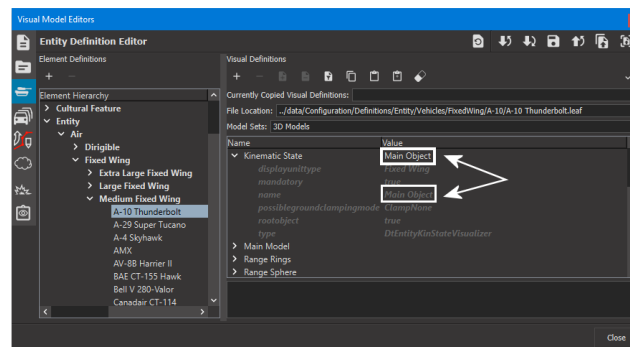
US Army Infantry HQ Team, US Army Infantry Platoon, US Army Javelin Team, US Army 240 Team, US Army Vehicle Team, US Army Weapons Squad, Vehicle Crew (Notional), Vehicle Crew (USA) Notional, Vehicle Team (Insurgent), Vehicle Team (USA Army), Weapons Squad (USA Army).

- Added "fuze-type" to the detonation parameters table in `./data/simulationModelSets/base/detonationParams.mtl` as an additional parameter to determine the results of a detonation.

Visual Model Editors

- In the Visual Model Editors, any Visual Definitions with a name attribute now show that name in the Value column (Figure 1).

Figure 1. Visual Definition name



Simulation Object Editor

- You can replace a system on a simulation object with another one. See ["Replacing a System"](#) in the *VR-Forces Users Guide*.
- When you open an SMS in the Simulation Object Editor (SOE), there is now a progress bar that displays what files are loading and provides you with a sense of when you'll be able to work on the SMS.
- The SOE now defaults to a dark mode interface. To use light mode instead, use the new `--lightMode` command-line argument.
- The Time of Day in SOE's Environment Settings is now a slider instead of a list.
- To assist with model work, the Render Settings are now available in the System menu. The Debug Visuals list in the SOE's Render Settings includes EMAT options.
- Models are better cleared out of the SOE's memory, allowing you to look through numerous models without issues.
- In the 3D model view, the Top Down View and Front Side View now use the isometric view instead of the perspective view.

- When editing units in the SOE, there is a Function button in the Unit Composition box that you can use to specify a subordinate's function in the unit. There is also feature that you can access through the Edit menu: Subordinate Functions. These are text-based handles that identify a user-defined role or function that the subordinate performs in that unit. See "[Defining Functions for Subordinates](#)" in the *VR-Forces Users Guide*.
- The Particle System Editor is now available in the SOE. To learn how to use this, see the [Special Effects \(Particle Systems\)](#) chapter in the *Adding Content to MAK Applications Reference Manual*.

1.0.1 New and Updated Tasks and Sets

- VR-Forces 5.0 introduces the Command Panel, a new tool for building plans and assigning tasks. The Command Panel brings together all the tasks and sets available to a simulation object, along with basic status information, and presents them in a categorized menu that lets you control how many options you see. See "[The Command Panel](#)" in the *VR-Forces Users Guide*.
- There is a new feature that allows you to coordinate the actions of entities and units. For details, see the chapter [Synchronization Matrix](#) in the *VR-Forces Users Guide*.
- There is a new engagement task for artillery entities, Provide Indirect Fire, which is designed for call-for-fire artillery exercises. See "[Provide Indirect Fire](#)" in the *VR-Forces Users Guide*.
- The new Execute Surface Attack task replaces the old Execute Close Air Support task. Also, Execute Gun Attack replaces Strafe Ground Target. (The old tasks have been hidden from the GUI, but are preserved to support scenarios that include those tasks.) See "[Execute Gun Attack](#)" and "[Execute Surface Attack](#)" in the *VR-Forces Users Guide*.
- There is a new movement task for human entities, Visit Neighbor. See the chapter on [Human and Crowd Tasks](#) in the *VR-Forces Users Guide*.
- There are new tasks and set data requests for units as part of the improved behaviors. See the section on "[Set Data Requests for Units](#)" and the chapter on [Unit Behavior Tasks](#) in the *VR-Forces Users Guide*.
- You can now specify a rank and name for soldier characters. See "[Rank Patch](#)" and "[Name Tag](#)" in the *Setting the State of Entity-Level Simulation Objects* chapter of the *VR-Forces Users Guide*. At this time, the soldier characters that support these data set requests include: DI Lasing, Pakistani Soldier, Paratrooper, Sergeant M16, the Singaporean Soldier entities, the US Army entities (excepting the medic), and the USMC entities.
- The Orbit task now shows task visualization to allow you to see the intended orbit path.
- When you use the Set Appearance data request on a rotary-wing aircraft or other aircraft with rotors or propellers to turn the power plant on or off, the propellers speed up or slow down. As of this release, rotary-wing vehicles will not take off until the rotors have reached full speed.

Terrain and Navigation

- You can now enable or disable shadows on the dynamic ocean separately from the overall terrain. This can improve performance and can also make the ocean look more realistic when the ocean waves are high. See "[Displaying Shadows \(3D Only\)](#)" in the *VR-Forces Users Guide*.
- In Ocean Settings, you can now select the ocean spectral model: JONSWAP, Pierson-Moskowitz, or Tessendorf. For more information, see "[Specifying an Ocean Wave Spectrum](#)" in the *VR-Forces Users Guide*.
- The simulation terrain debugging tool now allows you to show the grid posts for elevation. See "[Displaying Elevation Tiles](#)" in the *Adding Content to MAK Applications Reference Manual*.
- The simulation terrain debugging tool also allows you to view intersections for simulation objects. See "[Displaying Recent Intersections](#)" in the *Adding Content to MAK Applications Reference Manual*.
- Navigation processing is now more parallel. Navigation area updates run in parallel. Previously, each frame would tick one area after another. VR-Forces now spawns threads to tick multiple areas concurrently. We also reduced the amount of processing that must be done in the navigation area tick by offloading some of the navigation query processing to a separate thread.
- When you task an entity to move to a location and start playing the scenario, it generates a path. You can then save the scenario with that path already planned. The next time you play that saved scenario, the entity does not need to calculate a path, which can improve the performance of the scenario.
- A new option in the Dynamic Terrain menu, Reset All Changes, lets you remove all damage and other changes to a dynamic terrain, returning the terrain to its original state. For details, see "[Resetting All Changes in Dynamic Terrain](#)" in the *Adding Content to MAK Applications Reference Manual*.
- The `navDataRegen` folders are no longer created by default. You can enable the new configuration option in the `vrfSim.mtl` file, `navigationRegenerationFileDirectory`, and specify a directory to save those files. The files that are saved there are useful when you need to debug navigation regeneration issues.
- `osgEarth` `pagedLod2` nodes are now supported. These are faster than `pagedLod` nodes and have additional features.

Weather

- New controls make it easier to set the wind direction and speed at different levels of the atmosphere; changes appear on the Atmospheric Conditions table. In addition, the Atmospheric Conditions table has been reordered so the lowest level of the atmosphere appears at the bottom and the highest level at the top of the table. The table and the wind controls are in the Environment Conditions dialog box. To try them, choose **Simulation > Environment Conditions** and select the Weather page.

- Snow areas now include precipitation shafts and height fog when viewed from a distance. Localized height fog has improved blending with the sky.

Performance

- The Frame Rate Monitor panel has been replaced with the Performance Monitor Panel, which displays more information than only the frame rate for each back-end in a session. See "[Monitoring the Back-end Performance](#)" in the *VR-Forces Users Guide*.
- The sensor calculations for a single entity can now span multiple frames to avoid single long-frame spikes from sensor ticks.
- Increased the speed of horizontal intersection checks on complex terrains to improve performance.
- Nahimic software can have a negative impact on performance. VR-Forces now warns you if the Nahimic service is running. See "[Performance and Display Issues](#)" in the *VR-Vantage Users Guide* to learn how to prevent this issue.
- A new HLA feature improves performance by turning off object requests while a scenario is loading. It also fixed an issue where rewinding a scenario could create more entities. To enable this feature use `MAK-VRLExt-1_evolved.xml` and use `--requestwhenInitialized` when you start the VR-Forces simulation engine and GUI.
- A performance improvement enables multiple network threads in the HLA Evolved and HLA 1516 RTIs.
- In HLA, a new scheme for pre-reserving object names for each simulation engine improves entity creation and scenario loading speed.
- A new parameter in sensor sysdef files, **allow-first-detection-without-terrain**, enables a sensor (radar, for example) to detect objects before the terrain is loaded. By default this feature is off, so VR-Forces pages in the terrain before detecting anything.

Configuration and Startup

- A new command-line option is now available for VR-Forces, `--enableDofConstraints`. Degree of freedom constraints are disabled for simulation objects by default. Use this command-line option to enable degree of freedom constraints.

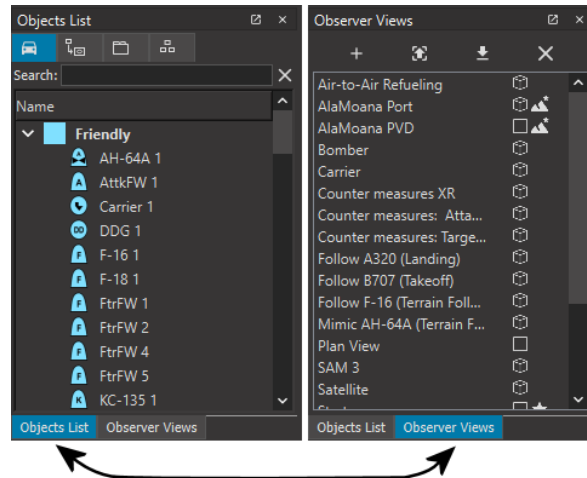
For details about this and other command-line options, see "[Command-Line Options](#)" in the *VR-Forces Users Guide*.

- The `--usePredefinedConnection` command-line option now allows you to override the device address and application number, allowing you to write scripts to run multiple front- and back-ends. See "[Command-Line Options](#)" for details.
- There are some advanced launcher configurations available in `./factory/settings/vrfLauncher/Advanced`: HLA 1516, HLA 1516 Evolved with the experimental RPR 3.0 IFF, and HLA Evolved 1516 with METOC.

GUI

- The Objects List and Observer Views Panels are now tabs in the same panel when they are both displayed. You can also add other panels to the tab group.

Figure 2. Objects List and Observer Views



- Dark mode is now the default in the graphical user interface. Light mode, the former standard, is also available. There are also dark mode and retro icon options. See "[Disabling and Enabling Dark Mode](#)" in the *VR-Forces Users Guide*.
- The Display Units Settings now limit the available measurements to those that are appropriate for each data type.
- In the Display Units Settings, you can specify the measurement units for the 3D compass and also range/bearing lines. Your options are degrees or NATO-MIL.
- The Display Units Settings now allow you to specify Grid as the Heading, in addition to True or Magnetic. You can also specify Grid North in the Observer Settings as the Map Alignment Preference for plan view.
- You can pin labels for entities in the Plan and Stealth views. (Previously, this feature was in the Decorations portion of the context menu. It is now available at the top of the context menu.)
- Symbol decorations are now hidden when the observer reaches a specified altitude in the plan view. See "[Hiding Symbol Decorations by Altitude](#)" in the *VR-Forces Users Guide*.

The 2D icons can also appear smaller as the observer rises in altitude. See "[Scaling 2D Icons by Altitude](#)".

Note that heading indicators, when enabled, are always visible regardless of the observer's distance from the entity.

- The symbol decoration settings are now listed alphabetically in the Symbol Decoration Settings page of Display Settings and the Symbol Decoration panel. Additionally, the list of symbol decorations fits all of its entries by default.

- There is a new toolbar, Scenario Components, which gives you quick access to Global Plans, the Synchronization Matrix, and Scenario Events.
- There is now a button on the Display Settings Toolbar to set whether 2D icons should rotate to a simulation object's heading: . (Some other toolbar buttons that were not frequently used have been removed.)
- Users can now right-click on a simulation object and select options from the Model Configuration menu item in the context menu.
- The contact information in the About dialog box (**Help > About**) is now easier to read. You can also click the link to the support portal.
- There is a new option in the Unit Display Settings, Show Labels for Ghosted Objects, that allows you to display symbol decorations for ghosted icons. See "[Displaying Ghosted Icons](#)" in the *VR-Forces Users Guide*.
- Unit Display Settings now default to hiding the bounding volumes and showing ghosted icons.
- The vertices of tactical graphics are no longer shown unless the graphic is selected.

API Changes

For detailed information about the changes that affect the API, refer to Migration Guide section of the *VR-Forces Developers Guide*.

- Lua modules have moved to the `./makLua` directory, and there are a number of new ones. For details on these modules and how to use them, refer to the Lua API Documentation. For a summary, see "[Lua Modules](#)" in the *VR-Forces Users Guide*.
- We have deprecated `markingText` in `simObject` and renamed it as `objectName`. For backward compatibility, `markingText` is still supported, however, new code should obviously use `objectName` instead.
- `DtDetonationManager` now processes detonations in parallel to improve performance.
- The GUI class `DtLocalObjectManager` has been renamed to `DtGuiLocalObjectManager` to prevent confusion with the similar named `DtLocalObjectManager` class in the back-end.
- `tMenuConfiguration` allows you to determine how to sort your menus. See the API documentation for more information.

Documentation Updates

Documentation has been updated for this release. The guides are provided as PDF files in the `./doc` directory. Online help is available from the VR-Forces Help menu. You can also find the most current PDFs at <https://www.mak.com/support/product-user-guides>. (You must be able to log in to the web site.)

Fixed Bugs

Problems identified in previous releases have been fixed. For a summary, please see the [./doc/FixedDefectsVRF.csv](#) file.

Known Problems

VR-Forces has the following known problem:

- If you have a setup that includes multiple monitors with different scale factors, such as one 4K monitor set to more than 100%, you might experience layout issues in the VR-Forces GUI. VRF-5665
- You can now save scenarios with entity's paths already planned. If you then edit the terrain, such as putting a prop in the entity's path, the entity will move through it because it does not recalculate its path. VRF-4370

For information on other issues that you might encounter while using VR-Forces, see the [Troubleshooting](#) appendix in the *VR-Forces Users Guide*.