MVRsimulation Virtual Reality Scene Generator™ (VRSG™) is a Microsoft DirectX 11-based render engine that provides geospecific simulation as an image generator (IG) with game quality graphics. MVRsimulation’s IG enables users to visualize geo-graphically expansive and detailed virtual worlds on commercial off-the-shelf Windows PCs. Since 1997, VRSG has provided real-time, single- or multi-channel visualization of virtual environments, dynamic moving models, and special effects. VRSG is used as a:

- **Dedicated computer image generator** coupled to an external simulation host in single or synchronized multi-channel mode. VRSG supports features often required for manned/unmanned flight training, driving simulations, and other applications.

- **DIS stealth visualization tool** for real-time or after-action analysis of distributed simulation exercises.

- **Self-contained first person shooter** to simulate individual combatants, JTACs, or forward air controllers.

- **Self-contained UAS camera operator** to render HD simulated UAS video and to stimulate video players such as a full-motion video (FMV) receiver.

Using advanced terrain and texture paging algorithms VRSG renders geospecific imagery over expansive round-earth 3D terrain while providing full-scene anti-aliasing and continuous level-of-detail morphing. VRSG is delivered with robust libraries of 3D models and high-resolution terrain of most of the world. As an executable-ready render engine, VRSG supports but does not require programming. Configuration files and interface protocols provide users the ability to control basic components of the render engine. Developers can use the plugin interface to augment VRSG’s functionality with their own low-level features.

VRSG is a component of MVRsimulation’s rapid virtual world terrain creation and visualization technologies.

### Image generator features

Asynchronous texture paging technology for visualizing high-resolution, photo-realistic databases at 60 Hz.

Database geometry paging, level-of-detail blending, decoupled terrain and texture level-of-detail.

Support for multiple synchronized channels and multiple viewports per channel.

Multi-texture techniques such as normal maps, shadow maps, light maps, and decals.

Light points that respond realistically to visibility conditions.

Realistic light lobes that yield per-pixel radial attenuation and per-vertex axial attenuation.

Object-on-object dynamic shadows cast by models and clouds.

Native support for DIS.

Dynamic lighting and time-of-day conditions, light-point based star fields, horizon glow, and multiple sky models. Multiple atmospheric layers including ground fog and haze with sun-angle dependent density and color.

Ephemeris model for sun and moon position, moon phase, and star position.

Volumetric clouds and storm cells with optional volumetric precipitation effects.

Simulation of ocean sea states: realistic 3D wave motion and wake waves, accurate environment reflections, and bathymetry.

User-extensible particle effects that respond to wind: dust trails, contrails, tactical smoke, volumetric flames, and blown sand or snow. Other effects include dynamic craters, wakes, track and wheel impressions, and solid particle ballistic effects.

Dynamic cratering, deforming terrain surfaces to represent craters resulting from munitions impact.

Utilities to convert FBX models and OpenFlight databases and models to MVRsimulation’s model and round-earth terrain formats.

Full mission function support to include height above terrain, laser range, line-of-sight (intervisibility), and collision detection.

OpenGL interoperability plugin for coding 2D overlay graphics in machine-native OpenGL and rendering in VRSG.

Significant Common Image Generator Interface (CIGI) support.

Native high-performance 3D human character render engine; no third-party software required. Capable of managing thousands of character entities and displaying hundreds in the field-of-view.

Support for VR and mixed reality systems: Varjo XR and Varjo VR, HP Reverb, HTC Vive Pro and Tracker, and Valve Index VR.

Edge blending and distortion correction support of solutions from Scalable Display Technologies, VIOSO, and Dome Projection.

**Figure:** VRSG real-time scene visualizing the gaze of the pilot through the collection of eye-tracking data, in a flight simulator wearing a Varjo XR-3 mixed-reality headset.
**Scenario Editor**
In-game drag-and-drop interface for adding and manipulating static culture to build up areas of interest on the terrain, and to script pattern-of-life scenarios intended to be played in VRSG.

**Sensor simulation**
Physics-based infrared simulation featuring on-the-fly classification of geoscientific visual spectrum imagery. Sensor simulation responds to environmental conditions and diurnal cycles. Radiance-based automatic gain control, manual level/gain over-ride, and noise as a function of dynamic range. Mid-range and far IR wavebands supported to model thermal imagers. Post-processing effects include noise, blur, depth-of-field, level, gain, polarity, digital zoom, and heat refraction. Electro-Optic (EO) and Night Vision Goggle (NVG) simulation.

Radar simulation to support applications such as F-16 DRLMS, SAR, and ISAR.

**3D content libraries**
Over 8,906 culture and dynamic models, and geospecific round-earth 3D terrain of most of the world in 15 meter or better resolution with higher resolution insets of areas of interest, some with extensive cultural features. (CONUS++ terrain at one meter or better resolution with over 35 geographically accurate modeled airports and MOUT sites.)

Nearly 4,000 military models, with ongoing entity additions in support of Combat Air Force Distributed Mission Operations (CAF DMO) requirements. Target recognition training supported using screen captures and videos of models placed in VRSG scenes.

Over 350 commercial vehicle models; 640 character and weapon models, with 1,760 BVH animations; over 4,000 culture models of buildings and other structures, foliage, signage, and street elements. Damage states are added to building models on an ongoing basis; currently 304 buildings have damage states.

Ability to preview model switch states, damage states, articulated parts, and thermal hot spots in Model Viewer.

Ability to add or modify model attributes/metadata in a JSON file.

**UAS / RPA simulation**
Built-in UAS sensor payload model allowing any DIS airborne platform to be used as a UAS, when a notional UAS is sufficient.

Real-time HD H.264 video generation with embedded KLV metadata using STANAG 4609-compliant MISB ST 0601.9 KLV metadata and MISB security metadata standard 0104.5. Full NGA Community Motion Imagery Test Tool (CMITT) compliance.

MVRsimulation’s own video player, optimized for VRSG H.264 / H.265 streaming; can decode and display KLV metadata.

Ability to configure H.264/.265 video streaming plugin as a Real Time Streaming Protocol (RTSP) server.

Built-in 2D overlays for several UAS and targeting pod platforms.

**JTAC / FAC simulation**
Laser rangefinder/designator mode for designating targets for other simulations. NVG IR pointer mode for night-time target marking.

Stimulate FMV devices with streaming HD digital video of UAS or targeting pod feeds.

Integration with simulated military equipment, such as BSI’s emulated SOFLAM device; support for off-the-shelf devices such as NVIS Ranger 47 virtual binoculars.

Coupled with BSI MACE, can simulate digitally aided close air support on a device running Android Team Awareness Kit (ATAK).

**Analysis / after-action review features**
Support for real-time or after-action review functions.

Ability to capture and visualize the gaze of the wearer from eye-tracking data of Varjo headsets.

Attachment modes: tether, mimic, orbit, compass, and track.

Fire lines and shot lines for visualization of engagements.

Savable viewpoints, entity-relative or database-relative.

Visualization of designator PDUs.

Virtual world 3D sound capability.

For more information, visit www.mvrsimulation.com or contact sales@mvrsimulation.com.

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