METAVR

VRSG™ Visuals in Aeriel Refueling Simulation

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Real-time MetaVR VRSG screen captures of three different refueling aircraft scenarios over geospecific 3D terrain. The daytime scenes show refueling operations of an F-16C (left) and F-15 (right) over the Barry M. Goldwater Range (BMGR) area of MetaVR's virtual North America terrain. The night scene shows the refueling of an A-10C during night operations on the 400 NS aerial refueling track area of MetaVR's virtual North America terrain. The scene features the shadows cast by the KC-135R's tail-mounted flood light illuminating the A-10C, and the cultural lights of Amarillio, TX.

MetaVR recently delivered multiple Virtual Reality Scene Generator™ (VRSG™) licenses and visual systems to three Air National Guard (ANG) aerial refueling training programs: QuantaDyn's MicroBOSS, Randolph AFB's KC-135R and C-130 Multi-Mission Crew Trainer, and QuantaDyn and AVT's BOSS.

MicroBOSS desktop refueling simulator
QuantaDyn received 25 MetaVR visual systems (game-level ruggedized rackmount PCs loaded with VRSG licenses) to be used in its production Micro Boom Operator Simulation System (MicroBOSS) for training KC-135R boom operators at 17 Air National Guard (ANG) sites.

The MicroBOSS is a desktop training system which uses a computer-generated receiver aircraft to train boom operators. The VRSG systems replace Quantum3D visual systems that have been used up to now in the boom operator trainer prototype.

The MicroBOSS incorporates software features and capabilities of the ANG Boom Operator Simulation System (BOSS) as well as the Air Education Training Command (AETC) Boom Operator Weapon System Trainer (BOWST). This desktop system uses selective-fidelity concepts in the hardware design to provide a realistic and cost-effective training environment. Through the use of photo-realistic graphical displays, touch screens, an aural cueing system, a high-definition out-the-window display, and representative joystick controls, the MicroBOSS provides the functional equivalent of a complete KC-135R boom pod station.

Using highly detailed visual models, the MicroBOSS can provide training on Air Force, Navy, and NATO receiver aircraft.

Image on the cover: *Real-time MetaVR VRSG screen capture of a simulated KC-135R aircraft refueling an A-10C on the 400 NS aerial refueling track area of MetaVR's virtual North America terrain.*

Training personnel can adapt MicroBOSS scenarios to support each unit's unique mission profiles, or concentrate on high-interest training times from operational lessons learned. Mission preparation for air refueling profiles, including the Boom Drogue Adapter (BDA), enables the aircrew to be mission ready.

The initial sale was for 17 MicroBOSS systems, with an option for additional systems to be purchased later so each ANG unit will have a MicroBOSS.

Multi-Mission Crew Trainer
Randolph Air Force Base (AFB), home of the 902d Force Support Squadron and the AETC, has acquired 6 new MetaVR VRSG licenses for the ANG's new C-130 Multi-Mission Crew Trainer (MMCT) program. The MMCT will provide enhanced capabilities to support pilot and co-pilot training in a full range of flight modes, incorporating multiple navigation systems and the ability to conduct in-flight air refueling missions via Distributed Mission Operations (DMO) training profiles. The initial aircraft platforms are the KC-135R and C-130H2.

VRSG already powers the visual channels for the initial MMCT simulator prototype. The AETC at Randolph AFB purchased the additional VRSG licenses for the full production run of six C-130 MMCT devices, which will be built by the Trainer Development team and delivered to the Air National Guard. The project includes an initiative to add a refueling simulation component to the trainer. Aircrew trainees will then be able to participate in DMO aerial refueling exercises using the C-130 MMCT and an F-16 DTT as receiver aircraft, and the MicroBOSS in the KC-135R tanker role through the Distributed Training Operations Center (DTOC) for multi-operator "person-in-the-loop" training. Future KC-135R versions of the MMCT will allow aircrew to operate the front end of the tanker so all these devices can operate in the same virtual airspace.

BOSS refueling simulator
AVT Simulation has taken delivery of seven MetaVR visual systems for the visual system upgrade to the ANG's Boom Operator Simulation System (BOSS) Prototype KC-135R refueling simulator. The BOSS Prototype, built by QuantaDyn, is a low cost, high-fidelity squadron-level KC-135R simulator and weapon system trainer. This fully immersive DMO-capable boom operator trainer is fitted within a high-fidelity KC-135R aircraft replica. The training system consists of a boom operator's pod, associated operating systems, 4-channel image generation and projection systems, instructor operator station, physics-based tanker and receiver models, threat environment generation station and ARCNet Gateway. Fully qualified boom operators at 17 ANG KC-135R flying units will use the eventual production BOSS for continuation training, mission qualification, up-grade training, currency training, and mission-rehearsal DMO training through the ANG DTOC.

As part of the AVT delivery MetaVR provided updated North America 3D terrain enhanced with cultural lighting in the area of the aerial refueling track 400 North South. This area of interest extends from the Texas panhandle to eastern Colorado, and the terrain features approximately 343,210 cultural lights points. At AVT's request for the initial delivery, MetaVR delivered 4-meter terrain tiles of the 400 North South refueling track derived from 1-meter imagery on a 2 TB drive. A delivery of terrain tiles of all of North America (4-meter terrain derived from 1-meter imagery) will follow.

The seven MetaVR visual systems replace the 4-channel Quantum3D visual system used up to now in the BOSS prototype. The additional 3 VRSG channels provide additional side views for refueling auxiliary wingtip fuel tanks and a floor view so the boom operator can see the receiver aircraft move away during separation of the receiver aircraft after refueling. The VRSG systems are housed in an 84" rackmount cabinet.

According to QuantaDyn, MetaVR VRSG was chosen for these programs for several reasons. From a boom operator's perspective, VRSG's high-fidelity graphical environment, atmospheric conditions, cultural lighting, and realistic precise shadow and lighting are very important components for providing realistic refueling training. The detailed ground representation of high-resolution terrain (such as MetaVR's Afghanistan virtual terrain) is important for identifying location; in daytime from the imagery on the ground, and at night, from the cultural lighting. The variety of sky models and cloud models and the ability to modify cloud effects and other environmental characteristics are all critical for maintaining situational awareness in the refueling operations, and provide the opportunity to train under adverse conditions. The high-resolution receiver models contain details useful in training. The shadowing of the boom on the receptor aircraft is fast and very precise, which is important for replicating exactly what a boom operator sees while refueling the receiver aircraft. The external light profile, which enables one to adjust the lighting as a rheostat rather than having to use a step illumination, is a distinctive benefit.

Using its own internal development resources, MetaVR worked closely with QuantaDyn, AVT, and AETC for 14 months prior to any VRSG sale for this effort, to ensure a smooth transition from the legacy visual systems used in their simulator prototypes to the MetaVR visual systems.

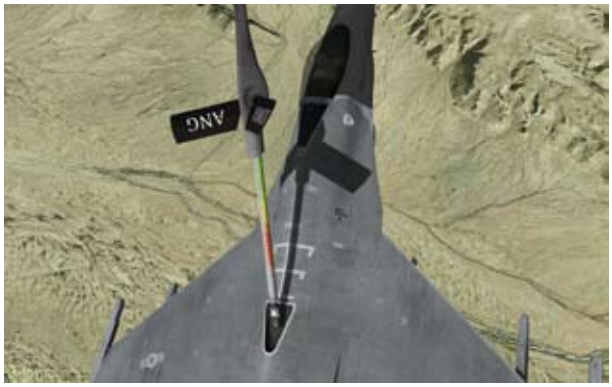
VRSG's support of refueling simulation

The 3D military vehicle model library delivered with VRSG contains a set of models that include geometric detail sufficient to support the aerial refueling mission.

The primary requirement of an image generator used in boom operator training is to provide accurate and high quality representation of shadows cast by potentially several light sources. VRSG version 5.7 includes advanced object-on-object shadowing features and can support up to four concurrent, independent, occulted, and shadowed light sources. These multiple shadowed light sources can be allocated to the sun or moon, the tanker tail flood light, the receiver nacelle lights, or any other light source requiring shadowing. Shadowed light sources can be attached to either the tanker or receiver aircraft.

Self-shadowing of the receiver aircraft is supported. For optimal performance, VRSG generates ultra high-resolution shadow maps of varying resolutions for each active light source to support shadows projected by tanker and receiver aircraft geometry.

To minimize perceived aliasing, VRSG multi-samples each shadow map, using a per-pixel-unique randomly oriented sampling kernel resulting in softened and anti-aliased shadow boundaries. With generating the varying resolution shadow maps, VRSG can use the highest resolution shadow map for the highest contrast light source, which is the light source most likely to cause aliasing artifacts.



During day operations when local light sources are not utilized, VRSG allocates more computing resources to the production of the sun shadow, as the sun shadow is of higher contrast and requires more anti-aliasing to achieve a quality result. During night operations, VRSG can reallocate these resources among multiple lower-contrast shadow casting light sources. Lower contrast light sources can use lower resolution shadow maps for better performance.

For light sources that do not require shadowing, VRSG supports a feature called "addressable light maps". Addressable light maps are built into models using multi-texture. Up to 16 addressable light maps are supported per model, and an unlimited number of models per-scene. Addressable light maps are useful for applications such as illuminating refueling receptacles, the F-16 tail flood light, or illumination of culture from local light sources. For any addressable light map on any model, the host software is able to specify an intensity level of the light map using a floating point continuum of 0 to 1.0.

VRSG's addressable light maps offer a full continuum of intensity control rather than requiring a finite number of discrete illumination levels baked into a switch node of a model.

For more product information, pricing, and ordering, see MetaVR's web site at www.metavr.com or contact sales@metavr.com.