VRSG™ Visuals in Flight Simulation
MetaVR™ visuals, terrain, and 3D models are used in fixed- and rotary-wing simulators at multiple US Air Force, Air Force Reserves, and Air National Guard training facilities in the US and abroad. This brochure briefly describes use of Virtual Reality Scene Generator™ (VRSG™) in a selection of programs.

Note that VRSG is also used extensively in unmanned aerial systems (UAS) training systems, which is covered in the brochure VRSG Visuals in UAS Simulation.

USAF A-10 AIRCREW TRAINING SYSTEM

Since 2001, MetaVR has been the primary supplier of 3D real-time visuals for the US Air Force A-10 Full Mission Trainer (FMT) used in the A-10 Aircrew Training System. Nearly 400 MetaVR VRSG software licenses are used for coordinated close-air-support training missions between pilots and Joint Terminal Air Controllers (JTACs).

The A-10 Aircrew Training System is defined as a Full Mission Trainer (FMT), a Hand-on-Throttle and Stick Trainer (HOTAS), a Brief/De-Brief System, and their supporting systems and equipment. The A-10 FMT uses MetaVR visuals for the out-the-window (OTW) and sensor views and consists of a high-fidelity replica of an A-10 aircraft cockpit, an Instructor Operator Station (IOS), a visual system and other equipment that provides trainees initial and ongoing training for flight, mission, and tactics. The HOTAS trainer is an A-10C precision-engagement functionality trainer used for initial A-10C pilot conversion and training. The base FMT simulator configuration uses VRSG to drive an eight-screen display configured to fit within a nine foot ceiling. Other visual channels are used to provide the sensor views, such as for the A-10 Maverick missile and Sniper Advanced Targeting Pod (ATP).

Ten sites have one or more MetaVR-based A-10 FMT simulators: Baltimore Air National Guard Base (ANGB), MD, Barksdale Air Force Base (AFB), LA, Boise ANGB, Gowan Field, ID, Davis-Monthan AFB, AZ, Ft. Smith ANGB, AR, Ft. Wayne ANGB, IN, Moody AFB, GA, Osan AB, Korea, Selfridge ANGB, MI, and Whiteman AFB, MO.

F-16 TRAINING SYSTEMS

VRSG is used in F-16 simulators at multiple US Air Force, Air Force Reserves, and Air National Guard training facilities.

AFRC F-16C aircrew training simulators

The Air Force Reserve Command (AFRC) recently acquired 20 new VRSG licenses for four new F-16C Multi Task Trainers (MTTs). Two AFRC F-16C Block 30 MTTs were installed this year at Homestead Air Reserve Base (ARB), FL, and two at Fort Worth NAS Joint Reserve Base (JRB), TX, supplementing two previously delivered simulators for each site. The addition of these new systems provides two, four-ship AFRC F-16C Block 30 MTTs with VRSG at each site. Geospecific terrain with airfields of Homestead ARB and Fort Worth NAS JRB with custom runway elevation data to match FAA airfield runway model, runway lights, geospecific control tower, hangars and other geotypical buildings, signs, light poles, and geotypical volumetric trees were delivered as part of the delivery.

The F-16C MTT is comprised of a cockpit, an instructor operator station, a 360° field-of-view (FOV) visual display and projection system, VRSG with MetaVR’s high-fidelity geospecific terrain and extensive libraries of 3D content, an electronic warfare threat server, and a host computer/power equipment cabinet. Each F-16C MTT can be operated as a standalone device or linked together to provide four-ship training within the facility or via ARCN/DTOC/DMO network for participating in distributed exercises.

The purpose of the AFRC F-16C MTT program is to provide high-fidelity trainers configured to the latest F-16C Block 30/40 aircraft and capable of training AFRC F-16C pilots in mission qualification, continuation, and mission readiness training tasks.

AFRL F-16 simulators

The Air Force Research Laboratory’s (AFRL) Warfighter Readiness Research Division 711th Human Performance Wing (711HPW/RHA) at Wright Patterson Air Force Base has long used VRSG in training research simulators. The 711HPW/RHA uses 157 VRSG licenses in multiple testbed programs both in the USA and in Europe, ranging from the MQ-1/MQ-9 Remotely Piloted Aircraft simulator (PRINCE) to the JTAC Training and Rehearsal System (JTAC TRS).

Most recently the 711HPW/RHA purchased 15 VRSG licenses for F-16 simulators to replace six Aechelon image generators that were installed in the simulators in 2008. These simulators are capable of networking with other AFRL simulators for joint missions, such as the ones described above.

Image on the cover: MetaVR VRSG real-time rendering of an F-16C entity in flight over geospecific 3D terrain of Denver, CO. The scene features 439,379 building models generated with Esri CityEngine®. The models were extruded and textured from OpenStreetMap data.
For several years, 26 VRSG licenses have been used in the 711HPW/RHA F-16 Experimental Deployable Tactics Trainer (X-DTT) simulators. The F-16 X-DTTs are deployable, medium fidelity, in-theater training systems for keeping the warfighter proficient between missions. Each simulator consists of an F-16 Block 30 aircraft shell with the actual F-16 Operational Flight Program (OFP) and high-fidelity aircraft stick and throttle. These simulators provide the essential F-16 cockpit switches on a touch-screen LCD in front of the pilot. Each simulator has six projected views in addition to a sensor view. Each system can be used as a standalone training tool or networked with other simulators to participate in larger exercises. The simulators are primarily based at the Aviano Air Base, Italy.

Visual system upgrade for EPAF F-16 simulators
MetaVR was recently chosen to be the image generation supplier for the 309th SMXG European Participating Air Forces (EPAF) program to upgrade the visual systems of Belgian and Portuguese F-16 simulators.

The upgrade calls for up to 40 MetaVR VRSG licenses, and two Terrain Tools licenses. In addition to supplying round-earth terrain of Europe and CONUS++, MetaVR will create and deliver five geospecific terrain insets (10 cm, 20 cm) of areas of interest in Belgium and model two geospecific Belgian airfields (Florennes Air Base, Kleine Brogel Air Base) and the Monte Real Air Base in Portugal.

ANG F-16 simulators for new Buckley Air Force Base training center
In spring 2018, Buckley Air Force Base (AFB), Aurora, CO, will unveil Air National Guard (ANG) F-16 four-ship training systems in its new training center. These simulators, which use 90 MetaVR VRSG licenses, will have 8-screen cockpit displays with native 4K (4096 x 2160) resolution, for an immersive FOV that renders the OTW virtual environment with near 20/20 visual acuity. The systems have been relocated from the Vermont ANG facilities at the Burlington International Airport, and are currently undergoing upgrading and integration prior to delivery to Buckley AFB. The F-16 training facility will be housed in the newly renovated Hangar 909. Once the new training facility opens, the simulators will be used train F-16 ANG pilots on F-16 Block 30 operations and exercises.

MetaVR recently built virtual terrain of Buckley AFB and Greater Denver, from 15 cm per-pixel imagery of the airfield area blended into 1 mpp underlying imagery of MetaVR’s CONUS++ terrain. The terrain’s elevation was built with interpolated NED 1/3 (10 m) and underlying CONUS++ DTED1. Airfield culture includes the runways, runway lights and signage, a geospecific control tower and 24 other geospecific buildings, fuel storage tanks, water towers, radars, geotypical volumetric trees, and light points. Geospecific culture models were created from publicly available photos and geolocated on the terrain. This terrain was built with the latest version of MetaVR Terrain Tools for Esri® ArcGIS®. Culture models were placed with Scenario Editor.

Surrounding the modeled airfield is terrain of Greater Denver, comprised of 439,379 geospecific building models which were generated with Esri CityEngine®, extruded and textured from OpenStreetMap (OSM) data. The terrain, including the nearby Rocky Mountains, has over 4.5 million trees. For simulating night scenes, the terrain contains thousands of cultural light points of the airfield and Greater Denver.

Luke Air Force Base F-16 full-mission training simulators
Luke Air Force Base (AFB) in Glendale, AZ, uses 53 MetaVR VRSG licenses in their F-16 full-mission training simulators at the base’s Network Training Center facility. Each of the four dome-based systems contains a full cockpit replica of an actual F-16. For each F-16 cockpit trainer, the VRSG multichannel visual system includes ten OTW channels and two sensor channels. Luke AFB is a major training base of the Air National Guard’s Air Education and Training Command (AETC) for providing advanced flight training to fighter pilots.

As part of the delivery, MetaVR built and delivered high-fidelity geospecific 3D terrain of Luke AFB, to include the modeled airfield and the Barry M. Goldwater Range (BMGR) with geolocated 3D models of all range targets. The terrain, built from natural color imagery, is in MetaVR’s round-earth Metadesic format. Imagery of the area of Arizona around Luke AFB is 1-meter per-pixel (mpp) resolution, BMGR is 0.50 mpp, and the Luke airfield with its on-base surroundings is .30 mpp resolution.

F-16 simulators for automatic collision avoidance
Using MetaVR visuals, ZedaSoft, Inc. built and delivered a dual-dome reconfigurable F-16 simulator system to Lockheed Martin Advanced Development Programs (ADP) group in support of the Automatic Collision Avoidance Technology Fighter Risk Reduction Project (ACAT/FRRP). The system uses VRSG for OTW views. The ACAT/FRRP program, with a team that includes AFRL and NASA’s Dryden Flight Research Center, develops collision avoidance technologies for fighter/attack aircraft that would reduce the risk of ground and mid-air collisions. This phase tests automatic collision avoidance technologies between USAF fighter aircraft.

FAA SYNTHETIC VISION SIMULATION
The Federal Aviation Administration (FAA) uses 15 VRSG licenses in two of its OTW general aviation flight simulators to support human factors research related to synthetic vision systems at the FAA Civil Aerospace Medical Institute (CAMI) within the Mike Monroney Aeronautical Center, Oklahoma City. The Advanced General Aviation Research simulator (with a Piper Malibu configuration) and the Very Light Jet simulator (with a Cessna 510 Citation Mustang configuration) use VRSG to render virtual airfields in MetaVR’s round-earth terrain format to study and test landing on runways with limited human OTW vision with the aid of synthetic vision. Synthetic vision research and simulation is focused on reducing approach-and-landing accidents caused by the pilot’s inability to see the runway in adverse weather conditions.

FAA Cessna Citation Mustang VLJ simulator using MetaVR VRSG, with five projectors and a 225° fixed dome. (Photo courtesy of the FAA.)
ANG BOSS AERIAL REFUELING TRAINER

Some 112 VRSG licenses are used in the production of KC-135R Air National Guard (ANG) Boom Operator Simulator Systems (BOSS), a program contracted to FAAC, Inc. BOSS has been certified by the US Air Force for boom operator training missions in lieu of actual flight time. In late 2013, the first 14 VRSG licenses were delivered to FAAC, part of Arotech Corporation’s Training and Simulation Division. FAAC’s total BOSS production run for the ANG consisted of 16 simulators, each with 7 MetaVR software licenses. Delivery of the training systems to the Air National Guard Refueling Wings was completed in 2016.

The fully immersive Distributed Mission Operations (DMO) capable refueling boom operator trainer is a high-fidelity replica of a KC-135R Block 40 boom pod. The BOSS environment emulates the actual aircraft boom controls and includes associated operating systems, 4-channel image generation and projection systems, sensor views, mission certification, and instructor upgrade training, and meet Aerial Refueling Airplane Simulator Qualification (ARASQ) standards. Mission-rehearsal DMO training is through the ANG Distributed Training Operations Center (DTOC).

The BOSS is intended for squadron-level training to be collocated with operational KC-135 air refueling wings. The ANG is fielding the 17 BOSS systems at locations across the US where fully qualified boom operators at the ANG KC-135R flying units use the BOSS for a complete training curriculum: initial qualification, difference qualification, certification, requalification, mission certification, and instructor upgrade training, and meet Aerial Refueling Airplane Simulator Qualification (ARASQ) standards. Mission-rehearsal DMO training is through the ANG Distributed Training Operations Center (DTOC).

For more information, contact sales@metavr.com or scan the QR code to your mobile device.

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