Training & Simulation Engineering Team
AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital.

A Fortune 500 firm, AECOM had revenue of approximately $18 billion during fiscal year 2015. See how we deliver what others can only imagine at aecom.com and @AECOM.

AECOM’s Training Simulation and Engineering Team (TSET) provide industry-leading simulation products and engineering services for government, commercial and civilian organizations around the world. The open design of our X-IG® based Image Generation System makes it possible for us to incorporate Commercial Off-the-Shelf (COTS) computer hardware and software into our products. This allows us to offer high-performance, versatile capabilities for various types of training, testing and experimentation. X-IG® and it’s suite of associated tools and programs offer superior image fidelity, realism and ease of integration with most simulation systems.

AECOM’s TSET is an industry leader in visual system solutions for virtual aviation, ground combat, and industrial database development for military, commercial and secondary education aviation simulators. Our 3D databases are world-wide, geo-specific and high-resolution up to 10cm. Our library includes more than 100 airfields from around the world detailed to FAA Level D requirements as well as thousands of moving and cultural models. AECOM’s TSET utilizes highly experienced subject matter experts and highly trained technical staff to provide the highest level of customer support while staying on the cutting edge of modeling and simulation advancement.

Our X-Gen® Generic Unmanned Aircraft Systems Trainer allows simultaneous training on a wide variety of simulated unmanned aerial vehicles and sensors without being affected by airspace restrictions/regulations, adverse weather conditions, vehicle/sensor availability, maintenance costs, or the cost of damage and destruction associated with flying actual aircraft. X-Gen® training stations can be as simple as a laptop or as complex as a full Unmanned Aerial Vehicle (UAV) Ground Control Station (GCS) configuration with a separate Instructor Operator Station (IOS).

We look forward to helping you find the solution that meets your unique simulation training needs.

To see product demonstrations and for current contact information, please visit our website at www.URS-Simulation.com.
X-IG® Image Generator System

AECOM Image Generators are the ideal choice for the visualization of simulation training systems. Since 1997, AECOM’s X-IG® has been providing unparalleled rendering performance through advanced software algorithms and optimizations.

AECOM’s X-IG® image generator integrated with Commercial Off-the-Shelf (COTS) product for PC-based visual simulations. X-IG® is specifically designed around the industry standard OpenGL®, a high performance graphics Application Programming Interface (API), and OpenFlight®, the 3D standard format for the visual simulation industry.

X-IG® is designed to render both real-time out-the-window and sensor scenes for training and simulation, creating real-world high resolution photorealistic training environments. X-IG® includes complete physics-based modeling for atmospheric, night vision goggles, Day-time TV (DTV) and Infrared (IR) simulations. X-IG® also includes special effects which add realism to the image generator enhanced scenes.

Currently in use with various military, civilian and commercial customers, X-IG® provides high fidelity visualization for flight simulators and a variety of other training systems. Advanced data compression, optimization and paging algorithms allow X-IG® to render high density, geo-specific databases of unlimited coverage.

Real-time rendering engine

- Renderings of 400,000 fully textured, shaded and anti-aliased polygons per channel, peak performance of over 3,500,000 polygons at 60 Hz
- Renderings of 100,000 light points in day/night/dusk at 60 Hz
- Synchronized multi-channel capability using hardware genlock solutions
- Auto-alignment and channel edge blending for continuous multi-window applications without performance penalty
- Database paging and texture compression for uninterrupted training through high resolution geo-specific databases
- Full scene anti-aliasing/anisotropic texture filtering
- Multiple light sources (ambient light, landing lights, etc.)
- Dynamic scene management with Field of View based Level of Detail control
- Integrated VT MAK DI-Guy® real-time human simulation

Special effects

- Highly realistic tactical and cultural effects with animations
- Advanced dust model for training/testing in the Degraded Visual Environment
- Emissive and reflective surfaces
- Multi-layer order independent transparency
- Dynamic shadow rendering of scene entities
- Effect, color and size characteristics are correlated to associated database material
- Graphical User Interface based special effects composer
- Night Vision Goggles (NVG)

Atmospheric and weather effects

- Comprehensive dynamic weather with accurate atmospheric effects
- Multiple lighting and volumetric thunderstorm models
- Directional and dynamic snow/rain models
- Volumetric clouds and lighting physically accurate

Semi-Automated Forces (SAF)

- Multiple SAF support with fully correlated visual and SAF databases

Standard interfaces

- Distributed Interactive Simulation/High-Level Architecture

Sensor modeling

- IR-TV payload sensor views
- Sensor fusion: LTV and R
- Multiple electronic/digital zoom and focus
- ROC-V modeling with controllable IR hotspots
- Tunable device specific effects: noise, focus, brightness
- AC coupling, polarity, auto/manual gain and level
- Contrast based Image Auto-Tracker (IAT)

Export control

- X-IG® is approved for export
- Civilian and commercial X-IG® sales are subject to the jurisdiction of the U.S. Department of Commerce in accordance with the Export Administration Regulations as EAR-99
- Systems built to U.S. government military specifications shall at all times be subject to the U.S. Department of State International Traffic in Arms Regulations

Previous page

From left:
High Fidelity Naval Vessel and Sea-State simulation

Top right:
Realistic Degraded Visual Environment

CL-415 Water bomber training, Canada

High fidelity 3D airfield imagery

From left:
High fidelity 3D airfield imagery with photo-specific buildings

Right:
IR capabilities
X-Gen® Generic Unmanned Aircraft System Trainer

AECOM has designed a high fidelity virtual training and testing Generic Unmanned Aircraft System Trainer based on its X-IG® Image Generator System that focuses on supporting the unique requirements of the commercial/civil community. X-Gen® incorporates the latest technology for training payload and air vehicle operators from basic through full operational, location specific training and rehearsal procedures for individuals and crews. X-Gen® is based on AECOM’s proven X-IG® image generator software for real-time scene rendering of the sensor views. It also has an open architecture design which provides a programmable six degree-of-freedom aero-model that supports any multiple air vehicles, controls, menus, cued symbology and 2D map displays. X-Gen® can be scaled to run on a laptop, desktop or in a full ground control station configuration. Users have the capability to design and train on custom scenarios as well as add future updates.

X-Gen® is adaptable to meet the diversified training needs of universities, municipalities, law enforcement agencies and commercial organizations without the burden of data rights restrictions. X-Gen® supports multiple air vehicle payloads with tunable sensor characteristics simulating any LLTV and IR sensors.

Air vehicle operation features
- Automatic Flight Control System
- 2D map display/airspace situational awareness
- Route planning
- AV checklist operations
- High fidelity fixed-wing and rotary-wing air vehicle

Payload operation features
- IR-TV payload sensor views (pan and zoom)
- Multiple electronic/digital zoom and focus
- Geo-stabilized point and entity tracker
- Sensor Fusion IR and TV
- Laser ranging and designation
- Contrast based IAT

Generic UAS parameters
- Multiple air vehicles; fully tunable in size, endurance, weight or payload

Instructor Operator Station
- Scenario and lesson plan selection
- Atmospheric effects weather (cloud, fog and haze) control
- Activation/deactivation of emergency procedures manually or through pre-selected criteria
- Automated monitoring and logging of trainee actions

X-Gen® Generic Unmanned Aircraft Systems Trainer

Generic Heads-Up Displays
- Toolbar bezel around perimeter of the monitor window for both pilot and sensor views

Databases
- Openflight, CDB and SECore compliant
- Extensive libraries of worldwide, geo-specific, high resolution databases
- Support for geodetic exported terrain
- Rapid placement of database features using the Environmental Modeling Editor (EME®) for fast turnaround and reduced cost
- Stenciling of airfields

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Above:
Generic medium altitude long endurance Unmanned Aerial System (UAS) flight trainer
UAS Flight Training Ground Control Stations at Embry-Riddle Aeronautical University

From top-left:
Full UAV GCS configuration
Desktop UAS trainer
Laptop UAS trainer
Single workstation in full GCS configuration
EME® Environmental Modeling Editor

**Environmental Modeling Editor (EME®) for rapid database enhancements**

The Environmental Modeling Editor’s ease of use combined with AECOM’s powerful X-IG® image generator software provides a complete solution for enhancing your training environment. EME® allows the user to make changes to the database. This feature includes:
- Rapid placement of 3D objects for population of airfields and urban areas (hundreds of features in minutes)
- Changes to database are available for immediate use in the training environment
- Structures are easily scaled in height, width and length
- Library of over 6000 structures, buildings and vegetation
- Production process to ensure 100% SAF correlation

**EME®**

AECOM Environmental Modeling Editor (EME®) software is the perfect solution for the rapid enhancement of X-IG® databases, allowing the end user to simply select and place features within the training environment in minutes. EME® is fully compatible with X-IG®, X-TUAS® and X-Gen®.

Four editing modes are available with EME®: Entity, Cultural, Waypoint and Stenciling. These modes allow the user to rapidly create additional cultural or dynamic content within the training environment.

**Entity mode**

In real-time, EME® allows the user to add entities to a scene and save to API script file for use by the X-IG® scripting engine either dynamically or at system startup. When in Entity mode, the full range of mouse and dialog controls are available to the user to position and edit the model.

**Cultural mode**

In EME® Cultural mode, the user may place permanent models in the database that will be present anytime the X-IG® database is started. When in Cultural mode, the full range of mouse and dialog controls are available to the user for positioning, editing and scaling the cultural model. This mode is useful when additional scene content is desired to enhance a particular training area of interest.

**Waypoint mode**

With EME® Waypoint mode, the user may create a set of waypoints for use by an entity model to follow, eliminating the need for a SAF and providing dynamic content to the training environment.

**Stenciling mode**

In real-time, EME® will cut, stitch and smooth the underlying terrain to allow the user to seamlessly and easily add custom or generic airfields and bomb craters to existing geo-specific terrain databases.

**Increased realism**

EME® provides the capability to achieve unmatched realism for navigation and orientation cues, final approaches, pattern references and visual checkpoints.

**Real-time editing**

EME® provides a user-friendly, real-time integrated viewer, as well as access to several feature libraries containing various cultural models and features. Data elements are added using a drag and drop interface and can subsequently be scaled, moved, rotated and then saved to small, easily distributed data files. The addition of new airports, terminals, and airfield features and the population of entire urban scenes including buildings has never been this easy.

**Cost savings**

EME® lets you freely and continually update airfields and training areas of interest without incurring the high cost and lengthy delays associated with republishing training databases. EME® was designed to meet emerging Federal Aviation Administration and Joint Aviation Authority standards as simulator certification dictates.
Virtual Reality/Augmented Reality

Although Virtual Reality (VR)/ Augmented Reality (AR) are relatively new concepts in the simulation industry, AECOM’s TSET has over 20 years’ experience with this technology. TSET’s X-IG® Image Generator has been used extensively in VR/AR Simulation and Training, and is adaptable to all Helmet Mounted Displays, including numerous head trackers. X-IG® has been used with CAE’s fiber optic Helmet Mounted Display (FOHMD), Kaiser’s Sim Eye, SA Photonics’ SA-92, SA-65, SA-62, and most recently, the Oculus Rift.

Oculus Rift
Oculus Rift brings consumer level pricing and usability to the VR/AR world. Even as the costs go down, the specifications continue to improve. For example, Oculus Rift provides 2 million pixels of resolution per eye while sustaining 90Hz update rate. There is a 110 degree field-of-view and seamless performance. As you transition your viewpoint looking left, right, up or down. The scene moves with you in a full 360 degree virtual field of view. The binocular vision achieved within the Oculus Rift gives depth perception not obtainable in collimated displays.

The TSET team at AECOM currently uses the Oculus Rift along with X-IG® to provide immersive VR training. Complete integration with a flight model within the system to allow flight training in the VR world. The application possibilities are endless while the system costs and size are affordable and manageable. X-IG® and the Oculus Rift run simultaneously on a single IGS with no performance issues even while traveling through the high density San Francisco database at over 300 knots. The system can be manipulated using only the game controller, or higher end flight controls can be attached conveniently via USB.

Talk to us today about your unique training needs, and we will be happy to work with you to develop a customized VR/AR solution.

Oculus Rift Full Configuration
X-IG Virtual Environment
Oculus Rift

Product of Choice

X-IG® is currently installed on Flight School XXI Advanced Aircraft Virtual Simulators (UH-60L, UH-60M, and CH-47F) and is the image generation system of record for the USAACE fielded flight simulators: the U.S. Army Lift Simulator Modernization Program (LSMP), the Transportable Blackhawk Operations Simulator (TBOS), Advance Blackhawk Flight Simulator (ABHFS) and the UH-60M Blackhawk Aircrew Trainer (BATS). X-IG® is also the Image generator for the test and development for Sikorsky for Multiple Systems Integration Labs, Northrop Grumman (E2 Systems Integration Lab), the Air Maneuver Battle Lab (AMBL), U.S. Army Aeromedical Research Laboratory (USAARL) (NUH-60 Research Flight Simulator project) and many others.