CAE Medallion™-6000 Series

The CAE Medallion™-6000 series is the latest member in CAE's powerful Medallion image generator family. The CAE Medallion-6000 series combines a proven, industry-leading feature set and image quality with the power and capabilities of the latest commercial-off-the-shelf workstation graphics. The CAE Medallion-6000 provides a highly modular, scalable and portable visual solution designed to satisfy your full range of military training needs.

The CAE Medallion-6000 image generator is a proven system, in operation on many programs, that provides training benefits such as:

- Extremely detailed environments and realistic night scenes;
- Smooth dynamic shadows correlated to sun/moon positions;
- High resolution imagery and textures for enhanced fidelity;
- Highest scene density on the market;
- High-end sensor simulation capabilities.

Features

CAE's Medallion-6000 includes the rich feature set the Medallion family has pioneered for fast jet, tanker/transport aircraft and rotary wing visual training, including:

- Environment reflections on lakes and oceans;
- Dynamic environment with many moving models, special effects and characters;
- Fully compatible with common database (CDB) specification for ease of content reuse (open database format);
- Reflective model for rainy conditions and fog simulation;
- Multiple cloud layers with true 3D cloud models;
- Sun, moon and stars ephemeris model, physics-based sky model;
- Shader-based light points, dynamic shadows;
- Particle-based weather simulation including rain, hail, and snow;
- Full suite of special effects, including tracers, missile trails, explosions, smoke, rotor downwash, conforming craters and bullet impact;
- Lifeforms simulation with suite of animations for soldiers, marshallers, and landing signal enlisted (LSE):
- Up to sea state 6 dynamic 3D ocean model with ship wakes, swell and wind lanes and a 2D ocean model for high level flight;
- Comprehensive mission functions (height above terrain, collision detection, line of sight, laser ranging);
- Correlated sensor suite for FLIR, NVG, EVS, EO, Day TV and LLTV computed using sensor textures with 16-bit radiance values and advanced video post-processing;
- Highly scalable visual system entirely based on COTS workstation components;
- Based on industry standards: Windows 7, OpenGL, OpenFlight, CDB, CIGI 3.2
- Fully backward compatible with CAE Medallion interfaces and databases;
- Compatible with ultra-high resolution projectors (including the latest 10 million pixel models)
- Low latency (< 52 ms).

Common specifications

- Windows 7 operating system (64 bits);
- COTS graphic card;
- Sustainable iteration rate: 60 Hz;
- Simulation polygonal capacity: 275,000 at 60 Hz;
- Light point capacity:200,000 at 60 Hz;
- Internally generated blend zones;
- 1024 addressable moving models;
- Up to 24 level-of-detail (LOD) geo-specific satellite imagery texturing;
- Up to 5,000 MegaTexels equivalent through optimized adaptive texture memory paging;
- 256-level alpha transparency;
- Fully projected light lobes;
- HUD overlay support;
- Outstanding performance, leveraging latest graphics processor (GPU) technologies;
- Advanced shader-based 3D engine;
- 16-bit radiance computation with advanced sensor post-processor (SPP);
- Embedded non-linear dome mapping (NLIM) for curved surface projection;
- Analog and digital video output modes;
- CDB content level selected on-the-fly (one run-time database);
- Assured correlation across CDB systems when operating in network;
- Centralized database repository for ease of database maintenance and deployment;
- Low operating costs.

Capabilities	Model 6120	Model 6220	Model 6x20
Application type	- Stealth view display - FTD/CPT - Role playing station - Low-end OTW - Sensor simulation	- Full-mission simulator - Mission rehearsal - High-end OTW	- Full-mission simulator - Mission rehearsal - High-end OTW
Number of channels	1 to 8	1 to 64	1 to 64
Support of multiple-inputs projectors	N	N	Y
Full-scene anti-aliasing (max.)	16x	32x	32x
Anisotropic filtering (max.)	16x AF (angle invariant)	16x AF (angle invariant)	16x AF (angle invariant)
Resolution/Anti-aliasing/ Anisotropic filtering (typical application)	2048x1536 NI @ 60 Hz 8x AA, 4x AF	2048x1536 NI @ 60 Hz 16x AA, 8x AF	as per application 16x AA, 8x AF
Genlock & frame Lock	Y	Y	Y
Centralized database server	Y	Y	Y
Common database (CDB) support	Y	Y	Y
HLA support	Optional	Optional	Optional

Note : The 6220 can be configured in a multiple IG configuration per channel to support very high resolution projector (10 million pixels)




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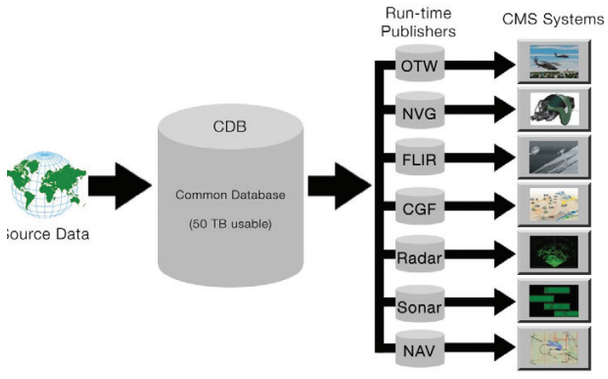
Common Database (CDB)

Training devices such as flight simulators have traditionally required a variety of different and unique databases to provide a synthetic representation of the world. These traditional databases are generally created in a proprietary format for the associated simulation system, also called simulation clients, needing to use the database. These simulation clients include subsystems such as the out-the-window visual, radar, forward-looking infrared (FLIR), computer-generated forces (CGF), and more. Having many unique databases for each simulation system creates a number of challenges, such as correlating the databases or making rapid changes to the databases to support training and mission rehearsal requirements.

CAE has developed a new approach and architecture for database publication called the common database (CDB). The CDB is a single, standard database that defines a single synthetic representation of the world, and all simulation systems use the same database – the CDB. The CDB is used as a run-time data repository from which the various simulation clients simultaneously retrieve relevant information to perform their respective run-time simulation tasks. The bottom line result is that with the CDB, the creation, modification and correlation of run-time databases can take minutes or hours instead of days, weeks or months. Just as importantly, these changes can be made very rapidly using the latest intelligence and source data available.



Benefits

The implementation of a CDB significantly enhances interoperable training and mission rehearsal capabilities, while reducing development time, configuration control and associated database development costs. One of the main objectives of the CDB is to ensure unity and correlation between the various simulation subsystems, while improving database maintainability. A key benefit is the elimination of all source-level correlation errors.

The CDB also largely eliminates the time-consuming off-line database compilation process for each of the simulation clients. Current compilation steps lead to the replication of data and to a loss of correlation across the simulator network. The CDB redefines a new balance between off-line and on-line compilation processes because modern computer platforms can accomplish most of the compilation process in real-time. The CDB provides a single, logical repository consisting of a static synthetic representation ranging from small areas of interest to the entire world. It includes all the relevant information for clients to perform their respective simulation tasks and avoids any data content duplication.

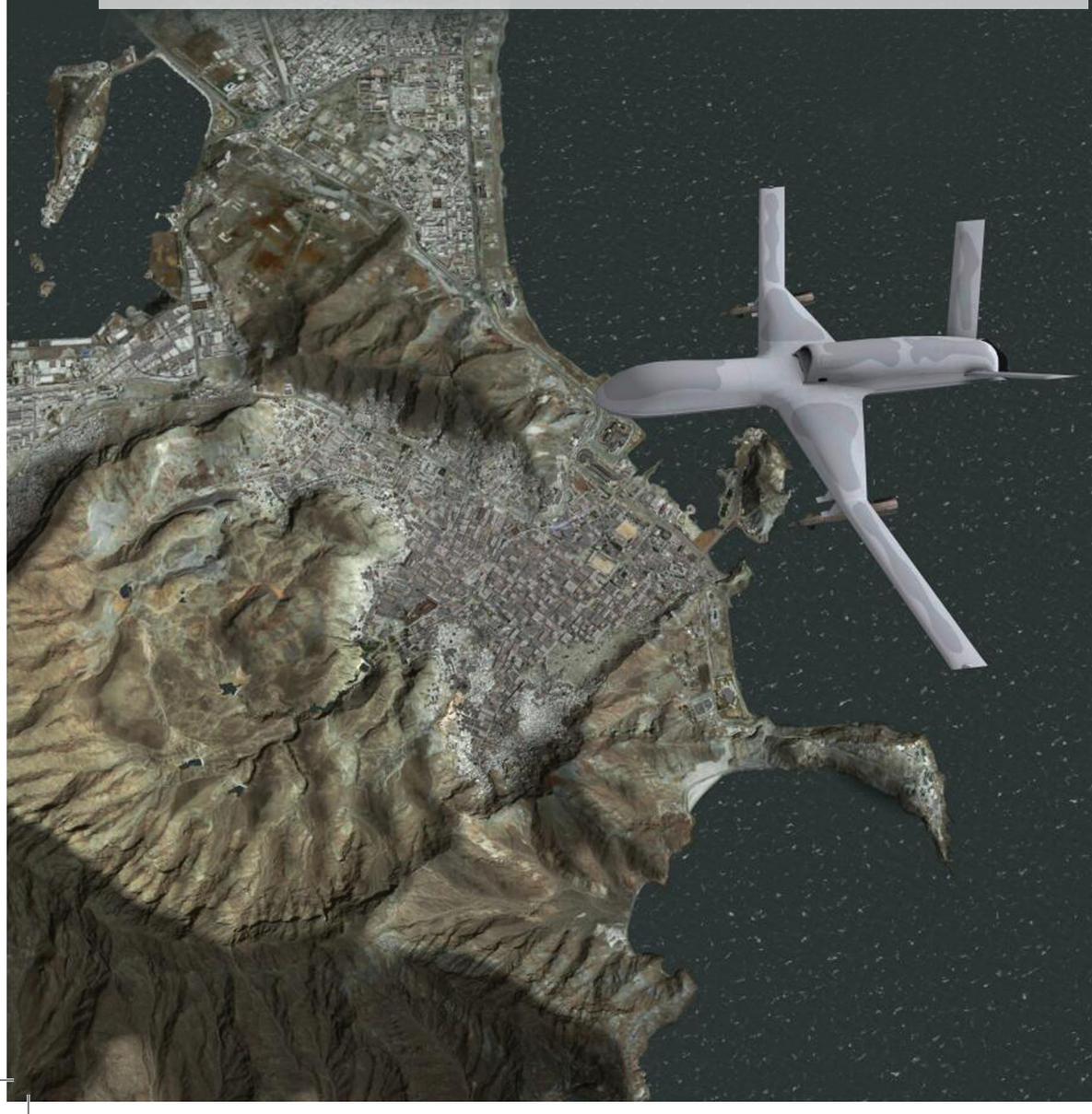
The CDB also facilitates rapid database updates, thus shortening database generation and build process times. Also, database content is unique and without duplication, so configuration management efforts are reduced significantly. All of these benefits help contribute to another key benefit – reduced costs for database generation deployment, and maintenance.

Program Examples

CAE originally designed and developed the CDB for the United States Special Operations Command (USSOCOM). Following the development of the CDB architecture, CAE was responsible for implementing the CDB on two combat mission simulators. The CDB has and continues to play a key role in meeting USSOCOM's requirement for enhanced capabilities to support rapid mission rehearsal timelines using high-fidelity simulation.

While the initial implementation of the CDB was on two high-performance combat mission simulators, that does not mean the CDB is only applicable to high-end simulators. For example, the CDB can be implemented on commercial-off-the-shelf (COTS) laptop computers and used for mission preview or deployable training systems. The CDB represents the only fully correlated, rapidly developed, single source, run-time published database solution that is available and deployable today.

Since being implemented for USSOCOM, other global militaries have adopted the CDB standard. At the German Army Aviation School at Bueckeburg, CAE has upgraded the 12 helicopter simulators with the CAE Medallion-6000 image generator and supported the integration of the CDB. CAE designed and manufactured two Hawk 128 full-mission simulators (FMSs) as part of the U.K.'s Military Flying Training System (MFTS) program and both simulators feature the CDB architecture. Havelsan and the Turkish Air Force have adopted the CDB architecture to significantly enhance the ability to correlate and rapidly update databases to support training and mission rehearsal requirements for Turkey's fighter and trainer aircraft simulators.



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Motif Compositing

More than ever, today's training devices rely on portraying realistic views of the synthetic environment. This synthetic environment can be seen through the visual system, radar, forward-looking infrared (FLIR), and a growing list of other sensors. To achieve a realistic synthetic environment, there is a generally accepted axiom – content is everything. More content means increased realism and improved cues for the trainee. While a large amount of content is always desirable, acquiring or manually modeling every detail is usually cost prohibitive.

Motif compositing is CAE's breakthrough technology that addresses the challenge of adding realistic content to databases while doing so cost-effectively. Motif compositing brings rich correlated content to the virtual world and matches all geo-specific attributes in the source data. It automatically enriches sparse source content through smart rules and algorithms that are tailored for hundreds of terrain types throughout the world.

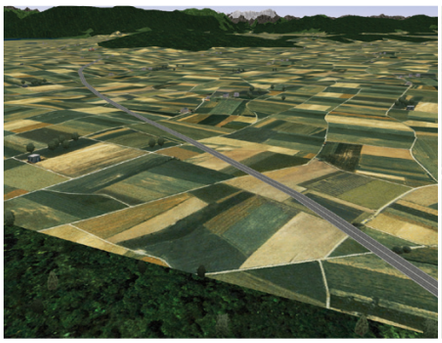
Before Motif Compositing

Earlier so-called "geo-typical" databases provided good height cues over large areas at the expense of unsightly joints and repetitive textures that limited scene realism. Recent high-end synthetic environments typically involve satellite imagery databases to address the demand for better realism. Although appealing at first, these databases are often weak in three areas. They lack the correlated 3D content critical to low altitude visual cueing, and the high-resolution imagery and material textures are often limited in coverage. Additionally, imagery shading, shadowing and time of year are permanently etched into the picture, thereby preventing real-time control. These factors seriously affect training tasks that involve low-level flight operations. Although manual modeling within a small area can address critical portions of the training curriculum, this approach is cost-prohibitive and cannot be scaled to nation-size databases. Considering that today's new systems boast the ability to render significant amounts of database content at higher and higher resolutions, it becomes clear that industry is challenged to deliver enough database content.

The Future with Motif Compositing and CDB

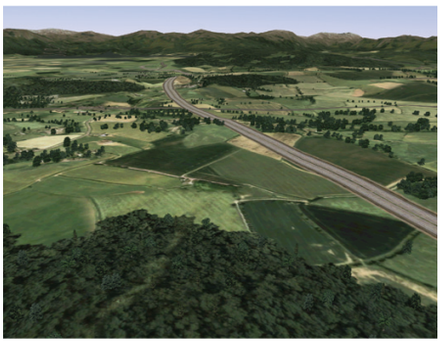
With CAE's motif compositing, large segments of a database are built with smooth terrain transitions, no repetitive patterns. Indeed, when paired with CAE's pioneering run-time publishing of the common database (CDB) format, database content adjusts automatically in order to fully exploit the graphics rendering performance of the image generator or any other client device. Because motif compositing automatically enriches sparse source content through smart rules and algorithms, realistic databases can be generated quickly and cost-effectively.

CAE qualifies scenes built using motif compositing as "geo-representative". It allows you to model any geo-specific buildings and content you need for training and have it placed in a backdrop of rich and convincing representative content. For example, a city outline in the Mediterranean is expanded as clay rooftop villas along winding roads, while the same outline in North America would result in asphalt-shingled bungalows on regular grid streets. A deciduous forest in Australia expands to high eucalyptus trees, whereas the same in New England results in a mix of birch and maple trees.



This image shows the original database.

Google image of the area represented in the original database.



Area of the database generated automatically using CAE's motif compositing.

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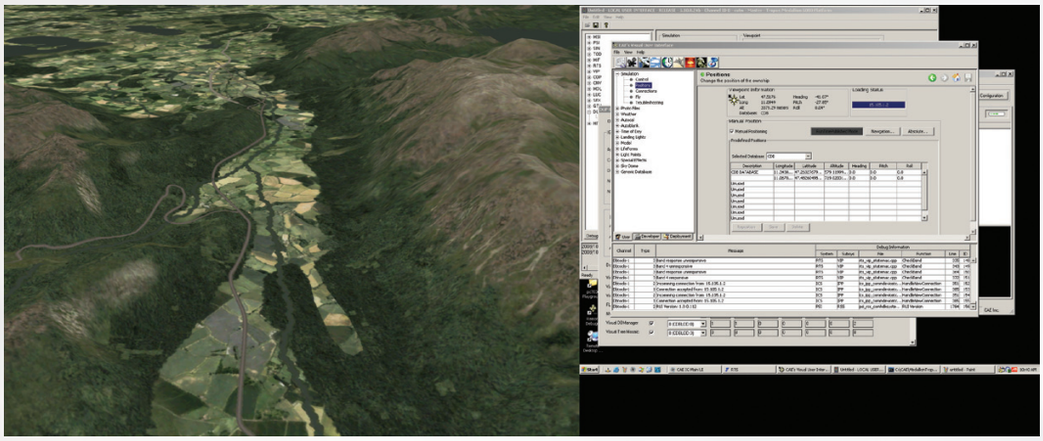
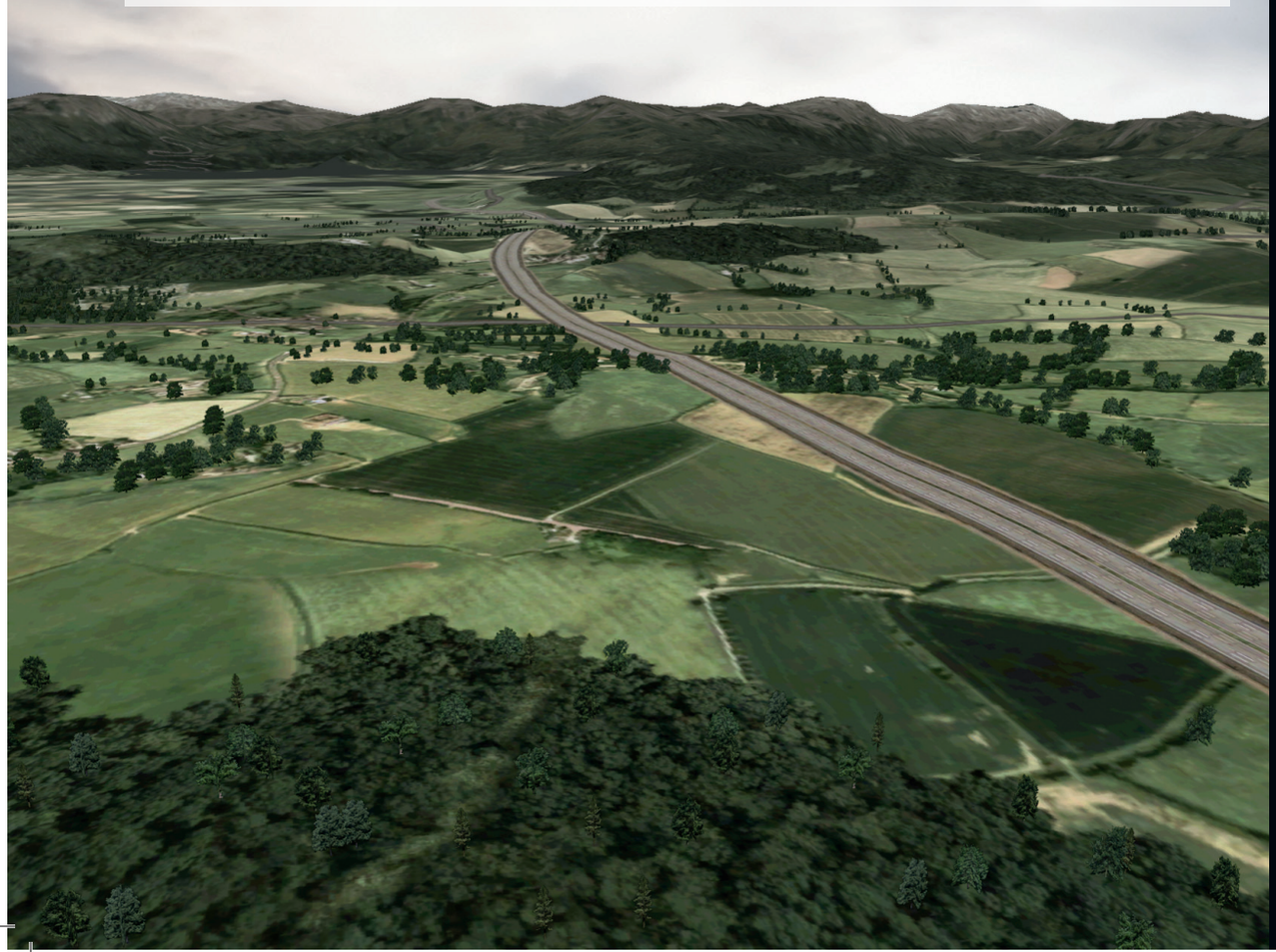
Benefits of Motif Compositing and CDB

The combination of CDB and motif compositing is ideally suited to breathe new value into existing sparse training databases. You can easily embed newly developed areas into your existing converted training database and leave motif compositing to make it rich with content and more realistic. Either way, your content and investment is protected in the years ahead, as CDB is an open format and provides run-time database interoperability. The CDB is the only format to do so in the simulation market.

Motif compositing offers a significant reduction in the cost of database ownership, allowing you to exploit the advances in visual systems and other simulation devices. The approach also provides full season generation as well as material attributes for infrared, night vision, radar and semi-automated forces (SAF). This is poorly addressed when using visual satellite imagery as the primary source of scene content for military training.

By using CAE's motif compositing, you get richer, more realistic training databases that are more cost-effective and can be generated more rapidly. In addition, you get increased realism at high and low altitudes and a greater sense of immersion for the trainee in the synthetic environment. CAE's motif compositing is truly a paradigm shift, simplifying how synthetic environment databases are built while setting the stage for rapid content growth in line with the continued performance increases in computer graphics hardware.





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Visual Databases and Moving Models

CAE's military business unit provides a wide range of update products and services to customers operating military training devices. These products and services are delivered by CAE's dedicated team of experienced professionals, including project management, engineering and training solution experts. The focus of these updates is to enhance existing training capabilities, add new training capabilities and reduce lifecycle operating costs.

CAE's military update service offerings for visual databases and moving models are designed for both existing customers operating a CAE Medallion™ series image generator and customers that are interested in upgrading their current image generator to the latest CAE Medallion™-6000 image generator.

Features

- Update of existing visual databases and moving models currently in operation.
- New custom visual databases with standards developed by CAE training solutions experts for typical military training requirements.
- Airports built to Level D specifications.
- New custom moving models with standards developed for medium complexity aircraft training.
- Visual database and moving model specifications can be tailored to match specific customer training requirements.
- Possibility to support interfaces with other simulation databases such as computer-generated forces (CGF) and radar when designing the training solution.
- Update of existing CAE Lithos™ database creation software to the latest version.
- New database modeling station (DBMS) to allow customer support of databases.

Coming in the future:

- Library of visual databases and moving models providing a cost-effective solution to expanding training operations.

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Specifications

Visual databases and moving models:
- Supports out-the-window (OTW), forward looking infrared (FLIR) and night vision goggles (NVG) operation;
- Compatible with CAE's world database;
- Supports common database (CDB) or CAE Medallion™ classic formats.

Standard visual database (helicopter) includes:
- Nine geo-cells gaming area;
- Two high-resolution areas (50km x 50km) for navigation training;
- Three high-resolution areas (100m x 100m) for landing training for example CAL and pinnacle;
- One Level D qualifiable airport;
- One commercial off-the-shelf (COTS) airport.

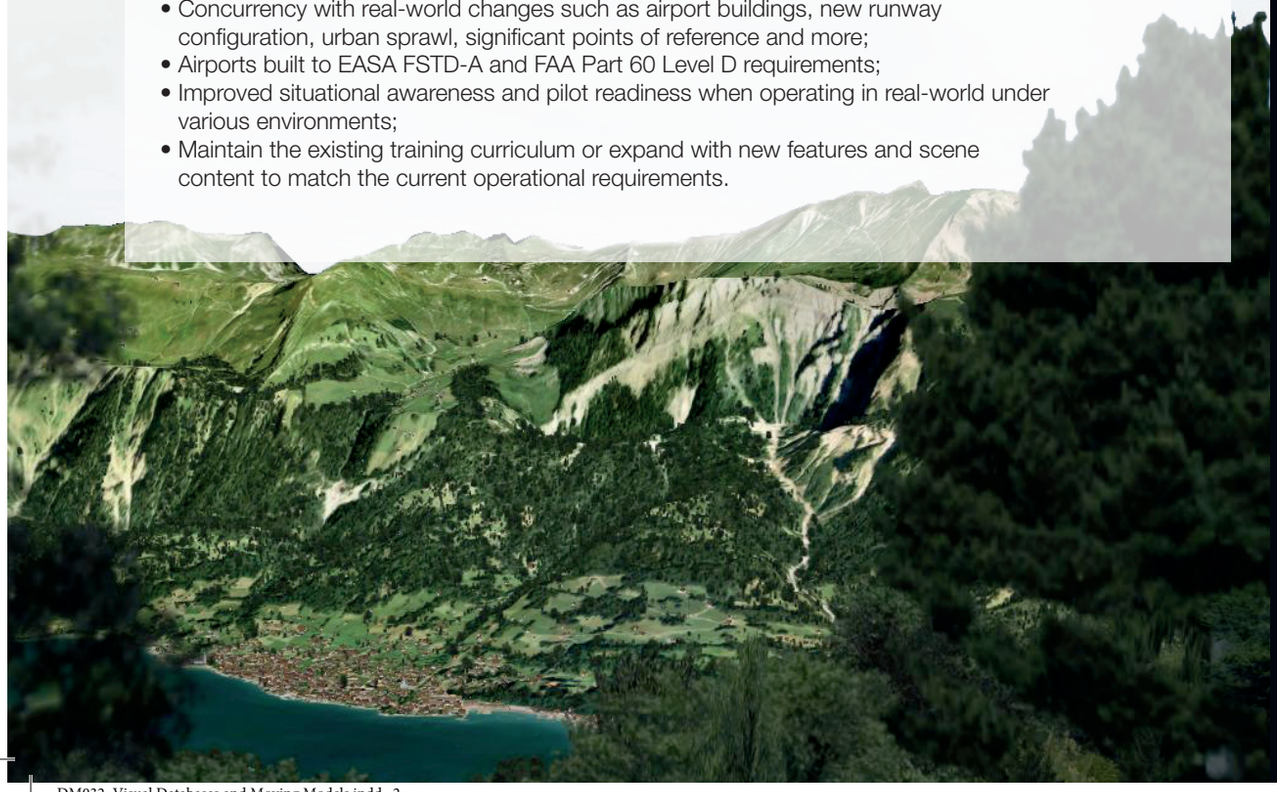
Standard visual database (transport) includes:
- One high-resolution area (60km x 40km) for drop zone training;
- One Level D qualifiable airport;
- Two COTS airports.

Standard visual moving model includes:
- Medium complexity with normal, damaged and destroyed states;
- Major articulations (up to three);
- Major attachment points (up to three).

Standard designs can be customized to meet specific customer requirements by adding or reducing scope from the typical configuration.

Customer Benefits

CAE's military update services for visual databases and moving models can help deliver the following benefits to military customers:
- Enhanced realism for training crews during mission rehearsal;
- New scene content providing additional training scenario scope;
- Concurrency with real-world changes such as airport buildings, new runway configuration, urban sprawl, significant points of reference and more;
- Airports built to EASA FSTD-A and FAA Part 60 Level D requirements;
- Improved situational awareness and pilot readiness when operating in real-world under various environments;
- Maintain the existing training curriculum or expand with new features and scene content to match the current operational requirements.



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Unmanned Aerial System (UAS) Mission Trainer

The use of unmanned systems by defence forces globally has grown substantially over the past decade, and is only expected to continue to grow significantly. In addition, unmanned systems will be used increasingly for commercial applications such as remote inspection of pipelines and hydroelectric installations, surveillance of forest fires, observation of critical natural resources, assessing natural disasters and a range of other applications. This increase in the use of UAS capabilities results in the need to have more highly skilled UAS pilots, sensor operators, and mission commanders.

The CAE UAS Mission Trainer combines an open architecture with commercial-off-the-shelf hardware and simulation software that minimises the use of proprietary designs to provide a comprehensive, platform-agnostic training system. Customers benefit from greater flexibility for evolution, networking, distributed mission training and combination within an integrated training environment. CAE's UAS mission trainer is a solution that optimizes operational readiness while minimizing the use of live assets to train and prepare the integrated mission team for operations. The comprehensive solution also prepares the integrated mission team (pilot, payload specialist, and commanding officer) in platform operating procedures, data interpretation and analysis, and team interaction.

Features of the CAE UAS Mission Trainer

The CAE UAS Mission Trainer is platform-agnostic, meaning the product can be tailored to simulate any specific UAS with any sensor payload suite. Leveraging the common database (CDB) open architecture and commercially available technology, CAE's UAS Mission Trainer is not subject to any international traffic in arms regulations (ITAR) or restrictions.

The completely immersive synthetic environment provides capabilities for training as well as mission planning and mission rehearsal.

The CAE UAS Mission Trainer is available as an integrated product that includes:

- Ground control station (GCS) that is STANAG 4586-compliant allowing operators to switch between real and synthetic environments;
- High-fidelity simulation software for sensors such as electro-optical (EO), infrared (IR), synthetic aperture radar (SAR), and others;
- Simulated communication systems;
- Simulation software for generating training scenarios;
- CAE Medallion-6000 image generator;
- Tactical synthetic environment and computer-generated forces representing maritime, ground and air assets;
- Tactical synthetic environment and computer-generated forces representing maritime, ground and air assets;
- Instructor operator station (IOS) and mission brief/de-brief station;
- Correlated weather simulation.

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Comprehensive simulated payload suite

The CAE UAS mission trainer includes a comprehensive suite of state-of-the-art simulated sensing technology models. These include:

- Electro-optical Imaging: Charge coupled devices (CCD)/Day TV/EO, infrared systems (IR), low light TV (LLTV) sensor payloads, with laser rangefinder (LRFD), laser target designator (LTD) and laser pointer;
- RADAR: Synthetic aperture radar (SAR) payload including ground moving target indication (GMTI) mode, maritime patrol radar (MPR) including Real beam ground map (RBGM), weather, spot SAR and ISAR modes, as well as target track-while-scan capability;
- Signal intelligence (SIGINT), Communication intelligence (COMINT) and Electronic intelligence (ELINT);
- Effectors: Smart and laser guided weapons.

The CAE UAS mission trainer can further be expanded to draw upon CAE existing state-of-the-art simulated sensors and models:

- Electronic warfare (EW): Protection sensors, including radar warning receivers (RWR), laser warning receivers (LWR), missile approach warning receivers (MAWS), and sophisticated electronic support measures (ESM) systems;
- Countermeasures: Countermeasure (chaff/flare) dispensers, infrared jammers, and radar jammers;
- Light Detection and Ranging (LIDAR);
- Acoustics and sonar;
- Magnetic anomaly detector (MAD).

The synthetic environment

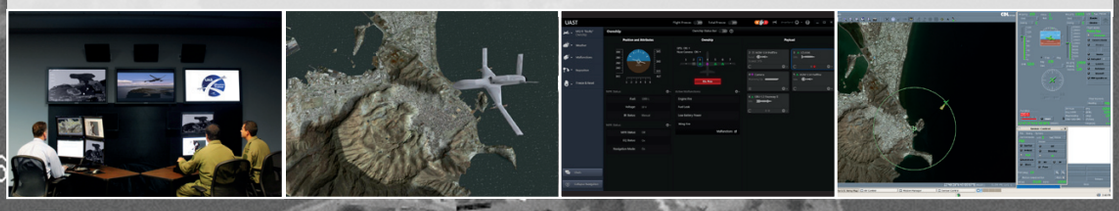
CAE's UAS mission trainer features a tactical virtual environment that simulates, in real time, a virtual battlefield for air, land, and naval operations. The HLA-compliant software provides high-fidelity, physics-based models that populate the synthetic environment with friendly, hostile, and neutral forces to conduct operational training and mission rehearsal. The standalone desktop graphical user interface (GUI) application allows the instructor to define scenarios and provide real-time control and monitoring of the entities within the tactical environment.

Train as you operate

The synthetic environment is integrated with the operational ground control station software developed for each unmanned system, or a high fidelity simulation of the actual systems. CAE's UAS mission trainer is a solution designed to be STANAG 4586 compatible, which is the standard for interoperability between ground stations and air vehicles. Students train and interact with the UAS using the controls and displays they would use when operating the unmanned system in theatre, giving them the realism required to train as they would operate on a mission.

Extending the use of simulation beyond training

CAE's UAS mission trainer can be used as part of a systems integration laboratory, and is ideal for use as a research test bed to support option analysis, operational concept development, and system evaluation and integration. Simulation plays a key role in supporting acquisition teams as they evaluate different UAS platforms to join existing C4ISTAR capabilities. Within the synthetic environment, decision makers are able to conduct scenario-based analysis of any platform and any payload to assess a proposed UAS's ability to fulfill client-identified system and user requirements as well as the system's compatibility with existing capability and sensor platforms. As a mission planning tool, the CAE UAS mission trainer allows mission commanders to plan and assess mission plans to ensure the right assets are working in combination to achieve mission success. Within the synthetic environment, the team can rehearse the mission scenario prior to operations to identify any potential risks to the mission and alter plans and tactics to greatly enhance the probability of success.



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UAS ISR Services

Overview

CAE and Aeronautics have teamed to perform analysis and demonstration flights of the Aeronautics Dominator XP unmanned aerial system (UAS) in Alma, Quebec. Under Project Miskam, which is the name given to the Canadian version of the UAS, CAE and Aeronautics are demonstrating how unmanned systems can be used for commercial applications such as remote inspection of pipelines and hydroelectric installations, surveillance of forest fires, observation of critical natural resources, assessing natural disasters and a range of other applications.

Combined with a diverse array of sensors suitable for civil, homeland security and defence-related market requirements, the Miskam UAS performs a wide range of intelligence, surveillance and reconnaissance (ISR) services. CAE is leveraging its modelling and simulation technologies as well as in-service support capabilities to develop a comprehensive offering of unmanned ISR services. The vast amount of information and intelligence that can be gathered by sensors on the Miskam UAS can be collected in a simulation-based synthetic environment and then used to support decision-making based on integrated information.

The Miskam UAS

The Miskam UAS is the Canadian version of the Aeronautics Dominator XP, which was originally developed for defence purposes. This medium-altitude long endurance (MALE) UAS is based on a Diamond DA-42 twin-engine aircraft that has accumulated more than half-million flying hours, thus making it one of the most reliable and safest unmanned systems worldwide.

The benefits of using the proven Miskam UAS platform include:

- Reduced risk and cost
- Long range and persistence
- Simple to operate
- Data gathering and analysis for improved decision-making
- Superior airworthiness, all-weather flight capability
- Low logistic footprint and deployable solution

Potential missions and users

CAE and Aeronautics have initiated a comprehensive research and development program to demonstrate and evaluate a range of possible commercial applications for the Miskam UAS, and have engaged potential users from government and industry to participate in the project. The flexibility and capability of the Miskam UAS, combined with the valuable information collected by its sensor payloads, is creating new opportunities to perform a variety of missions more safely, efficiently and cost-effectively.

Some of the potential missions to be performed by the Miskam UAS include:

- Intelligence, surveillance, and reconnaissance (ISR) applications
- Aerial visual inspection infrastructures
- Geographical, geological and resources air mapping
- Geographic information system (GIS)
- Light Detection And Ranging (LIDAR) mapping
- Magnetic surveys and maritime patrol
- Arctic ice reconnaissance and characterisation

Some of the potential commercial industry and government users of UAS ISR services include:

- Forest fires protection agencies
- Homeland security and defence
- Search and rescue
- First responder agencies
- Oceans and fisheries agencies
- Weather and environment
- Coast Guard
- Oil and gas industry
- Strategic infrastructures and sensitive facilities
- Natural resources
- Mining industry

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Project Examples

Forest Fire Support

Canada is home to vast uninhabited territories and forestry natural resources where surveillance for early detection and support for rapid suppression of forest fires is crucial. The Miskam UAS, carrying its state-of-the-art sensors, can offer a safe and low cost solution to fly over areas where smoke and heat is dense. The Miskam UAS can go places where it would normally be too distant or risky for aircrews to fly over. A range of sensors combined with modeling and simulation technologies will provide the tools required to analyse data effectively for just-in-time decision making to detect and support suppression of forest fires. UAS support to the fire-fighters provides an increased level of safety and effectiveness, hence protecting lives and natural resources.

Observation of natural resources

There is an increasing demand for cost-effective and efficient observation of natural resources such as bodies of water, shore inspection, glacier movement, mineral deposits, forest, crop health monitoring, and wildlife monitoring. Imagery gathered by sensors on the Miskam UAS combined with modeling and analysis tools can reduce cost of labour and time required to manually perform these inspections.

Inspection of power-lines and pipelines installations

The Miskam UAS and its sensors can be used to perform long range inspections of ground equipment or infrastructure facilities over vast surfaces for pipelines, roads, and hydroelectric installations.

CAE's UAS ISR solutions will combine modeling and simulation technologies to provide just-in-time critical information for decision makers to increase safety, security, and cost efficiency.

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CAE Dynamic Synthetic Environment™

Most know simulation offers a range of compelling benefits, including significant cost advantages, saving wear and tear on weapon systems, addressing environmental impacts, and perhaps most importantly, providing an effective environment for learning and building critical experience. In the current climate of defence budget constraints, the use of simulation is expected to increase dramatically as defence forces look to maintain readiness and capability yet do so more cost-effectively. This means a greater reliance on simulation and synthetic environments for analysis, training, mission rehearsal and operational decision-making.

A major challenge to a dramatic increase in the use and effectiveness of synthetic environments, though, is that they need to be more realistic, easier and faster to create, and less expensive to develop, maintain and integrate. CAE has developed a capability and solution called the CAE Dynamic Synthetic Environment™ (DSE) that aims to create and maintain a virtual synthetic environment that more accurately and realistically simulates the real world.

DSE Objectives

CAE's development and implementation of a dynamic synthetic environment will allow for the real-time modification of the database in response to actions taken by players interacting with the synthetic environment, environmental effects, or by computer-generated entities in the scenario. In other words, the synthetic environment database will constantly change and evolve, just like the real world does. CAE had four primary objectives guiding the development of the CAE Dynamic Synthetic Environment:

- **Dynamic** – the synthetic environment database had to have the ability to change anywhere in the world in real-time without advance preparation;
- **Persistence** – once the synthetic environment changes as a result of any interaction with the synthetic environment, such as weather or a bomb detonating, those changes had to "persist" in real-time;
- **Scalable** – the synthetic environment needed to support single users on a mobile or laptop-based system all the way up to large, distributed live-virtual-constructive federations;
- **Open** – the underlying database architecture had to be based on an open specification to enforce correlation and interoperability.

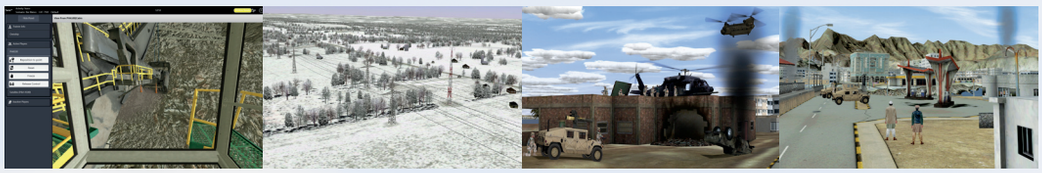
The Common Database (CDB)

The ability to make a synthetic environment dynamic, persistent and scalable has as a prerequisite a requirement for a server-based, common run-time database format. CAE has built its implementation of a dynamic synthetic environment on the Common Database (CDB) – an open, non-proprietary database specification that supports the creation of standardized, rapidly updatable synthetic environments. The CDB enforces correlation and interoperability between client devices, simulators, and simulation systems using the synthetic environment by requiring everyone to use a single source database at run-time. In other words, a common database shifts the focus from building a synthetic environment around an individual client device (i.e. a simulator) and places the emphasis on creating a dynamic synthetic environment that all clients use.

What is a dynamic synthetic environment?

A dynamic synthetic environment is a computer-based simulation of the entire world, including terrain, oceans, vegetation, buildings and other man-made objects. Importantly, CAE's Dynamic Synthetic Environment evolves over time and is changing autonomously based on various simulations that interact with the synthetic environment. CAE's Dynamic Synthetic Environment solution allows for the real-time modification of the worldwide synthetic environment database that would be used within virtual and constructive simulations. So, the synthetic environment database will be modified without stopping the simulations in response to things such as:

- actions taken by human-in-the-loop trainees who are involved in a training or mission rehearsal exercise;
- actions taken by computer-generated forces (CGF) entities that are interacting with the synthetic environment;
- effects on the environment including weather and weapons detonations.



Combat Engineering | Weather | Weapons Effects | CGF

Benefits of a dynamic synthetic environment

CAE's Dynamic Synthetic Environment will improve training, mission planning and rehearsal, and operational decision-making because the synthetic environment will be more realistic and more accurately simulate the real world. Because the solution is based on the common database, the issues of database correlation and interoperability are eliminated, thus saving time and engineering effort. Importantly, all synthetic environment content can be shared across all domains – air, land, sea, or joint. Traditionally, synthetic environment databases have been built around a single training device for a specific domain, for example, a flight simulator. For numerous reasons, there is a growing desire and requirement to use virtual simulation for more joint and coalition training, as well as use simulation in command centres for operational decision-making. CAE's Dynamic Synthetic Environment solution now provides a general synthetic environment that is dynamic and persistent, and is not constrained to any one domain. This means the dynamic synthetic environment can be used to facilitate networking and interoperability, as well as the re-use of data and content across all domains.

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CAE 3000 Series

Military helicopter flight and mission simulators

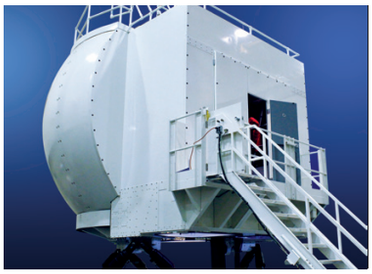
CAE 3000 Series helicopter flight and mission simulators provide an immersive training experience for the full range of military helicopter pilot training requirements. This new CAE simulation capability offers unprecedented realism for helicopter-specific mission training, including ship landing, search and rescue, hoisting operations, combat scenarios, confined area and rooftop landing, night-vision goggle missions and other operations.

The CAE 3000 Series is the result of CAE's decades of simulator experience and helicopter flight training expertise, the requirement for militaries to extend the use of simulation-based training, extensive input from CAE's Helicopter Advisory Board (which includes pilots, operators, manufacturers, and insurers), and assessment of current and emerging regulatory requirements.

Simulation improves safety and efficiency

Simulation is cost-effective and improves safety by enhancing pilot proficiency and eliminating risks of training in the aircraft. The simulation environment enables risk-free exposure to events not suitable or possible for training on the actual aircraft. Training in a CAE 3000 Series helicopter flight simulator costs less than training in a turbine-powered helicopter, extends the service availability of aircraft fleets, and frees up aircraft for operational use.

Maximum training value to enhance helicopter mission readiness



The CAE 3000 Series enables:

- Unlimited aircrew training schedules – not influenced by training aircraft availability
- More effective training, including tasks not feasible for training on actual aircraft
- Realistic visual fidelity for near-the-surface maneuvering
- Designed for fast cockpit interchanges for maximum utilization and training flexibility
- Low acquisition costs
- Significantly reduced lifecycle training costs
- Ease of operation and maintenance
- World-renowned CAE customer support service

CAE is a helicopter flight simulation and training leader

CAE has delivered the largest number of high-end helicopter synthetic training devices than any other company, with more than 120 devices fielded representing nine different manufacturers – AgustaWestland, Bell, Boeing, Eurocopter, Hindustan Aeronautics Limited (HAL), Kaman, MD Helicopters, NH Industries, and Sikorsky.

CAE-owned and joint venture helicopter flight training operations (civil and military) are located in five global regions:

Asia

- India: Bell 212/412, AS365 Dauphin N3 and Dhruv in Bengaluru at the Helicopter Academy to Train by Simulation of Flying (HATSOFF)
- China: S-76C++ (2012) at Zhuhai Flight Training Center
- Brunei: S-70i Black Hawk (beginning in 2014); S-92 (beginning in 2014) at CAE Brunei Multi-Purpose Training Centre

Europe

- Italy: AW109 (multiple variants), AW139 and AW189 (beginning in 2013) in Sesto Calende at Rotorsim
- Norway: AS332L/L1 Super Puma, S-61 and S-92 (beginning in 2014) in Stavanger
- Sweden: Bell 412 in Stockholm
- Germany: NH90 training in Bückeburg, Fassberg and Holzdorf
- UK: AS332L2 Super Puma in Aberdeen, Scotland; CH-47 Chinook, AW101 Merlin and Puma at RAF Benson in Oxfordshire, England.

Latin America

- Brazil: S-76C++, Eurocopter EC-225 (2014) and S-92 (beginning in 2014) in Sao Paulo
- Mexico: Bell 212/412 in Mexico City / Toluca

Middle East

- UAE: Bell 212/412 at Emirates-CAE Flight Training

North America

- Canada: S-76C++ in Vancouver
- USA: AW139 (Rotorsim), S-76B and S-76C+ in Morristown, New Jersey, near New York City
- USA: AS350B2 Astar in Phoenix, Arizona

The CAE 3000 Series addresses current and emerging regulatory requirements

The CAE 3000 Series is designed to address emerging global standards for helicopter flight simulation training devices (FSTD), developed by an international working group sponsored by the International Civil Aviation Organization (ICAO). The CAE 3000 Series has already been qualified to U.S. Federal Aviation Administration (FAA) Level-D standards, and will also meet European Aviation Safety Agency (EASA) Level D fidelity.

Unprecedented visual realism

All CAE 3000 Series military helicopter flight and mission simulators feature a CAE Medallion™-6000 visual system with high-definition fixed-matrix projectors, up to a 220-degree horizontal by 95-degree vertical field of view direct projection dome with chin window coverage, and high-density 3D databases based on the common database (CDB) format tailored to helicopter training operations.

Advanced Computer Generated Forces

The CAE 3000 Series for military helicopters includes computer generated forces to support complex mission training as well as joint and coalition operations through HLA (high-level architecture) connectivity. Enemy threats behave with realistic doctrines, and can be tailored with interactive scenario creation tools. Weapon systems and counter-measures are accurately simulated, including proper ballistics and scoring.

Industry-leading vibration, motion cues

All models of the CAE 3000 Series feature CAE's industry-leading three degrees-of-freedom vibration platform. CAE 3000 Series full-flight and mission simulators include six degrees-of freedom CAE True™ electric motion system and high-fidelity digital control loading.

Highly realistic mission training scenarios

- Offshore maritime environments, including wind and 3D wave effects up to Sea State 6
- Realistic ship deck landings in high seas, including wind turbulence caused by ship
- Confined area landing procedures
- Helipad, oil platform, rooftop and pinnacle landings
- Dynamic scenes in highly detailed urban areas in support of emergency response mission training
- Night flying and day/night transition
- Inadvertent entry into instrument meteorological conditions (IMC)
- Night vision goggles (NVG) and forward-looking infrared (FLIR)
- Open-format Common Database (CDB) synthetic environment, facilitating content reuse, correlated interoperability and fast mission rehearsal
- HLA and DIS connectivity to enable distributed mission training
- Scenario editors enable customization to specific end-user training needs.

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