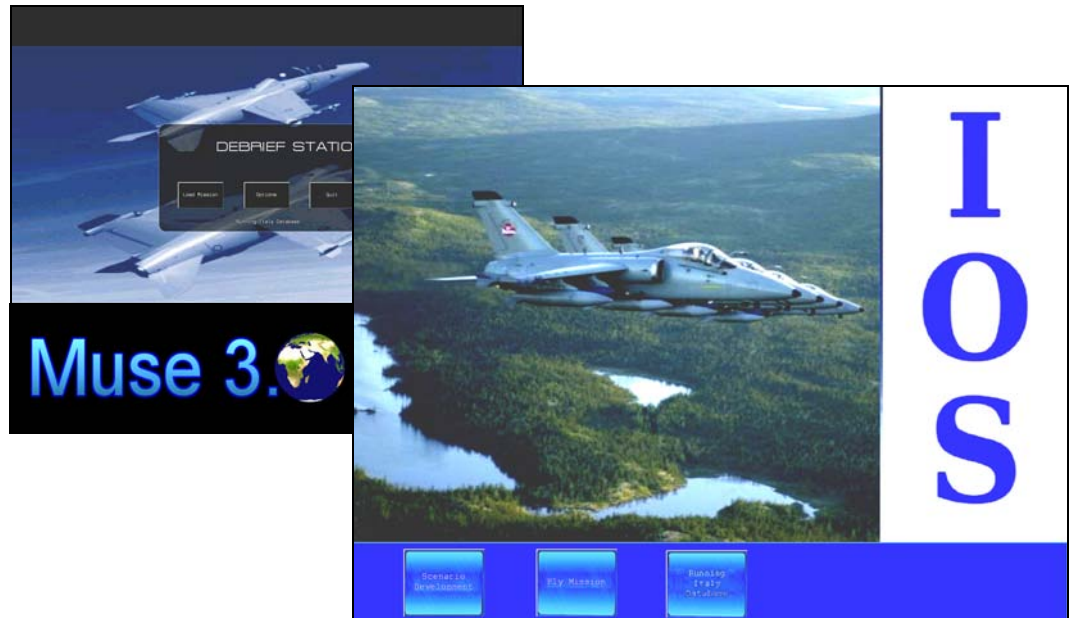# MUSE™

COMPRO's Modular Universal Simulation Environment (MUSE™) software is a unique simulator development and real-time simulation environment. MUSE™ is specifically designed to facilitate customer code re-use for modeling common platforms or mission systems in aerial vehicles (fixed wing or rotary/UAV), land vehicles, and sea-borne vessels.

MUSE™ is one of the most dynamic, comprehensive, and easy-to-use training software packages available for use by military and commercial companies. The MUSE™ simulation – from the visual database to displayable instruments, controls, panels, and/or indicators – is customized to meet your site's specific training requirements!

FEATURES

- **Realistic Dynamic Simulation**

- **Mission Scenario Development**

- **Real-world Digital Terrain Database**

- **Out-the-Window (OTW) Visual Scene**

- **Realistic Threat Environment Simulation**

- **Re-configurable Displays**

- **Customized to Meet Your Requirements**

BENEFITS

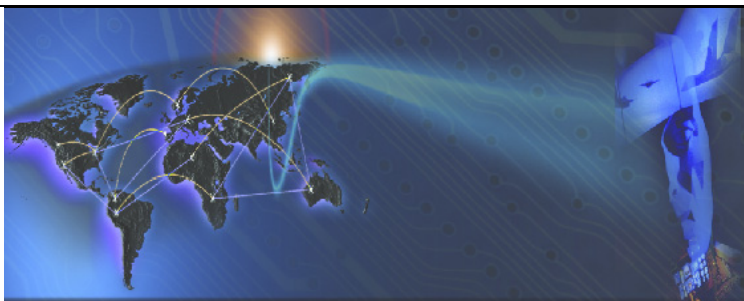- **Significant Reduction in Development Cost and Risk**

- **Shorter Development Schedule**

Capabilities

Capabilities include:

- **Mission Scenario Definition**
    – Geographical mission area
    – Multiple dynamic and static players (friend versus foe)
    – Aircraft/land or space vehicles/marine vessels
    – Weapons systems
    – Layout of the tactical environment

- **Simulation Control**
    – Run and freeze the simulation state and change conditions/positions
    – Initiate emergencies
    – Change the environment

- **Mission Review**
    – Dynamic replay at any angle
   – Static event analysis

About MUSE™

MUSE™ is a comprehensive software framework for creating a high-fidelity simulation environment for any vehicle or system. It provides multiple-player (friend and foe) interactions within a simulated real-world environment. MUSE™ is a multiple-entity, interactive environment and may simulate any aircraft, ship, or land vehicle as well as a surface-to-air missile (SAM) site or anti-aircraft battery.

MUSE™ lets you define the initial mission conditions (scenario parameters) for the environment and players, and model the operation of sensors and countermeasure equipment, weapons, and enemy defense systems.

The MUSE™ database simulates a real-world environment. (You can use real databases or geographic maps to plan your scenario.)

You can increase the realism of the database environment by adding cultural features such as buildings, roads, rivers, and forests.
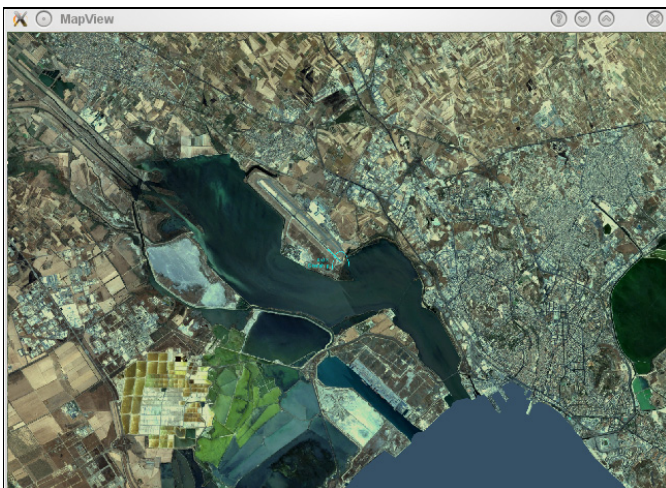

The software's tactical mission environments expose the simulated weapons system to realistic threat stimuli while performing a mission. The threat stimuli are generated via the simulation of enemy defense systems.

These threats can be in the form of surface-to-air, air-to-surface, and air-to-air engagements, generated wholly within MUSE™ or multiple Man-In-The-Loop (MITL) simulators.

Mission Planning

MUSE™ has an easy-to-use Graphical User Interface (GUI) that allows you to define the players and parameters for the mission's scenario.
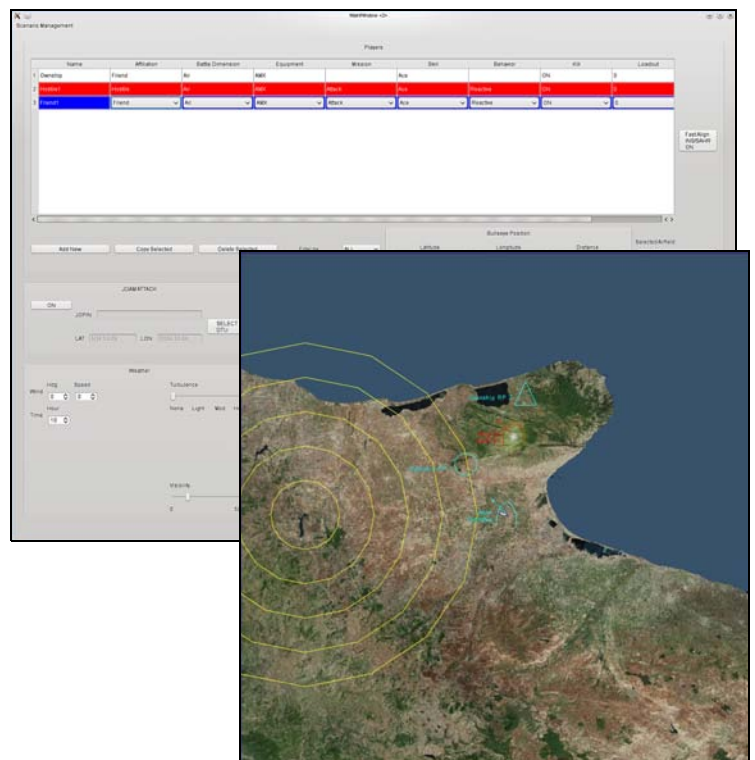
The parameters can include:

- Plan per player including geographic positions, speed, altitude, designated route points, and target
- Wind speed and direction
- Departure location and time of day
- Turbulence and visibility
- Loadout (ammunition/ordnance, electronic countermeasure quantities) and fuel quantity
- Mission configuration (reconnaissance/counterattack)

During mission planning, you can assign a battle dimension (aerial, land, and sea-based targets) and equipment type for each player. These allow the MUSE™ threat software to provide targets that include pre-programmed tactics and characteristics such as aerial, sea, and land-based emitters; radar frequencies; electronic countermeasures; and combat patrol patterns.

Mission Execution

The simulated systems available during mission execution can include:

- Engine and fire protection
- Flight controls
- Self-defense (such as chaff/flare dispenser)
- Reconnaissance pod
- Electrical/hydraulic/oil
- Landing gear and brakes
- Fuel
- Warning
- Oxygen/Environmental

The MUSE™ software allows you to "freeze" the simulation at any given time and insert new conditions, initial positions, stores, and configurations etc. Other capabilities can include:

- **Instrument/Panel Display** – You can display instruments and control panels, tactical movements, maps/terrain views with players and routes, and bomb and strafing gun sites.

- **Visual Effect Controls** – You can change visual effects (such as snow, rain, clear) and time-of-day.
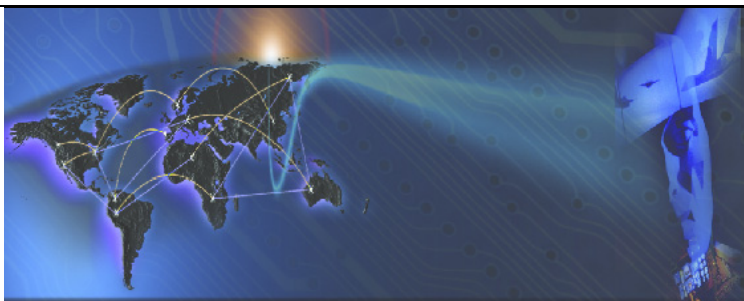

- **Multiple Vehicle Views** - You can display a player from any side (top, bottom, left, etc.) and distance.
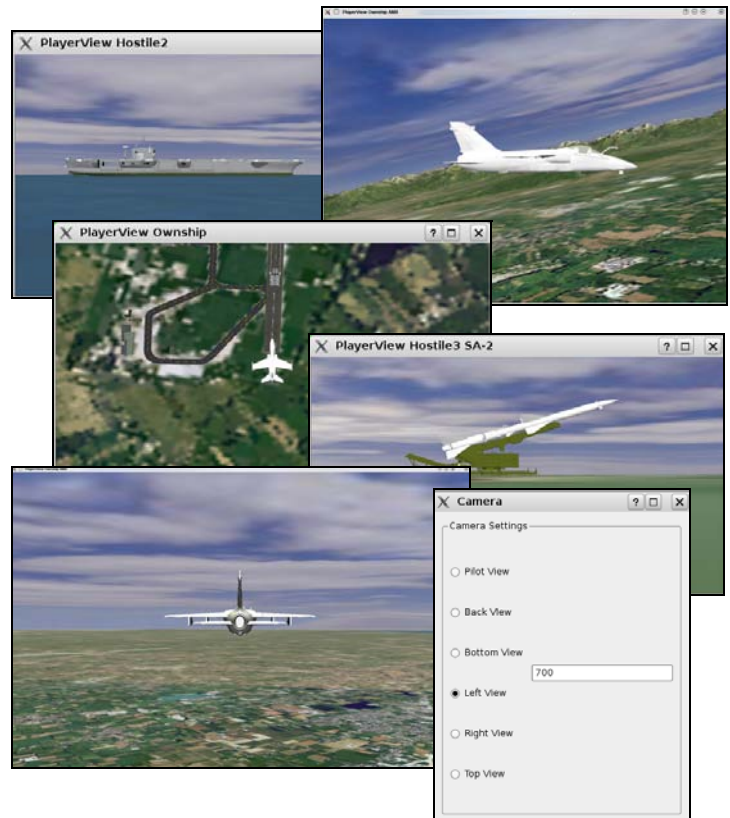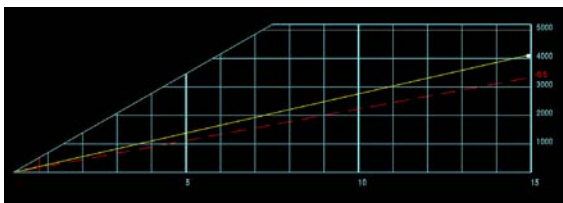

- **Ordnance/Stores Controls** – You can display Electronic Counter Measures (ECM), gun round, and weapon quantities, and display and adjust the fuel quantity.

- **Emergency Procedures** – You can select and invoke from more than 80 emergency procedures at any point.

- **Training Path Slope for Analysis** – You can display the training path taken in graphical form.

- **Visual Trails** – You can display visual trails that show the actual travel path of ordnance, ejected stores, etc.

- **Graphical Display for Analysis** – You can display a real-time 2D or 3D graphic during the mission showing any combination of parameters (such as altitude by meters per second).
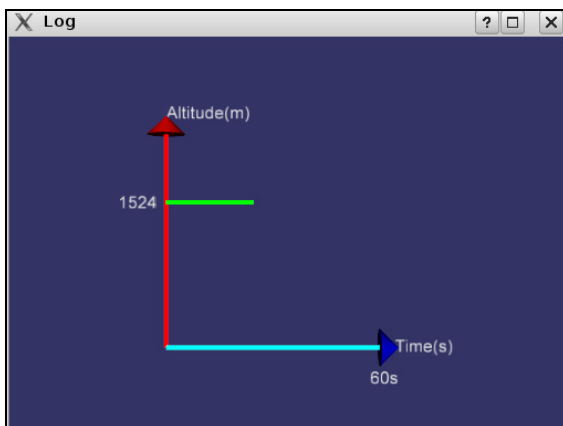
- **Radar Control for Any Player** – You can change the radar parameters for any player as well as display the radar and corresponding data for each player.

- **Real-Time Heads Up Display (HUD) Builder** – You can perform HUD changes on the fly! That is, you can reconfigure your HUD without having to restart your application every time a change is made.

Dynamic GUI

MUSE's dynamic GUI, which has full 3-D capability, provides you with the following features:

- **GUI Flexibility** – You can resize, move, and zoom in and out on windows, maps/database visuals/coordinates, instruments, and panels anywhere on the screen.

- **Multiple Windowing Environment** – You can have multiple windows open/layered.

- **Simultaneous Video** – You can simultaneously play a video with a sound track (such as a training video that demonstrates a particular operation) while a mission is in progress.

- **"Snapshot" Capability** – You can easily take snapshots of the MUSE™ windows for subsequent After-Action Review.

- **Web Access** – You can access the Web during a mission (if Internet access is available) or a local server.
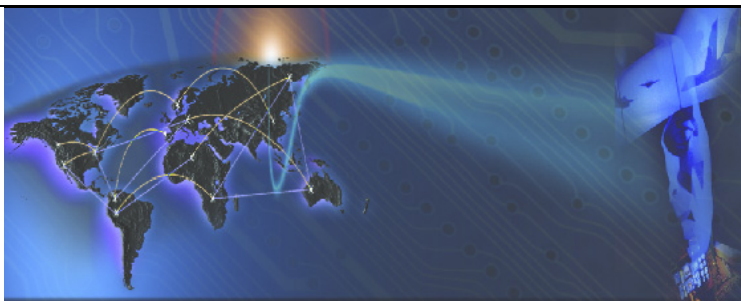
Options

The following MUSE™ options and tools are currently available if you want to further enhance your site's training capabilities:

- **Night Vision Goggle Simulation**

- **Instrument/Panel Builder**

- **Electronic Warfare Training**

- **Specialized Training Databases**

- **Flight Model Performance Tuning Tool**

- **High-Level Architecture (HLA) for distributed systems**

Night Vision Goggle (NVG) Simulation Option

COMPRO can provide an NVG simulated training system which is fully tunable, allowing you to adjust the luminosity and light "halo" effect.

The NVG option includes a real-time instructor-controlled (MITL) forward-observer model. The instructor can use the Tactical Situation Display (TSD) to control the model and use the joystick to perform CAS procedures.

The instructor can also control the model's direction to point at the pilot, signal a "lasso procedure" for the pilot, and designate a target by sending a laser/infrared (IR) beam to illuminate a target in the database.
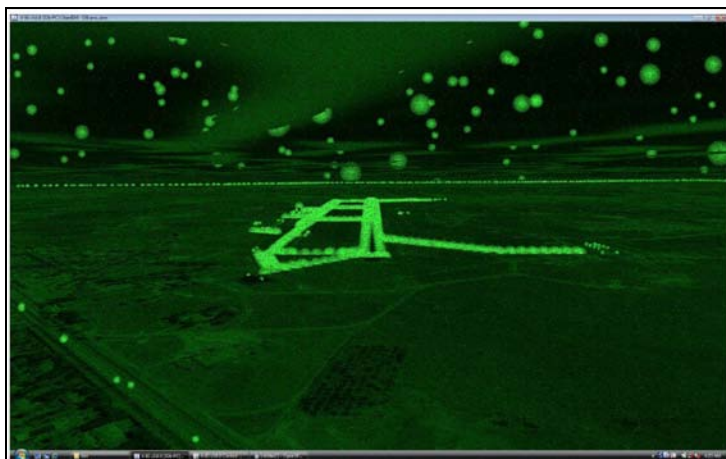
Instrument/Panel Builder Tool

The Builder tool allows you to easily and rapidly create and modify 2D and 3-D simulated ("glass") indicators and panels with just a few clicks of the mouse.

A special calibration tool also is included to allow you to quickly and accurately calibrate (as needed) any newly designed instrument/panel.
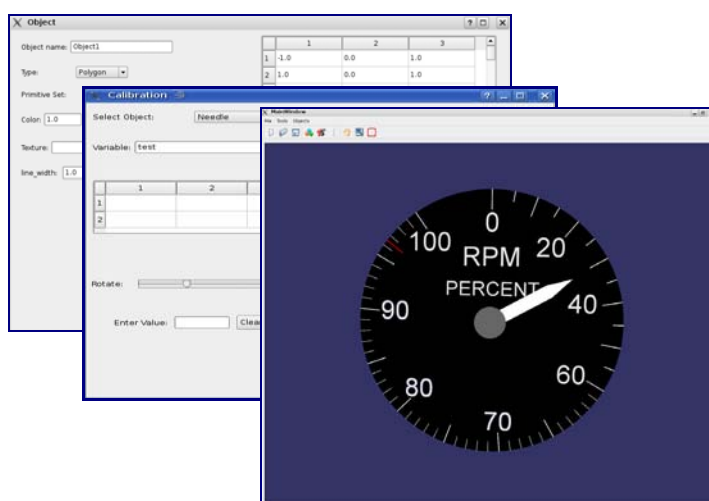
Electronic Warfare (EW) Training Option

The EW option provides additional aircraft/vehicle/vessel protection by detecting radar emitters, displaying threat information, and providing for the release of dedicated active and passive countermeasures.

This reliable and dynamic training scenario option has radar cross-section and infrared signature data, an emitter database, and a weapon database that allows launch programs to be simulated as well as their effect on the threat.

The EW option includes the following components:

- **Radar Warning Receiver** – Detects and determines if any signal represents a threat according to the programmed library. If a threat is indicated, the correct audio and visual alarms are provided, and dispense signals are made available for any automatic dispensing mode.

- **Countermeasure Dispensing System** – Deploys decoy devices to divert guided missiles and to deceive the echo radar signals according the selected launch mode.

- **Active Countermeasure System** – Automatically activates a deception program against threat radar.

Specialized Training Databases

COMPRO can provide high-fidelity visual databases of specific countries or areas that can be used for specialized training.

These can include areas in which to train specific tactics/maneuvers, test bombing ranges, reconnaissance locations, war zone/hostile territory, etc.

This option includes, but is not limited to:

• Entire country in 10-meter base color imagery and associated elevation data.

• Three 1-meter training areas. The areas can be up to 100 sq. miles in size.

• Up to 20 specific features to include geo-typical buildings and obstacles for the area surrounding the main training area.

• Navigational data and map upgrades in the MUSE™ software to support the new visual database for in-country navigation.

• Visual aids (for example, for aeronautical training: models of active runways and taxiways; airfield lights and lighting on runways, taxiways, and ramp areas to support takeoffs and landings; etc.).

Flight Tuning Tool

The Flight Tuning Tool (FTT) is a specialized software tool that assists in the development and rapid adjustment of details for the flight model.

The tool provides the following capabilities:

• **Profile Capture** – Allows for the capture of current flight profile for adjustments.

• **Performance Data Comparison** – Allows test plots to be compared with aircraft reference performance data from flight manuals.

• **Easy-to-Use Adjustment Tool** – Provides an interface through which you can adjust the flight plot to the baseline performance plot. By using the performance plot data from flight manuals, you can rapidly make near real-time adjustments to the existing flight model.

The FTT provides an interface that allows the model adjustments to have a controlled and repeatable flight mission for testing.

The Graphical User Interface (GUI) precisely builds a mission, thereby eliminating any variances in repeat test flights that are inadvertently introduced by humans in-the-loop.

Once the flight test profile is created, it is executed to generate current flight performance curves. These curves are then used as an overlay to the aircraft performance baseline charts to visualize any plot points that are not in compliance.

Any point in the plot can by moved graphically to line up with the underlining reference points. This curve will recalculate the adjustments to the test model data to correct the current flight model.

This corrected file can be saved and the test re-run to perform a new evaluation to the baseline reference data.
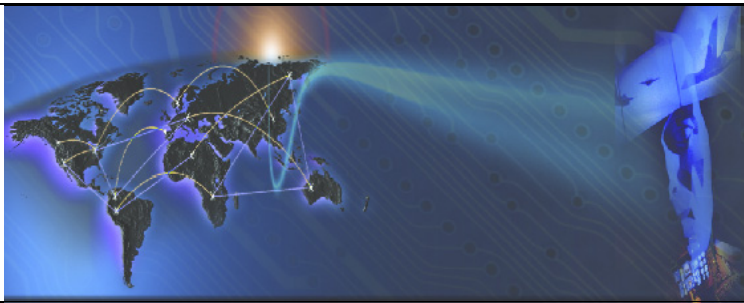
High-Level Architecture (HLA) Option

For distributed computer simulator systems, COMPRO can provide HLA functionality (in accordance with the IEEE 1516 standard) to facilitate the use of joint training tasks across physical locations and computer platforms. With this option, you can inject or change scenario or mission information and immediately re-distribute the changes to all locations.

This enables you to rapidly deploy and adapt personnel training in response to joint allied exercises and other training collaboration, newly uncovered changes in environments and hostile tactical maneuvers, etc.

The HLA option includes:

- The networking equipment required to support the local HLA networks between each cockpit.

- Communications upgrades to support the HLA environment.

- Upgrades to communication subsystems to allow communications to the simulators and instructor using the HLA network interfaces.

- Any ancillary equipment or facility adaptation needed because of the installation of HLA networks.

The HLA and communication modules use a standard Ethernet® interface to communicate with the Instructor/Operator Station (IOS). The specific transfer protocol for the communications with the IOS is TCP/IP and UDP.
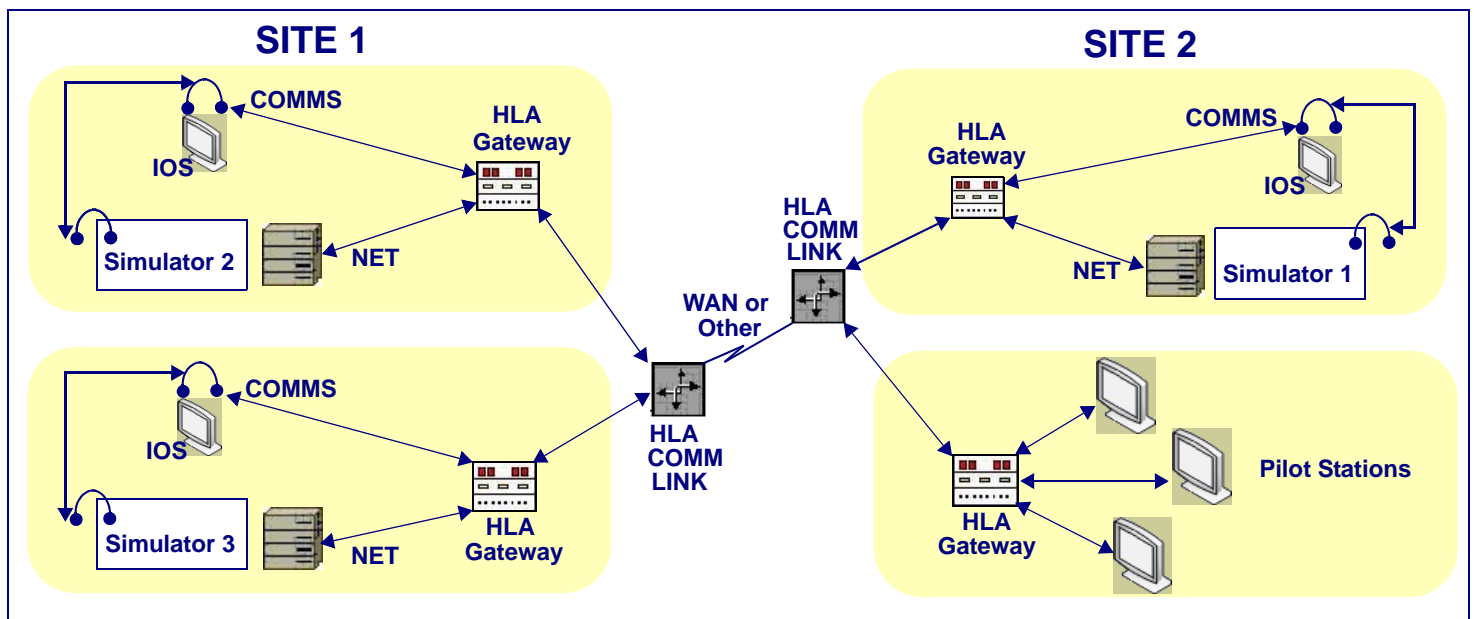
The data transferred can be used to generate the IOS views of the Tactical Situation Display (TSD) and communication for the instructor.

The Instructor/Operator Station (IOS) for the simulator configures, controls, and monitors the HLA federation. The IOS also captures all relevant HLA data to perform After-Action Reviews (AARs) and debriefing functions for the simulators.

COMPRO's MUSE™ host software is used as the system integrator for the different simulator cockpit components. The image generator, IOS station, and real-time I/O controller all communicate with the simulation host through a UDP Ethernet® network interface.

The modules in the cockpit communicate with the simulation host through a RS-232 serial interface. The aircraft dynamics software is built into the MUSE™ simulation host.

The HLA module is fully integrated into this architecture and shares the same communications architecture as the existing protocols.

Core Software Specifications

Software Base
Object-oriented C++ code running under the Linux® operating system

Communications with other Operating Systems
Can connect to a Windows® system via an API using RMS or Ethernet®

Data File Capability
• Reads and writes data in XML (Extensible Markup Language) format • Delivered with unclassified model data (such as Jane's, NACA); can be customized to accept classified data, public domain data, and full-fidelity OEM data

Core Functionality
• Basic simulator capability includes a data file manager, image generator, aural cueing, models, tactical environment, Finite Element Model (FEM)-based engine, scheduler/executive, and an event system • Other modules include Graphical User Interface (GUI) Builder, System Builder, Vehicle Model Toolset (VMT), and Synthetic Environment Builder • Includes an Application Program Interface (API) for the image generator, aural cueing, motion, control loading, HLA/DIS, RTE, etc. • Supports native I/O subsystems such as Ethernet, Reflective Memory, High Speed Device (HSD), IEEE 1553, ARINC 529, Serial Bus Interface (429), etc. • Optimized to better use system resources and take advantage of advances in state-of-the-art hardware

Other Specifications

Certification Capability
• Capable of FAA, JAA, or CAA Level D FFS Certification • Capable of Level-5 FTD Certification

Licensing
• Flexible licensing – Single license allows for multiple non-concurrent simulators; custom licensing available

Additional Options Available
• Night Vision Goggle (NVG) Simulation • High-Level Architecture (HLA) for distributed environments (IEEE 1516 standard-compliant) • Electronic Warfare (EW) Training System • Flight Model Performance Tuning • Specialized Training Databases • Instrument/Panel Builder Tool

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