# Ovation™ Embedded Simulation

Features

- Ovation-based high-fidelity simulator models are embedded directly into virtual Ovation controllers versus third-party models that run in separate hardware
- Establishes a foundation for future technology that enables predictive and prognostic decision making through synchronizing live plant data with simulation
- Single platform for simulation and control provides familiarity with operation, configuration and maintenance activities
- Common engineering tools creating simulator models and control system logic eliminates the need for specialized programming knowledge
- Use of virtual configurations reduces hardware costs
- Supports the ability to mix fidelities to meet requirements, project schedules or budgets
- Provides ability for customers to update the simulator models
- Single source for simulator implementation, service, and maintenance with access to control experts
- Comprehensive set of services to keep pace with control system and plant changes
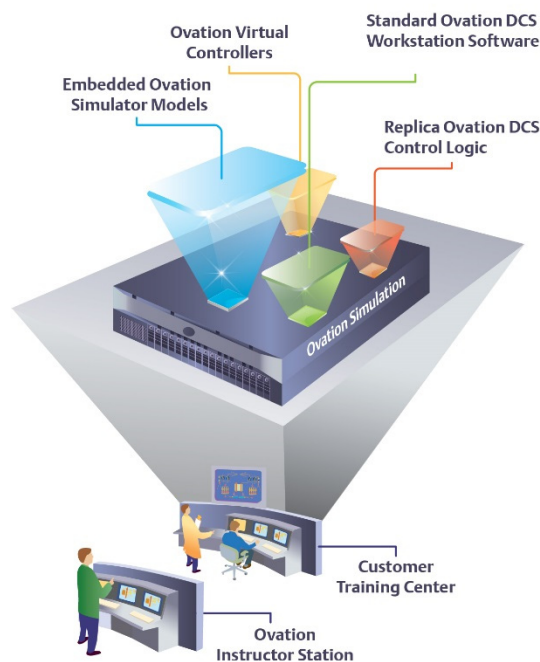
Introduction

Ovation™ simulation by Emerson provides scalable, engineered solutions to assist customers with:

- Operator training and certification programs
- Procedure development and validation
- Control logic testing and verification
- Engineering test bed scenarios for plant process improvements

An Ovation simulator with embedded Ovation-based models provides a single platform for simulation and plant control; both utilizing the same hardware, system software and powerful engineering tools.

Ovation models are created using standard Ovation engineering tools and are embedded within virtual Ovation controllers to provide a common simulator platform from a single vendor. Customers familiar with Ovation controls can now apply that knowledge to their simulation system for ease-of use, system familiarity and simplified maintenance.

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A Foundation for Future Technology

Ovation simulators with embedded Ovation models establish the foundation for Emerson's phased evolution of the simulator product line.

The second implementation phase will provide a single integrated control and simulation database that simplifies system maintenance and upgrades. The last phase of the Ovation simulator product line enhancements will synchronize the Ovation simulator with live Ovation plant control data to enable prognostic capability. Real-time data from the control system will be used on the simulator to precisely mimic live plant conditions. Operators will be able to manipulate real data on the simulator to show future plant behaviors based on current conditions.

Prognostic applications, enabled by synchronizing simulation with live, real-time plant data will allow operators to predict responses to changing plant conditions and adjust plant operations before issues occur.

Common Platform

Ovation simulators with embedded Ovation models use the same hardware, operating system, and software application components of the accompanying plant control system. Use of a common platform across your control and training systems provides significant benefits due to the existing familiarity with workstations, equipment operation, maintenance, and control features.

Ovation models are built using standard Ovation Developer Studio control builder engineering tools. Plant personnel accustomed to working with Developer Studio features for the control system can easily apply that knowledge to updating the embedded simulator models.

Simulators using third-party models require an extensive modeling background and specialized programming understanding to support and maintain. Additionally, use of third-party models could have potential compatibility issues with the simulator hardware and have higher life cycle costs when keeping pace with changing technology.

A key advantage of an Ovation simulator is that a specialized modeling background is not required for maintenance and support. The simulator uses all standard Ovation tools and the Ovation-based models run directly in the virtual Ovation controllers. Use of standard Ovation tools also ensures that there are no compatibility issues between the various components.

Mixed-fidelity Simulation

A unique feature of a simulator with embedded Ovation models is the ability to mix fidelity levels to meet multi-unit or multi-plant requirements, aggressive training schedules or budget constraints.

Ovation simulation with empirical models uses both simplified as well as enhanced models based on empirical data with realistic accuracy for key processes. Empirical simulation provides fundamental power plant operator training as well as familiarization with workstation functions and control system navigation.

High-fidelity Ovation simulation models are based on dynamic first-principle engineering and thermodynamic relationships which accurately reflect the operation and interaction of a plant's equipment during normal and abnormal operating conditions. Conservation equations in a complex matrix solver for mass, energy, and momentum balances are used to provide fast and stable responses for pressures and flows.

Mixing or blending, functionality provides customers with the flexibility to place high-fidelity focus on more complex portions of the plant combined with the realistic simplicity of simulating more general equipment. Empirical simulation can be upgraded to higher-fidelity models when needed and as budgets allow.

Ovation simulators can be expanded or updated as a plant or training needs change. The modular design provides customers the flexibility to simulate either the entire plant or selected plant processes. Expanding an Ovation simulator may include adding control system components such as virtual controllers and workstation software to match the changing plant

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control system or adding models for new equipment or processes.

Ovation-based Simulator Models

All Ovation-based simulator models adhere to the ANSI(ISA)-77.20.01-2012 standards. High-fidelity Ovation models are created using standard Ovation control builder tools and first-principle engineering that follows physical laws and the laws of conservation for mass and energy. Empirical-based simulation also uses standard Ovation control algorithms that are programmed with plant specific data and tuned to approximate operating conditions.

Ovation-based simulation models, just like control logic, are created by dragging and dropping graphic icons for common plant equipment such as valves, pipes, pumps, and tanks into a work area known as a control sheet.

The simulator model building tool presents information in an industry-supported SAMA format, but can also utilize any other custom format via the use of an internal symbol builder. By utilizing graphical user interface symbol and drawing capabilities, the user is automatically supplied with online/offline documentation of simulation models. Unlike third-party packages, the drawing capabilities in the Ovation control builder tool are tailored specifically for creating and editing the models; thereby simplifying and streamlining the simulator development and maintenance processes.

Ovation-based simulation models can be saved as macros or algorithms in a library for future access and modification to match the plant's control system. Stored models can be re-applied to similar applications throughout the plant to minimize engineering time.

Additional features of Ovation's control builder that can be applied to the Ovation-based simulation models include:

- Uses a graphical editor to create the simulator models that run in the virtual Ovation Controllers
- Ovation-based models are created from a library of over 135 standard Ovation control algorithms

placed on functional drawings (simulation sheets) that direct the simulator operation
- Simulation sheets and supplemental documents (PDF, Word document, html, etc.) can be linked and grouped into functional units for easy management
- Selected simulator sheets can be converted into PDF documents for easier verification and archiving

Architecture

A typical high-fidelity Ovation simulator includes virtual controllers for executing the plant models, an instructor station for manipulating simulation scenarios during training sessions, running computer-aided exercises, and providing trainee proficiency reviews, and various operator and engineer workstations for configuration, operation, and maintenance training.

Ovation simulators use virtual technology to replicate traditional control system controllers using current state-of-the-art server products known as virtual hosts. The simulator logic and algorithms use a simultaneous solver, which executes in the Windows operating system environment, to calculate flow networks. Each workstation can virtually replicate multiple controllers. The Ovation-based models are embedded within the virtual controllers, thus eliminating the need for additional hardware and leaving the original controller code undisturbed.

Instructor Station

The Ovation instructor station controls simulator operation. The instructor station serves two purposes: for instructors to develop and run training exercises and for engineers to control the simulator during testing of DCS changes. T

he instructor station can operate online for direct simulator control or offline for simulator configuration activities.

Ovation simulators include a host of instructor functions to help fully train your operations personnel to handle normal and abnormal plant operations.

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Some basic functions include:

- Simulation control such as run, freeze, snapshot, reset, and backtrack
- Training session commands such as insert malfunctions, remote functions and I/O overrides
- Automated plant procedures that automatically run simulation scenarios during training sessions
- Training session monitoring to track all calculated and logical simulation parameters
- Trainee performance reviews to monitor and evaluate trainee actions during simulation testing

Lifecycle Services

When our customers select an Ovation simulator with embedded Ovation-based models, they get more than just the simulation. Emerson's simulator project team works hand-in-hand with our DCS project implementation department. The simulator lead has direct access to the experts who engineered the Ovation control system, thus gaining a unique advantage when designing or re-tuning the simulator system to keep pace with the plant's control system changes. System upgrades or maintenance is simplified since both products use standard Ovation components already familiar to Emerson's implementation team and the plant personnel.

Emerson offers a complete set of lifecycle simulation services, including:

- **Simulator tuning services** - created for simulators that are designed using non-commissioned controls, and on systems that have deviated significantly from the DCS, Emerson's simulator tuning service includes modifying the existing simulator models to match commissioned or updated controls.
- **Simulator update services** – sign up for scheduled services including software updates to maintain consistency between your simulator and control system, resolution of I/O database discrepancies, process model modifications, simulation configuration updates and additions, backed up simulation software.
- **Ovation Evergreen** – one contract can cover the upgrade of both your simulator and control system components to keep pace with changing technology.

- **Training** - less money is spent on training costs since the simulator uses the same platform as your control system. Ovation Training classes for system operation and maintenance are also applicable for simulator operation and maintenance. Additional courses are available that are specifically designed for Ovation simulation.

Requirements

Ovation simulators with embedded Ovation models require the following at a minimum:

- Ovation system level 3.3.1 or higher
- Ovation simulation licenses for algorithms, instructor station, hard panel and virtual control execution

Please refer to these data sheets for more detailed information on Ovation simulation:

- *Ovation Simulation Solutions Overview* (PWS_003823)
- *Ovation Simulation with High-fidelity Functionality* (PWS_003825)
- *Ovation Simulation with Empirical Models* (PWS_003824)

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