L3 MAPPS - High-Fidelity Power Plant Simulators

When you are looking for increased reliability in your power plant’s performance, you can count on L3 MAPPS’ simulation experience to get you there. Our dedication to true-to-life power plant simulators ensures that your personnel have the knowledge required to safely and efficiently operate your power plant. Providing more than just training devices, our simulator solutions—powered by L3 MAPPS’ unparalleled Orchid® suite of simulation products—will elevate your engineering team to new heights in addressing plant design issues, procedural deficiencies, and reliability improvements.

L3 MAPPS simulators provide superior real-world power plant training. We offer a variety of products and services, including full-scope simulators, classroom simulators, engineering simulators, part-task trainers, severe accident simulators, simulator retrofits, learning modules, system knowledge modules, learning simulators and simulator upgrades. We provide design-to-completion turnkey systems, specific components, and simulator design tools as required by the customer. With a worldwide presence, a solid leadership position and our Owners Circle™ service program, L3 MAPPS ensures the success of your simulator projects. Our simulators offer the highest quality in simulation fidelity and training to provide trainees and instructors with user-friendly tools for learning, controlling, and exploring complex power plant systems.

FULL-SCOPE POWER PLANT SIMULATORS

The superior training environments of L3 MAPPS simulators provide clear advantages for obtaining operator certification, optimizing plant operating procedures and reducing costs. Operators trained on L3 MAPPS simulator environments acquire the skills necessary to increase plant performance, minimize downtime, and provide confident emergency response. Simulator uses include interactive team training, severe incident management, plant design testing, and start-up/shutdown optimization.

L3 MAPPS replica-quality hardware controls and touch-screen virtual panels create realistic and credible control environments. Real-time responses to operator actions and interactive instructor controls ensure maximum training effectiveness and adaptability. Any scenario, no matter how complex or dangerous in a real plant, can be reproduced, monitored, and varied in real-time, providing a highly valuable tool for training and plant engineering.

Our commitment to customer support extends far beyond industry norms. L3 MAPPS’ unique knowledge transfer program allows customers to gain expertise and total confidence in the simulator. Users can directly implement simulator modifications to exactly reflect plant changes, evolve their training programs, and expand simulator use into other areas.
USES AND ADVANTAGES

Cost-effective training for:

- Experienced operators and new recruits
- Overall plant and individual system operation and control
- Improved team interaction and performance
- Emergency plan implementation and incident management
- Command of malfunction and transient situations
- I&C familiarization

Other benefits:

- Operations optimization, including start-up and shutdown
- Fewer unplanned outages
- Improved plant safety
- Analysis of plant response to equipment and/or instrument failure
- Efficient plant design planning and upgrading
- DCS and plant process computer verification and validation
- Ease of simulator upgrade and ability to keep current with plant
- Multiple configurations on one simulator
- Portability of simulation for classroom training

SIMULATOR UPGRADES

Evolving training needs, greater fidelity expectations, changing standards, plant modifications, plant fuel updates, obsolescence, and plant life extensions are some of the realities the simulation industry now faces. To keep up, simulator owners need to take advantage of rapid advances in computing technology and implement cost-effective updates. L3 MAPPS provides updates to legacy simulator platforms, including computer hardware, the instructor station, and/or the control room panel interface system. L3 MAPPS upgrades take advantage of available computing power to improve the modeling fidelity of the reactor core, nuclear steam supply systems and all other plant systems.

EXPERIENCE

For over 40 years, we have worked with our customers to create superior training systems and have established ourselves as the world’s pre-eminent manufacturer of power plant simulators. L3 MAPPS is a company of people with ideas and vision, with a desire to create value through innovation and with the experience to achieve success.
Total Development & Simulation Environment

L3 MAPPS has always been known to deliver high-quality simulators. With its advanced suite of simulation products, the Orchid® suite, L3 MAPPS continues along this same tradition with a complete cutting-edge simulation software environment.

The Orchid® tools have been designed to be highly integrated with one another to create an effective and efficient working environment. Each tool follows a standardized approach, providing the same guidelines for menu structure, icons, documentation, and even training material. A focus on using common icons, layouts, themes, and menus has greatly helped us in reducing our users’ learning curve when adopting the Orchid® products.

Orchid® features the latest in graphical user interfaces using an enhanced, modern look-and-feel, and providing an unparalleled level of customizability. Each Orchid® application comes loaded with new features that help our users utilize our tools as efficiently as possible. User manuals, help menus, and tool tips are all accessible directly from within the tools.

Our tools are faster and easier to maintain. Orchid® supports recent releases of third-party software operating systems, database management tools, and software compilers.

Using important feedback from our user community, we’ve incorporated hundreds of productivity features, making the Orchid® product suite a powerful and complete set of tools for all your simulation needs.

With its complete Orchid® suite, L3 MAPPS continues to provide the highest standards of quality to all of our customers, aiming for even higher levels of customer satisfaction.
Orchid® Introduction

- Orchid® Network Loader
- Orchid® Instructor Station
- Orchid® Touch Interface
- Orchid® Graphic Editor
- Orchid® Modeling Environment
- Orchid® Simulator Executive
- Orchid® Core Builder
- Orchid® Multimedia Manager
- Orchid® Sound System
- Orchid® Control System
- Orchid® Communications Exchange
- Orchid® Input Output
- Orchid® Configuration Manager

- Orchid® Instructor Station
  State-of-the-art Modular Instructor Facility for Controlling Simulator Training Environments

- Orchid® Control System
  Simulator-ready DCS Human-Machine Interface Simulation

- Orchid® Simulator Executive
  Graphical Real-time Simulator Task Scheduler

- Orchid® Multimedia Manager
  Effective Simulator Synchronized Training Session Monitoring & Debriefing

- Orchid® Core Builder
  Design-grade Neutronics Rapid Model Development

- Orchid® Graphic Editor
  Development Environment for Graphical Control Panel and Purpose-built Schematics

- Orchid® Modeling Environment
  Advanced Real-time Graphical Component-based Simulation Environment

- Orchid® Configuration Manager
  Fully Integrated Graphical Simulator Configuration Management Utility

- Orchid® Network Loader
  Multi-platform Distributed Simulation Component Loader

- Orchid® Sound System
  Simulator Control Room Sound and Noise Utility

- Orchid® Multimedia Manager
  Emulating Multi-party Communications in Simulation Environments

- Orchid® Control System
  Extending the Benefits of Classroom Simulation while Offloading the Full Scope Simulator

- Orchid® Touch Interface
  Versatile Simulator I/O Communication and Diagnostics
TOTAL SIMULATOR TRAINING CONTROL

Orchid® Instructor Station (Orchid® IS) is L3 MAPPS’ instructor station designed to assist the instructor in controlling the training environment while monitoring all aspects of trainee and simulator performance. Orchid® IS offers a portable, flexible, and functionally rich software solution.

Orchid® IS is an advanced and innovative simulation software package. Its modular design allows it to be integrated into any existing simulator environment or perfectly coupled with L3 MAPPS’ simulations. Orchid® IS comes with full Windows-based desktop and tablet clients.

Integrating advanced features such as the deficiency logger (which creates replay files for noted deficiencies), SBT² supporting scenario-based testing requirement, and AutoTest, which allows for automated regression testing, Orchid® IS helps to truly unlock the value of your training programs.

Orchid® IS is designed with customizability and user ergonomics in mind. High-resolution graphic pages, based on Orchid® GE graphics, create an intuitive and user-friendly interface which can be easily panned, zoomed and cropped for maximum versatility. Dynamic virtual panels and system schematics reflect plant states in real-time, using symbols, readouts, and colors to represent the current simulation status.

To suit the needs of individual users/instructors, purpose-built graphic pages for monitoring and manipulating the simulator can be created on-the-fly.

The scenario manager is an important discriminator of Orchid® IS. Utilizing a graphical flow-chart approach, scenario automation can easily be accomplished by performing actions and capturing them into the scenario in edit mode. This feature, which also incorporates error checking, allows scenarios to be created effortlessly by the instructors by dragging and dropping actions, malfunctions and other steps without any compilation or linking. The scenario manager includes an easy-to-use student assessment system.
Orchid® IS is also equipped with a user-friendly scenario-based testing (SBT²) facility that simplifies data collection, archiving and report generation.

Well-integrated with the other Orchid® applications, Orchid® IS hosts all the Orchid® ME schematics dynamically, allowing the user to search and find any device or object that is part of the model. For example, the instructor could seek an individual fuse and disable it. In this way, the user can access all the model schematics to dynamically monitor and control the modeled plant systems and subsystems in the same way as the virtual panels, making Orchid® IS an ideal classroom tool.

**FEATURES**

- Intuitive and ergonomic graphical user interface
- Built-in security features/exam mode
- Searchable malfunction/remote function menus
- Graphical scenario manager
- Trainee Performance Review for student evaluation and record keeping
- Automated regression testing feature (AutoTest)
- Scenario-Based Testing and Training (SBT²) tool designed to collect and collate all necessary data per the Nuclear Energy Institute (NEI) 09-09 white paper and ANSI/ANS-3.5-2009
- Monitoring, plotting and data recording, including drag and drop capabilities, X vs. Y plots, comparison overlays, savable workspaces and data export to third-party applications
- Ability to access all Orchid® ME graphics in run-time
- Support for various modes of operation: classroom mode, instructor mode, operator mode, engineering mode
- Customizable settings and instructor layout features
- External controls from Microsoft Office documents using the Microsoft Word Add-in feature
- Online deficiency logger (with playback for deficiency resolution)
- Integrated control room panel diagnostics

**BENEFITS**

- Easy to learn and use, reducing training of new instructors
- Convenient initial condition (IC) offline editor reducing simulator maintenance time and effort
- Reduced time and effort involved in regression testing
- Decreased configuration update time, leading to reduced backlog of simulator changes
- Single environment for use in full scope simulator and classroom simulator
DESIGN-GRADE NEUTRONICS RAPID MODEL DEVELOPMENT

Orchid® Core Builder (Orchid® CB) is L3 MAPPS’ graphic tool for the easy creation and validation of cycle-specific fuel data, used by L3 MAPPS’ reactor core model. Orchid® CB provides 2-D and 3-D graphics to fully validate and document the input fuel data and the output model, together with user-defined test reports. Orchid® CB incorporates the Nodal Expansion Method (NEM) to produce advanced reactor kinetics models. The core neutronics model is founded on the fundamental equations of time-dependent neutron diffusion theory. Diffusion equations are solved at each time step using reactor design code techniques. The models developed with Orchid® CB are true two-group, three-dimensional, multi-nodal, fully dynamic models computing in real-time the flux for each node at each time step.

Orchid® CB is based on a technique used for core analysis and/or other engineering purposes. The model solves the diffusion equations using the Nodal Expansion Method (NEM). The flux is represented by a fourth-order polynomial within each node, while leakages are represented by quadratic polynomial expansions. This method is much more accurate in representing the flux than simpler methods, like the finite difference method.
More than a high-fidelity core neutronics model development environment, Orchid® CB provides real-time feedback on simulated neutronic parameters through its unified user-friendly graphical interface. Users can select specific fuel assemblies and obtain axial distributions of the following parameters:

- Power
- Fuel temperature
- Moderator temperature
- Moderator density
- Moderator void
- Xenon concentration
- Samarium concentration

Users also can view and rotate a dynamic three-dimensional image of those same parameters at different axial levels. This way, the user can visualize on a 3-D flux map, in real-time, the core dynamics such as the effect of dropping a rod.

**FEATURES**

- NEM-based simulation
- Automated fuel data conversion for multiple fuel codes
- Capability of fine tuning fuel data
- Graphical user interface showing core neutronics parameters in real-time
- 2-D and 3-D flux maps
- Automated reactor model initialization
- Automated updating of initial conditions following burn-up and/or fuel cycle updates
- Considers power history

**BENEFITS**

- Highly precise core modeling, ensuring realistic responses
- Can be integrated with third-party simulation models
- Easily integrated with thermal-hydraulic models
- Useful as a teaching tool, showing the inner workings of the reactor
- Simplifies core parameters modification
- Eliminates maintenance costs of fuel-cycle updates
RAPID MODEL DEVELOPMENT AND RUNTIME ENVIRONMENT

Orchid® Modeling Environment (Orchid® ME) is L3 MAPP’s powerful object-based design and modeling tool for simulators and control systems. It is ideal for modeling complex systems and allows testing under “real world” conditions quickly and inexpensively. Orchid® ME is designed to support collaborative team efforts by allowing users to design and develop either locally, over a local area network, or remotely to create and run simulations. Orchid® ME represents decades of ongoing simulation and control systems software development. Combining user-friendly design tools, plant data, and interactive documentation, Orchid® ME allows users to quickly build and modify objects, subsystems, and complete simulations, offering unprecedented flexibility and ease of use.

Orchid® ME easily integrates external modules to form a complete simulation for verification and validation of system designs, digital control systems, and future plant improvements.

Orchid® ME utilizes a complete set of library objects, built up with over three decades of experience, to model all components of your power plant, from containment, to control, to electrical, to single and two-phase thermal-hydraulic components. Schematics are quickly assembled to resemble the plant’s piping and instrumentation diagrams (P&ID), allowing objects from different libraries (such as electrical and hydraulic components) to be placed on the same schematic.
Orchid® ME helps users track the evolution of the simulation models by including advanced configuration control and source management features and tools. Visual comparison, revision history and workflow management simplify simulation development, modification and maintenance while ensuring the highest quality standards are met.

FEATURES

- Real-time simulations based on first-principle models
- Graphical icon-based model editors
- Intuitive inter-schematic browsing
- Object-oriented design with automated code generation
- Mature multi-disciplined object libraries and code generators
- Single development environment for all model types, including single and two-phase hydraulics, electrical, and I&C
- Integrated object calibrators
- Debugging, test, and validation capacity
- Multi-user distributed client/server environment
- Customizable user interface
- Open architecture
- SQL database
- Built-in configuration management features to control concurrent simulator updates
- Compound objects
- Drag-and-drop capability
- Pan and zoom navigation schematics
- Link objects and schematics to reference data
- Ability to manage external source code
- Supports multiple versions of schematics and libraries with rollback capability
- Visual version comparison

BENEFITS

- Simulation-based design provides end-to-end validation of conceptual design
- Build, operate, and test designs prior to committing substantial resources
- Objects and models used for all aspects of the project, from conceptualization to implementation and lifecycle support
- Rapid model development and subsystem integration
- Focuses project teams on critical design issues
- Reuse of design simulation for operations/training
- Promotes concurrent engineering
- Provides interoperability with other distributed simulations
- Used for rapid prototyping of control system designs
- Provides detailed runtime graphics for each plant system
Orchid® Control System

INTEGRATED DCS HUMAN-MACHINE INTERFACE SIMULATION

Orchid® Control System (Orchid® CS) is L3 MAPPS’ application for the emulation of operator stations for plant process computers (PPC) and distributed control systems (DCS). Orchid® CS is a real-time data acquisition and control system comprised of geographically distributed nodes. It is used for the monitoring and automation of electrical substations and power generation equipment. Orchid® CS’ well-integrated architecture provides a complete solution to customers, including operator user interfaces and control sequence development tools through the same interface.

Orchid® CS is often accompanied by a system-specific translator that processes the actual plant DCS or PPC control and graphic files to generate emulated solutions. This approach is ideal for testing modifications in the test system and exporting the results to the simulator.
FEATURES

- Built-in support for typical operator station functions: alarms, reports, trends, history, and point data displays
- Built-in graphic editor with on-the-fly modification capabilities
- Automatic graphic display generation
- Automatic database generation
- Built-in interfaces to L3 MAPPS’ simulator modeling and instructor station
- Operator commands logged directly in the instructor station
- Inherent support for simulator commands such as run, freeze, store, restore, backtrack, speed-up, slow-down, etc.
- Built-in database maintenance tools
- Software Development Kit (SDK) available for custom development

BENEFITS

- Provides an economical, flexible alternative to stimulated hardware solutions
- Removes dependency on stimulated hardware, allowing multiple copies of the simulation to be created
- Simulation-based design provides end-to-end validation of conceptual design
- Used for rapid prototyping of control system designs
- Build, operate and test design prior to committing substantial resources
- Rapid control logic updates and integration
- Provides interoperability with other distributed simulations
PHOTO-REALISTIC VIRTUAL PANELS

Orchid® Graphic Editor (Orchid® GE) is L3 MAPPS’ development tool for the creation, modification, and testing of sophisticated real-time graphical displays. Using a true world coordinate system and an advanced tiling and layering scheme, Orchid® GE is capable of creating dynamic virtual panel displays and active schematics used to provide a useful and interactive instructor and/or student simulator interface.

Orchid® GE produces vector-graphics displays that can be magnified without loss of resolution. The graphical displays support full pan and zoom navigation using mouse or keyboard, making Orchid® GE a powerful application for simulation purposes.

Through a simple graphical user interface, Orchid® GE provides access to complete libraries of objects for panel displays and learner-oriented plant system schematics. Each library object is embedded with dynamic functionality accurately reproducing the real device behaviors. Library objects are even equipped with shadows and real-time trend lines, ensuring a truly realistic reproduction of panel displays.

Virtual panels can be easily created by dragging and dropping these objects onto a canvas. Orchid® GE is also unique in featuring a single-world approach to panel graphics, where all panels are laid side by side in a single graphic instead of being separated into segregated panel portions. This allows users to pan across several panels or to zoom into a section across adjoining panels.
Designed specifically for application in training simulators, the virtual panel displays can show additional information, visible only to the simulation instructor (instructor mode) to provide better feedback and control, while the same information is suppressed from the student or operators (operator mode) to prevent negative training from occurring.

**FEATURES**

- Object-oriented design & development
- Pre-programmed dynamic behaviors
- Extensive panel instrument libraries
- Debugging, test, and validation capacity
- Drag-and-drop capability
- Pan and zoom navigation schematics
- Supports single-world graphics (no breakdown of graphics into sections)

**BENEFITS**

- No graphical build step required
- Changes can be made and tested on-the-fly
- Photo-realistic soft panels
- No loss of detail at any magnification
EXTENDING THE BENEFITS OF CLASSROOM TRAINING

Simulator users have already invested in their high fidelity simulators with L3 MAPPS virtual panels which run on the instructor station and which are also available in student mode. Take it a step further with Orchid® Touch Interface (Orchid® TI). Offload the demands on your full scope simulator by reusing the exact simulation software and virtual panels without a significant investment. With new and improved large touch screen technology, L3 MAPPS now brings classroom training to another level with Orchid® TI.

HARDWARE CONFIGURATION

Orchid® TI takes L3 MAPPS’ control and auxiliary room panel displays to a new level of realism. High fidelity panel graphics are displayed on large touch screen monitors with 1080p (full HD) resolution. The monitors are mounted on frames and can be arranged in many different configurations to mimic different control rooms. Orchid® TI can be used on one bay of large touch screens capable of displaying all panels of the control room or several monitor bays configured differently to replicate different control room layouts.

Use one bay of large touch screen monitors or reproduce the entire control room with multiple monitor bays.

The top monitor of the three-monitor bay articulates allowing passage through a standard 32” x 84” doorframe. Each bay is mounted on swivel casters for easy maneuvering from one room to another. Levelling pads are also provided in each bay to fix them in place once they are rolled into their final destination.

A two-monitor version is available for desk operations and a four-monitor version can also be provided for higher control room panels.
USER INTERFACE

Orchid® TI’s touch screen interface allows students to operate the panel graphics manually and obtain life-like visual and audible real-time responses.

To keep training as realistic as possible, the popular panning and zooming of the soft panels in the instructor station are disabled for Orchid® TI, providing individual students and teams the opportunity to know the actual location and orientation of panel devices that are vital to operating your plant. Navigation can be performed from one panel to another providing a realistic layout of panel devices. In addition, Orchid® TI offers the capability to integrate the display, control and navigation of HMI screens (DCS, PPC, etc.) directly in the virtual panels. Several options are offered to optimize the display of such HMI screens.

In a scenario where all panels are not visible at the same time, off-view annunciators can be missed, creating a gap in training. With Orchid® TI, any time an off-screen alarm actuates (annunciators located on panels in an area that the learner is not presently looking at), an indicator appears to warn the student. With a simple touch of that indicator, an overview of the control room is displayed, indicating which panel is in alarm. From that interface, the student can quickly navigate to the alarm.

1. At the bottom screen in each bay, an indicator is always available to access other panel sections.

2. When an alarm or alarms activate on other panel areas that are not in the student’s field of view, the indicator turns red, immediately alerting the student that attention is required on other panels.

3. By touching the indicator, students are presented with a pop up overlay that allows easy navigation to the area of concern. In this example, students can see that they are currently working on MC2 and that alarm(s) should be considered on MC8.

BENEFITS

- Full scale control room training environment at a fraction of the cost of your full scope simulator, capitalizing on the investment you have already made.
- Life-like training environment to augment your current full scope simulator environment, for both individual and team training.
- Offload your full scope simulator by using a device that fits the needs of young learners.
- L3 MAPPS’ client-server architecture guarantees realistic response times for all virtual panels, whether the simulated plant is in normal conditions or a severe transient is being experienced.
- Take full advantage of the powerful instructor station capabilities you already have through Orchid® Instructor Station with Orchid® Touch Interface.
INTUITIVE AND COMPREHENSIVE REAL-TIME SIMULATOR EXECUTIVE

Orchid® Simulator Executive (Orchid® SE) performs the real-time scheduling of the simulation. The simulation modules (or programs) are scheduled for execution by a simulation dispatcher. Dispatchers are organized by synchronous and asynchronous tasks, where the synchronous tasks are assigned a higher real-time priority than the asynchronous tasks, which are not time critical.

Orchid® SE supports multiprocessor multi-core computers, allowing simulations to run in a balanced fashion across all available CPUs. The executive ensures that the task for each processor is synchronized with the master task to ensure real-time execution and repeatability.

Orchid® SE uses a simple graphical user interface, providing access to detailed timing information and enabling the user to drag and drop modules into different time frames. Orchid® SE also offers simulation speed-up and slowdown, and even supports a “free-running” mode.

Orchid® SE integrates performance reporting at the task, frame, or individual module level, and the information is readily displayed on-screen. Each process, band, leg, or module can be unlinked and relinked to the executive through the graphical user interface, allowing the user to perform debugging tests. Each module can also be dragged and dropped on-the-fly into different bands through the same interface, enabling the user to better balance the usage of the different processors.
Orchid® SE also manages the speed of the simulation, allowing overall simulation speed-up and slowdown, and even features a “free-run” mode, allowing the simulator to run as fast as possible. Orchid® SE detects frame overruns and provides error exception handling. Runtime error messages which are generated by the underlying third party compilers (underflow, overflow, floating point exception, array out of bounds, etc.) are indicated in a log window by type of error along with additional information allowing the user to diagnose the issue. This information is stored in a file for post-analysis and debugging.

FEATURES

- Graphical user interface
- Runtime for easy simulator oversight
- Quickly generate timing and logging reports
- Real-time debugging by unlinking and relinking modules on-the-fly
- On-screen timing information
- Extensive timing and utilization reports
- Timing histograms exported to Excel

BENEFITS

- Offers on-the-fly simulator software task management
- Cuts down on effort involved in debugging timing and module order issues
- Improved access to dispatcher information
- Integrates timing and reporting capabilities into a single application
- Provides comprehensive error reporting and debugging capabilities for quick problem resolution
SIMPLIFIED SIMULATOR CONFIGURATIONS MANAGEMENT

Orchid® Configuration Manager (Orchid® CM) is L3 MAPPS’ simulation configuration management application. Orchid® CM manages application software source code and simulator configurations.

Orchid® CM handles all operations required to make modifications and updates to your simulator configuration. Through its easy-to-use graphical interface, the user can access all functions required to update simulator configurations, including database management and regeneration of configuration modules.

Orchid® CM supports Microsoft Visual Studio and Intel Fortran compilers to build the simulation configurations. Through Visual Studio, Orchid® CM offers fully graphical debugging capabilities, allowing the user to effectively resolve simulation issues.

Orchid® CM is used to efficiently manage configurations both locally and over the simulation network. Configurations can be created, copied, renamed, password-protected, backed up, deleted, and restored. Orchid® CM stores all the elements required by the runtime simulator within its configurations, including application model source code, compiled executables, databases, graphics, setting files, initial conditions, and lesson plans. This way each simulator configuration is stand-alone and can be easily dispatched or retrieved in full, at any time.

Orchid® CM has a Portable Simulator (PortSim) feature that exports configurations to a memory stick or portable hard drive. Using PortSim, users can create portable versions of the runtime simulations that can be plugged into most computers and run as a stand-alone copy of the simulation. This feature provides unprecedented flexibility to set up portable simulators that can be used to setup exam scenarios away from the simulation network, or provide a copy of the simulator to students so that they may practice; freeing up time otherwise spent on the Operator Training Simulator.
At the network level, Orchid® CM’s powerful configuration server mechanism can be enabled. This feature addresses the complexity of managing copies of the simulator configuration across different machines, a process that is error-prone if performed manually. Orchid® CM can be configured to point to a central repository of information, through which configurations can be checked in/out from any machine on the network. Orchid® CM indicates the status of local configurations in comparison to those stored in the central repository. Through Orchid® CM, users can check out configurations from the server (either a full configuration with all source, or only the executables and runtime elements) or check in a locally modified configuration to make them available to other machines. Through this mechanism, configuration management errors can be reduced, and redundancy across the network machines can be properly managed.

**FEATURES**

- Support for multiple configurations
- Extensive logging and reporting features
- Graphical debugging capabilities
- Built-in configuration management features
- Configuration check-out/check-in for distributed development environments
- Export simulation to run off a USB key (jump drive/memory stick)

**BENEFITS**

- Reduced maintenance effort and configuration update lead times
- Greatly simplifies complex configuration management tasks
- Allows export of runtime simulation to a memory stick, expanding training capabilities (portable USB Simulator)
- Efficient and centralized management of multiple simulator configurations
MULTI-PLATFORM DISTRIBUTED SIMULATOR COMPONENT LOADER

Orchid® Network Loader (Orchid® NL) is L3 MAPPS’ tool for detecting and controlling simulation software over the network. Orchid® NL works by detecting instances of itself installed across the computer network.

Through Orchid® NL, users can:

- Load and unload the simulation
- Monitor the status of simulations on the different servers across the network
- Identify which machines are online and communicating with other network machines
- Synchronize elements across different computers
- Get quick access to the Orchid® suite, including a dynamic Core Viewer, with the Orchid® Simulation Hub

Orchid® NL provides the flexibility for users to define their own sequences and even create their own scripts, empowering the user to utilize the service-oriented architecture of the tool to its fullest.

Orchid® NL is designed to execute predefined scripts across the simulation network computers, allowing its users to load all the distributed elements of a simulation from a single station, with the click of a button. Regardless of the programs needed to be loaded for the simulation, Orchid® NL will dispatch the load and unload commands across the network, including the plant simulation on the simulation server, the instructor station programs on several workstations, and any other programs on stimulated devices and peripheral machines.

Orchid® NL provides the flexibility for users to define their own sequences and even create their own scripts, empowering the user to utilize the service-oriented architecture of the tool to its fullest.
Orchid® NL’s usefulness is also demonstrated in the classroom setting, allowing instructors to configure and launch the simulation on the various desktops in a classroom. The instructor could choose to load different plant simulations on each student’s computer or configure the entire classroom to run under a single environment.

Orchid® NL also offers powerful synchronization features, allowing users to synchronize various elements of the simulation software across the network machines. Using Orchid® NL, users can dispatch new simulation configurations to all desired server machines, simplifying the configuration update process and eliminating configuration management errors.

FEATURES

- Quick access to other Orchid® tools via the Simulation Hub
- Monitoring status and activity of the separate computers on the network
- Defining subgroups for different simulation networks (classroom, hard panel, etc.)
- Synchronizing feature to dispatch updated elements of the configuration to the selected machines across the network
- Open architecture for creating new scripts and services
- Support for more advanced networking functionality
- Visual warning when a computer is taken offline
- Auto starts when a computer is brought online

BENEFITS

- Simple and easy loading and unloading of the different simulation components
- Provides real-time feedback on network status
- Manages all distributed elements during a simulation load and unload
- Reduces the reliance on simulator staff for loading/unloading of simulator and its components
- Allows for shorter reload times
- Provides synchronizing features, helping to reduce maintenance efforts
EFFECTIVE TRAINING SESSION MONITORING AND DEBRIEFING

Orchid® Multimedia Manager is part of L3 MAPPS’ Orchid® product suite used for audiovisual recording and playback of simulator training sessions. Linked to a simulator control room’s cameras and microphones, Orchid® Multimedia Manager replaces traditional audio-visual recording systems by recording real-time audio and video directly onto a PC-based platform.

Designed to be integrated with any L3 MAPPS simulation or as a plug-in for other simulator platforms, recording and playback are synchronized to the instructor station’s run/freeze and record and replay functions, and enable the user to replay the various video and audio feeds in sync with the simulation playback.

Orchid® Multimedia Manager operates in two different modes, synchronized or stand-alone:

SYNCHRONIZED MODE

Orchid® Multimedia Manager operates in step with the simulation and receives all backtrack, store and restore commands. The instructor can insert manual time markers by simply clicking the marker button within Orchid® Instructor Station. Markers are displayed on Orchid® Multimedia Manager’s progress bar, which also displays all replay points.
STAND-ALONE MODE

Orchid® Multimedia Manager is manually controlled by the instructor for recording and playback. Once the sessions have been recorded, Orchid® Multimedia Manager can be used to replay the various sessions on a separate computer, typically for debrief sessions.

Orchid® Multimedia Manager typically runs on a dedicated PC connected to the simulator network and is displayed on one or more large monitor(s) located in the instructor facility.

FEATURES

- Orchid® Multimedia Manager can easily be connected to an L3 MAPPS simulator or a third-party simulator
- Support for analog and IP cameras (most of the commercially available A/V equipment)
- Orchid® Multimedia Manager’s standard setup supports up to twelve (12) video channels and twelve (12) audio channels
- Orchid® Multimedia Manager can be time-synchronized with the simulator and support synchronized A/V playbacks
- Insertion and display of markers used for post-analysis either directly from the Orchid® Multimedia Manager UI, through a simulator database variable which can be mapped to a hardware button or through an instructor station soft button
- Recording and playback of a selectable set of fifty (50) simulator parameters (e.g. reactor power, levels, flows, etc.) directly inside the Orchid® Multimedia Manager UI to facilitate comprehensive debriefing in Stand-Alone Mode
- IP camera controls integrated directly into the Orchid® Multimedia Manager UI
- Stores files using an industry-standard AVI format which can be replayed using any standard video software program
- Video recording and playback of computer screens (plant computers and DCS pages)
- Preview of all cameras to allow the monitoring and playback of all cameras at all times
- Recording of audio from different microphones separately so that they can be controlled individually during playback
- Provision of audio output during real-time monitoring
- Direct connection to hardware I/O for “on air” indication in the main control room

BENEFITS

- Facilitates the implementation of the U.S. NRC recommendations regarding the video and audio recording (NUREG-1021, Rev. 10)
- Fully synchronized with the simulation functions, such as freeze, run, restore, store backtrack, replay, etc. (no need for manual intervention to start and stop the recording)
- Preview and/or playback available on any computer linked to the simulator network (instructor booth, debriefing room, etc.) with direct access to the recorded A/V
- Debriefing capability outside the simulator network by using the Orchid® Multimedia Manager client (or any commercial video viewer) from external media (flash disk or media device)
- Flexible architecture supporting analog and/or IP cameras and microphones
EMULATING MULTI-PARTY COMMUNICATIONS IN SIMULATOR ENVIRONMENTS

Orchid® Communications Exchange (Orchid® CE) is L3 MAPPS‘ software platform to simulate communications systems for applications within control room training simulators. The platform is fully configurable to simulate any communication system and runs on commercial off-the-shelf (COTS) hardware.

In an actual ship or power plant, operators have access to diverse communication systems such as telephones, public-address systems and touch-capable communication panels to be able to communicate with other areas of the ship or plant.

In a simulated control room, operators must likewise have access to the same communication systems. However, since the remote location being called is not always simulated, instructors in the instructor booth must “role play” the remote site operators. When this occurs, the operator using the communication systems must have the impression that he/she is dealing with an actual remote system operator. This includes dialing the correct number of the remote operator and hearing the appropriate background noises when the communication occurs. Orchid® CE provides the backbone to provide these capabilities.

For most projects, Orchid® CE will require some customization to replicate the exact look and feel of the target communications systems. For example, L3 MAPPS is able to modify an actual plant phone to add simulation capabilities such as processing the dial keys, volume control, off/on-hook, etc. Orchid® CE is based on and compatible with the other Orchid® tools.

Orchid® CE is a flexible platform to simulate communications systems using COTS hardware and software. Orchid® CE provides the ability for instructors to monitor conversations between students, insert background noises and allows them to “role play” in order to provide a realistic training environment.
While customization may be required to interface to plant-specific equipment, Orchid® CE does this entirely with COTS hardware: Windows PCs for call management and sound recording/playing, off-the-shelf amplifiers and adapters for earpiece and microphone interfacing, and L3 MAPPS’ compact I/O solution for pushbutton, keypad, and visual indicators interfacing.

**FEATURES**

- Allows control room operators to make voice calls to outside the control room locations. The calls are automatically forwarded to the instructor.
- Allows the instructor to see which area (telephone number) is being called, and to answer as if the call was being answered from that location.
- The system automatically superimposes background noise if the simulation conditions are in a state which would cause the called location to be noisy. For example, if the operator calls the turbine room and the turbine is running, the operator will hear a turbine rumble during the call.
- Supports various real-life communication modes: one-to-one calls, conference calls, broadcasting, transfers of calls, hold, etc.
- Supports public address and broadcast speakers for general notifications.
- Supports instructor-initiated failures such as dropped lines and communication failures.

**BENEFITS**

- Low-cost emulation of communications systems.
- Use of COTS hardware and software to emulate target communications systems for reduced maintenance costs.
- Fully integrated with simulation environment.
SIMULATOR CONTROL ROOM SOUND GENERATION

Orchid® Sound System (Orchid® SS) is L3 MAPPS’ application for simulating plant sounds in the main control room. Orchid® SS is designed to enhance simulations with a set of sounds played through the simulator sound system, allowing for a truly realistic training experience. Orchid® SS supports a variety of sounds and noises, from control room ventilation background noise, to the opening of Atmospheric Steam Valves or the winding up of the large Reactor Cooling Pumps.

Orchid® SS uses DirectX technology to play recorded “.wav” plant sounds automatically triggered by the simulation models. Orchid® SS allows the remote activation of these sounds in a continuous or single play-fashion. Special sound algorithms such as audio count rates are also supported.
FEATURES

- Multi-channel system allows playing simultaneous sounds in the simulator main control room and/or in different rooms
- Full control of individual sound volume and frequency Global sound volume control
- Client/server architecture
- Can be used in classroom simulators to provide full audible feedback
- Supports earthquake simulation
- Can also be installed with Orchid® Touch Interface

BENEFITS

- Supports full range of sounds and noises
- Provides audibly realistic training sessions
- Inexpensive implementation of sound generator
- Supports use of off-the-shelf sound cards
- Can be connected to commercially available speaker systems
Orchid® Input Output

SIMULATOR INPUT/OUTPUT CONFIGURATION AND GRAPHICAL DIAGNOSTICS

Orchid® Input Output (Orchid® IO) is L3 MAPPS’ software application for communication with the simulator control room hard panels. The I/O system drives a multitude of switches, lamps, meters and various other instruments available to the operators in the main control room. Orchid® IO provides users with full graphical control, monitoring, debugging, and reporting capabilities.

Orchid® IO sets itself apart as a smart I/O system, supporting local mathematical manipulation directly in the I/O system itself. This allows for special device handling routines to be embedded into the I/O system rather than adding code on the real-time simulation, ensuring more realistic device responses.

Orchid® IO is designed as a distributed application program, enabling the user to view information from any I/O chassis in the system. Using a graphical user interface, the user can obtain information on the I/O cards of a specific chassis and drill down to the individual I/O point level - the connector pins (analog input, analog output, digital input, and digital output) - to view or set individual point values. Orchid® IO is a state-of-the-art monitoring and debugging application, providing a greater amount of visibility and feedback into the I/O system than other I/O applications.
Orchid® IO supports several independent I/O platforms, including Datapath SC, VDMC, PCI-based, and compact I/O systems. One of Orchid® IO’s strengths is that it can support any combination of these different I/O systems on a single network, allowing our customers to upgrade parts of their systems (just a few I/O chassis, for example) without requiring a full I/O replacement.

FEATURES

- Automatic reconnection if communication between chassis and simulator is severed
- Streamlined communication protocol transmitting only value changes after initial update
- Error checking and reporting at the node level, module level and/or channel level
- Detailed log of all I/O communication events
- Possibility of adding specific point traces and monitors
- Intrinsic support for devices with unwired positions
- Support for mathematical calculations directly within I/O system

BENEFITS

- Provides unparalleled level of visibility and feedback on I/O system
- Equipped with tracing and debugging capabilities for quick troubleshooting and resolution of issues
- Eases integration with complex stimulated devices
- Automated regeneration of points database for quick and painless updates