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NErTet
2016

NUCLEAR EDUCATION AND TRAINING

Sizewell B Simulator Project: Benefiting from the Latest Technology

7 October 2015

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Sales Manager

L-3 MAPPS Power Systems and Simulation



Topics



- About L-3 MAPPS
- Introduction to EDF Energy/Sizewell B
- Simulator Upgrade Scope of Work
- New Learning Technologies
- Project Schedule
- Success Factors
- Conclusions





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About L-3 MAPPS

L-3 MAPPS Power Systems and Simulation



L-3 MAPPS



- **Owned by L-3 Communications (NYSE:LLL)**
 - 2015 Net Sales: \$10.5B
 - Approx. 38,000 employees
 - #252 in Fortune 500 (2015)
- **L-3 MAPPS headquartered in Montreal, Canada**
- **Three Business Areas**
 - Marine Systems and Simulation
 - Power Systems and Simulation
 - Space Systems and Simulation
 - Common technology basis for all three businesses
- **Global Nuclear Power Plant Simulator Leader**
 - From Americas to EMEA to Asia
 - Simulators powered by cutting-edge Orchid®



L-3 MAPPS NPP Simulation

- Pressurized Water Reactors
- Boiling Water Reactors
- Heavy Water (CANDU) Reactors
- Gas-cooled Reactors



L-3 MAPPS Extensive Experience





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Introduction to EDF Energy/Sizewell B

L-3 MAPPS Power Systems and Simulation



EDF Energy's Current Sites

Nuclear



Advanced Gas-cooled Reactor (AGR)

Pressurized Water Reactor (PWR)



Sizewell B NPP

- **Utility:** EDF Energy
- **Reactor Supplier:** Westinghouse
- **Reactor Type:** Pressurized Water Reactor (PWR)
- **Capacity:** 1,191 MW (1 Unit)
- **Date of Operation:** July 1995
- **Location:** Near Leiston, Suffolk, on the East Anglian coast





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Simulator Upgrade Scope of Work

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Scope of Work

- **Phase 1: Platform Migration**

- Computers running Windows Server 2012 (servers) and Windows 7 (workstations)
- Third-Party Software (Microsoft SQL Server, Microsoft Visual Developers Studio, etc.)
- Conversion of legacy simulator SGI platform to Windows-based Orchid® simulation suite
- Interfaces to External Systems
 - Stimulated Distributed Computer System (StDCS)
 - Concentrator Data Centre (CDC system): main control room alarm system
 - Fire Protection and Alarm Status System (FPASS)
 - MicroGovernor touch screen
- Upgrade of the I/O system communication drivers to the latest Orchid® Input Output software
- Audiovisual System (Orchid® Multimedia Manager)
 - Including 10 x PTZ IP HD Cameras

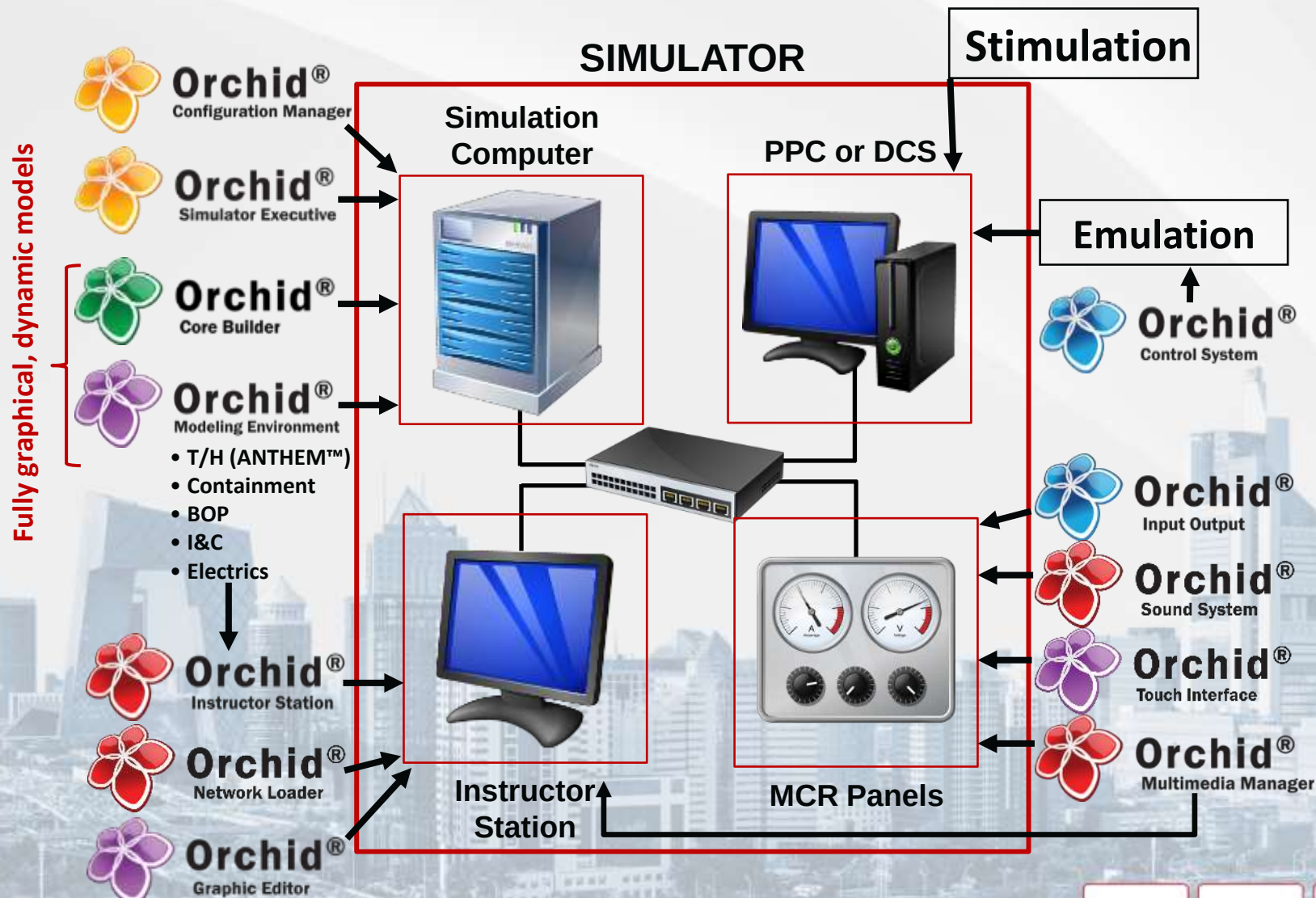


Scope of Work

- **Phase 2A: Models Upgrade**
 - Reactor Core (Orchid® Core Builder → Comet Plus™)
 - Containment (Orchid® Modeling Environment)
- **Phase 2B: New Learning Technologies**
 - Classroom Simulator
 - 6 x Orchid® Touch Interface bays
 - Learning Modules
 - System Knowledge Modules
 - Learning Simulators
- **Comprehensive Documentation**
- **Extensive Training on Simulator Operation & Maintenance**
- **Field Service Representative**



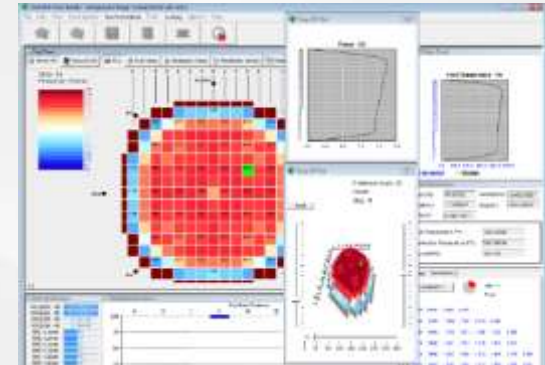
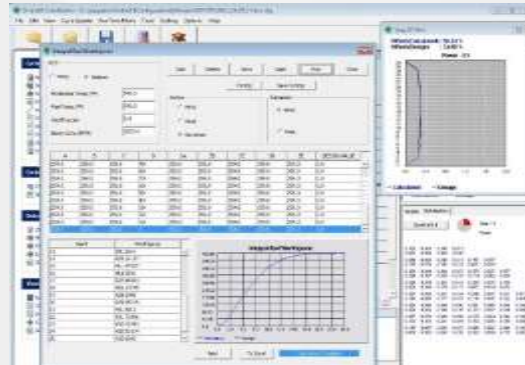
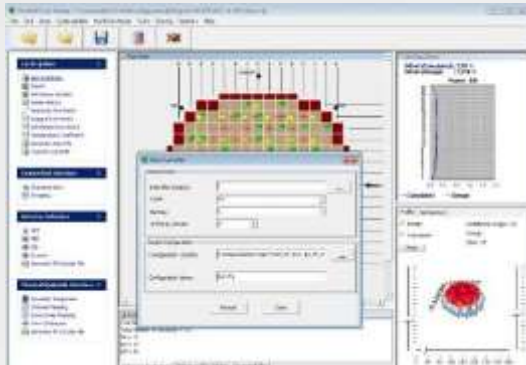
L-3 MAPPS Software Overview



Fully integrated *Graphical Models* for the *Whole Simulator Lifecycle*

Orchid® Core Builder

Reactor Core

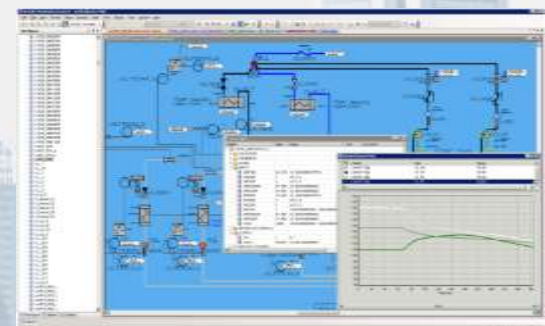
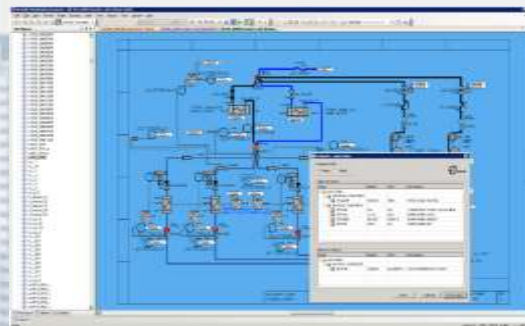
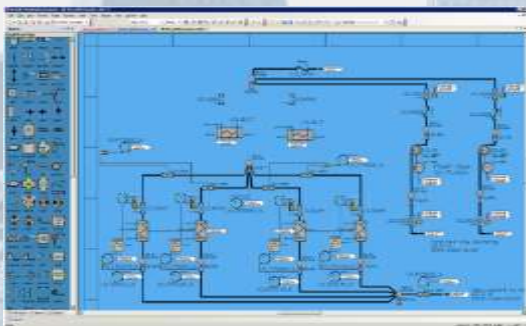


Development

Testing/Validation

Runtime/Maintenance

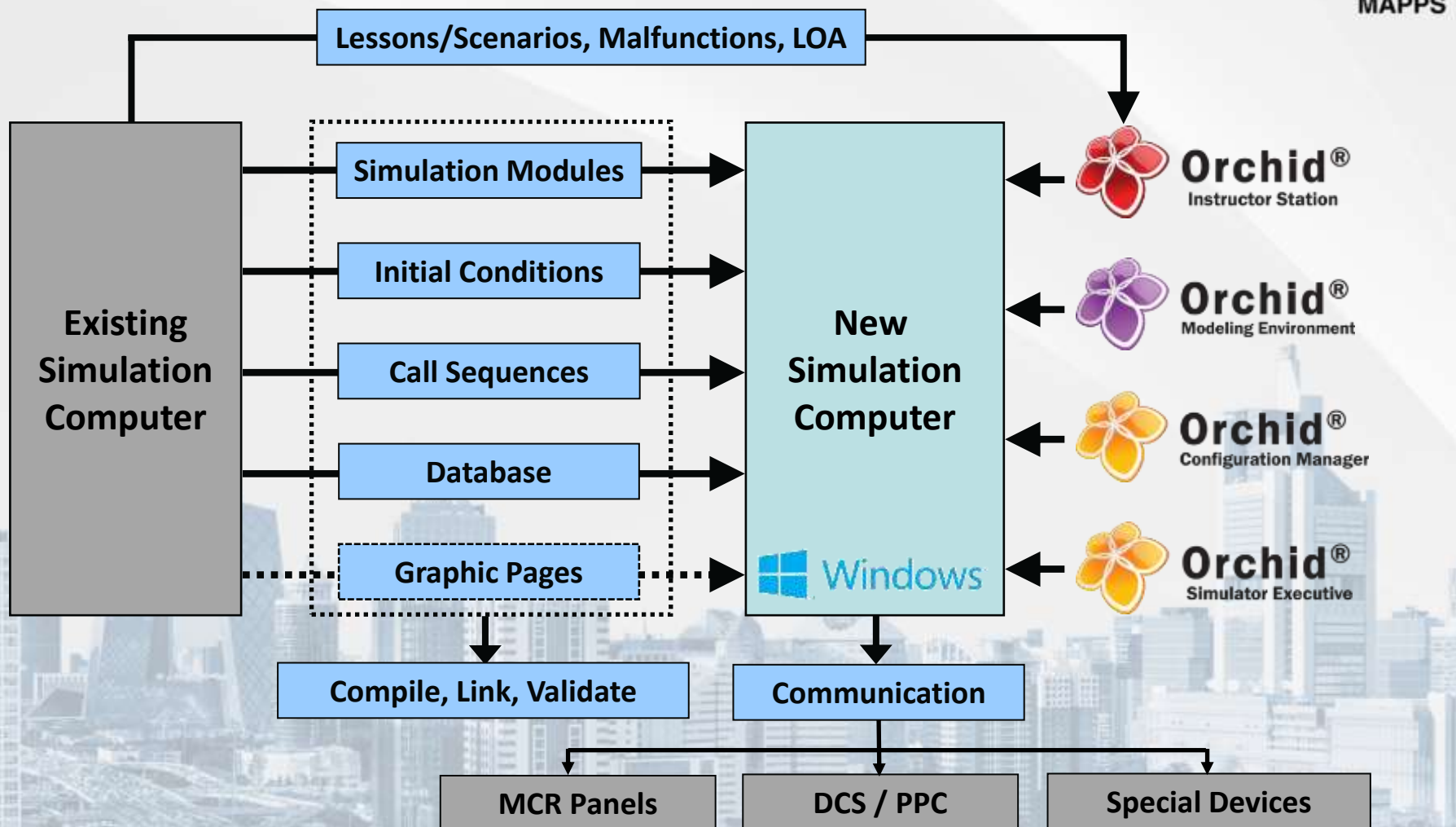
ALL other plant
systems



Orchid® Modeling Environment

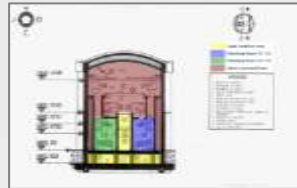


Phase 1 Software Rehost Methodology

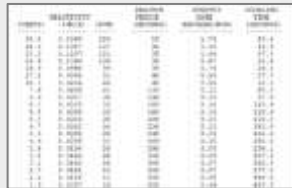


Plant Modeling with Orchid®

Containment



Reactor



RCS



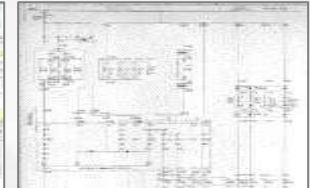
BOP



Electrical



I&C

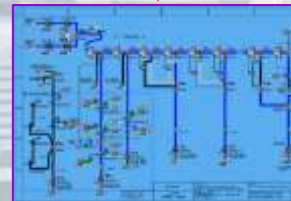
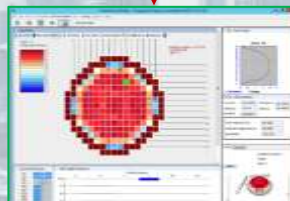
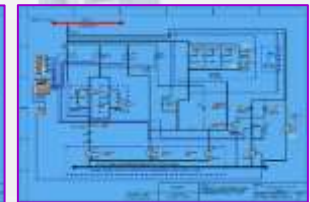


Plant Documents Repository

Plant Documents *synchronized* with Simulation Models

Simulation Models *synchronized* with Plant Documents

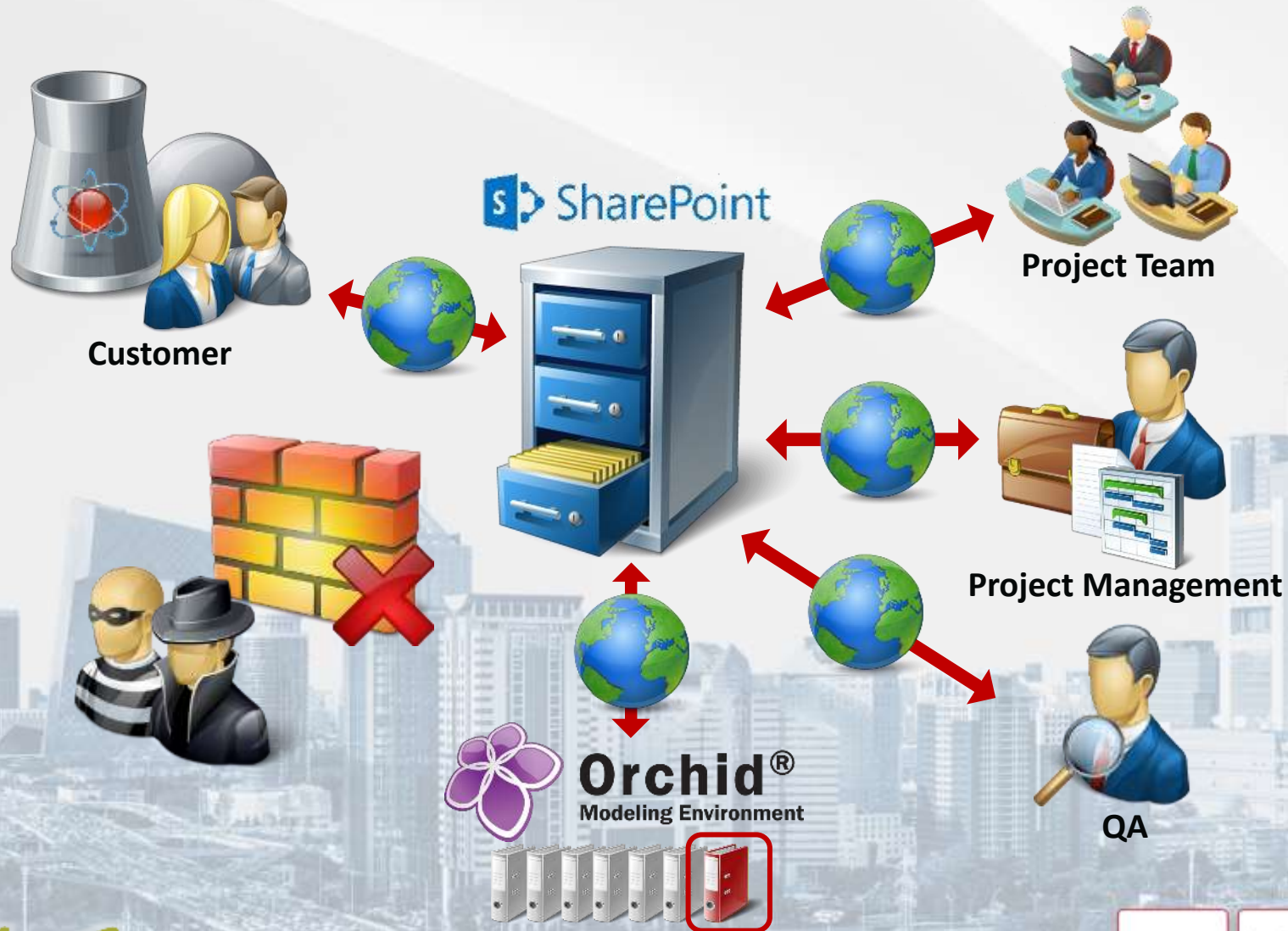
Plant System Models (Orchid®)



Fully Integrated, Interactive Visual Simulation of Whole Plant
Used for Verification & Validation + Operator Training



Project Documentation Control/Management/Access





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Audiovisual System (Orchid® Multimedia Manager)

L-3 MAPPS Power Systems and Simulation

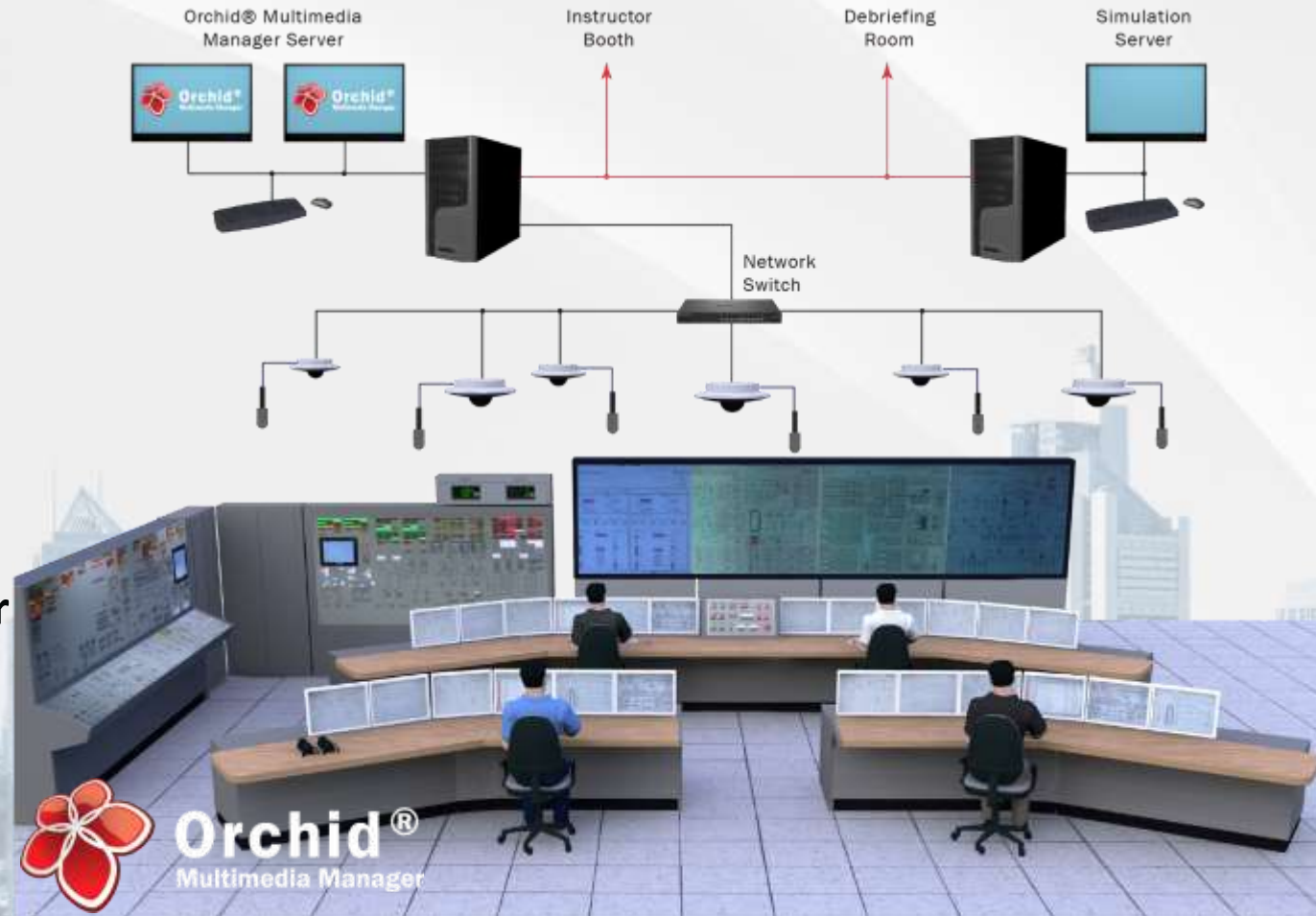


Orchid® Multimedia Manager Overview

- **Networks**

- Simulation
- IP Cameras
- Microphones

- **Connectivity with debriefing room**
- **Fully integrated with the simulator (L-3 MAPPS or third-party)**



Orchid® Multimedia Manager Key Features



- Time-synchronized with the simulator and supports synchronized audio-video playbacks
- Supports analog, IP cameras and IP digital encoders to capture other video sources (DCS, HMI, etc.)
- IP camera controls integrated directly into the Orchid® Multimedia Manager GUI
 - zoom, pan and tilt
- Preview of all cameras in a mosaic display to allow monitoring at all times
- Supports up to twelve (12) video channels and up to twelve (12) audio channels
- Camera and microphone selection during real-time monitoring and during playback (all cameras and microphones are recorded individually)
- Provision of audio output during real-time monitoring
- Stores files using an industry-standard “AVI” format



Orchid® Multimedia Manager User Interface



Mosaic
Preview

Microphone
Controls

Enlarged
Previews



Timeline
with
Markers
(Backtracks
and Manual)

Status Bar:
-Session
-Time
-State

Camera
Controls

Manual Marker
Trigger Button

Playback
Controls

Mode
Control

Volume Control





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New Learning Technologies

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New Learning Technologies



- Classroom Simulator
- Learning Modules
- System Knowledge Modules
- Learning Simulators



Classroom Simulators



- “Second” simulators for Sizewell B training without expense of new full scope simulators
- Displayed on large touch screen monitors with 1080p (full HD) resolution
- Close to life-size virtual panels
- Use one bay of monitors or reproduce the entire control room with multiple monitor bays
- Use bays separately to simulate different control room arrangements
- Sizewell B received six (6) Orchid® Touch Interface bays



- **Fully interactive modules allow user to**
 - Pan, zoom & rotate 3-D model of equipment
 - Control animation playback



Learning Modules Quick Demonstration

L3 MAPPS Learning Modules Library

Ball Valve 	Plug Valve 	Gate Valve 	Globe Valve 
Stop Check Valve 	Check Valve 	Relief Valve 	Safety Valve 
Pinch Valve 	Butterfly Valve 	Parallel Slide Valve 	Needle Valve 
Diaphragm Valve 	Single-Stage Centrifugal Pump 	Multi-Stage Centrifugal Pump 	Reciprocating Pump 

0:00:00



System Knowledge Modules

- **Simple simulation of basic plant systems or loops, such as**
 - Plant heating/cooling systems
 - Flow/level control loops
 - Pump & breaker logic
 - Etc.
- **Simple system representation**
 - Simpler than detailed simulator modeling diagrams to help focus student's attention on what's most important
- **Interactive diagrams**
 - Requires student input to operate the various equipment
 - Real-time status indication provides direct feedback to student actions
 - Can be integrated with L-3 MAPPS Scenario Manager which includes automatic student evaluation system
- **Why not use the full scope simulator models?**





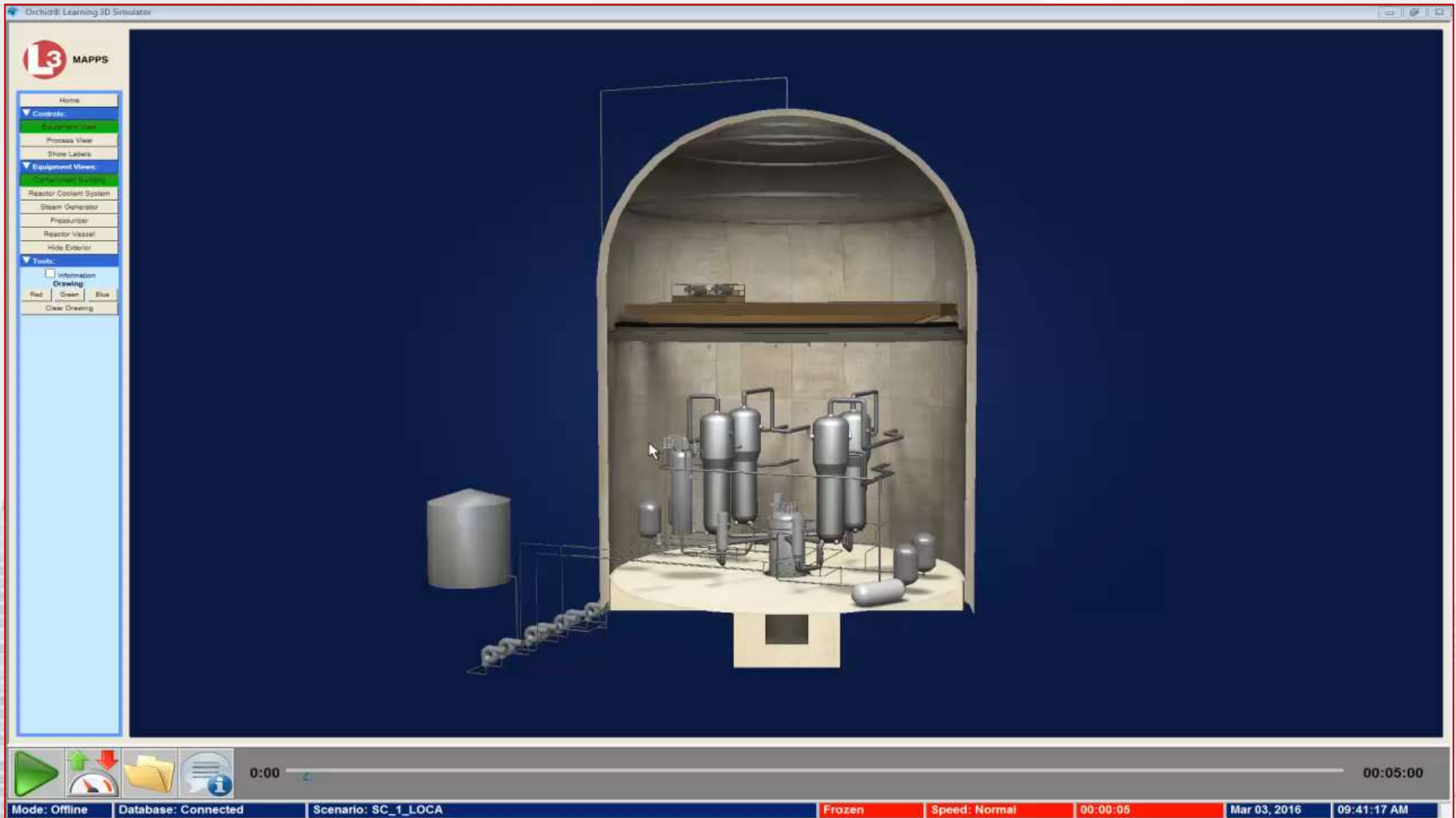
Learning Simulators



- **Designed to assist teaching and learning of major plant transients and the associated systems and behavior**
 - Goal is to increase/accelerate understanding while increasing retention
- **Couples 2-D & 3-D interactive graphic visualization with high-fidelity simulation**
 - Provides a visually rich graphical representation of complex plant events
 - Interactive environment provides engaging student experience
- **Primarily focused on the Nuclear Steam Supply System (NSSS)**
 - All plant systems can be represented in 3-D but the Learning Simulator focuses on the most complex parts of the plant
- **Versatile tool that can be used in**
 - Instructor-led sessions
 - Individual (personal) sessions with built-in, automatic instructional feedback



Learning Simulators Quick Demonstration



Learning Simulators – Training Delivery



- Can be instructor-led
- Blend of 2-D and 3-D animations
- Objective is learning “how something works” vs. “knowing what switch to turn when”
- Can be individually used by students
- Allows students to learn at their own pace and to focus on what they have trouble with
- Designed to guide students in the learning process
- Can be integrated into virtual or full scope simulator control room
- Allows students to understand the consequences of their actions
- Reinforces comprehensive learning instead of procedure learning





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Project Schedule

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Project Schedule



Phase 2



AOC: Award Of Contract
FAT: Factory Acceptance Testing
SAT: Site Acceptance Testing
RFT: Ready For Training

Site Activities





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Success Factors

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Success Factors



- **L-3 MAPPS' knowledge of existing Sizewell B simulator technology**
 - Automatic conversion of simulator data and files
- **Comprehensive data package provided by EDF Energy and prompt responses to data requests**
- **Detailed planning and mitigation plans**
- **Availability of most of the DCSs L-3 MAPPS' Montreal facility during the development and factory acceptance test stages**
- **On-site pre-testing to mitigate risk during the final installation**
- **Outstanding teamwork between EDF Energy and L-3 MAPPS**



Opening of Upgraded Sizewell B Simulator

21 January 2016



Upgraded Sizewell B Simulator Opening Ceremony (January 21, 2016)
From left to right: Jon Heley, Gavin Lancaster, Julie Greenwood, Kevin Gatton, Santosh Sajani, Andy Hill (EDF Energy), Michael Chatani (L-3 MAPPS), Nick Alexander, Nigel Bowerman, Stephen Killalea (EDF Energy), Suzanna Guentoro (L-3 MAPPS), Ian Lowe, Simon Goldenfritz, Nick Biddiscombe, Mike Parkes (EDF Energy) and Bernard Gagnon (L-3 MAPPS).



Upgraded Sizewell B Simulator Opening Ceremony (January 21, 2016)
Jim Crawford, Sizewell B Station Director (EDF Energy) accepts plaque from Michael Chatani (Vice President, Marketing & Sales, L-3 MAPPS) (right).

“Working with L-3 MAPPS, we have been able to embrace new technology to further enhance our nuclear training program here at Sizewell B.”

Jim Crawford, (former) Sizewell B station director





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Conclusions

L-3 MAPPS Power Systems and Simulation



Conclusions

- Once again, EDF Energy and L-3 MAPPS realized a very successful project working together
- In addition to the platform migration and models upgrade, this project gave us the opportunity to introduce several new learning technologies
- L-3 MAPPS is pleased that it has been able to enhance the training program at Sizewell B—a highly valued customer
- This upgrade is the seventh successful project performed for EDF Energy for four sites
 - Hartlepool A – *on time, on budget*
 - Heysham 1 – *on time, on budget*
 - Hinkley Point B – *on time, on budget*
 - Sizewell B – *on time, on budget*





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Thank you

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L-3 MAPPS Power Systems and Simulation

