High Fidelity Operator Training Simulator Implemented Ahead of the Plant Commissioning for a South American Utility

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Overview

• Simulator project Goals & Objectives
• South American Project schedule
• Unique Challenges
• Execution strategy
• Virtual Ovation™ System
• High fidelity modeling approach with JADE™
• Summary
Simulator Project Objective

• GSE and Emerson provided a high fidelity simulator with models and controls indistinguishable from a real-time running plant

• Simulator allows for extensive DCS testing/tuning and operator training prior to plant commissioning
Project Goals

• Test the Distributed Control System (DCS) logic thoroughly ahead of plant commissioning
• Begin training operators ahead plant commissioning
• Configure simulator interface with Emerson Ovation™ Virtual Controllers
Simulator Project Example

- South American coal-fired drum unit located in Chile
Key Project Stake Holders

• Coordinated effort between
  – Simulation vendor, GSE
  – DCS vendor, Emerson
  – Utility company
The customer requested that we analyze block diagram and test the DCS logic ahead of the startup.
Delivery Milestones Aligned with Commissioning Dates

A set of key target milestone dates were established as a result

<table>
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<th>Milestone</th>
<th>Commissioning Schedule Description</th>
<th>Commissioning Date</th>
<th>File Upload to FTP Date</th>
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<td>Initial Firing</td>
<td>9/10/2010</td>
<td>11/1/2010</td>
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<td>TBN Initial Roll</td>
<td>12/6/2010</td>
<td>11/15/2010</td>
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<td>Gen First Syncho</td>
<td>12/20/2010</td>
<td>11/29/2010</td>
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<tr>
<td>4</td>
<td>Initial Coal Firing</td>
<td>1/5/2011</td>
<td>12/15/2010</td>
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Project Implementation Challenges

• Unique project management approach focused on creating a comprehensive simulator within a **limited time frame**

• **Bi-lingual** communication to Spanish-speaking customers by lead project engineer
Project Execution Strategy

- High resource staffing levels due to compressed schedule
- Simulator logistics focused on maximizing productivity and customer interaction
- Operator training available ahead of plant startup
- Simulator retune at site - update the DCS & models with running plant controls after commissioning is complete
High Resource Staffing Levels

• GSE provides 3 to 4 simulator team Engineers
• Emerson provides simulator lead project global simulation Engineer and one project management lead Engineer
• Utility provides operators for testing and I&C technicians for the first initial startup
Project Schedule

• Simulator Schedule
  – 8 month compressed schedule
  – (12 - 14 months typical)

• Extensive review of P&IDs versus scope

• Analysis of external logic outside of the DCS some typical examples include:
  – Smart breakers
  – Plc logic
  – Relay logic
Project Schedule

• Model Acceptance Testing (MAT) at GSE proves the accuracy of models prior to DCS integration
  – Complete startup with functional controls
  – Reduces schedule risk since models will be fully tested before linking them to new controls

• Simulator models interface directly with DCS controls verifies DCS performance prior to plant commissioning
Customer Acceptance

- Factory Acceptance Testing (FAT) at GSE involves plant operators working directly with simulation team to perform startup and shutdown testing
- Variances are documented and corrected
- Site Acceptance Testing (SAT) at customer site. Ensures system performs the same as it does on the factory floor
Simulator Logistics

• A copy of the non-commissioned DCS controls were used for staging at GSE in Maryland

• International component of the project required eight weeks of customer/operator participation in the US
Operator Training and Retune

- Operator Training began prior to DCS implementation on the newly constructed plant

- Simulator retune was performed at the plant site by Emerson and GSE to update the simulator to the commissioned DCS controls
Simulator System Architecture

- DCS converted to Ovation™ virtual controller drops on a virtual controller host (VCH)

- DCS application software (control logic, database, and graphics) are installed on the simulator
Typical Virtual Ovation™ Layout 1
Typical Virtual Ovation™ Layout 2
High Fidelity Modeling Approach

GSE JADE™ software: High Fidelity models of plant systems using a two-phase dynamic solution based on conservation of mass, momentum, and energy

GSE SimExec software: Controls and monitors the execution of solutions in Real-Time Interactively via freeze, run, snap, and reset
Variance Recording System

• GSE, Emerson, and Utility communicate using a discrepancy reporting database accessible via the web called Mantis

• Allows quick and efficient documentation and resolution of data requests, model discrepancies, and DCS discrepancies
GSE Testing Checkpoints for Model Readiness Verification

• Simulator schedule incorporates testing checkpoints throughout project to ensure model readiness
  – System Unit Test (SUT):
    Models tested stand-alone
  – Model Acceptance Test (MAT):
    Models tested integrated together
  – Factory Acceptance Test (FAT):
    Models tested integrated with the DCS
The Advantage of Testing a DCS on a Simulator Prior to Plant Installation

- Allows correction of errors in DCS and ensures the DCS works properly
- Prevents complications during operation of the real plant
- Saves time and money spent on attempting to debug the DCS while controlling real equipment
- Avoids multiple startups/shutdowns needed to make DCS changes
Other Major Benefits of Simulator

• Mimics the real plant for life-long testing and training
• Allows for first pass at field tuning to be performed prior to DCS delivery
• Capable of updating and retuning simultaneously to real plant
• Extensive training for emergency scenarios
• Future DCS logic updates can be tested on the simulator before the real plant
Questions

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