

Simulator Project Profile: Reduce Control System Upgrade Risk through Simulator Controls Checkout

Location: Springerville, AZ

Industry: Power

Process: Coal-fired

Systems: Foxboro I/A DCS, Alstom Turbine Control, SimSci-Esscor High-Fidelity Training Simulator

Customer Objectives:

- High-Fidelity Operator Training Simulator (OTS)
- Controls Checkout Tool
- Reduce risks with new Alstom Turbine Control
- Performance Enhancement Tool



Project Background:

Tucson Electric Power's Springerville Station consists of two 380 MW net, Combustion Engineering Drum Boilers, fired by coal, and with an ABB steam turbine. Constructed in the early '70's, the plant was still on its original Leeds and Northrup analog control system and ABB Turbotrol turbine control system. As these control systems neared the end of their life, the unit could no longer be run in full automatic control. Furthermore, the unit needed upgrading to include overfire air and low NOx burners, and new hydraulic actuators for the turbine stop/control valves.

TEP chose Foxboro I/A as its new automation system. Recognizing that this new Distributed Control System was a major shift away from bench-mounted analog control, and realizing that TEP's main operator workforce was approaching retirement age, TEP also chose SimSci-Esscor to provide a high-fidelity simulator not only for operator training, but also for a detailed control system checkout prior to the unit coming back on-line.

With any major plant upgrade, there are risks inherent with the project – in this case any control system error, even if minor, could delay the unit start up and return to service. In extreme cases, control system errors could cause catastrophic equipment damage. Therefore, the decision to include control checkout on the simulator could easily be justified by a simple economic analysis: assuming each day of lost generation amounts to a loss of \$250,000 to \$500,000, it is easy to see that saving two to four days of outage time could completely pay for the simulator project. However the benefit of the simulator doesn't end there; as the unit returns to service the simulator becomes an invaluable training tool.

SimSci-Esscor, an Invensys company (along with Foxboro), pioneered the Virtual Stimulation approach to simulating the control system with its FSIM™ simulation of the I/A control system. This approach uses the actual I/A controller algorithms, man-machine interface, and DCS configuration tools to provide the most accurate representation of the I/A system. Indeed, controls and graphics can even be moved back-and-forth between the simulator and control room, making the simulator a complete I&C workhorse.

As the project unfolded a unique challenge emerged: in order for the new Alstom turbine control valve actuators to be guaranteed, an Alstom Turbine Control System had to be part of the package. This led to unexpected questions about interfacing to the I/A system, I/O, turbine protection, and operator controls. Able to utilize the power of FSIM, the project was modified to include connection to GE Fanuc PLC 90-70 and 90-30 controllers, running the Alstom Turbine Control System programs.

The simulator and DCS design went through concurrent development, with major DCS loops tested and pre-tuned on the simulator. Feedback from operators using the simulator was used to fine-tune graphics and to make control function changes based on TEP's operating procedures.

Simulator Factory Acceptance Testing found over 350 errors that were identified and fixed before going into the plant. According to Chris Wallace, Simulator Project Manager "Granted that the majority of problems found were minor: graphics configuration errors, simple point mis-connections, etc. However, without the simulator these errors would have to be found while testing on the live unit. It is easily imaginable that even simple configuration errors would take minutes to hours to find and fix, especially in that pressure-cooker environment."

But the real value in the simulator came when the I/A and Alstom control systems were merged: just trying to start the turbine on the simulator uncovered dozens of interfacing problems. More seriously, one error in particular could have caused repeated turbine trips, if not damage, on startup as the initial control valve demand would cause runaway turbine roll-up.

According to Mike Puzzi, Senior I&C Manager for the DCS upgrade project: "I can't believe how smoothly the actual unit startup went, especially with this complicated interaction between Foxboro and Alstom. I think this is directly due to the repeated testing and training we did on the simulator." Rex Brown, TEP Project Manager for DCS Retrofit Project, said "the Simulator saved at least 1 week of start up time due to operators familiarity with the controls and how the controls with the unit". Also an interesting comment from one of the new operators was "without the time he spent on the simulator, he would not have been as confident starting up the unit." He thinks the simulator will continue to be a benefit to operators. Anytime they want to test a runback to understand how the unit will operate, they go down to the simulator and test it out. TEP will be experience less trip's by saving the unit with Foxboro's Intelligent Runbacks because the operators understand how the unit and controls will react.

According to the Plant Manager, Andy Hoekstra, the simulator paid for itself because his operators went through training on the simulator during their normal training cycle. The simulator was on site for 6 months before the new DCS was put into Unit 1.

When all was said and done, testing on the simulator uncovered over 300 necessary changes. This case study should prove that with the right technology and engineering from SimSci-Esscor, simulators are for “more than just training.”

For Additional Information on this topic, contact:

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