



Case Study

Avon Lake Unit 9:

- 650 Megawatt supercritical coal fired unit.
- In-service 1970
- Reliant Energy plant in Ohio.

Solution Facts:

- Medium fidelity simulation.
- Much less than typical cost.
- Standard ABB Conductor NT console with 11,700+ tags
- 70,000+ Bailey DCS control blocks.
- **Direct** execution of binary CFG controller files.
- 26 controllers in 1 PC at real time.
- Maintain with ABB Bailey WinCAD.
- Restore process state in seconds.
- Monitor trends with ABB WindowView
- Test control logic before changing the DCS.

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The Problem at Avon Lake That Needed to be Solved

The Avon Lake power plant is on the south shore of Lake Erie in the western Cleveland suburbs. Avon Lake was originally built as a 4 unit station in the 1920's. Four plant additions increased the number of steam units to nine. Avon Lake Unit 9 was the latest addition in 1970.

Avon Lake Unit 9 is a 650 MW once-through B&W supercritical pulverized coal fired unit with a Westinghouse turbine generator. The boiler capacity is 4,628,000 lbs/hr at 3785 psig and with a 1005 Deg F superheater outlet temperature.

Prior to 2004, Unit 9 operated with a panel mounted control board and an ABB (Bailey) Net 90 DCS system. In 2004, the controls were substantially up-

graded to transition to an Infi 90 DCS system with a much larger CRT based control system. The new Infi 90 DCS has approximately 5000 field IO points and provides automated controls for startup systems, burner management, combustion control, motor controls, main turbine, balance of plant, as well as additional data acquisition and PLC interface.

The new Infi 90 DCS system had been installed and in-place for some 18 months prior to the switchover. During this time plant operations used the new Infi 90 DCS for operator training, but not for control. However, this meant that once the cutover to the new Infi 90 control system was completed, plant operations lost the operator training simulator that they had previously used.

Avon Lake management wanted to retain an operator training facility for two main reasons:

1. Trained replacements are needed to accommodate retirements within 10 years.
2. It is difficult to properly train on a Unit that is designed and intended to be run 100% of the time.

A single operator mistake can cost thousands of dollars in lost generation and may damage equipment. A training simulator can pay for itself by keeping operators trained and preventing potential costly operating errors.

Avon Lake needed a cost effective operator training facility.

The Solution

Before the Avon Lake project, Previs had already developed a Bailey DCS simulator. This simulator mimics the behavior of the Bailey DCS, including function block, CIU, exception reporting, tuning and more. Bailey Infi 90 binary MFP controller files (CFG format) are executed "as-is" within the simulator which executes in a standard Windows PC.

From when the Infi 90 was used for operator training, Avon lake already had a simulation system, consisting of a set of Process Simulation CFG files and a set of DCS controls CFG files. With no field IO, plant simulation used several MFP controller modules, with field IO mapped into the MFP controller modules containing the actual plant control logic.

Within the process simulation CFG files, the systems simulated include burner management, combustion control, turbine control, and part of the balance of plant. Soot blowing air compressor controls and some miscellaneous loops were not simulated.

The current simulation is viewed as a medium fidelity simulation of the plant. Developers used most of the tuning specs used within the real plant. However, by adding & tuning logic, the simulator can be pushed towards even higher fidelity.

The simulator will support any standard Operators Console. However, as Conductor NT v5.0 was used in the control room it was also used within the training facility, with the same HMI screens as in the control room.

Bernie Kruse of Kruse Controls Engineering was able to use WinCAD, connected directly to the simulator, to make all of the final CAD file and tuning changes to complete the simulation. "The ability to use WinCAD and WindowView connected directly to the simulator makes my job a lot easier," says Bernie. In the end the system contained 18 DCS control CFG files and 8 process simulation CFG files, with a total of over 70,000 blocks.



**Avon Lake Unit 9
Operator Training Facility**

Training facility costs included US\$38,000 for Conductor NT nodes, \$59,000 for Bailey DCS simulator engineering (future projects would be less), \$10,000 for turbine simulation & \$23,000 to Integrate latest file versions.

Project leader Kent Hardman at Avon Lake states "Training simulators are not within the budget of many plants. However, the Previs approach made the simulator affordable for us!"

Previs Inc

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Products & Services for Bailey DCS Systems

Previs provides products & services for ABB/Bailey Net 90/Infi 90/Harmony DCS systems. Serving end users, system integrators and engineers worldwide, Previs supplies:

- OPsCon Operator console replacement
- OPC Server
- Bailey DCS Simulator
- Operator training simulator
- Other tools and services

Contact support@previs.com for further information.

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How we did it.

The operator interface to the training facility is via Conductor NT, with the same graphics screens that are used in the main control room. The Avon Lake facility uses two Conductor NT nodes dual screens.

Conductor NT connects via a high speed SCSI connection to a simulated INICI03-SCIL within the simulator.

The Bailey DCS Simulator executes as a service under Windows XP Professional. Though the simulator supports W2003, experience with performance has been excellent with XP.

The simulator is configured at startup via an INI file. Through this INI file, the simulator receives all configuration information including:

- Address for controllers
- Location of controller CFG
- CIU type and address
- Other information

When the simulator starts, it loads the CFG files, performs a cold start and then executes each module & segment at the defined execution time, and generates data exceptions to

the console as if it were a real DCS.

All required function code behavior, inter-module communications, specifications and other aspects are simulated so that the modules perform like real ones.

The end result is that the Conductor NT (or another) console initializes itself to the simulated DCS and sends commands and receives process data as if it were connected to a real DCS.

Connect with WinCAD, WindowView and other ABB tools. Use WinCAD to modify the CFG files, to monitor execution, and to tune as required.

The simulator supports trainer functions (shown on the central CRT screen in the picture at right) to save & restore operational scenarios. Save the 200MW operating state and restore the 600 MW operating state in seconds.

The simulator provides full DCS function at a fraction of the cost.



Training Simulator consists of two Conductor NT nodes with dual screens, and a PC hosting the Bailey DCS Simulator. Other operator consoles can be used, including the Previs OPsCon consoles. Connect to the simulator using ABB WinCAD and WindowView.

