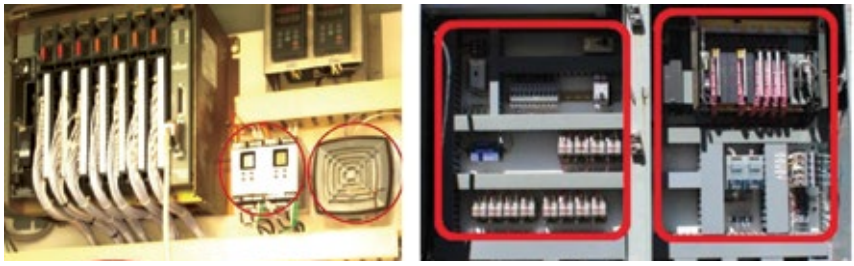
Control system as powerplant brain: The quest continues

Anyone using a state-of-the-art "phone," tablet, pad, or other personal digital assistant (PDA) knows that it has become less a "device" and more of a personal information, entertainment, and life management system.

Similarly, today's powerplant digital distributed control system (DCS) is looking more like a platform for real-time asset management than simply an "automation" system—a fully functioning plant brain, if you will. This broad trend was once again clearly evident at the Ovation Users Group annual conference, held in Pittsburgh, July 26-30, 2015. The meeting was sponsored by Emerson Process Management Power & Water Solutions.

The "big announcement" from President Robert Yeager in the opening session, and threaded throughout later presentations, exemplified this trend. He said Ovation™ now completely integrates a Machinery Health™ Monitor, eliminating the need for a separate vibration and health monitoring system. The "consolidated architecture" includes prediction and protection software and a common cybersecurity platform. The Ovation Machinery Health Monitor (MHM) fits into a spare I/O slot.



1. An Ovation retrofit of the burner management system (BMS) can make use of much existing equipment. Although Emerson specialists develop the logic, NFPA requires the procedure for burner-element staging to be approved by the HRSG and duct-burner manufacturers. Examples of hardware required by the new BMS include field-cable terminal blocks, flame-scanner amplifiers, cabinet heaters/AC, cabinet pressure switch, alarm horn, and utility outlets (left). Examples of hardware that will be removed include internal terminal blocks, interposing relays, PLC, power supplies, data-link hardware, and thermostats (right)

Another integration feature discussed across several presentations is bringing the HRSG duct-burner management system (BMS) into the Ovation platform, adding redundant controllers and power supplies and providing more unit flexibility for coordinated dispatch and faster response to grid and market dynamics.

In general, duct burners are playing more of a role in automatic generation control (AGC). Selectively placing burners in and out of service under cycling conditions helps the plant respond quickly to load demands.

The typical legacy BMS, usually supplied by the duct-burner OEM, is located at the HRSG (that is, local control), programmed on a programmable logic controller (PLC) platform, and has a serial or Ethernet link to the control room for remote HMI.

Today, a locally placed Ovation controller or remote Ovation I/O (with controller in the control room) can be interfaced with some of the existing equipment—such as field cable termination blocks, flame-scanner amplifiers, cabinet heaters/AC, alarm and utility outlets, and enclosure box (Fig 1). All Ovation features—logic, network, troubleshooting, diagnostics, etc—then can be brought to bear on the BMS.

Integrating the BMS and staging burner elements are not trivial exercises. For one, a revision to NFPA 85, the relevant code, was issued last January (2015). Compliance issues include ensuring no single point of failure for the master fuel trip (MFT), MFT relays, and the desire to incorporate burner-element staging. The code also includes two new options for the gas-turbine purge credit when firing liquid fuels.

Also, the startup sequence involves purging the gas turbine and HRSG, purging the duct burner, duct-burner light off, bypass-damper manipulation, and fresh-air firing. The MFT signals must be hardwired directly to the BMS; the operator must, by NFPA code, have a dedicated manual trip button. The bottom line is that while controls specialists can do the programming, the procedure must be approved by the HRSG and burner suppliers.

It stands to reason that any control capability integrated into the main platform not only eliminates hardware, but also potentially troublesome connections, digital language translation, time synchronization, networking hardware, need for spares, and wiring; reduces training and support services; and harmonizes configuration, trending, alarming, setpoints, voting logic, and I/O modules.

Speaking of training, simulation can also be embedded into an Ovation virtual controller. With this feature, operators can train using models integrated directly into the Ovation system. The models are configured using the same engineering tools used to build the control logic. In time, the "integrated" capability will have simulation and control run from a single integrated database, and the "synchronized" version will use real-time data from the plant and additionally provide a look-ahead feature with prognostic capability.

Southern Company's Mississippi Power affiliate already has demonstrated Ovation simulation capability at the "embedded" level for Plant Daniel Unit 3 and is working towards the integrated capability by next year and synchronized "real time" level thereafter, according to Keith Nelson, who presented at the conference.

Finally, Emerson's Steve Schilling offered a round-robin list of features (including the ones described above) coming with the Ovation 3.6 platform now being "teed up":

- Integrated generator excitation systems (Emerson also supplies excitation packages).
- Support for the newly released Windows 10 operating system from Microsoft.
- Ethernet-connected Ovation I/O.
- Faster networks, faster processors, and larger buffers.
- Repurposing of data historian for much faster point scanning with more accurate time stamps and transmitting of the "non-control" points—avoiding the need for a separate historian.
- Ovation playback—or the ability to record and replay an event on Ovation graphics for conducting post-mortem analysis.
- High performance control room with advanced alarm management and analysis based on the ISA 18.2 standard.

In the bragging rights department, the proliferation of Ovation as the dominant powerplant control platform continues. Schilling noted that Emerson controls are represented in half the power-generation capacity serving the US. Glen Wagner reported that the company has recently completed retrofits of Siemens T3000 (with 12,000 I/O points), as well as legacy Foxboro and Honeywell control systems (not combined cycles). Nearly 50 gas-turbine control retrofit projects were booked within the last 24 months in North America alone.

New solutions are in progress for Pratt & Whitney machines, Alstom GT24, and Siemens V84 and V94 engines; solutions have been completed for GE 7FA, 7EAa, and LM6000 machines and are in commercial service. While most readers may associate Ovation with applications inside large powerplants, the platform is versatile and used elsewhere as well.

One example is microgrid management. On Catalina Island, 22 miles off the coast of Southern California, automation technologies from Emerson help Southern California Edison efficiently manage electric generation (Fig 2) and distribution infrastructure.

Ovation provides SCE operators a concise view of all generating assets (including 23 microturbines and six diesel/generators) to meet electrical demand while reducing environmental impact. Plus, it helps SCE manage a battery storage system, the island's LPG plant, and water treatment/desalination facilities. Emerson's SCADA technology contributes by maintaining a stable grid voltage on Catalina while enabling rapid response to changes in demand caused by fluctuations during the tourist season (Fig 3). CCJ

2. Microturbines supplied by Capstone Turbine Corp provide the flexible generating capability required on Catalina Island

3. SCADA technology provided by Emerson Process Management helps maintain a stable grid voltage. Photo is of Catalina's 12-kV switchyard