CONTROL

THE DCS SPIRIT LIVES ON EVERYWHERE

Classic distributed control systems (DCSs) typically remain only in high-availability refining and power applications, but their strategies and capabilities persist in their descendants—digital controls, combined PLC/HMI-based systems, intelligent field devices and even in today's sophisticated networks. **by Jim Montague, executive editor**

It's been more than 10 years since DCSs were forced from their proprietary shells by Microsoft-based software, other commercial off-the-shelf (COTS) computing technologies and emerging open-networking standards. However, even as many shunned the DCS label's connotation of big, old, slow, hardwired systems, developers responded buy making DCSs more flexible and scalable to smaller applications.

"By seven or eight years ago, all the proprietary DCSs with their own hardware were dead," says Rick Pierro, president of Superior Controls Inc., a system integrator in Plaistow, N.H. "Now, all the DCSs run on Dell PCs. They're set up like PLCs and have dedicated controllers arranged on the backplane with I/O and network modules."

Evolution Revolution

"From our perspective, the traditional DCS is a legacy technology that's been replaced by integrated digital automation architecture," says Jane Lansing, marketing vice president for Emerson Process Management (www.emersonprocess.com). "Today's architecture is an open, interoperable, fully digital networking of intelligent components. The first-level computing platform is the field devices, which are digitally bussed with highly modular COTS-based automation systems, and the architecture features fully integrated asset health and management applications. Control and asset management integrated in the same architecture is the 'new world order.' "

In addition, after DCS control made so many of their applications safe, users began to ask how they could help optimize the processes they controlled. "DCSs still provide essential functions for users whose processes must be available 24/7 for four or five years straight; they just run on PCs and laptops now. However, as long as gas can potentially blow up, users will need the high-availability control that only DCSs provide," says Tim Sweet, product marketing manager for Honeywell's Experion Process Knowledge System (PKS) DCS platform. "The big breakthrough for

FIGURE 1.

NOT YOUR DAD'S DCS

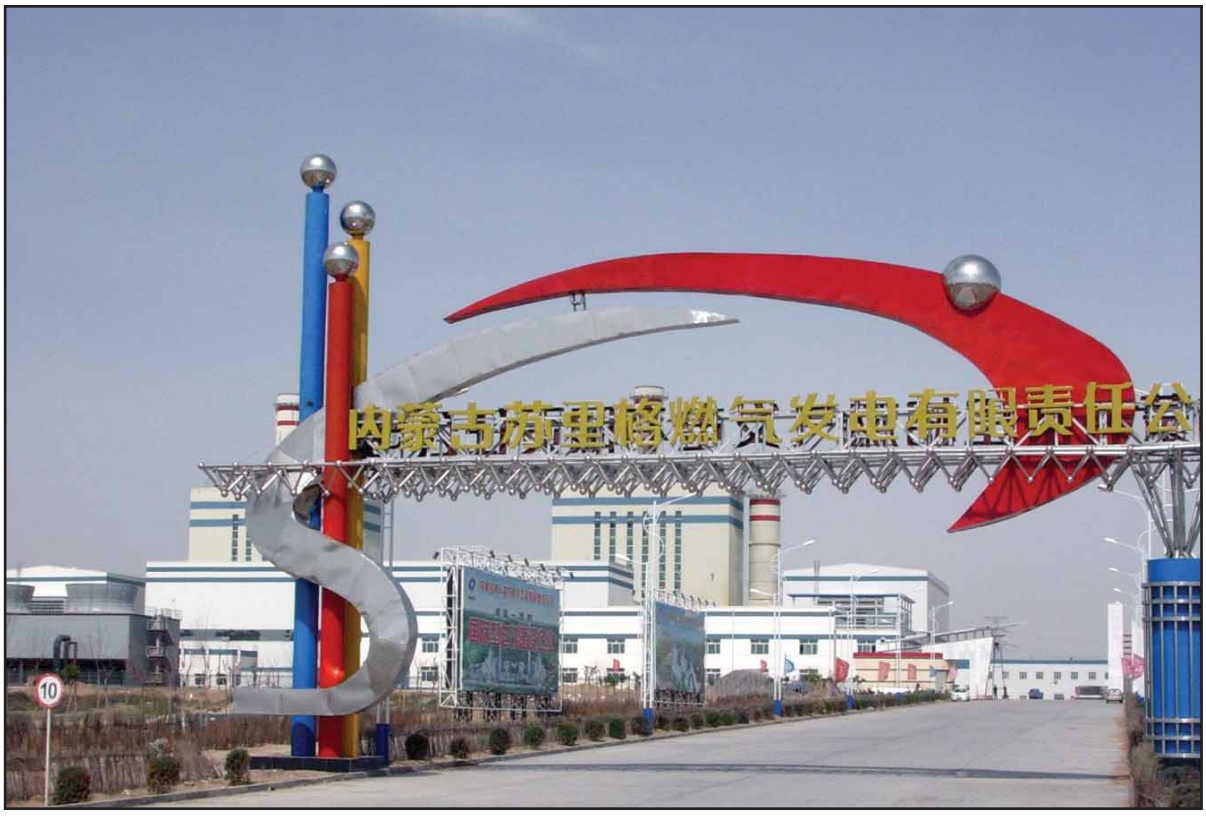
Predictive diagnostics in Foundation fieldbus help instruments improve maintenance efficiency via Asset Management System Suite software at Shell Deer Park refinery. ***Source: Emerson Process Management***

DCSs on PCs came in the mid-1990s when they started to ride Intel's microprocessor power curve, and PCs really started to get data from the processes. Now, plant-floor and IT people are using the same gear, being made to work together and learning to like each other to survive. IT guys now respect and trust that the plant floor is segregated enough from business systems by the right firewalls. I don't get phone calls anymore from plant guys saying they can't work with IT."

Roy Tanner, product manager for ABB's (www.abb.com) 800xA platform, adds that the job description of DCSs has grown, and this has blurred their former boundaries. "DCSs are using a lot more non-proprietary hardware and software, and this has allowed them to get into batch tracking, asset optimization, device management and safety applications. 800xA even has pre-integrated software plug-ins, so our historian doesn't require users to redefine everything again when doing configurations."

FIGURE 2.

POWERING INNER MONGOLIA



Inner Mongolia Solig Gas Power's new DCS system performs balance-of-plant control and links to a 126-megawatt GE PG9171E gas turbine. *Source: GE Energy*

Migration Concentration

To modernize and increase the availability of its catalytic cracker (including a gas-fractionization plant), selective hydrocracker and other process units, Shell Deer Park refinery recently completed a five-year, $125-millon control renovation. This project included implementing Foundation fieldbus via Emerson's PlantWeb digital plant architecture with a DeltaV digital automation system to minimize production losses caused by unexpected equipment failures. After successfully testing DeltaV in 105 fieldbus instruments in its North Effluent Treater, Shell began implementing PlantWeb, DeltaV and AMS Suite device manager software on 1,100 fieldbus devices in its gas-fractionalizaton and catalytic-cracker plants (Figure 1).

"AMS device manager receives diagnostic data from the control network and makes it available for maintenance. The architecture accepts any fieldbus-compliant devices, including our Rosemount pressure, flow and temperature transmitters and Fieldvue digital valve positioners," says Roger Erfurdt, Shell Deer Park's control system manager. "Process information is delivered to and from the controllers via the fieldbus communications protocol, while other systems are integrated by OPC, including the Triconex protective instrument/surge control system and vibration monitoring of 10 critical electric motors and steam turbines/expander turbines.

"Using OPC to facilitate high-speed, two-way communications between the Triconex system and the control room is unique. It's never been done before, and it was accomplished here only after considerable effort. The OPC connection enables operators to view far more data from the Triconex protective system on the same monitors used for process control than in previous systems. The operators are also able to communicate with the Triconex system in case some action must be taken. This allows direct control over several large turbines and compressors through Triconex."

Erfurdt adds that Emerson's personnel helped solve the OPC interface challenge by setting up a lab at their home facility to verify interoperability of the safety shutdown system and identify issues that could affect system performance or operation. As a result, Shell Deer Park operates its catalytic cracker at 100% of planned uptime or greater with no surprises and no unscheduled stoppages. The cracker now processes about 70,000 barrels of feedstock per day and is expected to show an increase in utilization of at least 1%. "The availability of sound diagnostics from the field will enable our operators to

have a better sense of what's going on in their processes and make it easier for them to avoid upset conditions or at least minimize the effects of upsets," adds Erfurdt. "If we can prevent the loss of three or four days of production in a year, this program will achieve its objective. We expect to be successful."

Mimics Go Mainstream

The long debate over whether combining other technologies can adequately recreate DCS capabilities is still going strong. Many developers and users claim that PLCs, HMI/SCADA software, a data historian, an OPC connection and other components can be merged into systems that can do most, if not all DCS jobs, and that traditional DCS functions are just a subset of these overall digital architectures. "We've installed more than 50 large-scale, high-end batching systems with more than 500 I/O each over the past eight years. These were PLC- and HMI-based and tied to relational databases to get directions," says Mark Hoffman, of Automation & Control Concepts Inc., a system integrator in St. Louis, Mo. "None of these applications missed having DCSs at all."

However, other observers say these combined systems still aren't integrated enough to provide true DCS availability. "The real acid test is every year when you need to update your operating system (OS), add new functions or remove software bugs. Can you migrate your DCS from one to another version without shutting it down? If you truly need high availability, how can you add software patches and fix viruses?" asks Sweet. "High-availability has to be architected in. DCSs are built to add upgrades without going off process. Combined PLC/HMI-based displays typically start and stop every day or shift."

New Regions, Greener Fields

DCSs also stay relevant because there are so many "distributed" geographic regions, such as India and China, where users are building plants that need high-availability controls. "The big challenge there is how to deploy massive amounts of control in places where people are just learning the technology," says Sweet.

For example, GE Energy's (www.ge.com/energy) optimization and control division recently installed its DCS solution at the first combined-cycle power plant at the Inner Mongolia Solig Gas Power Co., Ltd.'s facility in Dabuchake town and Wushengqi Eruduosi City (Figure 2). The Solig plant's DCS system performs balance-of-plant control and links to a 126-megawatt GE PG9171E gas turbine, which is controlled by a Mark VI control system. It also controls the heat recovery steam generators, the electrical system and the circulating water controls for Solig's two sets of combined-cycle units. "Standardizing our plant on one supplier will give us the best service and reduce maintenance and operating costs," says Yue Jianhua, Solig's chief director vice chief engineer for Inner Mongolia Power (Group) Co., Ltd.

FIGURE 3.

WHEN DCS WAS NEW

Operators inaugurate the then-new central control room at Saudi Aramco's Shedgum Gas Plant in early 1998.
Source: Saudi Aramco

Networking and Wireless

The next big journey for DCSs—like all other process-control devices and systems—is further into the Ethernet and wireless realms. This may be a familiar trip because DCSs and PLCs have long used fieldbuses to transmit I/O signals via twisted-pair wiring, and now use Ethernet to communicate to other devices and make graphics available via local area networks (LANs), virtual LANs and even wireless LANs.

"Just eight years ago, you needed an $18,000 proprietary gateway to make a Delta V DCS communicate with an Allen-Bradley PLC, but now you can do it with a $10 Ethernet gateway," says Superior Controls' Pierro. "Communication between different DCS and PLC packages and third-party devices also is simplified by OPC, which makes it easier to read register values for temperature, pressure and pH. Previously, we had to write costly and time-consuming I/O drivers." [See this month's *Industrial Networking* cover story for Superior's implementation of a wireless-enabled DCS in a bioreactor application.]

Similarly, Invensys Process Systems (www.invensys.com) just unveiled plans to renovate DCSs at Saudi Aramco's Shedgum and 'Uthmaniyah gas plants, which produce more than 4 billion standard cubic ft./day to fuel local power plants and provide petrochemical feedstock. The company's two largest gas plants have large I/A Series systems, which replaced analog panel board in the late-1990s (Figure 3), and will now be upgraded with Invensys' I/A Series Mesh Control Network via its Address Translation Station (ATS). ATS provides a transparent bridge between I/A Series stations on older Nodebus process control networks and those residing on the mesh network.

"While the DCS industry as a whole has reached a degree of maturity, DCSs continue to evolve in some exciting and beneficial ways, including greater field integration capabili-

ties, increased functional distribution and better integration with other plant- and enterprise-level systems," says Betty Naylor-McDevitt, Invensys' systems marketing director. "We believe that Invensys accelerated this trend with the recent introduction of the InFusion enterprise control system (ECS), which, while not itself a DCS, provides a common engineering, application and information environment across all plant-level systems, regardless of vendor."

Honeywell's Sweet adds that, "It costs a lot to put a sensor into a plant if you have to drill holes, run wires and do individual configurations. People are realizing that wireless doesn't just cost far less, but also allows them to put in many more sensors. This is like having a 10-bedroom house, and being able to have a thermostat in every room. For instance, though Honeywell recently announced a wireless version of Experion PKS, Sweet says it too will have to provide the same 24/7 availability and security that DCSs have always delivered. "We just have to figure out in the lab how to make sure a wireless DCS never drops a critical message, and make sure that no one can hack it," adds Sweet. "Then we have to adapt these methods for use in the field and get people comfortable using them there, though it may take a couple of years."

In short, while the "d" in DCS changed from meaning "distributed" to "digital," it now covers both at a level of intelligence and networking capability undreamed of when DCSs were invented.

"DCS evolution is continuing on the path toward an integrated, open, interoperable infrastructure to which traditional DCS companies add value through their knowledge, support and expertise. The reason for the slow progress here is this change requires modifying DCS business models. It's the business model, not the technology 'managing' the transition to the next generation of open systems," says Ian Verhappen, industrial networks director for MTL Instrument Group (www.mtl-inst.com).

"Once the hardware platform becomes based on industrial-grade, COTS technology with open standards, the added value of process knowledge/integration and long term support will be the differentiators and value adders. As hardware migrates to COTS, it also tends to become commoditized, and a new category of supplier enters this area to supply the needs of the process control industry," he adds.

"The second trend is that DCSs are becoming more truly distributed by migrating more of the control capability to the field. An example of this is the preponderance of remote I/O. However, the point where DCS systems stop from a price/performance ratio, has been traditionally where the PLC has been selected to fill the void," he says. "Unfortunately, the PLC's heritage is that of factory automation and discrete control, and they have a paradigm entirely different from the DCS paradigm. Some suppliers have therefore been building hybrid control products to fill this gap."

DCSs also are useful for capturing the procedural expertise of soon-to or recently retired engineers. DCSs can formalize measurements, collect data based on them and help provide consistent performance recommendations.

"This means users don't need to rely on tribal knowledge as much as they did in the past," says Sweet. "DCSs have evolved from using open-system technologies to working on PCs and onward to wireless. You can't call them dinosaurs."

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