FIELDBUS SOLUTION HELPS CONOCO CREATE INNOVATIVE PLANT

A Greenfield Carbon Fiber Facility Expands Data Access With a Foundation Fieldbus-Based Control System. **By A. Thomas O'Grady**

Petrochemical companies are always searching for new ways to leverage the performance advantages of integrated control architectures, smart field instrumentation, web-based technologies, and other advanced developments.

Conoco Cevolution is a division of Conoco that represents the company's new focus on carbon solutions. Despite being a new business unit, like other chemical producers we are challenged with lowering production costs and increasing revenue.

The company's Ponca City, Okla., manufacturing facility, commissioned in the first half of 2002, will be manufacturing a pitch-based carbon fiber. The material's unique properties enhance products ranging from paintable plastics and portable power sources to automotive parts, concrete panels, and other rugged structural materials. The plant will produce 4 million pounds of carbon fiber per year with the ability to be expanded to produce up to 8 million pounds of carbon fiber per year.

The production facility includes a 70,000-sq.ft. pitch plant and tank farm (Figure 1); a 50,000-sq.ft. manufacturing building for processing, spinning, and fiber customization; and a 50,000-sq.ft. warehouse, maintenance, and administration building. Manufacturing will capitalize on Conoco's 30-plus years of carbon-upgrading expertise and will use a proprietary process to produce carbon fiber products from low-value petroleum feedstocks.

When planning for the carbon fibers project began in the late 1990s, Conoco determined it would employ an innovative method of operating the greenfield plant. Rather than hire operators and maintenance personnel for those specific tasks, Conoco sought out individuals with strong problem-solving skills to fill multi-task roles as part of high-performance work teams. Employees were assigned both primary and secondary functions (for example, an operator might also be required to perform basic instrument repairs). This method of operation not only streamlined the facility's manpower requirements, but set the stage for using new, leading-edge control technologies.

Information Needs Point to Fieldbus

Conoco Cevolution recognized that its non-traditional operating strategy required plant personnel be given complete access to process and business information. The high-performance team philosophy, where each worker functions as a jack of all trades, placed a higher demand on information access. Without a regular instrumentation workforce, it was important that personnel be able to troubleshoot equipment problems before going out into the field.

Based on these requirements, a Foundation fieldbus-based control architecture for the Ponca City facility was chosen. Plant engineers determined that fieldbus equipment would be chosen over traditional I/O whenever possible. With its expanded availability of real-time system and device data, Foundation fieldbus helps plant personnel determine whether a problem is hardware or process-related. Self-diagnostics and automatic reporting functions embedded in fieldbus instruments provide a wealth of information regarding device health and status, allowing operators to quickly identify the nature of instrument malfunctions and other problems. In some cases, it may even be possible to repair or adjust the device remotely.

FIGURE 1.

PERFECTING PITCH

CONOCO CEVOLUTION'S PONCA CITY, OKLA., PLANT WHERE PITCH FLAKES ARE PRODUCED AND READIED FOR EXTRUSION AND SPINNING.

Working with its automation partner, Phoenix-based Honeywell Industry Solutions, Conoco Cevolution began engineering and design work to implement the PlantScape Foundation fieldbus-based solution in the spring of 2000. Front-end loading for the project was scheduled for completion by June of that year.

A major factor in the selection of the PlantScape system was Honeywell's new Fieldbus Interface Module (FIM). A chassis-mounted module combining controller and fieldbus information in a single, unified database, the FIM is designed to

plug into the controller I/O rack like any other I/O card (e.g., 4-20 mA, thermocouple, etc.). However, the FIM component had not been integrated with the PlantScape solution when the control system selection process began. A commitment by Honeywell to complete R&D work on the FIM and deliver the new PlantScape Release 400 by June 2000 helped to convince Conoco to move forward.

A unique characteristic of the Ponca City carbon fibers project was the close cooperation between supplier and customer on the development engineering work. From the outset, Conoco Cevolution's engineers were closely involved in the development process and shared data with their Honeywell colleagues. Both companies staffed a joint project team to manage risks and ensure the FIM and system software were completed on time. Weekly risk mitigation meetings and teleconferences tracked scheduled resolution against actual resolution, and in doing so, allowed the team to identify and mitigate risk.

Device interoperability testing for the multi-vendor fieldbus installation was another joint work process. The interoperability of equipment from a variety of vendors was verified as part of a step-by-step testing plan. Instruments housed at Conoco's construction warehouse were shipped to Honeywell's Fort Washing-ton, Pa., facility, where engineers built templates and downloaded device description files to ensure that all devices on the project would plug and play once installed in Ponca City. Fieldbus segments containing devices of different manufacturers were also tested to determine their load capabilities. Project team members developed a close working relationship with a number of third-party suppliers to obtain device information and correct problems.

Control Provides Flexibility

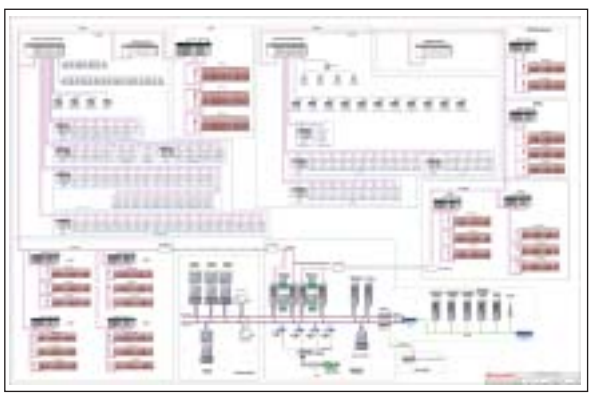
A key requirement for the control strategy implemented at the carbon fiber plant was the ability to integrate information from multiple systems and applications as part of a single, unified architecture. The facility has approximately 3,000 networked I/O points from programmable logic controllers (PLCs) and other devices communicating via five different protocols: Foundation fieldbus, Data Hiway Plus, ControlNet, DeviceNet, and Modbus. As a result, Conoco needed a flexible solution to deliver system-wide integration of data sources, control devices, network connections, and diagnostic information.

As part of the control architecture (Figure 2), Plant-Scape's hybrid controller is unified with the fieldbus database and communicates with a variety of packaged PLCs used for material handling. Unlike a traditional distributed control system, which would have required gateways to the packaged equipment, the Allen-Bradley-compliant hybrid controller provides seamless connectivity to the PLCs.

All communication for the plant control network runs on two redundant servers: a Pitch/Utility/Customization server and a Spinning/Furnace server. Using Honeywell's Distributed Server Architecture, multiple systems across the plant enterprise are integrated without duplication, allowing real-time data access to points, alarms, operator control messages, etc. Furthermore, the network's server-to-server communications regime enhances performance and loading by transferring information between clusters of interested users, rather than between individual subscribers.

FIGURE 2.

AGGRESSIVE INTEGRATION



THE NEW ACHITECTURE INTEGRATES DATA SOURCES, CONTROL DEVICES, NETWORKS, AND DIAGNOSTICS.

Plant personnel also have begun accessing control system data using personal digital assistants (PDAs) connected to the facility's wireless local area network.

While the plant is still undergoing commissioning, some advantages are already apparent:

- Efficient integration: The FIM and R400 software support integration of device data, control, connections, diagnostics, and alarms for plant operators to view on the control system. The facility's control network encompasses 65 FIMs, which integrate 130 Foundation fieldbus H1 (31.25 kbps) segments. Although this bus topology could accommodate more than 1,000 field devices, Conoco chose to limit the loading to roughly 700 instruments. Conoco's installed fieldbus instruments are from five different suppliers, proving interoperability does what it implies.
- Easier engineering: All function blocks within the control system and fieldbus network share a common database and appear in the same control strategies. As such, device and controller functions are easily integrated, and conventional and fieldbus I/O are transparently mixed and matched.
- Robust control: Conoco Cevolution's fieldbus-based architecture protects control integrity by supporting a defining characteristic of the Foundation protocol: the link active schedule (LAS) capability. LAS is a determin-

istic, centralized bus scheduler that maintains a list of transmission times for all data buffers in all devices needing to be cyclically transmitted. Only one link master device on an H1 fieldbus link can be functioning as that link's LAS. In this case, the FIM contains the LAS and controls all aspects of the link, with no dependence on the system beyond power.

- Remote access: The control system's support for virtual private networks allows secure interconnection of servers, or clients and servers, across the Internet or intranets. A case in point: Conoco and Honeywell engineers working at their companies' facilities in Houston can configure the system, modify interlocks, and address control loop problems from their desktops.
- Improved security: A digital video system will allow operators to monitor remote site locations, such as truck/rail car unloading and personnel entry gates, from their PC workstations. Plant personnel also can use PDAs to pick up live video via the digital video system.

Savings Plus Performance

The smaller system footprint achieved through the fieldbus wiring scheme and hardware configuration already has saved the company more than $70,000 in equipment costs.

With Foundation fieldbus diagnostics, operators are able to view detailed status information from their workstations, and make informed decisions about equipment service and repair. Such capabilities will eventually lead to a predictive maintenance program throughout the plant.

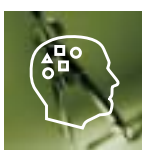
Expanded system and device information delivered by fieldbus also aids in engineering and support functions. The result: reduced field device commissioning and system configuration times, and faster implementation.

Most importantly, robust fieldbus diagnostics support the unique approach to staffing the carbon fibers plant. Without a dedicated instrumentation maintenance department to troubleshoot problems, operators rely on fieldbus data to alert them of equipment failures and process upsets.

Foundation fieldbus also integrates with Experion PKS (Process Knowledge System), Honeywell's next-generation control system, which was released after the Ponca City project essentially was finished.

Installation of a Foundation fieldbus-based control solution is expected to enable Conoco Cevolution's Ponca City carbon fiber manufacturing facility to achieve increased availability and uptime, focused maintenance efforts, reduced equipment failures, and fewer unplanned shutdowns. These benefits should go all the way to the bottom line.

A. Thomas O'Grady is a downstream technology consultant for Conoco's project management group. He may be reached at A-Thomas.O-Grady@conoco.com.



KNOWLEDGE

Some automation suppliers are content looking for results in the usual places. How can that be efficient? Honeywell, with three decades of industrial domain expertise, leads the automation revolution again with Experion PKS.™ A unified Process Knowledge System™ architecture embeds

INNOVATION

advanced applications that capture and manage your organizational knowledge. This innovative approach facilitates workflow collaboration and automates work processes. Applications cross boundaries to achieve results that cannot be touched by typical instrument-centric systems. Expanding visibility and squeezing productivity from places deep inside your process and business operations. Managing and optimizing your assets. Wireless productivity solutions save time and improve data integrity. Knowledge driven applications enable your employees to make smart decisions. Share knowledge. Ensure safe production. Avoid incidents. Experion PKS. An efficient, collaborative production management solution. What else would you expect from the process knowledge expert?

RESULTS

EXPERION PKS

www.co.experionpks.com

U.S.A.: 800-223-8947
Canada: 403-509-1200
Europe: 32 2 728 2450
Asia Pacific: 612 9353 7000
Latin America: 954-845-2600

AR-113

Honeywell

KNOWLEDGE | INNOVATION | RESULTS INDUSTRY SOLUTIONS