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BEST CASES: TURBOCHARGED DCSs DRIVE USERS TO NEW PRODUCTION HEIGHTS

Distributed control systems (DCS) are finally gaining the intelligence to deliver the true control in the field and optimized operations initially promised for them years ago. The advent of increasingly fast, powerful and inexpensive microprocessors is also giving DCSs expanded capabilities to better aid control system migration projects, secure more process application efficiencies, and improve profits for their users. Here are five of the best recent examples of the modern DCS in action, which show how other users can gain the same advantages. **BEGIN**



Table of Contents

IT tools elevate DCS capabilities	3
Solvay system migration doesn't miss a beat	7
Process automation, controls boost production at yogurt plant	9
Let the DCS fit the process	12
Pipeline integrator unifies control, safety, fire and gas	14



IT tools elevate DCS capabilities

Fewer rivalries and better collaboration are allowing distributed processes to apply more IT-based expertise, software and networking to streamline operations—and may even enable more BYOD, if security can be maintained

By Jim Montague, executive editor, *Control*

There's an inevitable progression when process applications and their distributed control systems (DCS) get their first fieldbus connections, Ethernet ports and Internet protocol (IP) addresses—and they all move toward information technology (IT) and its debatable focus on authentication over uptime. Luckily, despite past prejudices and rivalries, there are many useful tools and friends in IT, who can help DCSs take advantage of their increasingly broad and mobile network ties and Internet links.

For instance, [Byworth Boilers](#) in Keighley, U.K., builds industrial steam and hot-water boilers and accessories, including its Unity intelligent boiler-house control system. The company recently sought to improve its controls by reconsidering a boiler as one complex process, which could be better controlled as a single system, instead of depending on several, discrete, standalone controllers for each loop, such as water-level maintenance. Combined with improved sensors to improve control quality, Byworth reports its unified approach to control allows all critical loops and discrete measurements to be combined to produce a holistic system with cross-coupled and feed-forward actions, which produces optimized boiler control at all times, regardless of external variables and disturbances.

To achieve its single-control vision and adopt the most useful control hardware, functional specification, software design and initial commissioning, Byworth evaluated several supporting control systems, and selected [ABB's](#) Freelance because of its DCS-structured, all-in-one database for control and graphical display, compact size, ease of programming and lower cost, and then integrated the new DCS into its own functional control system design (Figure 1). So instead of the usual, fragmented PLC/SCADA solution, Byworth implemented multiple Freelance controllers, usually one per boiler, and then integrated them into its boiler-house system by duplicating Freelance's system code and making slight changes



BIGGER, SMARTER BOILERS

Figure 1: Byworth Boilers recently added ABB's Freelance DCS to its Unity intelligent boiler-house control system, which has an all-in-one database that enables operators to access data analyses and trends from a central user interface or touchscreen, or remotely via PCs, tablet PCs or smartphones. Source: ABB

needed by particular boilers. No master supervisory controller is needed because ABB's network connection between controllers provides one system view from any control position.

Freelance and Unity's system consists of a Freelance 2013: PM 783F controller running on a 2-MB central processing unit, as well as two DC 732F digital I/O modules, one AI 723F analog input module, one AX 722F analog I/O module and Control Builder F Professional software with DigiVis process visualization. Also, a touchscreen PC is used for local display and operations.

"Current integrated systems simply aren't using the data they collect in an effective manner," says Jason Atkinson, Byworth's control system developer. "With Unity, we thought about how all of these discrete signals can be brought together and made to work in a user-friendly system that's far



greater than the sum of its parts. What we're offering is a boiler house that makes intelligent decisions based on multiple pieces of information."

As a result, Unity operators can view boiler-house data analyses and trends relating to many values from a central user interface, built-in touchscreen, or remotely via PCs, tablet PCs or smartphones. These values include Byworth's boiler and manifold pressures, boiler water levels and conductivity, hot-well levels and temperatures, blowdown temperatures, flue temperature and gas analysis, and other ancillary values, depending on boiler configuration.

In addition, all alarms and tests conducted are logged and can be exported to a printer if required, while a straightforward traffic-light warning system alerts users to any changes in plant conditions and draws focus to areas requiring attention or adjustments.

Atkinson adds this comprehensive, joined-up approach to managing multiple processes gives Unity a unique advantage over other control systems, which typically employ third-party applications to control each aspect of the boiler house. Also, several options are available to connect Unity remotely by local area network (LAN) or wide area network (WAN), or more recently, via 3G connectivity. These links help Unity to quickly integrate into machine-to-machine (M2M) architectures, which allows more productive service visits via predictive maintenance and pre-accessing problems as they develop, as well as avoiding expensive, unplanned downtime and costly, energy-wasting, abnormal running conditions.

"There's a need to continuously increase productivity, move equipment closer to processes for better quality and cost effectiveness, and locate people further away from processes for safety, reduced costs and greater efficiency," says Bernhard Eschelmann, technology manager of [ABB's](#) process automation division. "The impact of these goals drive advances in fieldbus and wireless communications; improve cybersecurity; integrate horizontal and vertical systems and automation and electrical applications; enhance operator efficiency in central control rooms with remotely integrated operations; improve value-added functionality such as analyzing data from control systems; and increase uptime by using remote access, diagnostics, services and asset management.

"So, control may be found on any one or multiple levels,

such as drives, controllers, server and smart fieldbus devices, depending on their time, safety and availability requirements. However, there's still a requirement to separate critical process control from IT, but simultaneously more data needs to be provided to the IT environment in a secure way, so more components like routers/switchers, will require IT knowledge at the control level."

Cooperation Cures Misunderstandings

Of course, the improvements in Byworth's boilers are directly assisted by mainstream, IT-supported data processing, networking and software, and these gains are indirectly aided by better working relationships between plant-floor and IT personnel and closer ties among the systems and networks they use. "There are still big chasms between IT and automation infrastructures, but they're getting smaller because today's DCSs have more commercial, off-the-shelf (COTS) hardware and software than ever. And because COTS comes from the IT space, more IT is getting into the control world," says Peter Martin, vice president of business value consulting at [Schneider Electric](#) and a member of Control's Process Automation Hall of Fame. "In fact, the physical platforms used by process control systems (PCSs) are close to becoming indistinguishable from their IT counterparts.

Plant-floor SCADA systems used in PCSs look just like a lot of business hardware and software. So the opportunity now is less integrating two sides because technology has already brought them together, but more rethinking their remaining functional separations. IT is based on business transactions and human-scale schedules, but plant-floor control and computing is based on real-time timeframes relative to processes being controlled. What needed is for IT and automation to be less enamored of new technologies like the cloud, big data and the Internet of Things, and concentrate on specific problems they can solve with them."

Claudio Fayad, marketing director for DeltaV and DeltaV SIS at [Emerson Process Management](#), reports that, "Process control got the IT world's attention when we began using Ethernet and then wireless, but IT and automation soon realized that process applications require different policies than the current IT policies since, for instance, they can't be routinely stopped for software patching. We test patches at Emerson, de-



termine which are critical and which can wait, and work with users to apply them based on their schedules, required latency and service levels. Now the big push is in monitoring networks for threats, so users also need to have the right permissions. So we think the control side won't be invaded by IT, but instead we'll have more IT-friendly capabilities on the plant floor, such as providing reports showing that all users have passwords, or confirming IP addresses for all connected devices. In fact, DeltaV already locks all unused ports, controls MAC addresses and registers workstations on a database according to predefined assignments. Also, our year-old DeltaV firewall contains automation oriented firmware, so it and its users can pick only the servers and communications that they want to exchange data with, document activity, and set up alerts and alarms."

Mark Wylie, global vertical marketing manager at [Belden](#), agrees that IT and controls have converged around Ethernet, but each still retains different priorities. Control systems protect the availability of their processes, but IT protects confidentiality and data integrity. So what they're trying to develop now are hybrid experts that can speak to both worlds, manage their requirements and priorities, and develop well-planned Ethernet networks that can use the strengths of both sides."

Collaboration + Cloud = Efficiency

Similarly, many recent innovations can also help distributed control applications maximize the benefits of cooperation between IT and the plant floor. "There's stronger integration between process control and IT now, but it's still very different than what goes on in the traditional IT world," says Jack Gregg, director of Experion product marketing at [Honeywell Process Solutions](#). "And the latest technical innovations, like virtualized computing and cloud-based engineering, are integrating us even closer. Honeywell and our customers are executing many projects in the cloud. In the past, control engineering work had to be done in one place, but with the cloud, we can work and collaborate from wherever we're at, which also means we can leverage resources anywhere in the world."

Gregg explains that Honeywell and its clients use its cloud-based Virtual Engineering Platform (VEP), which lets users perform design and engineering tasks in a simulated, design-independent environment. This is accomplished by separating physical design and functional design. The func-

tional design can be performed in the cloud or VEP, while the physical design is completed separately, and evolves through the project. "This means functional design engineers can see simulated in the cloud all the displays, I/O points, controls and software they're going to use, and it behaves like the dedicated controls their systems will actually employ later," says Gregg. "So instead of spending a year on a traditional factory acceptance test (FAT), many engineers can now do it in a virtual environment and wait to order hardware until later in their job, which gives them a lot more flexibility and means they won't have to refresh equipment as soon."

Gregg adds that IT staffs understand that patch management is key to a secure and reliable control system, and so tools that help the to deploy software patches safely on the plant floor are crucial. Honeywell's control system patching tool assist in this area by checking that all nodes on a network are up to date, and then applies patches where needed. Honeywell also introduced its Secure Communications capabilities option this past April, which provides encrypted communications between control system nodes, preventing intruders from seeing what users are doing on their networks and stops man-in-the-middle attacks as well. "This is a control system perspective with an IT hat on," says Gregg. "Our technologies are evolving toward virtualization and the cloud. However, to apply them to process controls, safety and security have to be accounted for, risks assessed and addressed, and not just handled afterwards."

Streamlining Longer-Distance Links

Besides cozying up to IT systems in individual process applications and facilities, some DCSs are using their new and improved relations with IT to cooperate on aiding more remote functions. For example, the Summail Gas Plant in the Kurdistan region of Iraq is being developed for power generation by [DNO International](#) in Oslo, Norway, which holds stakes in oil and gas blocks in various stages of exploration, development and production in Kurdistan, Yemen, Oman, United Arab Emirates (UAE), Tunisia and Somaliland. Raw wellhead gas is processed to remove toxic gases and moisture content, and a high-capacity compressor builds up the gas pressure required to fuel its power station.

DNO uses an integrated control and safety system at the Summail plant, which includes process controls, emergency



shutdown, fire and gas detection and alarm annunciation systems, and a fully redundant SCADA server. However, as part of new factory acceptance test (FAT) requirements, the plant's engineers recently learned that safety and control components from [HIMA](#) and [Rockwell Automation](#), respectively, needed to communicate to exchange critical information.

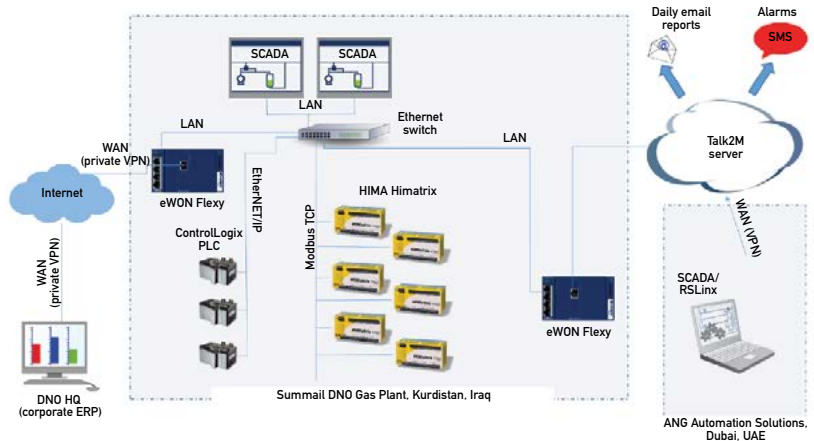
Consequently, system integrator [ANG Automation Solutions](#) in Dubai, UAE, suggested using [eWon's](#) Flexy modular M2M routers for remote access and PLC programming, protocol conversion, SMS alarms to field engineers and daily reporting to DNO's headquarters. Because it can link up and exchange data regardless of the protocols used by the devices it's connecting, Flexy routers were installed and fine-tuned by ANG in several cabinets before they were shipped to the Summail plant. Functioning as a Modbus TCP gateway, three Flexy 201 base modules were used for communication between the HIMA and Rockwell Automation PLCs, and one Flexy 201 base module with a WAN extension card provided remote access, support and troubleshooting from the plant in Iraq to the company's headquarters in Dubai (Figure 2). Combining a WAN card and Flexy gave the main office remote access to its LAN network, including PLC programming, emergency shutdown system, SCADA software and modifications.

Balaji Vedanarayanan, ANG's managing director, reports that eWon's solution was seven times less expensive than a standard system using a gateway and VPN server. "So we were more than happy to take eWon into an oil and gas application," added Vedanarayanan.

Bring Your Own—Securely

Because smartphones and tablet PCs have invaded every area of mainstream life, they're also inevitably showing up in many process facilities. However, the presence of BYOD handhelds is usually tightly regulated to avoid unauthorized communications and access, and the potential for intrusions and data loss.

"Many businesses allow employees to bring personal devices to work and link to their corporate networks, but we're not see-



PLCS PLAY NICE

Summail Gas Plant in the Kurdistan region of Iraq uses three of eWon's Flexy 201 base modules to communicate between HIMA and Rockwell Automation PLCs and one Flexy 201 base module with a WAN extension card to provide remote access, support and troubleshooting from the plant in Iraq to the company's headquarters in Dubai.

ing much of this in the process industries. Most of the BYODs we're seeing are dedicated, secure, point-to-point devices, such as companies giving out tablet PCs, but requiring them to be tied securely to the firm's secure server, and only allowing them to be used for "company business," says Roy Tanner, global marketing manager for 800xA distributed control platform at ABB. "We have heard of some smaller sites and system integrators that use 800xA on their tablets via VPN connection, but these should have at least three to six layers of protection, and probably still shouldn't allow access to control functions. Just like in Jurassic Park, "Nature will find a way," in this case to have control via BYOD and virtualized computing, but they'll first have to prove they have the right security layers in place. For instance, ABB Tropos wireless communications can put different security levels and priorities on different virtual local area networks (VLANs), so users can have different VLAN for controls, video, guests and other functions, and this make it easier to secure multiple devices."

Once security is achieved and maintained, Tanner adds that ABB can display KPIs in a 3D format on 800xA's collaboration table, on energy-harvesting wireless instruments, or on augmented-reality interfaces such as tablet PCs or Google Glass that overlay value-added information onto existing display images.



Solvay system migration doesn't miss a beat

The Wyoming trona ore mine and refinery upgrade from Yokogawa Centum CS3000 to Centum VP-R5 involved two domains, 21 RIO and FIO field control stations, 17 operator stations, six engineering stations and eight different plant servers

By Jim Montague, executive editor, *Control*

The best process controls upgrade project is one that's so seamless, most people don't even know it's going on, says Kevin Kelley, process control foreman at Solvay Chemicals.

It might seem impossible for such a huge, fast-moving and critical project to be so stealthy, but that's exactly what happened earlier this year at Solvay's trona ore mine and refinery in Green River, Wyoming. The facility migrated from Yokogawa Corp. of America's Centum CS3000 distributed control system (DCS) to its new Centum VP-R5 control system, and updated 21 field controllers and numerous other support components.

"We'd migrated from Honeywell's TDC to Yokogawa's CS3000 in 1998," said Kelley during his Sept. 9 presentation at the 2014 Yokogawa Users Conference and Exhibition in Houston. "So we had to upgrade now because our Microsoft Windows XP components were no longer supported in 2014, and their costs were going to go way up. We were scheduled for a five-year, total plant outage, and we needed to update our RIO field control stations with new templates and offline downloads that had never been done since they were initially installed. Also, we had an old infrastructure with PCs that were seven years old, so we were having frequent hardware failures. We also needed to upgrade our system security to meet Solvay's overall corporate IT standards."

Solvay's control system at Green River has about 7,000 individual, hard-wired I/O points and about 3,000 communication I/O points for its SCADA system, PLCs, Honeywell FSC system and other packages. Its controls cover processes that are up to 20 miles apart, and its Yokogawa system resources include two domains, 21 RIO and FIO field control stations, 17 operator stations, six engineering stations and eight different plant servers.

World's Largest Trona Trove

All of these control systems and devices help extract and pro-

cess Green River's abundant trona ore, which contains sodium sesquicarbonate, a relatively rare, sodium-rich mineral that's used to make soda ash. The mine and refinery's trona reserve in southwestern Wyoming is the largest and purest in the world. In fact, it contains 80% of the world's trona with more than 100 billion tons, including 40 billion tons that can be mined with conventional methods.

"The 10-foot seam we're currently mining is 1,600 feet below the surface and is 10 feet thick," reported Kelley. "We use four continuous bore miners to do room-and-pillar mining. They cut curved tunnels that are 8.5 to 9 feet high and 14.5 to 15 feet wide. We also do long-wall mining with equipment that's 10 to 11 feet high and 625 feet wide, and creates tunnels that are a mile long. We mine about 11,000 tons of ore per day from the mine."

Kelley adds that the Green River facility also is defined as a hard-rock, gassy mine because its operations also free about 6 million cubic feet of natural gas per day, which must be vented to keep the atmosphere in the mine at less than 2% methane. Solvay used to simply burn off this gas, but it recently implemented a capture system that gathers the natural gas from its long-wall operation and uses it to help run its refinery. "We were the first in the U.S. to use our waste natural gas as fuel, and we've been doing it for a couple of years," said Kelley. "We compress the 96% to 98% pure natural gas to about 70 psi, and send it to our kilns to subsidize our gas use, which gives us some carbon credits too."

Once the trona ore reaches the surface, it's crushed to ¼ inch or less. Next, it's run through one of four calcination lines that cook the rock at 350 °F. Then water is used to leach out about 6,000 tons of pure trona per day. The resulting liquor is heavy with sodium sesquicarbonate, which is filtered, crystallized and dried into soda ash. This product is an essential ingredient in



“For the total upgrade, we experienced no loss of production, and the plant came back online without any problems. Next, we’re undertaking a project to convert our graphics from the old 1990s style to more high-performance, alarm-oriented graphics.”

Kevin Kelley, process control foreman at Solvay Chemicals.

glass containers and other products, chemical manufacturing, soaps and detergents, flue gas desulfuring, pulp and paper, water treatment and other products and processes. The refinery also produces sodium sulfite and sodium bicarbonate.

Migration Is All About Timing

To keep its operation running smoothly, Kelley explained, “Our biggest challenge on this upgrade project was timing. The plant shutdown was scheduled for the last week of April 2014, and our total plant outage was the first Saturday and Sunday in May. However, although funds were slated for the upgrade two years ahead of time, they weren’t fully committed until the first week of February 2014, making the purchasing process difficult and putting Yokogawa’s standard lead time well past the shutdown deadline. This also made it difficult for us to have the time to install the needed upgrade to infrastructure, cabinets, switches, UPS racks, etc. Fortunately, Yokogawa worked very hard with us and went out of their way to meet our deadlines. The Yokogawa hardware arrived just in time to be installed.”

Kelley reported it was of utmost importance that he and his colleagues at Solvay to perform their needed offline downloads while the plant was down. “We only had 12 hours to do the downloads while the plant power was out and before the power came back on, and the plant started coming back online,” said Kelley. “We had to think of every part and piece ahead of time.”

Besides installing servers, cabinets, control room equipment and other VP-R5 components that were much less cluttered than their CS3000 counterparts, Kelley added that some of Solvay’s staff traveled to Yokogawa’s Houston offices for Centum VP graphics evaluation and training. They determined what their new graphics would look like and evaluated Solvay’s existing CS3000 database of more than 350 graphics to make sure it would cut over to VP’s graphics.

“With our short cutover timeframe, it was important that we maximize our time to do the offline downloads and operator station replacements,” reported Kelley. “This meant that we needed to have all of the infrastructure in place as much as possible when Yokogawa arrived. It involved months of prep work, spec-ing out parts and installing cabinets with UPS power, fiber runs for the

KVMs and Vnet routing. We also pre-mounted the KVM units under the control desks. All we needed to do during the outage was to slide new machines in the racks and hook them up.”

Cutover Time

The first phase of Green River’s cutover involved one Yokogawa engineer, one Yokogawa service technician and four Solvay technicians, who pre-loaded workstations and staged them in the new cabinets. “We also ran reports before the offline downloads that showed us what the modes and status of each block in the control system were. These reports would be used after offline downloads to compare and identify the changes,” added Kelley.

The second phase was Cutover Day and also the day of the plant outage. “The Yokogawa engineer upgraded the field control stations in System View software and performed offline downloads,” added Kelley. “Immediately after the offline downloads, we ran the reports again and then ran a comparison report to identify all the changes in the block modes, so we could return them to the proper mode before the plant start-up. This was a big safety concern that took a few hours to complete.”

The third phase was upgrading and verifying that Green River’s OPC server was up, and that it was gathering data in its AspenTech plant historian. The team also upgraded and verified that its VTSPortal was fully functional and that other EXA and PRM software had the latest revisions.

“Finally, our operator and engineering stations were changed out live, one at a time,” said Kelley. “Each operation area has two HISs. We changed out one station at a time, until each area had one VP station and one CS station. This took two days to complete, and it gave the operators time to get accustomed to the new stations. After the two days, we went around again and changed out the remaining stations. This worked well.

“For the total upgrade, we experienced no loss of production, and the plant came back online without any problems. About one month after the outage and cutover, a Yokogawa engineer returned to the site to do a follow-up. This gave us an opportunity to ask questions about VP-R5 and to tie up any loose ends. Next, we’re undertaking a project to convert our graphics from the old 1990s style to more high-performance, alarm-oriented graphics.”



Process automation, controls boost Production at yogurt plant

PC-based controls provide DCS capabilities, but they can also be implemented and reconfigured more easily than dedicated, hardwired, less software-based systems

By Jim Montague, executive editor, *Control*

Sometimes success can be as challenging as failure. For example, too much demand can be as scary as no demand at all, especially when you're lacking production capacity. This is where process automation — lately in the form of PC-based control — can do its best work.

For instance, after discovering Paul and Grant Mathewson's Australian-style yogurt in Noosa, Queensland, Koel Thomae convinced the brothers to bring their family recipe to the U.S., and start [Noosa Finest Yoghurt](#) at Morning Fresh Dairy in Bellvue, Colo. Launched in 2010, the new company's full-fat product was originally intended for local Colorado consumers, but demand snowballed so fast that Noosa decided in 2012 to build a new, 25,000-square-foot plant just 50 meters from its original facility, so it could expand distribution to all

50 states. However, it also had to move quickly from producing its artisanal yogurt manually to automating production to keep up with its skyrocketing demand.

Along with measuring and metering ingredients by hand, Noosa's operators had been manually monitoring and documenting critical processes, setting up valve-transfer paths, dialing in mixer and pump speeds, and adjusting temperature control valves. Unfortunately, when problems occurred, they had to spend hours troubleshooting, and often could only speculate on the cause because they couldn't backtrack their data and pinpoint the difficulty.

"We had no expectation our product would take off so quickly, but when we picked up some large retail customers, we had to expand quickly to fulfill orders," says Wade Groetsch, Noosa's COO. "The only way we could increase capacity was to automate. We also saw demand increasing well into the future, so to meet production goals, we needed a system that would monitor the process, collect data and allow for easy future expansion. And we needed to track data for our quality assurance and for different regulatory reports required by the FDA."



CULTURE CONTROL

Figure 1: Noosa Finest Yoghurt migrated from manual to automated controls and increased production 300% with no added staff or resources, and reduced lost batches by 96% by adopting the PlantPax process automation system at its expanded plant in Bellvue, Colorado.

Fill More Cups

To ramp up production and process controls, Noosa worked with [Malisko Engineering Inc.](#), a system integrator in St. Louis, Mo., and Denver, Colo., and member of [Rockwell Automation's](#) PartnerNetwork program. In just six months, they jointly designed and implemented an automated control system for yogurt production, clean-in-place tasks and utilities, and integrated Rockwell's PlantPax process automation system, which includes a predefined process system library to enable Noosa's components to work together. This library consists of software-based, HMI process-object tem-



plates with PLC add-on instructions for many process-related functions and control tasks. Using an EtherNet/IP backbone to deliver real-time data throughout Noosa's plant, Malisko's team deployed PlantPax servers on a VMware virtualized host and deployed thin-client HMIs in the plant floor (Figure 1). Also, Microsoft's Active Directory domain controller was installed for user security, and it uses Cisco's VPN firewall for secure, 24/7 access and troubleshooting from anywhere with Internet access.

"The PlantPax system-sizing tools coupled with the pre-defined library of process objects enables us to deploy projects more rapidly," says Dan Malyszko, operations director at Malisko. "The rich functionality of the library's HMI device faceplates allows users to configure and troubleshoot more efficiently, reducing the need to dive into complex PLC code for routine maintenance operations. Users can save approximately 30% on upfront integration costs by using software libraries such as those in the PlantPax system."

Noosa reports its new automation system is easy to set up and operate, and allows operators to capture material tracking information, such as raw milk/cream receiving information, critical temperatures at specific process points, ingredient amounts, batch cycle times and CIP tracking, more easily. Information can now be retrieved to investigate process excursions, which saves troubleshooting time and expense, and eliminates much former guesswork.

This improved visibility into its production process has made Noosa's operations and overall yogurt process much more efficient. In fact, since opening its new facility, the company has increased production capacity by 300% without adding more staff. Likewise, when it started in 2010, Noosa's equipment could only fill one cup of yogurt at a time, but now its two automated lines can fill about 100 cups per minute.

"Our new facility allows us to produce more yogurt, but also produce it more consistently," adds Groetsch. "Our manual process had many inconsistencies and many times resulted in lost batches of yogurt. With the PlantPax system, we've decreased lost batches by 95%."

Finally, because demand for its yogurt is continuing to accelerate, Noosa is presently working on another plant expansion, which it expects to finish by the end of 2014. Aided by the scalability of PlantPax, this new plant will have a redun-

dant, fault-tolerant server architecture. "As new equipment and process units are needed to support demand, Noosa can add more I/O, PAC controllers and servers without adversely affecting the base characterized architecture of the PlantPax system," says Malyszko.

Careful Carbonation

Along with aiding the migration from manual to automated processes, PC-based solutions let users maintain much tighter control and tolerances in their applications.

For example, [Allied Petro Chemical](#) produces petroleum-based distillates at its facility in Alvin, Texas, just south of Houston. The facility has two main sections, including the refining side with two vacuum-distillation towers that separate petroleum distillates to produce naphtha, kerosene, diesel and residual fuel oil, and the additive side that has three reactor units where high-molecular-weight alkylates are sulfonated to produce Allied's SA-320, SA-470 and SA-490 additives. Following initial production, these additives are neutralized and carbonated to create neutral- and over-base calcium sulfonate products. However, sulfonation is a rapid, highly exothermic reaction, so its reaction mass must be continually cooled, and the amount of sulfur trioxide added must be precisely controlled to avoid side reactions and unwanted carbon from forming.

Previously, Allied controlled its refining process manually, but this was labor-intensive, increased potential for errors, and made it difficult to expand the firm's operations and business. Consequently, Joey Kessel, Allied's manager, researched several process control solutions, and selected [Opto 22's](#) Snap PAC hardware and software mainly because control points could be easily mapped and changed in its PAC Control programming software. Specifically, Allied installed Snap PAC S- and R-Series controllers, I/O processors, I/O modules, PAC display software and a plant-wide Ethernet network.

Kessel reports that changing distillation from manual to automatic control delivered several benefits. "It's now easier to achieve and maintain the quality of the final distillate products," he says. "Instrumentation added to the control system makes extensive process data available for production and regulatory purposes, while new equipment monitoring and logging capabilities allow preventive main-



tenance that keeps downtime to a minimum. Having the new control system in place reduced the number of personnel needed to operate the plant by half. Operators are needed at the plant 24 hours a day, so this resulted in significant savings. This also gives staff time to fine-tune production processes, maintain equipment and scale up production.”

Contacting, Coordinating Controllers

Beyond enabling quicker reconfiguration and tighter performance, PC-based controls often can use more closely integrated network connections to achieve more efficient operations — and even help users break into new industries and markets.

For instance, [Repete Corp.](#) in Sussex, Wis., has been building and integrating automation and controls for agricultural milling applications for almost 50 years. These include process-specific controls and plant-wide automation systems for manufacturing fertilizer, mixing animal feed, batching and pelletizing pet food, and processing seed and other products (Figure 2). The company traditionally uses Rockwell Automation’s PLCs and data servers, but when it recently began working with users outside the U.S., it encountered some less familiar PLCs and communication protocols, such as those from Siemens and Mitsubishi. It needed a way to interoperate with any control protocol, as well as prevent downtime that can cost \$50,000 to \$200,000 per hour, so two years ago it launched its FLX software, which interoperates with different controllers with help from [Kepware Technologies’](#) KEPServerEX that uses an OPC server and supports more than 150 communication protocols.

“Our goal has been to become hardware agnostic, so our conveyors, motors, valves, pellet lines, grinders, mixers and other equipment can plug-and-play with different controllers, and allow us to deliver 100% tested solutions,” says Wade Leverett, Repete’s president. “Over the years, PC-based controls have outstripped PLCs, and these PC tools enable us to do regression testing at the push of a button and simulate solutions before we go to a customer’s site.”

Mike Peters, Repete’s operations director, explains that FLX and its OPC server let Repete’s devices communicate



AUTOMATING AGRICULTURE

Figure 2: Repete developed its FLX solution with KEPServerEX software and an OPC server, which allow its conveyors, motors, grinders, mixers and other devices to communicate and work with unfamiliar PLCs in international applications.

with different controls more easily, convert ladder logic instructions with fewer adjustments and handle customers’ change requests much more quickly. FLX also helps operators schedule production runs by taking raw material and other input data, and then creating a unique plan for executing product formulas with users’ available equipment and controls—much like enterprise resource planning software takes in orders. Finally, FLX also allows remote monitoring, diagnostics and control, so Repete can troubleshoot and service clients’ systems without having to be on-site. Consequently, the company is presently building an average of six major integration systems per month, and its ability to communicate with almost any PLC is even enabling it to expand beyond its core focus on food production to serve new industries, such as recycling in Asia and cargo-handling in Europe.

“Every job is a custom job, and we still create many unique solutions, but FLX’s software plug-ins enable us to pull components from our equipment library far more often and implement them faster with less programming and the right controls. Our software and OPC server also link seamlessly with other ERP and management executions systems,” says Peters. “As a result, automation system installations that used to take five or six weeks to put together can now be done in just two or three weeks. In fact, we can simulate a full mill in one business day, and this means a lot less errors and time on-site than with traditional controls.”



Let the DCS fit the process

Distributed control systems (DCSs) are gaining new capabilities, such as integrating with safety systems, to match the unique needs of their process applications

By Jim Montague, executive editor, *Control*

You can't just waltz into a refinery's process control system with mainstream, IT-based computers and expect to be successful.

Big process applications are unique environments—even from one to another—so they need the appropriate controls hardware and software deployed in the correct manner to operate safely and efficiently. One size definitely doesn't fit all when it comes to process control.

This isn't to say that the latest software and smart computing devices can't be used in refineries or other process facilities, but they must be adapted to meet the individual performance requirements of each new setting, especially when it comes to safety. Fortunately, many of today's distributed control systems (DCSs) are gaining some improved capabilities, and getting the chance to perform in new applications.

For instance, 47-year-old [OOO Kirishinefteorgsintez \(OOO Kinef\)](#) is northwest Russia's only oil refinery located near Baltic Sea ports. It has a refining capacity of 19.8 million tons per year, and produces 80 refined petroleum products for the Russian Federation and Europe, including unleaded gasoline, diesel fuels, jet fuel, heating oils, bitumen, hydrocarbon liquefied gases, aromatics and solvents, polyalkylbenzene, linear alkyl benzene (LAB), alkylbenzene sulfur acid (ABSA), normal paraffins, sulfuric acid, sulfur and roofing materials.

To upgrade its process control systems and improve operations and financial performance, OOO Kinef recently implemented [Honeywell Process Solutions'](#) Experion Process Knowledge System (PKS) on its gas fractionating unit (GFU) and crude distillation unit (AT-1). Experion PKS serves as the core control platform, and provides basic process control, safeguarding functions, anti-surge control and compressor equipment protection. Also, the refinery has equipped its two process units with Honeywell's specialized Advanced Alarm Manager software to enable early incident detection and response, alarm initiation analysis and task-specific reporting.

OOO Kinef reports the benefits of its new control system include increased reliability and overall performance improvement, maximized equipment utilization, targeted return in investment (ROI) and faster project implementation and interoperability with its existing systems. "When choosing a control system, we wanted to address the primary objective of automating selected process units, as well as related challenges, such anti-surge control, compressor equipment protection and process safety monitoring," says Vadim Somov, OOO Kinef's general director. "In particular, we're using Honeywell's specialized Advanced Alarm Manager platform to help operators prevent incidents."

Complex Jobs. Added Safety

Besides making existing processes more efficient, DCSs are also implemented to help coordinate automation and safety systems in increasingly complex process applications that must comply with new specifications and regulations.

For example, [INA Rijeka](#) refinery is located at the northern end of the Adriatic Sea near Kostrena and Bakar in Croatia. It recently implemented integrated automation and safety systems on three units at its hydrocracking plant (Figure 1). The project included a new hydrocracking and hydrodesulphurization unit, a hydrogen generation unit, a sulfur recovery unit and a new centralized control facility for all three units. The facility's upgrade was required to enable INA Rijeka to produce Euro V-quality fuels that comply with the European Union's (EU) environmental standards.

The hydrocracking plant's integrated solution consists of [Emerson Process Management's](#) PlantWeb digital plant architecture, including its DeltaV automation system and DeltaV SIS safety instrumented system. In addition, Emerson provided field instrumentation and control valves, and its Asset Management Suite (AMS) predictive maintenance software is used to configure devices on the three process units. Also, Emerson

served as main automation contractor (MAC) and point of contact for three engineering, procurement and construction (EPC) firms working on the project. “Emerson was able to deploy its local resources to coordinate these activities, and ensure the integrated system offered a common user interface for all three units,” says Igor Šepi, INA Rijeka’s refinery director. “Emerson’s project management services helped us start the units up on time and within budget.”

In all, the revamped complex incorporates nearly 50 process controllers, 180 logic solvers and approximately 5,000 process and safety I/O points. Following commissioning, INA Rijek reports its operators were able to bring the plant on stream quickly and smoothly because, prior to start-up, they were trained off-line using Emerson’s OTS simulator. This enabled them to respond to simulated process upsets in an off-line, no-risk environment prior to actual plant operation.

More Product, Less Variability

Beyond optimizing operating conditions, another persistent problem must be solved as process applications produce ever higher product volumes and varieties—how to reduce variability.

For instance, [Glatfelter’s](#) 120-year-old Chillicothe mill in Ohio manufactures 400,000 tons of specialty papers per year on four paper-making machines, which are supplied by a timber yard, bleached Kraft pulp mill, eight batch digesters and four boilers, and also work with one coater and a variety of paper converting machines. The largest of the four machines, nicknamed the Chief, was built in 1980, renovated in 2000, and produces a wide range of specialty products.

However, as product mixes diversified, converting equipment evolved and paper chemistry improved, Glatfelter reports that coating buildups increased on its caliper gauges, which caused more measurement errors and more ridging, roping, wrinkles and other quality problems on its paper. “Bad readings create



DCS ALSO DOES SAFETY

Figure 1: To produce fuels in compliance with EU environmental standards, INA Rijeka oil refinery in Croatia installed integrated control and safety systems in a centralized control room (above) on three units at its hydrocracking complex (top). Photo Credit: Emerson Process Management and INA Rijeka

false control actions, which result in low-quality products, internal rejects and ultimately in low-quality yields,” says Chad Biddix, Glatfelter’s stock preparation superintendent.

To improve its caliper measurements and quality control, Biddix and his colleagues at Glatfelter decided to adopt [ABB’s](#) Extended Automation System 800xA and two Network Platform NPI200 scanners with optical caliper sensors—one at the size press and the other at the reel. These optical caliper sensors stabilize the sheet on one side, and then make a confocal, non-contact measurement on the other.

Following start-up, the benefits of the new control system and scanners were immediate. Glatfelter reports that internal rejects due to caliper errors or mechanical defects caused by poor caliper control were virtually eliminated, and the time needed to make paper-grade

changes was drastically reduced.

“Our controls group and ABB developed an automated paper-grade change process, which allowed us to make paper-grade changes with no losses,” explains Randy Dittman, the Chief’s superintendent. “Even when making the most challenging of changes, we can now reach the right specification in seven minutes. This means that paper-grade changes have less than a 1% impact on our efficiency. Also, despite all the paper-grade changes the Chief makes, its winder remains one of the most productive in North America. The paper must be perfect before going to the winder, which runs at 8,500 feet per minute. If it runs well on our winder, then we can be confident it will run well on our customers’ winders, too.”

Likewise, Dittman adds that 800xA controls allow Glatfelter to study the Chief’s frequency of disturbances, and apply them to the mill’s other machines. “It’s allowed us to link changes in performance to process upsets,” he explains. “This means we’re able to identify and eliminate sources of variation. We can test as much as we want to test. The online, spectral analysis has been a big help with all of this.”



Pipeline integrator unifies control, safety, fire and gas

Sirio Sistemi Elettronici tackles control and safety systems with Rockwell Automation technology

By Jim Montague, executive editor, *Control*

For most of us, two birds with one stone would seem quite enough of a stretch. But system integrator Sirio Sistemi Elettronici (SSE) of Prato, Italy, reported it had taken down three in one throw of [Rockwell Automation](#) technology when it extended the control and safety capabilities of a crude oil transfer pipeline. The application included 70 kilometers of 38-inch pipe, one onshore master control unit and four remote terminal units (RTUs), including offshore RTUs, and two onshore RTUs. The pipeline also included a variety of remote I/O data acquisition equipment and other components.

“This project was to provide integrated process controls and a supervisory control and data acquisition (SCADA) system and help establish the reliability of the existing pipeline system between two offshore terminals, an offshore maintenance terminal and the customer’s main onshore terminal,” said Bruno Zanotti, SSE’s technical director.

Zanotti and SSE’s commercial director, Cristiano Tatini, presented “Integrated Control & Safety System for Crude Oil Transfer Pipeline” today at Rockwell Automation’s Process Solutions User Group (PSUG) meeting in Houston. Established in 1984, SSE is a Rockwell Automation Recognized System Integrator that typically integrates oil and gas and power generation applications in Italy, Algeria, Kazakhstan, Brazil and Iraq.

“Our system design for this pipeline included a process control system (PCS), emergency shutdown system (ESD) and a fire and gas (F&G) system,” explained Zanotti. “Common requirements for all systems included dual-redundant power supplies, processors and commu-

nication and I/O modules, while the ESD and F&G systems needed to be Safety Integrity Level (SIL) 3 and comply with the IEC 61508 standard. Common environmental conditions were 5°C minimum and 50°C maximum, while maximum temperature inside the field enclosures was specified to be up to 80°C.”

Zanotti added that networking for the pipeline would be mostly redundant Ethernet, but it would also use fiber optics for its especially long runs, as well as some wireless where applicable. “Our backbone communication network is based on fault-tolerant, redundant Ethernet TCP/IP and OPC protocol and with redundant communication system interfaces for each node,” he said. “The communication system is based on automatic bumpless switch-over. The external, subsystem interface is also based on fault-tolerant redundant Ethernet TCP/IP and OPC.”

The pipeline’s software requirements were based on a three-level hierarchy: Level 1 is the high-level master terminal unit that provides 24/7 monitoring and control of all facilities; Level 2 is the mid-level RTUs that provide monitoring and control areas for operators in cooperation with Level 1; and Level 3 is the low-level subsystem that provides monitoring and control of subsystems and communicates with the RTU in each area.

“Our main challenges were that the PCS, ESD and F&G systems had to be programmable automation controller (PAC)-based and had to operate on the same PAC architecture,” said Zanotti. “We also needed to use a common engineering tool for PCS, ESD and F&G controls



“This was a very cost-effective solution for our customer.” Bruno Zanotti, of Italian integrator Sirio Sistemi Elettronici, on the company’s recent implementation of an integrated process control, emergency shutdown, and fire and gas system based on Rockwell Automation technology.



and for the operating interfaces for monitoring functions. In addition, we had to have a strong operating and environment condition for field device system equipment, such as our remote I/O. Also, we had to assure a single fault tolerance for power supply, processor and communications between the operator workstations, processors and I/O modules.”

These requirements were needed so the pipeline could guarantee:

- The functionality of a DCS system through the use of a PAC-based system with clear economic benefits;
- System scanning time lower than 500 ms;
- Better availability and reliability compared to a traditional DCS system;
- One simple programming language between systems and operator stations through the plant network;
- Easy system expansion.

“We evaluated different technologies available in the market with different system suppliers and found that Rockwell Automation’s proposal was the best, and that it was the most complete solution for all of our customer’s technical requirements,” said Zanotti. “These included having the same supplier for all types of their required PCS, ESD and F&G systems; full integration of all installed components; a common engineering tool, in this case FactoryTalk View, for the operator interfaces; and fi-

nally worldwide commercial and technical support that would be available locally.”

In short, the pipeline’s PCS implemented Rockwell Automation’s PlantPAx processors, power supplies, I/O modules and other components, while the ESD and F&G system implemented its AADvance processors, redundant modules and I/O components; remote I/O data acquisition on the PCS is performed on Flex I/O XT modules.

“The master station in the main control room allows full access for monitoring and control to the data of all RTU stations. Upon the master station operator’s request, under a protected password, the control of each facility can be switched to each local RTU operator,” explained Zanotti.

Likewise, the ESD system in the onshore main control room provides shutdown functions for all facilities, and the ESD systems in each RTU station provide shutdown functions of each respective facility. Also, the F&G systems in each RTU station provide fire and gas protection of their respective facilities.

“This was a very cost-effective solution for our customer,” Zanotti concluded. “We reduced costs and time needed for spare parts change-out and servicing, and we implemented a fully integrated plant-wide control, while reducing engineering efforts and ensuring worldwide customer support.”