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Conference Highlights from the
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PAST INNOVATIONS POWER A BOUNDLESS FUTURE

By Jim Montague

Just as past events and behaviors are good indications of the future, Emerson's long history of innovation is good evidence that more is on the way.

"I've gained many perspectives over 25 years with Emerson from operations to services, and most recently with emerging markets, so I know that we co-create with our end users every day," said Vidya Ramnath, senior VP and chief marketing officer at Emerson. "Innovation begins with customers and mindfully listening to them, and deeply considering their voice to find the pathways and innovations."

Nathan Pettus, president of process systems and software at Emerson, added that, "Innovation is critical to the combined success of our customers and ourselves. Together, we are the stewards of the process industries." But, he added, innovations that can really move the needle and change the world are difficult and rare, requiring both collaboration and domain expertise on both sides.

Ramnath and Pettus delivered the second-day keynote at Emerson Exchange Immerse this week in Anaheim, Calif.

A history of innovation

Ramnath reported that historic innovations inspired and driven by Emerson's customers in recent decades include greater use of microprocessor-based instruments and DCSs, and open standards for fieldbus and wireless instrumentation protocols. "Emerson Fisher-Rosemount was one of the first automation companies to take a chance on general-purpose microprocessors and Microsoft software when

many people thought such tools were just toys," explained Pettus. "And now, everyone uses some kind of commercial, off-the-shelf product."

Even as computing and software made other inroads, Ramnath added they've also moved out to the field and up to cloud services, where users can interact with them to further enable plant productivity and reliability. "We jumped in to pioneer smart devices that could measure flow, pressure, vibration and corrosion, and gathered diverse groups to develop and transform protocols like HART, Foundation Fieldbus and WirelessHART into industry standards," said Ramnath.



"We can form cohesive links from the edge to the cloud and provide the data and semi-autonomous systems that users need to optimize their processes." Emerson's Vidya Ramnath, together with Nathan Pettus, put the company's Boundless Automation vision into the context of past innovations during a keynote address at Emerson Exchange Immerse this week in Anaheim, Calif.

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“Emerson has long supported open, non-proprietary standards, so that everyone can use them,” Ramnath continued. “Whether it’s conveyed via wires or wireless, users always need data to support their analytics, better decisions and improved performance. Working together, we’ve always persevered, and that gives us the energy for whatever lies ahead. The best is yet to come.”

Presence in the present

Extending its tradition of innovations at Emerson Exchange Immerse this week, Pettus and Ramnath highlighted the company’s vision for Boundless Automation. This software-defined, data-centric, flexible, automation platform consists of a simple architecture that enables operational excellence by removing former obstacles. Its main features in the field, edge and cloud include:

- Cohesive software platform,
- Spans cloud, edge and field,
- Democratizes data,
- Holistic security,
- Broad interoperability,
- Extensibility for innovation, and
- Unlimited scalability.

“Even though Emerson came up with capabilities like electronic marshalling, today’s challenges to productivity and sustainability are driven by macro forces that require even more innovative solutions,” said Ramnath. “Today, users have to do even more with even less. Plus, they have net-zero goals, and many infrastructures aren’t ready. Emerson lives these same realities every day, too.” The good news is that Boundless Automation and the Emerson innovation it represents can help users maintain productivity and profitability without sacrificing sustainability.

Pettus added that Emerson is focused on developing the inspiration and purpose that can solve today’s problems, along with the tools required to achieve these goals in reality. For example, Emerson has launched DeltaV IO.Connect, which can seamlessly integrate its DeltaV automation system with legacy devices, such as Honeywell TDC3000 or other third-party I/O modules, substantially cutting modernization costs. Likewise, the company is pursuing Ethernet-APL communications technology to safely extend the reach of high-performance Ethernet into the field.

“This all starts with Boundless Automation that can access oceans of data, including information that used to be stranded,” said Ramnath. “Reaching devices out in the field is still vital, and whether it’s Ethernet-APL or upcoming 5G, we can reach them faster and cheaper, form cohesive links from the edge to the cloud, and provide the data and semi-autonomous systems that users need to optimize their processes.”

THE BOUNDLESS AUTOMATION TOOLKIT

By Jim Montague

A journey with no boundaries grants tremendous freedom, but such a long trip also requires serious commitment and capable tools.

For instance, Emerson embarked on its Boundless Automation a year ago, and is already well on its way to overcoming the traditional barriers that make it hard for end users to gain efficiencies and streamline operations.

“We’ve been busy breaking down the silos between control, networking and safety, and doing the same for silos that generally align with the multi-layer Purdue reference model for industrial control systems,” said Claudio Fayad, technology VP for process systems and solutions at Emerson. “Our vision is to replace those silos with a cohesive platform for intelligent field, edge and cloud devices that will allow users to optimize their assets. We’re bringing that vision to life by combining remote terminal units (RTU), supervisory control and data acquisition (SCADA), distributed control systems (DCS), manufacturing execution systems (MES) and safety instrumented systems (SIS) in our rebranded DeltaV process automation platform.”

Fayad presented the “Boundless Automation Unleashed” press event, along with Erik Lindhjem, reliability solutions VP at Emerson, and Kristel Biehler, life sciences VP at Emerson, at this week’s Emerson Exchange Immerse event in Anaheim, Calif.

“Boundless Automation is a software-defined, data-centric, flexible automation platform that includes key innovations in three main areas—intelligent field and edge and cloud computing,” explained Fayad. “This unifies our broad portfolio, combines our deep experience, delivers consistent user experience, and shapes the future.”

Intelligent Field innovations

Lindhjem reported that Emerson’s Intelligent Field innovations primarily expand connectivity between sensors and applications. This includes new field devices that cost less to install, can be easily added to running processes, and are simple to integrate into existing systems.

Chief among these smarter field solutions is DeltaV IO.Connect that was released in October 2022, and reduces DCS modernization costs, complexity and time by preserving I/O connections and introducing third-party I/O as DeltaV natives.



Boundless Automation with AI will unleash even more tools and streamline even more workflows.” Emerson’s Claudio Fayad led a press briefing on the company’s latest innovations in the field, at the edge and in the cloud.

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Maintaining links to legacy I/O, such as Honeywell's TDC 3000, can reduce project schedule by 90%, and cut modernization capital spending by 40%. IO.Connect also simplifies and speeds up transitions to DeltaV control technologies and software, future-proofs operations by allowing opportunistic I/O updates, and enables flexible subscriptions.

Likewise, the DeltaV PK Controller gained native PROFINET, Modbus TCP, OPC UA, EtherNet/IP and Ethernet-APL connectivity in September, which enable a more flexible approach for I/O integration and communication. They allow the DeltaV PK Controller to:

- Support up to 250 devices,
- Simplify installation,
- Employ star, ring, hybrid and APL network topologies,
- Seamlessly connect with AMS (coming soon), and
- Support S2 redundancy (coming soon).

Launched this past July, AMS Device Manager Data Server is a digital enablement tool for smart field devices that can:

- Replicate AMS data outside the process control network,
- Integrate with other data sources for advanced analytics and machine learning,
- Perform continuous, automated collection of field data, and
- Operate a centralized management program with a secure infrastructure, and
- Use instrument diagnostics for early detection of underperforming equipment.

"AMS Device Manager connects data from intelligent field devices to any application, which simplifies maintenance, reduces complexity, and democratizes data," explained Lindhjem. "This means there are a lot fewer configuration tasks and hurdles."

Likewise, Emerson is also working on wireless devices that are easier to drop in for pervasive monitoring. They'll run on 5G and feature increased density, longer range, reduced costs, wider geographic dispersion, anytime communications and more rugged products.

Thriving on the edge

A step up from the field, the edge computing realm is where operations technology (OT) personnel typically meet up and clash with their information technology (IT) counterparts. To ease these former conflicts, Fayad added that Emerson's innovative DeltaV Edge solutions simplify networking, enhance security, democratize data, accelerate co-creation efforts, better align IT with OT and improve overall robustness.

"We've always been on the edge, but the Industrial Internet of Things (IIoT) has been changing approaches. What makes the edge powerful is it lets us rethink how OT and IT can work together," said Fayad. "Data that used to go from the edge to the cloud can now come back with responses and instructions, and use of more of the edge's layers. We're working with several partners to reassess what the edge can do. This can include simplifying networks and/or enhancing security."

The solid foundation that Emerson's present and future edge solutions are built upon is a virtualized, hyperconverged infrastructure (HCI). Released in September 2022, Emerson's HCI can be built with two, three or four servers. Software running on HCI eliminates the need for much of the hardware necessary for traditional virtualization architectures, creating a more unified virtualized system, incorporating compute, network, and storage into a single, tightly integrated software system to reduce overhead and improve performance. This allows users to perform easy, scalable virtualization with improved performance. It also lets them:

- Reduce deployment time by 50%,
- Easily maintain, expand and upgrade applications,
- Improve performance by more than 20%, and
- Reduce energy use and carbon footprint.

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“Many users collect huge amounts of data, only to throw away 99% of it later because they didn’t figure out how to use it,” explained Fayad. “The edge lets users democratize data, and distribute it more easily, so anyone can use it, instead of tossing it. This also fuels co-creation that can bring OT and IT together. The edge aligns them because, instead of one or the other owning particular data and problems, they all own them together. We want to help them both with solutions.”

HCI and its servers also act as the base of Emerson’s software-defined control system that it’s developing to allow easier upgrades and reduce carbon footprint. This innovation was launched in September 2023 for DeltaV DCS and PKFlex Controllers, and includes flexible, subscription-based licensing, and decoupled hardware and software. This strategy will be released for DeltaV DCS in the next 12 months with a software-defined controller for the process and hybrid industries. It will also be released for Emerson’s Ovation DCS in the second quarter of 2024.

“This software is still tied to the controller, but it’s more flexible, and can run on an HCI like VMware,” said Fayad. “This means no more bottlenecks at the controller for DeltaV or Ovation.”

Fayad added that Emerson’s efforts at the edge are aided by its recent majority stake investment in and integration of AspenTech, which is driving synergies between their portfolios that can improve operations. For instance, Emerson is integrating AspenTech’s historian, advanced control and analytics platforms software. This will soon allow AspenTech’s software to run on virtual machines in Emerson’s HCI, deploy quickly and easily via DeltaV, and scale up and expand data sources with IP.21 Historian.

Even though its other on-the-edge innovations are impressive, Fayad reported that the most important innovation is likely its DeltaV Edge Environment that’s launching now, and delivers enhanced OT connectivity and runtime capabilities. Its features include:

- DeltaV DCS runtime and configuration data,
- Handles up to 300,000 parameters,
- Bridges IT and OT technologies and policies, and

- Enables both centralized and remote management.

“We’re the most excited about DeltaV Edge Environment because it really changes the role of the DCS,” stated Fayad. DeltaV’s first Linux-based node, the edge node is secured with a data diode. “And once data gets to the edge node and is available, users can work with it using Python, Power BI, RESTful API or other analytics or programming tools, and allow other users to easily see it via MQTT publish-subscribe protocol, or feed dashboards in the cloud,” Fayad said. “In fact, users can even install 10 or 20 edge nodes, and deploy them anywhere with one click.”

Cloudy connections

Once field and edge processes and networks are secure, Fayad reported that links to cloud-computing services can enable consistent services across large regions. Emerson’s latest Cloud innovations create a connected enterprise system that can perform fleet management, collaboration, reduce upfront costs, ease deployments, scale limitlessly, and centralize security monitoring and management.

For example, Emerson’s Integrated Engineering Environment (IEE) leverages the cloud for improved project engineering, easier acceptance of late changes, improved project speed, seamless collaboration, data sharing between disciplines, and security by design. Its parts include:

- E&I Studio for browser-based I/O configuration,
- Sequence Studio for automated sequence data and configuration management,
- Project Data Link for common single instance data and configuration generation, and
- Test Studio that enables remote factory acceptance tests (FATs) and management.

Likewise, Emerson’s Guardian software and subscription-based, lifecycle-management and support uses similar methods, such as single sign-on (SSO), software downloads, subscription management, personalized and enterprise dashboards, and AI-powered search and recommendations, said Fayad. “Boundless Automation with AI will unleash even more tools and streamline even more workflows.”

AUTOMATION, DIGITALIZATION TO POWER SUSTAINABILITY INNOVATIONS

By Keith Larson

If society's ambitions to curb carbon emissions and stem climate change are to be achieved, industry will have played a leading role. The effort must include optimizing the energy efficiency of traditional facilities and finding ways to capture or sequester what carbon emissions remain; integrating new sources of clean and renewable energy into the industrial value chain; and developing and scaling entirely new processes that fundamentally transform—in quantity and/or nature—the energy required to support society's needs.

“When you look at all the dramatic climate change events happening around us, it's clear we need to do something—and fast. But it's also a great time for engineers who enjoy a challenge,” said Emerson Chief Technology Officer Peter Zornio, addressing a conference center hall packed full of just that sort of engineers. Zornio, together with Mike Train, Emerson chief sustainability officer, delivered the closing keynote address at Emerson Exchange Immerse 2023. Together, they discussed how automation plays a critical role in enabling the innovations that will stem the tide of climate change.

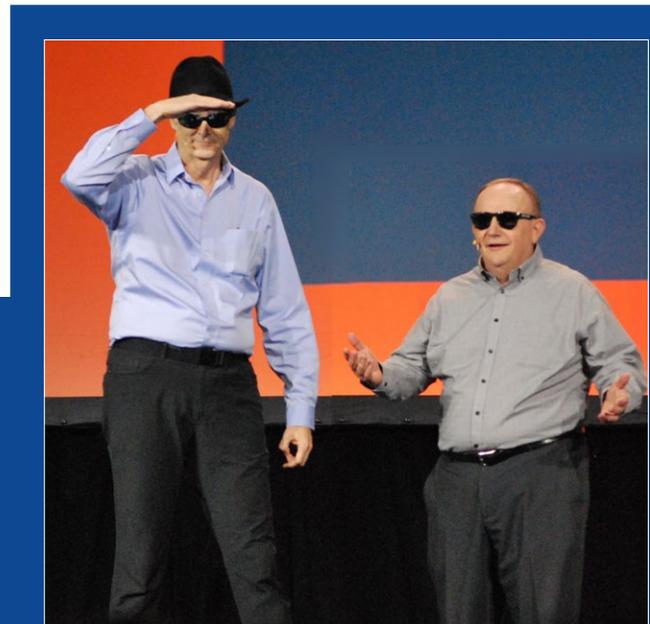
“Sustainability is a conversation everyone is having,” added Train. “And we have both a front row seat and the honor of participating in many of them.”

When you look at all the dramatic climate change events happening around us, it's clear we need to do something—and fast. But it's also a great time for engineers who enjoy a challenge.” Emerson's Mike Train and Peter Zornio took the Immerse keynote stage to discuss the role of automation in achieving industry's sustainability transformation. But first, they drew a laugh from the crowd as brothers Jake and Elwood “Green”—recycled monikers for a new industrial age based on past musical cameos as the Blues Brothers.

A 'greening of' update

Indeed, Emerson's sustainability pledge consists of three pillars of concerted effort: the greening of, by and with Emerson. The greening of Emerson refers to how the company improves its own internal sustainability performance. Greening by Emerson relates to how Emerson technologies, solutions and expertise enable customers' sustainability journeys. And greening with Emerson encompasses how the organization fosters collaboration and innovation among its global value chain partners.

Train first updated attendees on Emerson's own greening, which features a reduction by half in scope 1 and scope 2 emissions since 2018 largely from energy efficiency gains (53%), renewable electricity investment (22%) and grid decarbonization efforts (25%). “It's about activating, unleashing our people to identify opportunities,” Train said, citing more than 50 employee treasure hunts to



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identify opportunities for efficiency gains and 4,200 Earth Month Challenge participants.

The company has pursued a series of gatherings to share sustainability ideas with its suppliers and customers, Train said. “These include Greening Together Supplier Summits, Sustainability Executive Summits, and Green Innovation Days held around the world,” Train explained.

Transformation of industry

Emerson has also been active in road-mapping sessions to chart the innovations that can remake the current industrial energy landscape. “For traditional industries, the focus is on enabling the decarbonization and clean energy transition of a broad range of critical industries,” Zornio said.

The four pillars of this effort include:

- Energy source decarbonization, including low carbon power (solar, wind, hydro, nuclear, biomass), low carbon fuels (biofuels, biogas, LNG), plus hydrogen and hydrogen-based fuels;
- Energy & emissions management, including emissions monitoring & control, carbon capture (utilization, storage, removal), plus advanced controls, analytics and simulation;
- Electrification & grid systems, including smart grid and network management, energy transport and storage, workforce safety and productivity, plus critical mineral value chains; and,
- Circularity & waste management, including new molecule production, materials and minerals recycling and circulation, water and waste management.

Zornio and Train went on to highlight a range of projects where Emerson has participated in the transformation of representative industries—not only with established players who know Emerson’s standing in the automation arena, but with start-ups that stand to reinvent how industry operates. With Neste, for example, where Emerson technologies helped the oil refiner to expand capacity for sustainable aviation fuels and green diesel. With Albioma, where Emerson expertise helped the independent renewable energy provider convert a coal-fired facility to 100%

renewable electricity from biomass. With Burns McDonnell, where Emerson helped the engineering firm to design and build the world’s largest battery storage facility. And with PureCycle Technologies, where Emerson technologies are helping transform polypropylene recycling to yield near virgin-quality resins.

Further, on the green energy front, Emerson is working with Mitsubishi Power to create green hydrogen storage facilities to augment electrical supply during peak demand periods, with KoHyGEN to build the first of 35 high-capacity hydrogen refueling stations in South Korea, with Li-Cycle to build recycling capacity for spent vehicle batteries, and with Origin to convert biomass to chemicals with zero carbon loss in the process.

These and other industry players are using Emerson technologies to get new projects up and running quickly, leveraging “born digital” methodologies such as automatic commissioning, electronic marshalling, robust data foundations and a reliability architecture to build new processes that are optimized from the start. “Some of these start-ups may not know Emerson, but they know experience counts when it comes to project execution,” said Zornio.

Digital today, boundless tomorrow

While Train and Zornio are justifiably proud of the Emerson innovations that are transforming industry today, they also pointed to the company’s Boundless Automation vision that will continue to break down the last obstacles left by the automation industry’s analog, proprietary past.

To take automation further, Boundless Automation is centered on a cohesive software platform that spans the entire enterprise—from field to edge to cloud, Zornio explained. Siloed system architectures will yield to Boundless Automation, data islands to a unified data model, defense-in-depth cybersecurity to inherently secure designs, a focus on hardware to data-centricity, device administration to fleet administration, single-site operations to cloud-enabled enterprise operations, and from mostly CAPEX spending to mostly OPEX investment.

“Today’s architecture is good, but issues remain,” concluded Zornio. “Boundless Automation is designed to capitalize on the opportunities.”

PURECYCLE'S 'BORN DIGITAL' PLATFORM BUILDS ITS FUTURE

By Len Vermillion

Plastics recycling has been around for decades, but that doesn't mean it can't be improved. An eight-year-old company, PureCycle Technologies, has made it its mission to do exactly that, and it's received a big assist from an Emerson DeltaV control system and other Emerson technologies to develop not just a smart plant but what the company refers to as a "smartest" plant as production ramps up around the globe.

PureCycle was founded in 2015 in Ironton, Ohio, and developed a unique purification process to transform polypropylene plastic into a versatile, replenishable resource. Its process lets recycled plastic be reused multiple times, whereas traditional recycling is limited in scope. While people around the world use polypropylene every day, most of it goes unrecycled and much of it ends up in the oceans. PureCycle's patented process separates color, odor and other contaminants from plastic waste to transform it into ultra-pure recycled resin. This process helps close the loop on plastic waste while making recycled plastics more accessible at scale.

But as a young company on a fast track to growth and with little time to waste while attacking a rapidly growing worldwide problem, it's had to be creative while planning for new facilities. As Ronetta Bagby, senior automation engineer with PureCycle, told an audience during this week's Emerson Exchange Immerse conference, "We don't have time for a digital transformation. We must be born digital."

For the company, that means it must be ready to rapidly scale its operations. So, as it grows to include additional facilities in the U.S. and internationally, it must move

beyond traditional smart facility standards and take it one step further, and faster.

Being "born digital" means its plants must not only be built with traditional qualities, such as integrated control and safety systems, process historians and condition monitoring, but also advanced attributes, such as design for mobility, a sound alarm management philosophy, predictive analytics, simulation models and digital twins.

Bagby pointed to the need to accommodate remote workers and cybersecurity measures as requirements for plants that go beyond traditional digitalization efforts. In short, the new plants must be future-ready, even though no one can be sure what the future holds.



We don't have time for a digital transformation. We must be born digital." PureCycle Technologies' Ronetta Bagby shared how the company is using Emerson's DeltaV control technologies to rapidly scale its innovative polypropylene recycling process.

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The whole purpose of the born digital program is to make sure the company is providing its operators, company and the organization with a system that will self-diagnose, solicit help when it needs it, and eventually, help build itself using emerging technologies such as artificial intelligence, according to Bagby.

One of the enablers of PureCycle's efforts is Emerson's DeltaV automation system, which is designed to simplify operational complexity and lower project risk. The Emerson products and services increase plant performance with intelligent control that is easy to operate and maintain, Bagby said.

Virtualization meets remote access

PureCycle has 13 workstations on its Ironton, Ohio, production unit, and with traditional methods each workstation would need a server, power and cabinet space—and for all of that to be connected. But with virtualization, up to 40 machines can run on a single host, Bagby said. “That gives us redundancy,” she added. “If one of our virtual machines fails, it automatically switches to another host. We see minimal downtime.”

She also pointed to time and cost savings during commissioning, as each virtual machine can be stood up in

about an hour. Most important is the fact that virtualization gives the company the ability to quickly scale up its process when it is ready, without interrupting production. PureCycle also takes advantage of electronic marshalling to connect its field devices to DeltaV. This cuts cabling costs as well as increasing flexibility and redundancy, Bagby said.

Bagby also pointed to the changing nature of the industry workforce, particularly post-COVID. None of her team lives in Ironton, so the company had to stand up a secure, third-party network that not only allows them to communicate with more than 50 devices across its network, but also allows remote access for all its engineering department, operations, and external business and supplemental organizations.

The company also hosts its electrical system data on DeltaV Mobile, a read-only platform that allows managers, engineers and operators to access operational data whenever they need it. “It lets us view our electrical usage and remotely troubleshoot electrical equipment that's running in our facility,” Bagby said.

It's another step toward creating that “smartest” plant the company values, and it's another step toward expanding adoption of the company's innovative recycling methods around the world.

HOW BIOGEN, SYZYGY AND TESLA UNLEASH AUTOMATION

By Len Vermillion

The world is changing more rapidly than ever, and technological innovations are leading the industrial sector into a more productive, efficient and sustainable future. Automation is at the forefront of transformation efforts as companies seek solutions that are simultaneously productive, predictive and prescriptive.

The good news is that process automation technologies are no longer far-flung dreams, but today's reality. "The technology is here today. The innovation is here today," said Nina Golder, vice president of lifecycle services for Emerson, who along with Liam Hurley, the company's vice president, process systems and solutions in North America, welcomed some 1,500 attendees to Emerson Exchange Immerse 2023 this week at the Anaheim Convention Center.

Emerson backed up the claim as a trio of end-users took the stage at the general session of the annual gathering to attest to how process automation technologies are helping to tackle some of industry's—and the world's—most pressing problems, such as reducing carbon emissions, scaling electrification and leveraging cloud technologies and AI to create value from data.

Eliminating emissions

Perhaps no issue requires the attention of the process industries, such as oil and gas and chemicals, than mitigating carbon emissions. As climate change data pours in, governments and consumers have taken increased notice of industrialization's role. The question is, what can be done to turn the tide?

"Eliminating emissions is difficult," said Trevor Best, CEO of Syzygy Plasmonics, which manufactures all-electric chemical reactors powered by light instead of combustion. "We do not have a modern society without the chemical and energy companies, but they are synonymous with emissions to most people."

The Pearland, Texas-based company's technology is based on 30 years of research and development at Rice University. "This is a platform that, by changing out what the nanoparticles are made of, we can adapt it to do many different chemical reactions," Best said.



We always start with a well-defined problem statement and consider the purpose-driven intent behind the products we make." Tesla's Chuck Fortner was one of the keynote headliners who shared how industry is partnering with Emerson to accelerate innovation and transformation at this week's Emerson Exchange Immerse event in Anaheim, Calif.

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Syzygy is developing reactor technology and scaling it for commercial use. Best said that the company has scaled up the reactors at an unprecedented rate and gave credit to Emerson for helping deploy the company's product, the Rigel reactor, which notably is made of non-exotic steel alloys, glass and aluminum together with nanoparticles of select catalysts. "To start with, it's being used to generate green hydrogen more efficiently than electrolysis and to take CO2 and put it back into many innovative products," he continued. The company expects to deploy into the field within the next 12-18 months.

The same Emerson process automation technology that enabled Syzygy's rapid development from laboratory to commercial scale, Best said, will enable the company to scale the reactor well into the future.

Purpose-driven development

Another response to climate change concerns is the ongoing electrification of many systems formerly powered by fossil fuels. Perhaps no company is more synonymous with such efforts than Tesla, the all-electric vehicle manufacturer made famous by its founder Elon Musk. The company's leader of advanced innovation, Chuck Fortner, described the targeted efforts the company has taken to pursue its industry-disrupting innovations.

"Innovation doesn't just happen," he said. "We always start with a well-defined problem statement and consider the purpose-driven intent behind the products we make."

Tesla's well-documented work includes innovations that accelerated the electric vehicle market such as electric-vehicle batteries, self-driving automation and super-charging abilities. "These are all products that are not only transformational in the problems that they solve, but also novel in the way they are made," he continued.

Fortner, whose expertise is in automation engineering and cell manufacturing, said many of the problems that have always hindered automation engineering during the innovation process, still exist. These include field connectivity, computing capability, network throughput, storage capacity, system security and operational excellence.

The effective use of data is also a hindrance, Fortner said, noting that accelerated value creation based on data is paramount to transformation. The sheer volume of data produced by industry is expanding faster than its ability to adopt effective data analytics software.

Manufacturers generate thousands of petabytes of data every year, but effectively "throw away 99 percent of the data," according to Fortner. That means most manufacturers are missing an opportunity to create better value from data collection to better be able to efficiently pursue transformational innovation opportunities.

Fortunately, software technology is continually developing to help manufacturers gain actionable insights from data. Tesla, according to Fortner, works with Emerson to look at solutions for modeling and simulation, digital twins, data analytics and machine learning. "What better place to start to solve this problem than with a trusted technology partner like Emerson," he added.

Mastering the cloud

Implementing data analytics is an issue unto itself. Cloud computing offers a cost-efficient means for collecting and storing valuable data. However, adoption of cloud technologies is often messier than it seems prior to implementation.

Tim Alosi, head of lab IT and data analytics at life sciences leader Biogen, told the Exchange audience that selecting and deploying new cloud technologies can be not only a benefit to companies, but also a burden on their IT and OT service delivery teams. Cloud technology has changed the infrastructure for companies from locally installed software to subscription-based licenses to large-scale software-as-a-service (SaaS) platforms that cover a large swath of their businesses.

"In a perfect world, cloud adoption would be complete and seamless," Alosi said, "but we end up with a mix of old tech, new tech and everything in between. There are many vendors and multiple components to stitch together to deliver end-to-end solutions and drive benefits."

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The result is dilution of the potential value gained by the technology adoption. Just as Fortner pointed out, companies continue to adopt new technology faster than their skill sets allow for effective use.

“We need to increase our ability to deliver value from the technology,” Alosi added.

To increase value, Biogen developed an integrated system intended to maximize its ability to deliver the right skills for the new software. It also constrained its technology options to further limit the developing skills gaps between legacy technology and new technology. Finally, it sought tricks to help increase the speed to value of the new technology.

One of those tricks was to embrace pre-trained language models of AI. Alosi said Biogen has used them successfully in its cloud strategy. Alosi said vendors such as Emerson are creating solutions to help automatically write code. “How exciting will it be if your automation team can automatically generate some DeltaV code from a process description?” he asked. For its part, Emerson is displaying such technology on the show floor at Emerson Exchange Immerse.

All three speakers stressed how automation solutions from Emerson have helped create better value and scalability for their companies. And as technology continues to accelerate, even more companies will be able to tackle those big innovations that transform the world.

THERMO FISHER ADVANCES GENE THERAPY WITH DELTAV AUTOMATION

By Keith Larson

For decades, the foundations of cancer treatment have been surgery, chemotherapy and radiation therapy. These continue to be critical mainstays of treatment, but in recent years new categories of treatment have helped transform the treatment outlook for many people with cancer.

CART cell therapy, in particular, has been revolutionary, producing durable and effective clinical responses in patients. However, the T cell therapy manufacturing process is complex, labor-intensive, and traditionally has involved many open processes that can impact regulatory compliance and lead to inconsistencies in the final product.

“The therapy is also logistically challenging,” according to Prajakta Bhanap, software engineer for Thermo Fisher Scientific, who spoke this week at the Emerson Exchange Immerse event in Anaheim, Calif.

The process starts with leukapheresis, the extraction of a patient’s white blood cells, and ends with genetically altered cells transfused back into the patient’s body. But the manufacturing workflow in between consists of a series of complex separations, gene transfers, activations and replications. “And it’s always batch size 1,” Bhanap added.

A paradigm shift was needed in cell therapy manufacturing, Bhanap said, and Thermo Fisher Scientific set out to create one. They started with a portfolio of modular instruments designed to support a diverse range of cell therapy manufacturing workflows and efficiently scale to commercial manufacturing.

And to orchestrate the necessary processes they partnered with Emerson to create an off-the shelf software solution called Cellmation that allows users to connect their Thermo Fisher Scientific cell therapy instruments within a standard DeltaV network to control and sequence workflows across multiple cell therapy instruments in a 21 CFR Part 11 compliant environment.

“We selected DeltaV control technologies because we see Emerson as the leading automation provider to the life sciences industry,” Bhanap said.



We selected DeltaV control technologies because we see Emerson as the leading automation provider to the life sciences industry.” Prajakta Bhanap of Thermo Fisher Scientific discussed the company’s creation of Cellmation, a digital solution that dramatically streamlines the manufacture of cell therapies.

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The DeltaV automation system works with the modular Thermo Fisher instruments in a supervisory role, capturing cGMP batch records in a DeltaV Continuous Historian. All communications are via standard OPC UA, with a DeltaV PK Controller and Emerson Ethernet IO Card (EIOC) also playing the respective roles.

Together, the Cellmation software, Thermo Fisher Scientific instruments and DeltaV control technologies integrate and manage the manufacture of cell

therapeutics, ensuring traceable, reproducible and secure data storage and easier data transfer to third-party MES and ERP systems. The full system has been in beta test with several users and is now being released to the market.

“We invest a lot in innovation,” Bhanap said in closing. “And we look to help guide our partners in their journeys, to accelerate cell therapy through industry partnerships.”

NEW SMALL-BATCH GENENTECH PLANT RELIES ON EMERSON CONTROLS

By Jim Montague

It's never simple to build new pharmaceutical manufacturing and support plants, but as you might imagine, it was even trickier during the COVID-19 pandemic. Despite epic challenges, Genentech broke ground in February 2020 on its new Clinical Supply Center (CSC) at its headquarters in South San Francisco—where it basically invented biopharmaceutical manufacturing just a few decades earlier.

The CSC uses several types of advanced manufacturing technologies, and employs a modular, agile design to enable on-demand delivery of Genentech's medicinal pipeline to patients in clinical trials. It was also designed for easy reconfiguration and future technology implementation. Naturally, all of these quicker and more variable operations must be performed by personnel that are just as agile and adaptable at operating its lab, quality and control systems.

Genentech and its partners integrated several Emerson platforms at CSC to meet these requirements, including DeltaV DCS, Syncade MES and Fluxa PKM, along with a range of software platforms from third-party vendors. Genentech and Valspec, a provider of system validation and lifecycle services, implemented an innovative commissioning and qualification strategy based on their detailed knowledge of Emerson's solutions and industry best practices.

“The world of biopharma is changing. Where we previously used large-capacity, stainless-steel reactors, we now

do more small-volume production of more personalized medicines in disposable containers. This allows quicker turnover, which is especially helpful when our scientists have a new molecule they want to try,” said Tiffany Button, quality chapter lead for computer systems validation at Genentech. “Of course, quick turnover was also essential during the pandemic, when vaccines had to be developed and delivered with unprecedented speed.”

Button and Nimit Amipara, validation engineer and engineering supervisor at Valspec, presented “Commissioning and qualification of Genentech's International Society for Pharmaceutical Engineering (ISPE) Facility of the Year Award (FOYA) 2023 Winner for Pharma 4.0” this week at the Emerson Exchange Immerse in Anaheim, Calif.



The automation objectives for the CSC's single-use technologies included having a highly integrated and fully paperless automation solution.” Valspec's Nimit Amipara, together with Genentech's Tiffany Button, discussed the ambitious new validation processes that trimmed plant completion from five or more years to only two and a half.

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Small but mighty automation

To produce a greater variety of smaller batches, such as gene therapies and other medicines with widely variable costs, Button reported that CSC must:

- Enable rapid and seamless transfer of products from research to its clinical and commercial departments,
- Maintain colocation of CSC with Genentech's R&D partners for speedy interactions and problem solving,
- Exploit the benefits of technical advances in single-use technology and digital manufacturing,
- Provide a design template for facility, equipment and automation for rapid and cost-effective, copy-and-paste deployment at Genentech's future commercial, small-volume facilities, and
- Accommodate a range of known and unknown future process platforms and therapeutic modalities.

“The automation objectives for the CSC's single-use technologies (SUT) included having a highly integrated and fully paperless automation solution,” said Amipara. “It would also need built-in flexibility for clinical, ad hoc activities and be enabled for commercial launches. We also need to be able to introduce new technologies as simplified standards for functions, such as review by exception (RBE), process and knowledge management (PKM), data visualization, analytics and collection (DVAC). All of these requirements meant we needed to create a standard automation platform to minimize customization, as well as support rapid deployment of future sites.”

Consequently, Amipara added that Valspec and Genentech envisioned implementing a four-layer automation landscape with controllers and I/O points at Level 1; HMIs, batch management and SCADA system at Level 2; historian and manufacturing execution system (MES) at Level 3; and corporate applications at Level 4.

Innovative testing and commissioning

To achieve the speed and flexibility its new facility required, Button added that Genentech also adopted an innovative procedure for testing and validating new equipment. This involved more testing of high-priority devices with less certain performance, and less testing for common devices with well-known performance characteristics.

“We used the ASTM E2500 risk-based approach that's highly driven by subject matter experts, integrates quality

into the team early, and leverages as much vendor qualification as possible,” explained Button.

“We sought agreement and approval of acceptance criteria with our quality department during design phase. We employed quality approvals at planning and release stages only, and focused on the value-add in the compliance. We also conducted forward-looking verification planning with the SMEs and sought quality department feedback and approval.”

Button added that Genentech's team minimized risk assessments to complex systems only, and applied standards to simple and well-understood systems. “Standard systems received streamlined testing without gating requirements,” said Button. “We also performed end-to-end, development run tests as a main operational qualification activity. Most importantly, we used a minimal-viable-product approach that accepted the MES and DCS systems with a known list of punch items that were determined to be low-risk to good manufacturing practice (GMP) operations. Our project mantra was to isolate high-risks and fix them immediately, and accept low-risk or items with acceptable workarounds to be fixed later.

“Instead of doing the same old testing, we looked where we could add the most value. Once we devised that list, Valspec did the testing and streamlined the process. Quality also wasn't held up because I was able to do it for 12 systems. We did ‘pulse checks’ to make sure we were still adhering to the guardrails we agreed to earlier, so we didn't need as much traditional oversight, and we still had all the documents and reports we might need at the end.”

Future cookie cutting

Button reported that DeltaV DCS, Syncade MES and Fluxa PKM all worked well together at the CSC as Genentech and Valspec implemented their new processes. They'll serve as a pilot plant and template for a fleet management strategy for other upcoming facilities. In fact, Genentech conducted the groundbreaking for a second iteration in Oceanside, Calif (OSUT) this past February.

“From breaking ground to going live, the CSC took two years and eight months, instead of the five to 10 years that similar projects usually require,” concluded Button.

FUJIFILM FAST-TRACKS AMERICA'S LARGEST CELL CULTURE CDMO

By Len Vermillion

More than 2 billion people worldwide do not have access to medicine, and it's only getting worse. The COVID-19 pandemic showed that ramping up the production of medicines at breakneck speed can be of vital importance. The next time a pandemic hits, the life sciences industry must be equipped and ready.

The good news is that they will be, thanks to efforts such as the one being put forth by FujiFilm Diosynth Biotechnologies, a global contract development and manufacturing organization (CDMO) and provider of cell and gene therapy and viral vaccine products. FujiFilm doesn't make its own products, it quickly gets them to market for others. It offers solutions for cell line development, process development, late phase activities, clinical and commercial manufacturing of a wide variety of biopharmaceuticals. CDMOs can be a vital cog in a well-orchestrated effort to quickly manufacture vaccines, such as happened during the pandemic.

FujiFilm is looking ahead and building the largest cell culture CDMO in North America, located in Holly Springs, N.C. The 1 million-square-foot facility will be ready for production in 2025. The company has additional U.S. locations in Cambridge, Mass., College Station, Texas, and Thousand Oaks, Calif., in addition to Hillerød, Denmark, and Teesside, U.K.

Jacob Grønnegaard, director of automation for FujiFilm Diosynth Biotechnologies, was on hand at Emerson Exchange Immerse 2023 in Anaheim, Calif., and told a captivated audience that the company has speed and flexibility in mind as it builds its latest facility.

"We change products, so we need to have flexibility in our facilities," he said.

Replicate to gain efficiency

FujiFilm has been through this process before. The Holly Springs site is a nearly identical clone to its Hillerød facility. "We take a different approach. We want to reduce the time to completion," Grønnegaard said.

That's why FujiFilm uses a cloning-across-sites system that is built on utilizing Drug Substance Manufacturing (DSM) modules. The modules are designed with identical automation concepts intended to allow for fast



The ultimate goal is to deliver the completed project in less than 24 months lead time, 50% of the working hours and 85% of the installed costs of the previous facility." Jacob Grønnegaard of FujiFilm Diosynth Biotechnologies discussed how the company's unique cloning processes dramatically reduce project execution time, effort and expense at this week's Emerson Exchange Immerse.

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scalability for production and agility and redundancy for supply chain management.

Grønnegaard said the company increases cloning percentage as a project progresses. “As we move from DSM expansion to completion, we increase the percentage with the ultimate goal of delivering the completed project in less than 24 months lead time, 50% of the working hours and 85% of the installed costs of the previous facility.”

DSM modules

What is a DSM module? The modules are the core of the facility, and it's where the production takes place. Each module consists of two upstream trains, four production bioreactors, a harvest suite and a purification suite.

Such a highly sensitive environment needs a high-level system architecture. Each DSM module has its own Emerson DeltaV automation system and two DSM modules will share an Emerson Syncade manufacturing execution system (MES).

The DSM modules in Holly Springs will be the same as in the Denmark facility. Both facilities have the same layout and process equipment. They have the same process and instrumentation diagrams (P&IDs) and 3D engineering models. Most notable is that they will have the same DeltaV and Syncade application code. The only localization,

according to Grønnegaard, will be for required building code differences between the U.S. and Denmark, such as electrical standards. Both facilities will be governed by the same standard operating procedures.

Application code process

Grønnegaard outlined FujiFilm's DeltaV application code development process utilizing its unique cloning procedure during the session. Before the process even begins, the application code is developed for the initial DSM and goes through full qualification testing.

From there, FujiFilm exports the DeltaV code and design documents. It uses a qualified tool to convert tag numbers complete with code and graphics from the initial DSM to the new DSM. It uses a qualified tool to update design documents with the new DSM tag numbers.

FujiFilm then implements any changes that exist between the new DSM and initial DSM. From there, it qualifies each change individually. Finally, the DeltaV code is qualified ready for use during equipment commissioning.

The result is intended to be one of the top medicine production facilities in the country. Hopefully, it won't have to ramp up production for a virus vaccine to combat a worldwide pandemic, but if the time ever comes again, it will be scalable and ready.

GSK HAMILTON'S DIGITAL TWIN JOURNEY

By Keith Larson

With a name derived from the Latin word for “to help,” adjuvants are pharmaceutical substances that increase the intensity of immune response when administered with a vaccine or other medication. They can reduce the required vaccine dose, the number of injections and even increase stability of the vaccine itself. An unlikely source of such helpful medications is a campus nestled in the scenic Bitterroot Valley of western Montana, GlaxoSmithKline’s Hamilton facility—a figurative stone’s throw from the Chief Joseph Ranch featured in the popular Yellowstone TV series.

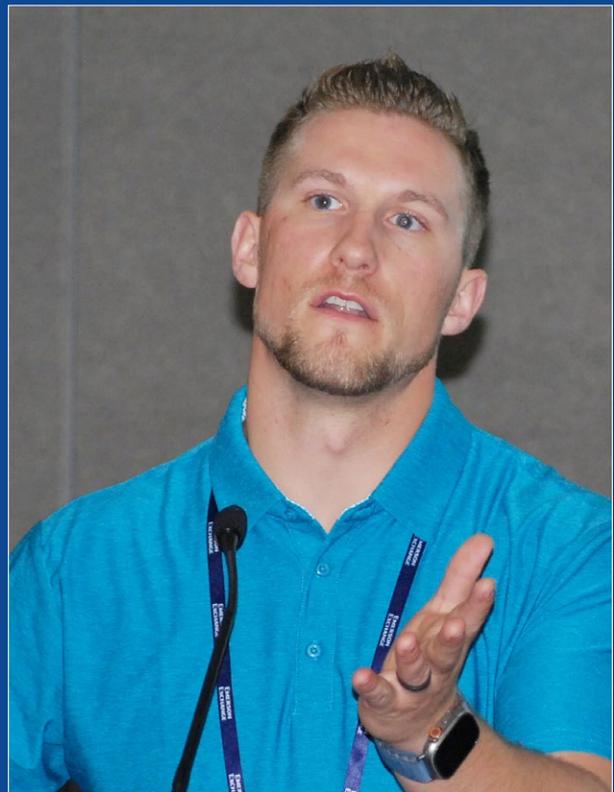
Here, Levi Merkel, automation engineering lead, is among the team working to ensure the safe and efficient production and isolation of such adjuvant compounds. He spoke this week at Emerson Exchange Immerse to share his experiences with digital twin technology commissioned in conjunction with the start-up of a new production unit in January 2023.

The unit hosts both DeltaV automation and safety instrumented systems (SIS) along with a range of “smart” and “dumb” skids—the former supplied with their own third-party automation controllers and the latter fully controlled by the unit’s DeltaV system. “There are 1,200 DeltaV I/O points and another 400 on the smart skids,” Merkel explained. And because the process uses toxic acetonitrile as a solvent, the SIS provides essential protections.

What made the production unit somewhat unique on the Hamilton campus is the inclusion of an operator training simulator based on Emerson Mimic software. “Everything that the operator interacts with in the production unit is replicated in the simulator—it all looks,

tastes and smells the same,” Merkel said. While the production system consists of a DeltaV console, redundant PK controllers and both smart and dumb skids, the OTS consists of a DeltaV console, simplex PK controller, the Mimic software as well as separate software to emulate the third-party automation PLCs.

Merkel also thought it important to explain that the Mimic system as it’s currently deployed represents not so much a digital twin (although that’s the ultimate destination), but a digital model that supports increased process understanding. “It’s the lowest fidelity and lowest cost option,” Merkel explained, noting that there’s no automatic feedback of data from the production unit to the model.



Everything that the operator interacts with in the production unit is reproduced in the simulator—it all looks, tastes and smells the same.” GlaxoSmithKline’s Levi Merkel discussed the many beneficial uses of an operator training simulator—many of which have nothing to do with operators.

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He envisions that with continued investment they can move from a digital model into the realm of a “digital shadow” that better supports decision-making with automated data transfer from physical object to digital one, and ultimately to a digital twin, with closed-loop data transfer between physical and digital worlds—providing the highest fidelity model but at the highest cost, Merkel said.

Since the production unit in question was the first of its kind, a low fidelity model was deemed adequate, both because the process was not well enough understood to justify more upfront investment and because the process centers primarily around a chromatographic separation and does not entail more sensitive reaction kinetics.

Best laid plans

The original purpose of the Mimic system was two-fold. First, to provide an offline environment on which personnel could be trained. Second, to provide a platform on which process control code could be tested before being deployed on the production unit.

As things have turned out, the team has been so busy supporting production that most of the operator training has been done on the production unit itself. But the simulator has not been idle, instead earning its keep during commissioning and qualification and to test the effects of potential automation changes on unit performance.

For example, the simulator was used to verify the clean-in-place recipe for the column-packing skid, allowing development of the standard operating procedure (SOP) well ahead of schedule. It has also provided a platform to troubleshoot and test solutions to identified problems without interrupting production.

Time savings during the unit’s site acceptance test and commissioning activities added up to some 270 hours—from an estimated 400 hours on the production unit to 130 hours on the simulator. Also, some 50 issues were addressed at least in part on the simulator, substantially avoiding any significant impact on the production unit. “Time on the production unit has been at a premium since before start-up,” Merkel said.

In addition, the knowledge gained via the simulator has saved an estimated \$144,000 in raw materials and another \$552,000 in waste handling expenses—returning more than its entire cost, despite little time spent training operators as initially intended. But Merkel and the team have big plans both short and long term, to formalize the operator training originally envisioned, add the unit’s SIS to the model’s scope, increase its fidelity and ultimately close the synchronization between production unit and simulator to achieve the ultimate destination of a fully functional digital twin.

BAYER ROLLS OUT A 'ONE-STOP SHOP' TO MANAGE ASSET HEALTH

By Jim Montague

It's crucial to “care for the caregivers,” so they can keep helping patients and loved ones. In the same way, process automation systems and users may need some labor-saving automation of their own, so they can stay healthy and keep optimizing production. Today, this usually means some form of digitalization. However, such projects may also include the streamlining of systems and removing unnecessary functions to gain efficiency and save time and effort.

Bayer's 155-acre plant in Muscatine, Iowa, was built in 1961. Located in southeast Iowa near the Mississippi River, the plant has more than 450 employees. It encompasses eight production units with about 3,200 devices, which are all linked to Emerson's AMS Device Manager software and managed by four separate DeltaV distributed control systems (DCSs). They've run DeltaV S-Series software in a cross-domain architecture since 2008.

Bayer's hardware and networks also include about 750 control valves that talk to Fisher FIELDVUE ValveLink software, about 1,000 motors and related assets and nine client stations. Almost all of these components are networked via HART communications protocol, while about 125 use Foundation Fieldbus. The plant also employs about 3,000 infrared (IR) thermography devices.

“This is a big challenge, especially because the plant operates with only one-and-a-half to two reliability technicians, which is very lean,” said Joel Holmes, senior consultant for reliability at Experitex Inc. “The plant's maintenance staff can help with some tasks, but they're not certified like the electrical technicians, so they can only do so much.”

Holmes and Matt Forbis, principal product engineer at Emerson, and Derek Ybarra, maintenance and reliability system engineer at Bayer, presented “Solving the device alert puzzle during Bayer's digital transformation journey” at last week's Emerson Exchange Immerse event in Anaheim, Calif.

Less nuisance alerts = more savings

Holmes reported that Bayer's digitalization initiative has two objectives—preventive maintenance (PM) and predictive maintenance (PdM)—and it must achieve both to be beneficial. Its core electrical reliability and process safety principles also rely on IR thermography and motor analytics.

Consequently, Experitex and Bayer developed a “concentric” strategy that includes AMS Device Manager, AMS Device View software and AMS Trex handheld field devices running AMS ValveLink mobile software. It's also been integrating new AMS Device Manager Data Server software with Feature Pack 2 (FP2) that



AMS Device Manager can always be on, scanning and assessing usage, and sending active status alerts to a list. We now have a one-stop-shop to determine asset health.” Experitex's Joel Holmes, together with Bayer's Derek Ybarra, discussed strides Bayer has made to move from reactive to preventive and predictive maintenance of its instrumentation assets.

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was launched two or three months ago and plans to add FP3 when it's released in March 2024.

“The plant’s lean workforce had a hard time sifting through all the data from operations, which made it hard to find and track bad actors,” explained Holmes. “Much of this work had to be done manually, which meant more reactive, ‘firefighting’ events, which is much less safe.”

To simplify and streamline its data collection and analysis, Bayer and Experitex updated many of the plant’s device description (DD) files for its components and the alerts they generate. This enabled it to go from a baseline average of 150 alerts per day to about 60 alerts per day, or a 60% reduction thanks to its newly optimized alert definitions. “Over a 60-day period, we also found that 12 device types were producing 91% of all alerts, and 10 individual devices were producing 41% of all alerts,” said Holmes. “This saved the plant a lot of effort.”

See more, do more

In addition, upgrading to AMS Device Manager V14.5 with add-on Device View software improved performance in several ways when they were released two years ago:

- Device scanning that was 5-15% faster;
- Rebuilt hierarchy that was up to 75% faster;
- Concurrent performance/handshakes improved for AMS Device Manager’s plant-level applications;
- Field device integration support with user interface plugins (UIP) that talk to new devices; and
- Improved editing with templates that optimize workflows for bulk transfers, such as multivariable devices with many parameters.

“AMS Device View is a thin-client that’s easier to use because it has an audit trail for the last 20 events and provides a ‘parking lot’ for workflow projects and an overview on a web-based interface,” said Holmes. “This lets users

drill down, set manufacturing information, and learn why alerts are occurring, which improves safety, availability and costs because there are fewer bad actors, tasks take less time, and there’s less reactive work.”

AMS Device View also makes it easier to distribute data to users so they can make better decisions. “This thin client has both view-access and write-access, which is a big help,” added Holmes. “These capabilities allow reliability personnel to be the cheerleaders they need to be to get users to learn, grow, and promote best practices. We have about 10 power users at the Muscatine plant.”

Ybarra added, “Joel took the DD files and eliminated 60% of nuisance alerts. This also gave our technicians access via Device View, so we could also train them and establish standard work processes.”

Optimizations attributed to AMS Device View include:

- Reduced alert review workflows and execution by 10 minutes per day and 90 minutes per week, and enhanced visibility beyond the plant’s electrical reliability group;
- Increased cost avoidance savings by 67% by moving from reactive to proactive maintenance and related activities;
- Technician workflow process optimization earned more than \$225,000 per year;
- Availability increased 24% because it’s no longer tied to a thick client; and,
- Accessibility to smart field device data increased by 80%

Ybarra reported his team is excited to use the upcoming AMS Data Server. “Instead of looking for so much data on our own, we can depend on this system to make more of these checks,” said Ybarra. “This will let us catch more items and spend less time doing it. Plus, instead of having to search for details after an outage, AMS Device Manager can always be on, scanning and assessing usage, and sending active status alerts to a list. We now have a one-stop-shop to determine asset health.”

NOVO NORDISK DEBOTTLENECKS WITH EMERSON'S RTMS SOFTWARE

By Jim Montague

Because quicker data and answers allow faster decisions and optimization, close to real-time results enable the fastest solutions.

That's what Novo Nordisk discovered when it deployed Emerson's Real-Time Modeling System (RTMS) in the expression, engineering and formulation processes for its therapeutic proteins and peptides products. Implementing RTMS software allowed the pharmaceutical company to:

- Resolve bottlenecks and determine capacity analyses by using plant data to run what-if scenarios. This identifies other, previously unseen bottlenecks, which can also be resolved to improve throughput even more.
- Implement unified, site-wide real-time scheduling (RTS) using a Level 2/Level 3 automation-based finite scheduling module, which produces schedules that are continually updated and always feasible using the RTMS model. This includes integrating RTS with corporate manufacturing execution system (MES), enterprise resource planning (ERP), quality management system (QMS), distributed control systems (DCS) and maintenance systems to generate further updates.
- Employ Crosswalk software for statistical analyses, data fitting and process evolution tracking. This lets users create datasets from batch historians that RTMS can use. It also allows analysis independent of RTMS for use in overall equipment effectiveness (OEE), process evolution or golden batch projects.

"RTMS lets users add new data to their simulations, recalculate, update schedule times, and adjust future

times," said Keith Hope, RTMS engineering manager at Emerson. "Each activity is also mapped to markets in the automation system, which shows the impact on scheduled activity, and indicates if maintenance is needed and how to get back on track."

Hope and Mikael Johansen, project director at Novo Nordisk, presented "Hidden treasures: How to unlock additional value in your plant by adding RTMS software" this week at the Emerson Exchange Immerse event in Anaheim, Calif.

So far, Novo Nordisk has implemented RTMS at two of its existing proteins and peptides facilities, and is



RTMS lets us know when a high-utilization day is likely coming, so we can prepare our equipment and systems to handle them." Novo Nordisk's Mikael Johansen discussed how real-time management system software helped to dramatically improve unit productivity and process operations.

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preparing to install it at a third facility that's presently under construction.

Streamlined by scheduling

In 2020, Novo Nordisk deployed RTMS for day-to-day scheduling on three screens in the control room used by one plant's operating teams, which previously tried different planning systems. This plant lacked a unified production schedule, and had low confidence that it could ramp up production

“We wanted to capture all the knowledge we could for better planning, and perhaps add a couple of batches, which we couldn't do before due to a lack of training,” said Johansen. “RTMS let us go from running four or five batches per week to five or six batches per week, which was about a 20% increase in output.”

RTMS also pointed out some gaps in operator competencies among the plant's teams, which required some tasks to be done at certain times of day. Making the production schedule more visible during higher run rates showed where added training was needed. RTMS also codified and modeled the tacit knowledge that plant staff needed when scheduling manually, and that model was used to train new schedulers, process controllers and engineers.

Simulations untangle snags

In 2022, Novo Nordisk adopted RTMS for debottlenecking analysis at a second plant to reach designed production rates more quickly and easily, and reports it went on to achieve the fastest ramp-up to full production in the company's history. This new facility performs upstream and downstream production with buffer-stock solutions in a complex tank network and strives to process one batch every 24 hours.

“We built simulation models for all of the plant's process steps, which let us add more data to our simulations,”

explained Johansen. “This plant also simulated about 20 years of production, and identified long-term bottlenecks, such as buffering system delays. We often found that removing one bottleneck led us to find more behind the first one, which gave us an opportunity to resolve those, too.”

Johansen reported that Novo Nordisk also used RTMS to monitor the utilization loads on its clean-in-place (CIP) stations. Most averaged 29-37% utilization, but some days they ran at 60-70%, which could cause delays and risk the loss of a batch due to their often short, critical holding times. “RTMS lets us know when a high-utilization day is likely coming, so we can prepare our equipment and systems to handle them.”

New protein-peptide plant—with robots

While it's still being built, Novo Nordisk's third RTMS deployment is going into its \$2.3 billion plant. It will have four independent mammalian-cell production trains with a shared weigh-and-dispense (W&D) area, and an RTMS application for each train. At this facility, RTMS will:

- Forecast demands for the shared W&D area and perform real-time tracking of resource constraints for managing shutdowns and maintenance.
- Help the plant's automated guided vehicle (AGV) robots make deliveries by using the RTMS schedule to predict demand for materials, and work with the AGVs' fleet manager software to monitor and coordinate their locations.
- Similar to the second plant, RTMS will also be used during ramp-up at the third facility to identify process bottlenecks preventing full-capacity operations.

Real-time lessons learned

Johansen reported that using RTMS taught Novo Nordisk several valuable lessons, such as supporting sites and staffers to adopt new ways of working.

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“In the past, each team did things in different ways. RTMS shows where we can optimize and improve operations,” said Johansen. “If a schedule says a process must be done at 2 p.m., it can’t be done at 3 p.m. because other tasks or processes may need that equipment.”

The system also helped prepare for go-live operations and transition off old systems, and measure success for future gains. “We think old planning systems should die quickly, instead of running legacy and new systems in parallel for so long before shutting down the old one,” he said. “Even veterans, who know the most about these systems, still don’t know everything. This is where putting all our process knowledge into RTMS models can be a big help.”

RTMS models also capture key process and scheduling know-how, which mitigates the impact of turnover on the scheduling team, helps onboard new employees and assists in communication with management. Centralizing expertise in RTMS drives consistency, improves responsiveness to process needs, and maintains expertise with a consistent work stream.

Johansen revealed that RTMS even enhanced Novo Nordisk’s culture. “We had heavy involvement from operations in building our RTMS models. However, when we first did them, they looked like our operations interfaces used to. This meant they might not get used if there wasn’t enough of a difference,” he said. “So, we let the new RTMS models look like the old displays for a while, and adjusted them later, which helped us get more buy-in.”

CPS ENERGY MODERNIZES SCADA TO TRANSFORM GAS DISTRIBUTION

By Len Vermillion

As the nation's largest municipal utilities provider based in San Antonio, Texas, CPS Energy can't afford downtime. A lapse in operations can mean no power or gas for residents around the region, and in South Texas, no one wants to endure the heat without power. Keeping old systems updated is of vital importance.

So, when it came time to modernize its 10-year-old SCADA system, the company had a lot of considerations to address. Alex Solis, senior manager of SCADA technical support at CPS Energy, presented at last week's Emerson Exchange Immerse 2023 in Anaheim, Calif., where he outlined the company's SCADA modernization project, which took multiple years to complete.

CPS Energy started the project in 2019, right before the COVID-19 pandemic crippled the world. With some perseverance and the help of experts at Emerson and AspenTech, the new SCADA system went live in 2022.

CPS Energy utilizes multiple SCADA systems for its electric and gas distribution operations. The modernization project focused on its gas SCADA system, which manages gas pipelines to ensure proper flow and pressure. The system monitors 49 remote automation devices, which are a combination of RTUs and Emerson's Remote Operations Controllers (ROC 800s) and FloBoss 107s, according to Solis. A mix of communication devices and infrastructure (point-to-point radios, mashed wireless networks, fiber-optic multiplexers, microwave transport and cellular devices) connect remote stations to two control centers.

The old SCADA had a hard time keeping up. Its hardware was no longer supported and ready to be replaced.

CPS Energy had more than a few goals in mind when it began planning its RFP for the project. It wanted NIST-based cyber security protocols, a control room management (CRM) platform that could be integrated, consolidated applications for improved situation awareness, a common platform with appropriate network segregation, and an operator training simulator.



Alex Solis of CPS Energy discussed how the nation's largest municipal utility boosted the performance and reliability of its gas distribution system.

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Solis said growing cybersecurity risk necessitated the call for best-in-class industry standards to meet compliance.

Pandemic and regulatory obstacles

CPS Energy faced quite a few challenges to get the project completed, not the least of which was the sudden onset of the pandemic and new regulations that were dropped in their laps in the middle of the project.

The company was also limited by an aging workforce, so it hired consultants to assist with the RFP and implementation. The extensive RFP was won by Emerson and AspenTech and the project took off from there, according to Solis.

He said the executive leadership was active in the entire process, resulting in cross-functional governance and

support for IT, OT, SCADA support, controllers, compliance and security, to name a few.

In the end, improvements incorporated into the new gas SCADA system include modern visualization tools and alarm management, situational awareness displays, pipeline topology, dynamic coloring, inventory and linepack calculations, cybersecurity controls, synchronized disaster recovery, and an operator training simulator.

Solis said the biggest improvements include advanced display capabilities and an open architecture that allows for PI and GIS integration.

These days, CPS Energy is well equipped to handle any situation that may occur in its gas distribution system, and residents of the region can count on their utilities being available.

PANELISTS SHARE HOW OT CAN LEVERAGE THE CLOUD

By Len Vermillion

One of the biggest topics of conversation at Emerson Exchange Immerse 2023 held this week in Anaheim, Calif., has been the challenge presented by cloud implementation, particularly for OT and on the industrial edge. It's no secret that IT departments in many companies and industries have embraced cloud solutions successfully. After all, it's quick, cost-efficient and flexible. And while OT cloud implementation lags that of IT, the tide seems to be changing, said Emerson CTO Peter Zornio to a panel of industry experts convened on the topic. The panelists agreed.

Jose Valls, CTO of manufacturing at Microsoft, said just about every company is using the cloud in some way these days, mostly to optimize processes. "We've been working with almost any company you can name," he said.

Erik Lindhjem, vice president and general manager of reliability solutions for Emerson, pointed out that the changing nature of business post-COVID has made it easier and more necessary for OT decision-makers to embrace cloud applications. He said Emerson sees more customers with remote users accessing their OT instrumentation, so those applications have been moved into the cloud. "We have customers using AMS Optics across 20 facilities," he said, adding that the cloud has made data democratization among those users much easier to achieve.

Drivers of adoption

Zornio, Valls, Lindhjem, and fellow panelists Steve Williams, vice president of portfolio product strategy at AspenTech, and Brian LaMothe, vice president of cloud application development at Emerson, said distributed edge

operations have raised the profile of cloud adoption across the process industries.

"There could be cost advantages," Williams said of using cloud on the edge. "You just have to make sure those distributed systems are sufficiently managed. I'm very optimistic about the way DeltaV Edge is going." The DeltaV Edge Environment is a secure-by-design solution that enables users to easily access DeltaV data and make it available for use on premise or in the cloud.

Williams said that AspenTech sees a lot of processing facilities turning to cloud solutions for supply chain management, especially if they are sharing significant information with their customers. However, many are still at the point where they prefer to stick with their own private servers, he added.

Zornio and LaMothe agreed that collaboration is a big driver of adoption in OT cloud applications. LaMothe also sees two main areas where cloud-based OT applications have needs that IT applications might not. "It comes back to mean time to repair," he said. There must be a way to identify an issue and be able to process it in a timelier fashion than what is available now, he said. The second area of focus is the need for automated quality



Expert panelists from Intel, Microsoft, Emerson, and AspenTech offered an assemblage of operational technology professionals' advice on how to best take advantage of the capabilities offered by the cloud at this week's Emerson Exchange Immerse.

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systems that use AI or machine learning to test for and detect any operational unknowns in the data.

Other drivers of growth in cloud solutions for OT include the needs for process reliability and sustainability. Williams said the cloud can be very helpful for companies seeking to solidify their sustainable operations and reporting.

Selecting SaaS?

While companies may want to integrate cloud solutions into their processes, they still must figure out how they will consume and integrate the distributed technologies. IT adoption mainly happens via software-as-a-service (SaaS) solutions. All the panelists felt the SaaS model is well established by IT and OT will most likely follow the proven ground.

But Valls cautioned that it's not as simple as it seems. "They don't just have one SaaS model, but a variety of models from multiple companies," he said. "How will the end-user bring all those siloed SaaS solutions together to interconnect? That is the role a company like ours, Microsoft, wants to play."

LaMothe offered a solution. "You provide an API, and you can filter what data you want. Providing that mechanism through a standard API is our approach," he said.

Regardless of the method, operators must know their data is safe and for many, it's still hard to believe in safety when moving to the cloud, according to Williams. "It's a process," he said of efforts to appease customers. "We still have customers who want to do things in their private clouds. I will say there is a wave moving in the SaaS direction and a growing belief that security is advancing."

Panelists offered advice to those in the audience who may be teetering on the brink of moving into the cloud. LaMothe advised them to be open-minded and to start with lower risk action items, in terms of data security. Williams encouraged them to have faith in the advancements being made but maintain a purpose for adoption. He added that you need a business strategy for implementation to be successful.

Meanwhile, Lindjhem said there's no reason to try to avoid cloud adoption. "It's here and it's not going away," he said. "Now, with the edge piece, it's just a matter of finding balance. Security will make it possible. There's no reason not to pursue it."

AI LIKELY TO AUGMENT HUMANS, NOT REPLACE THEM

By Len Vermillion

Automation intelligence (AI) and machine learning (ML) certainly aren't new concepts to process control engineers. These technologies have been in play in industrial processes for 30 years or more, but they've largely been the realm of the technologist or data scientist. Today, AI has blown the minds of many people, and large language models (LLMs) have exposed generative AI to just about anyone with a Wi-Fi connection and an internet browser. Let's just say it has more than a few people thinking about the possibilities and the challenges, as well as the dangers of AI.

"We have been working on this for many years and believe it will be a big transformation for all of us," said Jose Valls, CTO of manufacturing for Microsoft, during a thought-provoking panel discussion called, "Forging Tomorrow: Unleashing AI Benefits" during Emerson Exchange Immerse this week in Anaheim, Calif. "It's here and it's not going to stop," Valls said.

Valls is far from the only one working on generative AI to take notice. "In my tenure, I don't think I've ever seen something that has so much potential," added fellow panelist Rick Kephart, vice president of technology at Emerson's Power and Water Solutions business, who has worked in industrial control for more than 30 years. "I've become a believer, and I wouldn't have said that last year."

AI is winning over many people in the industrial sector, just as it is in a plethora of other industries. At the same time, it stokes fears ranging from the practical—job losses, mistakes in production—to the fantastical—a dystopian society run by computers. (Perhaps thanks to decades of

Hollywood movies that tend to turn toward the dark side for dramatic effect.)

No need to worry about that just yet, the panelists pointed out. We're a long way away from a total surrender to autonomous manufacturing and processing plants. Rather, the focus these days remains on the opportunity to use AI to augment human productivity and efficiency. It can also help increase cybersecurity and super-charge real-time diagnostics and predictive maintenance in the plant.

Augmentation or autonomy?

"I'm really interested in the runtime and diagnostics," Kephart continued, pointing out two areas he's seen significant benefits already: machinery health and monitoring and reacting to off-normal conditions, much like a digital twin. "I think we are a long way away from taking the human out of [the plant]," he added. "We'll be needed even if to moderate between competing control functions. I'm a little skeptical about the autonomous plant."

Rita Wouhaybi, senior AI principal engineer, Intel, also isn't concerned about losing the human touch at this point. "I love the fact that we're talking about AI assisting



I love the fact that we're talking about AI assisting humans. Playing the role of assistant is the right attitude." Intel's Rita Wouhaybi together with co-panelists from Microsoft, AspenTech and Emerson, discussed the rapidly evolving capabilities of artificial intelligence (AI) and the role it will play in plant automation.

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humans,” she said. “Playing the role of assistant is the right attitude.”

For AI to become humans’ helper, it must speak the language of humans, she added. That’s where LLMs entered the party and turned it into a big bash. “It has to be present where anyone can consume it,” Wouhaybi continued. “At the end of the day, is it deployed in my pocket on my phone? Where is the value being delivered?”

Like Kephart, she sees value in diagnostics right now. She added that predictive opportunities are exciting for the near future, saying LLMs are good at predicting the next move. “They are basically saying what the human would do next,” she said.

Nithiya Parmeswaran, vice president of product management at AspenTech, also said the value of AI must be established for industrial processes before companies jump in the water with both feet. “In the industrial space, we need to talk more about the value and less about the technology,” he said. “We need to explain to the end user so they can understand the cost and why they should be using it.”

While the promise is off the charts, the hindrances are still many, with data at the top of the list. The dirty truth about AI is that it can only be as good as the data it is trained on.

The panelist said LLMs must be trained on specific plants, much like digital twins, to be successful. The idea is for the AI to know the plant just as a human worker would, so that it can function as a “shirt tug” to prod humans to react. There’s no doubt the holy grail would be for AI to handle issues itself, but we’re not there yet, they agreed.

Another hindrance, they said, is that AI will have to auto-learn to hit such heights. At the moment, it is reliant upon data scientists to have clean data, but as anyone working with data knows, perfect data is non-existent, so until AI can learn to sort good data from the bad, humans will remain in charge of the plant.

At the end of the day, AI is ready to be a super-worker, but don’t expect it to be the boss anytime soon.