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HIGHLIGHTS OF AUTOMATION FAIR 2023

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TABLE OF CONTENTS

Keynotes

Rockwell Automation's expanding technology strategy	3
Four industrial trends and the tools to navigate them	5
Digitalized help on the way for manufacturing challenges	7
People and technology: A time of profound change	9
Microsoft blazes the industrial metaverse trail	11
Ansari, Kamen believe innovation can save the world	12

Summits

The intersection of sustainability and productivity	14
OEMs, tech partners, end users comprise magic triangle	16
PlantPAx to take on mounting process challenges	18
Plex connects people to process, productivity and purpose	20

Media Panels

Otto Motors navigates familiar industrial terrain	22
A lifecycle approach to securing networked assets	24
Why a holistic view on sustainability is required	25
How to address the workplace skills gap	27
Why factories care about outcomes, not Al	28
Supply chains receiving AI attention just in time	30
FactoryTalk Design Studio accelerates with generative AI	31
Sustainability efforts delivering tangible benefits	33
Cybersecurity: People are your first line of defense	35

Plant tours

Inside the ARMI human tissue foundry	36
Downeast Cider realizes double-digit cost reductions	38

Save the Date

40

EXECUTIVE KEYNOTE

ROCKWELL AUTOMATION'S EXPANDING TECHNOLOGY STRATEGY

By David Greenfield

Resilient. Agile. Sustainable. These are the three key outcomes Rockwell Automation is focused on creating for users of its technologies, said Blake Moret, chairman and CEO of Rockwell Automation during the opening keynote at Automation Fair 2023. "Our job is to understand customers' complex challenges, help them better define what the specific issues are and simplify the business of automation, because I still believe that's really what's going to set apart the winners and losers over the next decade."

To do this, Rockwell is expanding on its core focus around production optimization to address resilience, human-centric automation, sustainability and digital transformation.

"Some of these things were not a big part of our portfolio 10 years ago. But we're building around our core automation technologies to add production design, production control and production logistics in addition to edge and cloud-native applications," said Moret. "We want to give customers a choice with cloud and edge because companies are at different points in their digi-

tal transformation journey. That's why we're looking at our roadmap to bring the best of both worlds together, such as with Plex and FactoryTalk, to meet you where you are in your journey. And this extends into logistics between machines with autonomous mobile robots, which have now become as important as fixed line control."

"Having a human-centric view of the plant floor is a winning hand for manufacturers because an idea that begins as a glimmer in someone's eye in corporate engineering will fail if plant floor operators don't feel empowered and engaged in the process." Blake Moret, chairman and CEO of Rockwell Automation, on the central importance of the human factor in industrial automation. Moret noted that building resilience in industry has become increasingly important since the COVID shutdowns, as it highlighted the need for redundant operations as well as the ability to better address unforeseen supply chain challenges. "We could not have conceived of the limited production that led to shortages of critical components as a result of COVID," said Moret. "That's why it's critical to be able to forecast demand accurately to deal with that kind of volatility."

He pointed to Plex DemandCaster (acquired by Rockwell Automation in 2021) as an example of how Rockwell Automation is helping its customers better understand the effects of demand on their supply chains. "We've talked about the idea of connected supply chains for years and customers intuitively know there are huge savings and efficiencies to be gained there," said Moret. "That's why we have significantly increased our capability to help deliver the connected supply chain and we will continue to invest in this area."

Cybersecurity is another key factor of Rockwell Automation's approach to resilient operations. "We just acquired



Verve to significantly increase our capabilities with respect to cybersecurity to build on our services around that and help make our customers the hardest possible targets," he said.

People and processes

Empowering people through a human-centric view of the plant floor is a "winning hand" for manufacturers when they can "energize people" with technologies they are more comfortable using, said Moret. "It may sound a little bit unusual for an automation company to talk about people as much as we do, but it's so important because we're in a period where workforce shortages are on a critical path to impact project completion across a lot of industries. That's why making the most of scarce resources—by getting people comfortable with technology and properly equipping them—can be the difference between a successful and unsuccessful project."

In line with the issue of scarce resources, Moret said to truly address the multiple dimensions of sustainability in the manufacturing industries, companies must start by "being better stewards of water and energy use." From this starting point, Moret said Rockwell looks at the sources of energy used and concentrates on decarbonizing traditional sources of energy as well as speeding the production and capacity expansion of renewable energy. "And we can do all this multi-discipline control work with our basic control technologies. We're doing it now with Occidental Petroleum on their 1PointFive large-scale, direct-air, carbon-capture project," he said.

Another key technology trend Moret noted is how digital twins are increasingly being used to simulate manufacturing processes. Industrial companies can model their operations and gamify potential changes to the layout to be able to move faster, de-bottleneck production and incorporate new requirements—such as new packaging formats, he said. "The technology to do this is available today, meaning companies don't have to run physical material through their processes for hours in a trial-anderror process," he said. "Our tools, like Emulate3D in FactoryTalk Twin Studio, help manufacturers model those processes to simulate them and then transform them into more efficient operations."

He added that Rockwell also has consulting services through Kalypso (acquired in 2020) to "accelerate this digital transformation and help customers define their problems up front to better address the change-management process. Because what begins as a glimmer in somebody's eye in corporate engineering will fail if plant operators don't feel empowered and engaged in that process."

KEYNOTE

FOUR INDUSTRIAL TRENDS AND THE TOOLS TO NAVIGATE THEM

By Mike Bacidore

utomation Fair is Rockwell Automation's annual gathering of its customers and partners to showcase what's available and imagine what's possible. "All of the ecosystem that has come together is about building the future of industrial operations," said Tessa Myers, senior vice president, intelligent devices, Rockwell Automation.

With a flurry of acquisitions leading into the Boston event, Myers focused her keynote presentation on how companies can achieve resilience, agility and sustainability in their operations. "Complexity for any industrial company is increasing," she warned. "And global value chains are being transformed."

That transformation is taking place by combining technology, such as production design and control, intelligent devices, production logistics and edge-to-cloud solutions, with expertise in cybersecurity, digital consulting and industry-focused solutions.

"We live at the intersection of your most pressing problems and the technology that can help you overcome them," said Myers. "We're focused on simplifying the difficult work you have. Over the next decade, we'll see supply chains powered by autonomous recent Rockwell Automation acquisitions, along with three Rockwell Automation employees—Matheus Bulho, vice president and general manager, production automation; Andrew Ellis, vice president, global portfolio engineering; and Rachael Conrad, vice president, global enterprise customer experience—showcased products poised for the next wave of automation implementations.

"Logistics is an opportunity to optimize production and empower people," explained Myers. "There's a need to retool operations and increase output. Historically we had one tool to handle product variations—throwing people at the problem. That's no longer an option." Labor shortages and the aging workforce are putting a strain on industrial operations. Traditionally forklifts and carts were driven and operated by human employees, for example.

"Our goal is to use autonomous mobile robots (AMRs) to create safer and more productive workplaces," explained Rendall. "Otto Motors AMRs are deployed in factories all over the world. Finding enough people has been a challenge. It's important to invest in new forms of automation to make better use of the scarce talent we have."

technology."

Myers was joined onstage by four colleagues who described Rockwell Automation offerings to address significant technology trends, including production-logistics transformation, rapid startup with new design tools, resilience building, data-driven productivity and data-driven sustainability.

Production logistics

Matt Rendall, co-founder of Clearpath Robotics' Otto Motors, one of the

"We live at the intersection of your most pressing problems and the technology that can help you overcome them." Tessa Myers shared Rockwell Automation's latest solutions at Automation Fair this week in Boston.



Rendall cited a manufacturer in Indiana that had been able to run at only 75% of production because of a staff shortfall. By implementing AMRs from Otto Motors, the factory was able to reallocate employees from materialhandling functions to operate an additional production line and increase productivity. "You want humans focusing on things they're meant to do, and you want robots focusing on work they're meant to do," explained Rendall.

"Autonomous technology is not the realm of science fiction," Rendall reassured the keynote audience. "We have lasers and cameras and advanced artificial intelligence (AI), allowing each Otto to perceive its environment and figure out the best way to get where it needs to go. The vehicle needs to be intelligent enough to respond to the unexpected. Our Fleet Manager [software] makes sure that the right vehicle gets assigned the right job, and it integrates with an enterprise resource planning (ERP) system and takes information from all sources. By automating material handling, manufacturers can elevate workers out of those jobs so they can work on other jobs where they're needed."

Digital design

Next up, a demonstration of machinery from Eagle Technologies, which was acquired in August by Convergix Automation Solutions, showed how digital tools can be utilized to speed design and commissioning, as well as provide data for predictive-maintenance capabilities.

"We have been working with companies all over the world to deploy new production systems and retool existing ones," explained Rockwell Automation's Bulho. "Leveraging virtual design and commissioning tools is one way we're doing this. Convergix is a great example of how we emulate devices, test and commission in a virtual environment. It's not uncommon for us to see companies like Eagle and Convergix take advantage of a 30% reduction in time of design and commissioning, which reduces the cost of startup delays."

FactoryTalk Twin Studio is part of the FactoryTalk Hub. It hosts FactoryTalk Logix Echo and Emulate3D. "One of the key technologies in the Convergix is independent cart technology," explained Bulho. "It frees equipment from traditional mechanical constraints." Other technologies, such as FactoryTalk Optix, Plex and Fiix, make the machines information-ready.

Data-driven productivity and sustainability

Rockwell Automation's been working across its portfolio to make products smarter and enable users to bring that intelligence to the edge and the cloud by creating the necessary infrastructure. "We've been investing in new capabilities," said Ellis. "We've had a long history of partnering with best-in-class companies, and we've partnered with Microsoft to do just that."

Ellis described the conceptual design of a machine with data-readiness as part of its inception. "We started with a digital twin," he said. "This provided us with the ability to visualize the machine before we started fabrication. We have a lot of intelligent devices, including 15 sensors, on it. This data is used to provide visibility to help drive productivity and efficiency. It has our Armor PowerFlex drives to provide an on-machine solution that reduces the overall footprint."

Once the data sources are established, they are integrated in FactoryTalk Optix, which connects to those devices and Plex Asset Performance Management (APM) software for rapid integration of OT sources. "It allows us to do production monitoring and reporting," said Ellis. "Now that we have the context on the machine, we can be more predictive. When we need to gain further insight, we can add context with IT data sources and OT data sources using FactoryTalk DataMosaix. It's all about connectivity—from the device to the edge to the cloud."

Cyber resilience

Finally, Rockwell Automation's Conrad joined Myers to walk through a cybersecurity demonstration at a fictitious water treatment plant. "We've experienced a perfect storm of disruptions," said Myers, "including COVID, climate change and cyber threats."

Using Rockwell Automation cyber tools, along with others from Cisco, Microsoft, CrowdStrike, Claroty and Dragos, Conrad was able to illustrate how an initial cyber attack and a secondary attack could be thwarted. "It takes an ecosystem to be able to deliver the right security," noted Myers, who also recommended a zero-trust approach to cyber resilience.

"We have a partner ecosystem to leverage," added Conrad. "While the challenges of OT are tricky, we can work through this together." Verve Industrial, a U.S.-based company with a powerful vulnerability management platform is the latest acquisition announced by Rockwell Automation. "This platform was built with IT level security to address OT challenges," noted Conrad. "With an asset approach, we're able to aggregate all of that data, even from other partners' tools, into a single pane of glass."

DIGITALIZED HELP ON THE WAY FOR MANUFACTURING CHALLENGES

by Jim Montague

here are always concerns that automation is going to take away jobs. However, in light of today's rapidly shifting technologies, supply chain disruptions—and millions of already unfilled jobs—it's more than likely there will be plenty work for everyone, even if job descriptions change and retraining is necessary.

"Rockwell Automation wants to expand human possibilities. And when we talk about the future and things like robots on the plant floor, we're not talking about removing people from the equation," explained Cyril Perducat, chief technology officer, Rockwell Automation. "We want to augment existing people and their capabilities. There are a lot of buzzwords today, including artificial intelligence (AI), but they aren't just about technology. They're about creating the right experiences for people. There's no way to invest in the future without making tools usable for people."

Perducat presented during the closing keynote address at Automation Fair 2023, held last week at the Boston Convention and Exposition Center. Perducat added the second big challenge is supply-chain volatility and shortages of raw and finished materials, such as semiconductors, which ramped up during the COVID-19 pandemic, and have continued more recently due to the ongoing war in Ukraine and other geopolitical turmoil. These upheavals and other uncertainties have been accompanied by increasing cybersecurity risks. "Cyber probes, intrusions and attacks typically come from malicious actors targeting manufacturing sites and infrastructure," explained Perducat. "These challenges are why users need to stay agile, optimized, and maintain high productivity."

To help users develop useful responses to these multiple challenges, Perducat outlined present and future conditions from four angles: production that is both agile and optimized as well as resilient and sustainable.

Agile optimization

First, flexible machines that enable fast changeovers will give way to reconfigurable manufacturing systems that also enable simplified updates. Plus, digital twins for machine

Challenges and strategies

Perducat reported it's important to start with the individual combination of challenges that each industry and company is facing. "Manufacturers want stable production, but many demands are quickly evolving," added Perducat. "Many cars are built as almost unique models, and many pharmaceuticals are produced using increasingly individual specifications."

"ChatGPT and other large language models can enable optimization in much less time. This gives users the copilot they need to drive production in the right direction." Rockwell Automation CTO Cyril Perducat discussed the rapidly advancing capabilities of generative Al at Automation Fair 2023.



and production line design will evolve into digital product lifecycle integration that enables constant evolution.

"This is about making data available and networks plugand-play, so users can get increasingly granular views of what's happening in their processes," said Perducat. "This can also enable development of digital twins for specific processes or pieces of equipment."

For example, if a user can understand the six or seven primary variables that drive production as well as the primary elements that characterize its physical and digital reality in real time, then production can be continually revised and optimized. "This intersection between digital twins of products and their production lines is important," added Perducat. "This is because optimization now also provides a foundation for re-optimizing processes later or customizing more 'batches of one' product."

Resources and sustainability

Second, materials considerations in the present will become product lifecycle designs in the future. Renewable energy sources become fully integrated along with carbon capture and other viable energy models. And, machine learning (ML) and analytics will be modernized for closed-loop optimization.

"All consumable raw materials and other resources can be optimized in the same ways as the processes that use them," explained Perducat. "Consequently, these considerations will also become part of product designs. This means they'll need more data for closed-loop systems, so product designs can help reduce consumption and contribute to sustainability, too. Likewise, we can look at scheduling energy intensive production tasks when solar is readily available."

Perducat added that Rockwell Automation wants to use AI for closed-loop optimization of complete production lines and facilities. "Even though many of today's tools aren't fast enough, users can still look to make operational adaptations," said Perducat. "AI allows users to not focus so much on the data, and instead concentrate on opportunities for optimization. This is because its algorithms are better than traditional methods at predicting variations and optimizing for better outcomes. AI can work at all levels, so we're developing AI tools and building blocks. The programmable logic controllers of the future will all have native AI capabilities to simplify operations and data analytics in devices."

Resilience gets a revamp

Third, supply chains will be strengthened by being made more adaptive and part of integrated ecosystems, which will be able to automate and integrate all material movement. Meanwhile, present cybersecurity directives to identify, protect, detect, respond and recover will be joined by zero-trust architectures and enhanced threat detection.

"The plant-floor must adopt the same cybersecurity practices for its people and equipment as information technology (IT), including zero-trust," added Perducat. "Rockwell Automation is doing this and looking to do more."

People-pleasing user experiences

Fourth, to further simplify things on the human front, Perducat reported that predictive maintenance systems will add natural-language interrogation to help users. Similarly, assistive features in design tools will offer AI-enabled code sharing, collaborative generation and verification. Plus, autonomous mobile robots (AMR) and intelligent conveyance will be advanced by robots that can perform all types of material movement.

"Why look at multiple screens and trends if you can just ask the system what changes have happened as a production system shifted from point A to point B? Experienced users know where to look, but the large-language models (LLM) underlying ChatGPT mean rookies no longer need to learn as much about what data to capture and use," explained Perducat.

"ChatGPT and LLM can do these tasks and enable optimization in much less time. This gives users the copilot they need to drive production in the right direction. It also lets everyone share the code and knowledge of their best developer and verify that they're following best practices and company standards, which is a huge aid to user experience. This is also how AI and generative AI can enable robots to act as moving sensors, improve movement of materials and systems, and further augment people."

THE FUTURE OF AI

PEOPLE AND TECHNOLOGY: A TIME OF PROFOUND CHANGE

By David Greenfield

s the former editor-in-chief of Wired, Nicholas Thompson, CEO of The Atlantic, has long had a front-row seat to the technology and societal changes that impact us personally and professionally. This vantage point provides him with a unique perspective on what he called this "time of profound exponential change" and made him an intriguing keynote speaker at Rockwell Automation's Automation Fair 2023.

Thompson is not a futurist who predicts what technologies will look like five or 10 years from now. Instead, he connects the dots between past and present technological change and highlights the current developments that will likely have the most impact on our lives.

A key technology transition pointed out by Thompson, occurred during COVID. "People underestimate what happened during COVID in terms of how much it changed the trajectory of artificial intelligence (AI). Suddenly we're all at home and instead of having conversations at the water cooler, we're communicating with Slack and Zoom and everything we do is recorded and transcribed and turned into data."

This aggregation of data that's being analyzed by AI creates a lot of fear, he said. The fear is that we'll soon reach a point where machines are more intelligent than humans and the question then becomes: What will happen to my job?

While AI will, of course, impact certain professions as nearly every form of technology has at some point, he said that technology generally increases the amount of work to be done by increasing opportunities. To illustrate a few past examples, he pointed out that though travel agents have disappeared as a result

"As good as a large language model can be, it is highly unlikely to approximate human capabilities because it is based on text." The Atlantic's Nick Thompson discussed the capabilities and limitations of generative Al. on do-it-yourself online travel booking, the job of flight attendants has remained stable and even increased. Likewise with the advent of automated teller machines (ATMs), many expected the job of bank tellers to disappear, yet bank tellers still exist decades after the introduction of ATMs, but their jobs have changed and increased their value to banks' operations.

The limitation of LLMs

The power of AI large language models (LLMs) is clearly not insignificant. Thompson points out however, that LLMs are more like an advanced version of Mad Libs than a thought process that considers an array of experiences as a human would.

In addition, as LLMs get trained not just on past human inputs but on synthetic data created by AI in the past year, there is a lot of concern about the results it can provide.

He showed a recent prompt entered into Google's AI that asked: What is an African country beginning with the letter K. The answer from Google was: "While there are 54 recognized countries in Africa, none of them begin



with the letter 'K'. The closest is Kenya, which starts with a 'K' sound but is actually spelled with a 'K' sound."

This nonsensical response was placed into a conversation on the Hacker News site, which is indexed by Google, meaning that this data will get fed into its LLM. When an AI-generated nonsense answer is used to train AI, those mistakes will be used to build other mistakes.

So, while there exists significant upsides and downsides to our increasing use of LLMs, Thompson said that, as good as LLMs can be in a number of areas, it is highly unlikely to approximate human capabilities because it is based only on text, and that's only a portion of our experience and what influences our perceptions, decisions and actions.

That's why he contends that "the more creative and/or social the job is, the more stable and resilient it will be to technological change."

What to watch

Amid all the concerns and hopes for how AI could change our future trajectories, Thompson noted three areas that bear watching as we move forward—AI impersonations, the convergence of humans and AI and legal impacts on open-source AI.

Regarding the increasing amount of AI-generated deep fakes, everyone doubts information now, he said. But hightrust sources remain available and could benefit from this. He expects the internet to become an increasingly lowtrust place as deep fakes proliferate.

On the subject of AI and human convergence, Thompson cited a study that compared radiologists' ability to identify tumors to AI's ability to do the same on its own and as an aid to humans. The results showed AI was better at image recognition than humans and that humans assisted by AI performed the worst of the three. "This is totally counterintuitive," he said, noting that humans assisted by AI would be the expected winner in this contest.

"It turns out that there's something about the AI results that made the actual radiologists less confident in their correct decisions and more confident in their wrong decisions," said Thompson. "So, when the humans disagreed with the AI, it led them to the wrong place, which suggests that there's some deep psychological issues and real complexities with the way we work with machines and the way machines augment us."

As for open-source AI, where much of the innovation around AI has occurred, Thompson pointed out how the Biden Administration executive order on AI could have good and bad effects. By requiring audits of AI technology in development, the order will require AI developers to rely heavily on lawyers and lobbyists, which will make it hard for small companies in this space to compete. Thompson worries that this could lead all the value from AI developments to accrue to the biggest companies. "It could be that just a small number of companies get all the value," he said.

Ultimately, a big factor we'll have to deal with is as we move forward is that AI companies made a huge mistake early on. This mistake, Thompson said, was to focus on making a technology that could win the Turing contest in which a machine's responses are so human-like that a person cannot tell that they're interacting with a machine.

Though it seems like this would be the right idea for AI companies, it's not the right goal because "what's happened is that, by creating these systems that act like us, they missed the idea of figuring out slices of human intelligence and ingenuity that could be made much better with the help of AI instead of trying to be completely like us," he said. "We should have a sphere of AI-ness and sphere of humanness."

MICROSOFT BLAZES THE INDUSTRIAL METAVERSE TRAIL

by Jim Montague

t's always nice to travel with someone who knows a new town or the local terrain—and the metaverse and its neighboring ecosystems are no exception. So, as part of his opening address on the third day of Rockwell Automation Fair 2023 this week, chairman and CEO Blake Moret held a wide-ranging discussion with Judson Althoff, chief commercial officer at Microsoft, about artificial intelligence (AI), generative AI, ChatGPT and other forms of digitalization that Rockwell Automation is quickly turning to its advantage the benefit of its customers.

"The industrial metaverse can have real-world impacts on manufacturing to build better products and processes," said Althoff. "The metaverse is the culmination of combining technologies that can simulate any manufacturing request and do it in the cloud or elsewhere." Althoff added that Microsoft has seen measurable performance gains from using generative AI. These were achieved in 13-week engagements, where Microsoft moved into brownfield and greenfield applications in plants, and improved sensing, reduced use of resources, and achieved other gains.

"This isn't just the hype cycle, and if you don't engage, you'll likely fall behind," said Althoff. "A year ago, many people were treating gen-

erative AI like black magic and hogwash. However, that disbelief quickly turned to fear because three months ago, they were all saying 'the AI robots are taking over the world!' Now, many users are coming in with hundreds of ideas about what they can do with generative AI and ChatGPT, whether it's individual productivity or Consequently, Althoff reported that Microsoft is integrating generative AI into all its products. It's even using generative AI to write its own code, so it can get those products to market quicker. Likewise, Moret added that Rockwell Automation is adding generative AI copilots to its configurations and other tools.

"We're adding generative AI copilots because they can augment our users, open up the platforms and ecosystems they need to reach, and let them and their partners co-innovate, using software like Rockwell Automation's FactoryTalk Design Studio," explained Althoff. "No one joins these technical fields just to learn syntax, so it helps if they can ask their software directly for help. This unlocks a lot of user joy."

Generative AI just getting started

To further enable inclusive collaboration, Moret and Althoff reported that generative AI can even enable joint design reviews that include copilots in Teams meetings. "We've used ladder logic for decades to understand relays, but many recent graduates, don't know it," added Moret.



"Generative AI is really a call to action for everyone because it can change employees' experiences and bend the curve on innovation." Judson Althoff, chief commercial officer at Microsoft, talks metaverse with Blake Moret, chairman and CEO of Rockwell Automation

democratizing, data."

"Generative AI will allow more users to understand what automation is about, and perhaps consider working with controllers and automation as their careers."

For example, Althoff added that the large-language models (LLM) that generative AI is based on enables lessexperienced users to interact with it more easily using the spoken words they're used to. "We're unlocking power of the prompt," added Althoff. "Frontline workers hold all the golden expertise about how things really get done, and deal with a lot of complexity. Now, they can pull out a mobile device, take a picture and tell the software it's not working. The software will then access a recursive knowledge base and provide recommendations and solutions in the language that workers know best."

"Generative AI is really a call to action for everyone because it can change employees' experiences and bend the curve on innovation," concluded Althoff. "We took the suggestion of our own staffers, and used AI to help answer complex questions to further build its expertise. We even took \$100 million off our support organization's expenses, while still increasing customer satisfaction. This means anyone can ask generative AI how to help their employees, and they'll get an answer."

HUMAN POSSIBILITY

ANSARI, KAMEN BELIEVE

by Jim Montague

nyone can innovate, but, like most tasks, it's easier said than done. Two of the world's best-known innovators and a couple of young FIRST Robotics teams took the stage at Automation Fair 2023 this week in Boston to demonstrate what's possible.

For instance, Dr. Anousheh Ansari, CEO of the nonprofit XPrize Foundation, described growing up in Iran, which included looking at the night sky and wanting to be an astronaut. However, after years of working as a telecommunications entrepreneur, she made her dream real by journeying to the International Space Station (ISS) as part of a three-person launch from the legendary Star City in Russia. She also cofounded the initial \$10 million Ansari XPrize, in which 26 privately funded teams collectively invested \$100 million and created the multibillion-dollar commercial space industry.

"Back then, it cost \$50,000 to get 1 kilogram into space. Now, it's a couple of thousand dollars, and Starlink and others are working to get the price down to a couple of hundred dollars," said Ansari. "This will allow us to put some data centers and other manufacturing in orbit, run them with solar power, build space stations and create a lot of other new industries."

Back on Earth, the foundation is deploying its XPrize model to spur competition and encourage solutions for many other of the world's most vexing problems. Its mission is inspiring and empowering humanity to accelerate breakthroughs toward creating a world of equitable abundance. The seven grand challenge domains in which it's presently offering prizes are:

- Climate and energy
- Biodiversity and conservation
- Health
- Learning and society
- Space and exploration
- Deep technology, artificial intelligence (AI) and quantum computing
- Food, water and waste.

"People who know things can help us do better, whether it's cleaning of oil spills, feeding more people or whatever our challenges are," said Ansari, who reports the XPrize Foundation leverages every dollar it offers in prizes 31 times. So far, its \$300 million in prizes have brought in \$9.3 billion in investment, research and change.

"The view from the ISS showed the world as it is, with none of the imaginary lines and boundaries on all our maps. There's nothing separating us," said Ansari. "We need to know we're all interconnected and that we need "The technical community needs to have a loud voice on the importance of being rational. We can't leave this task to the rest of the world." Dean Kamen, president of Deka Research and Development and founder of FIRST Robotics on the next generation of engineers and innovators.

> to collaborate to solve our problems. The lines are blurring between our intelligence and artificial intelligence (AI), which is scary because we're fearful of losing control. However, while we need to be aware of it, I can't make decisions or act out of fear. We need to understand, collaborate and work toward the good."

From robots to regeneration

Pursuing equally innovative and industry-building paths, Dean Kamen, president of Deka Research and Development and founder of For Inspiration and Recognition of Science and Technology (FIRST) Robotics, charted his and his partners' progress on several fronts:

- Pioneering the first wearable insulin pump
- Developing at-home, peritoneal dialysis devices
- Further improving self-balancing iBot and Segway mobility devices
- Building Freestyle fountains for Coca-Cola that dispense more than 5 billion sets of more than 200 beverage brands
- Researching an intradermal patch for more efficient vaccine delivery.

"The breakthroughs continue because we keep improving on our initial products. For example, iBot is adding LiDAR and radar, so it can identify its environments and serve in security applications," said Kamen. " "We have more stuff in our kit than the kids in FIRST Robotics, but the principle of innovation is the same."

In response to U.S. presidential requests to develop new industries and with some federal funding, Kamen and his partners also launched the Advanced Regenerative Manufacturing Institute (ARMI) in Manchester, New Hampshire, to produce replacement cells and organs for soldiers, veterans and other patients, which many academic institutions apparently can use genomic know-how to create, but don't make at-scale because they aren't manufacturers and are hobbled by antiquated labs and facilities.

"We just thought we could accelerate these processes for diabetic, dialysis and organ-replacement patients,"



explained Kamen. "I'd rather be on the innovation bus than under it. We can take chronic conditions, and, instead of treating them chronically, we can simply transplant organs with high-quality replacements grown using patient's own genetics, so there will also be no rejection issues. These aren't problems that can be solved with petri dishes and pipettes. We're bringing together the tenets of engineering science to regenerative medicine to create a new bio-fabrication industry."

Kamen added that Deka is making equipment for ARMI's member institutes, including United Therapeutics, which is located on the same campus and is now the largest facility focused on 3D printing tissue and organs.

"We spend 21% of our healthcare dollars on chronic conditions, and those costs are only increasing," added Kamen. "Wouldn't it be better if we could reduce that trend, replace organs at-scale and give all those patients a better quality of life at less cost?"

As for the innovators who'll be needed tomorrow, Kamen reported that FIRST Robotics was up to 81,000 teams worldwide in 2021 and had representatives from 191 countries at this year's event in October in Singapore. In addition, all of them signed the twin declarations of interdependence and responsibility that Kamen drafted after the start of the war in Israel and the Gaza Strip.

"We've often said that FIRST isn't about robots. It's about using robots to build kids," explained Kamen. "A seven-year-old girl in one of our videos showed us why when she said, 'FIRST is CrossFit for the muscle upstairs,' and added, 'FIRST is a machine for building people who will change the world.' We're more interdependent than ever in the 21st century, and we need to respect truth and science," concluded Kamen. "The technical community needs to have a loud voice on the importance of being rational. We can't leave this task to the rest of the world."

SUSTAINABILITY SUMMIT

THE INTERSECTION OF SUSTAINABILITY AND PRODUCTIVITY

By David Greenfield

Sustainability has been a business factor in manufacturing for more than two decades and the industry as a whole has made significant strides toward becoming less energy and resource intensive. But global economic issues over the past few years have slowed some of industry's progress.

"When the market is performing well, companies focus more on sustainability initiatives. But when the market struggles, we see the inverse as they cut back on these initiatives and focus on revenues and profits," said Alex West, senior principal analyst for industrial sustainability at technology research company Omdia, during the ESG (environmental, social, governance) Summit at Rockwell Automation's Automation Fair 2023.

As a result, West said manufacturers are falling behind on their sustainability initiatives from 2022 to 2023. To move forward sustainably in a way that also addresses financial concerns, West said companies need to "move from a siloed approach to sustainability to an integrated one to avoid potential negative impacts on their operations."

Making the move to an integrated sustainability approach—where sustainability initiatives are not treated as standalone goals but as

part of the manufacturing process—can be done by merging two megatrends: sustainability and digital transformation, said Andrea Ruotolo, global head of customer sustainability at Rockwell

This merger of sustainability and digital transformation is not a distant strategy for manufacturers but an impending At the ESG Summit, Tom O'Reilly, vice president of sustainability at Rockwell Automation, said, "The regulations are coming, such as the EU Corporate Sustainability Reporting Directive. In this directive, any publicly listed company in Europe will have to report around their Scope 1, 2 and 3 emissions and their targets and have them audited. So suddenly, sustainability reports will be as important as financial reports," he said.

Creating the sustainable digital factory

Recognizing the need to combine sustainability and digital transformation has led Rockwell Automation and Accenture to focus on developing the Sustainable Digital Factory, where sustainability is not looked at as a separate target but is seen as part of the manufacturing process. Other partners directly involved in this effort include PTC, Microsoft, Johnson Controls and Purdue University.

"If you look at this problem and try to solve it inside your four walls, it's going to be very difficult," said Andy Kohok, managing director at Accenture. "This is not an



"The most effective way for manufacturers to become part of the sustainability economy is to bring together the two megatrends of sustainability and digital transformation." Rockwell's Andrea Ruotolo discussed the emergence of "twin transformers" and their likelihood to outperform competitors.

Automation.

requirement.



In addition to half-day Summits focusing on key aspects of the Rockwell Automation portfolio, a number of Forums at Automation Fair focused on specific issues within key industry verticals. The Water Wastewater Forum, for example, addressed the scale and impact that economic, environmental, regulatory and cultural challenges have on water utilities and organizations. "All water has value," said Jennifer Baldwin, Digital OneWater Director, Jacobs, and one of the Water Wastewater Forum panelists who illustrated how these factors are driving the digital transformation to Smart Water to enhance efficiency, sustainability and security, as well as counteract workforce challenges.

issue that's solvable just by Accenture or Rockwell. That's why we brought our alliance partners together on this."

In the Sustainable Digital Factory, "key performance indicators (KPIs) have to be merged between business operations and sustainability to realize the positive and negative impacts—only then can you make the right decisions," said Kohok.

He explained that industry's long focus on productivity has enabled manufacturers to track several metrics in great detail. For example, everybody today knows how to track their overall equipment effectiveness (OEE) and multiple tools exist to do it that provide a high level of accuracy.

So why can't we do this with sustainability? Kohok asked. Because we keep looking at the problems without seeing the intersection between sustainability and productivity.

"The assembly line that's making product is also impacting carbon emissions, water and energy use," he said, "and this is all considered in our solution and why we call it the Sustainable Digital Factory. We're bringing all these together on a single pane of glass."

A high-level view of the Sustainable Digital Factory architecture, previewed at the Automation Fair ESG Summit, showed how real-time and historical data from sources such as CAD, MES and SCADA systems to enterprise asset management, customer relationship management and ERP systems—can be ingested, analyzed with artificial intelligence and provided to users with context against sustainability scorecards. Key performance indicators such as total manufacturing cost, asset and plant OEE versus thresholds, line and plant throughput versus expectations, as well as energy utilization, water use, waste and emissions versus targets can then be delivered via one pane of glass using persona-based KPIs.

Technology suppliers noted in this architecture preview included Rockwell Automation, PTC, Cognite and Microsoft Cloud. Kohok noted that this architecture also addresses security operations and monitoring, data and model governance, and business and regulatory rules.

"If you improve your production line, you should be able to predict what the impact will be on sustainability," said Kohok. "If you're a plant supervisor, you should know which assets you're using and if you're using them for efficiency purposes. Only then you can make the right decisions around productivity and sustainability."

Ruotolo pointed out that companies that effectively combine sustainability within their digital transformation are called "twin transformers." According to Accenture, such companies are 2.5x more likely to be among tomorrow's top-performing businesses.

OEMS, TECH PARTNERS, END USERS COMPRISE MAGIC TRIANGLE

by Mike Bacidore

isruption in the global supply chain has left companies with lingering pressures that have swollen to a transformation point along this leg of the innovation journey. Machine builders have found themselves caught in the middle, looking to technology partners for the tools they need to give factory end users what they want when they want it. Design improvements and data tools were two of those elements discussed during the keynote presentation of the OEM Leader to Leader Summit during Automation Fair 2023 this week in Boston.

"The big challenge to the supply chain has been disruption," explained Paolo Butti, vice president, global industry, OEM and emerging industries, Rockwell Automation. "We need to keep building resilience and strength. We know the supply chain has been forcing you to accelerate machine redesign. When we look into the market, we see a strong demand for new machines and retrofits, but not everyone goes at the same speed. In the service area, there's a different demand from the end user. We've entered a transformation point, accelerating the innovation path."

Customers' highest-priority business imperatives are driving faster innovation and embracing new technology standards; meeting end-user performance demands; staying ahead of workforce challenges; and elevating competency, said Butti. These involve reskilling and upskilling existing employees, onboarding new employees to make them productive as quickly as possible and addressing cyber needs and threats.

"How do we convert the market outlook into the way you're driving achievement?" asked Butti. "We want to drive innovation with rapid adoption and continuous

"Everything—proof of target, verification and acceptance, knowledge transfer and futureproofing—is moving more into the digital world." Rockwell Automation's Paolo Butti sets the stage for OEM-to-OEM discussions at Automation Fair 2023 in Boston. deployment. The concept phase is when you design your machine. How do you do that?" Technology fit, application purpose, performance and value prediction all must be considered.

"The design phase is where everything that was ideated in the concept phase is proven," continued Butti. "Everything—proof of target, verification and acceptance, knowledge transfer and future-proofing— is moving more into the digital world. Future-proofing is the new paradigm of flexibility. We call it machine adaptation."

Butti also acknowledged the shift from a machine-based focus to a service-based focus. "The service component is essential," he stressed. "There's a continuous demand for optimization and throughput, enhanced capabilities, new compliances and value adaptation."

The next generation of innovation is being adopted, and disruption and experience capture are part of the business model. "During the machine lifecycle, there's a process of capturing experience," explained Butti, who cited the importance of the machine builder, technology partner and end user working together, referring to it as a magic



triangle. "How do we capitalize on the learning and make sure the machine gets improved?"

Modern design and data-ready equipment are two important steps toward that end, and Rockwell Automation is focused on enabling both.

Collaborative design

"Active design has become a much more collaborative experience," explained Dan DeYoung, vice president, product management, software and control, Rockwell Automation. "It's turned into a variety of people working in collaboration. Our aim is to do this from anywhere and at any time with the lightest-weight tool—a web browser. We want to build, test and commission hardware virtually, ensuring first-time-right quality."

Being able to remotely deploy updates and troubleshoot problems saves time and money, he added. "We want to enable and scale the workforce, leveraging the portfolio we have," explained DeYoung.

By making four of FactoryTalk Twin Studio's design tools—Arena, Studio 5000 Logix Designer, FactoryTalk Logix Echo and Emulate 3D—available in a cloud environment, the tools are accessible from a web browser, making designs scalable across teams in multiple locations. Upgrades and changes can be validated, and commissioning done virtually. Plus, development expenses can be scaled to actual usage. "It's taking our existing software tools and making them available to leverage in the modern environment."

FactoryTalk Design Studio's modern, multi-user environment is also multi-controller, said DeYoung. "Collaboration tools support scalable teams," he explained, "but it was also intentionally designed to allow multiple controllers in a single project."

A new capability, part of a collaboration with Microsoft, includes a plug-in to FactoryTalk Design Studio that can use generative artificial intelligence (AI) to write code. "You still need to validate it," cautioned DeYoung, "but it's really changing the conversation."

Visualizing data flows

In addition to FactoryTalk's design upgrades, FactoryTalk Hub is generating the next wave of data-ready equipment, which can empower workforces with an open and interoperable architecture. FactoryTalk Optix edge management and FactoryTalk DataMosaix data platform can optimize the data flow and associated costs based on customers' IT choices, explained DeYoung.

"This enables new business models through service offerings, leveraging architecture and structured data, which can be turned on at a later time," he said. "FactoryTalk Optix is a platform that came to us through the acquisition of ASEM, S.p.A. It leverages the hardware that ASEM had been building, but it brings data visualization into our portfolio. Optix can be on-prem or in a cloud environment. It's dynamically synchronized, and it's scalable. We can deploy it on a panel, on a PC, on a server, in the cloud. It's a hyperflexible environment. At the heart is OPC UA, so it can work with virtually every manufacturer in the market."

Meanwhile, FactoryTalk DataMosaix was born out of the oil and gas industry. "It has an inherent machine-learning capability," explained DeYoung. "The visualization tools it offers can analyze disparate data. Its scalability is excellent, as well." FactoryTalk DataMosaix's ability to collect data on hundreds of machines in a manufacturing site makes it scalable, and it can deploy applications for a variety of industries, said DeYoung.

Following Butti's and DeYoung's keynote presentations, summit participants broke into four groups, discussing risk reduction in the face of complexity; how to cultivate the customer experience with after-market services; valuation of machine data; and evolving workforce issues.

PLANTPAX TO TAKE ON MOUNTING **PROCESS CHALLENGES**

by Jim Montague

ultiplying problems require multiplying solutions—or at least one that's super-capable. Experts from McKinsey & Co. set up all the challenges arrayed against industrial and life sciences manufacturers at the opening of the Process Solutions User Group (PSUG) Summit, held this week in conjunction with Automation Fair 2023 this week in Boston. Then, experts from Rockwell Automation showed how the company's PlantPAx distributed control system (DCS) is adding even more muscle and speed to knock these challenges down.

Host of hassles? Digitalization and AI

McKinsey & Co. reported the key difficulties facing the process and other industries include:

- 25% increase in raw material costs over the past three vears;
- Labor shortage highlighted by a doubling of unfilled manufacturing jobs during 2010-23;
- Increasing environmental sustainability goals that only 29% of manufacturing believe they're on track to meet; and
- Plateauing performance improvements characterized by labor productivity growth that

obtaining talent and capabilities," said Vivek Arora, partner and industry leader 4.0 for North American life sciences at McKinsey & Co. "And, because Industry 4.0 means digitalization, generative AI will open up even more opportunities and potential gains."

For instance, Arora reported that cumulative productivity gains attributable to digitalization have included:

- 15% increase by adopting tools like supervisory control and data acquisition (SCADA), laboratory information management systems (LIMS) and enterprise resource planning (ERP) in the 2000s;
- 20% increase by adding digitally enabled performance management and advanced analytics in the 2010s;
- 30% increase by adding touchless solutions, such as integrating operational technology (OT) and information technology (IT) and selectively converting batch operations to continuous manufacturing; and
- 50% increase by implementing interactive AI to automate machine learning (ML), produce prescribed insights with generative AI, and allow on-the-go decision-making.



decreased by 38% over the past 15 years.

"Based on what McKinsey has learned, process industry leaders are concentrating on five priorities to overcome these challenges: continued focus on quality compliance and excellence; at-scale technology adoption (Industry 4.0); reimagining supply chains to build agility and resilience; focusing on environment, sustainability and governance (ESG) in the medium term; and succeeding in

"Scaling champions must master three musthave skills: building a clear vision and strategy, investing in people, and setting up the right governance and ways of working." McKinsey & Co.'s Vivek Arora discussed how leading organizations are overcoming the challenges that the process industries face.

"Generative AI is really the next frontier because it can extract insights in seconds—if it's attached to the right data sources," said Andy Luse, partner and industry leader 4.0 for North American industrials at McKinsey & Co. "It can also generate content tailored to specific contexts and interact with users through human-like conversations."

Luse added that digitalization and AI can obviously help with many of the essential process industry functions that he and Arora outlined, including supplier connectivity, workforce management, plant-floor production, quality control and facility support. However, he reported that McKinsey also discovered that companies who maximize the value they get from digitalization and AI are those that apply it end-to-end in their operations to integrate workflows and other overall tasks. These breakthrough gains include 20-40% increases in the capacity of formerly bottlenecked equipment, 20-35% reductions in conversion cost, 30-50% reductions in deviations, and even 10-20% decreases in greenhouse gas (GHG) emissions.

Scaling overcomes obstacles

Despite the potential gains, Arora reported that only 11% of companies have deployed Industry 4.0 digitalization in their production networks. He stated this is due to several headwinds, including:

- Large and complex manufacturing footprints of varying digital maturity—often with hundreds of sites and suppliers on a network;
- Thousands of people are needed to participate in digital transformation, so more training and capability-building are needed;
- Many use cases aren't standardized and their asset performance can't be assessed yet; and
- Technology is evolving faster than many users can keep up.

"We believe there are six strategies that successful scalers use to digitalize their processes and organizations, and all six must be employed together," says Arora. "They include having a strategic roadmap and project pipeline to drive value; attracting and retaining expert talent to carry out projects; using an iterative model to support teams and provide agile delivery; possessing enough plant-floor technology like sensors to support production; maintaining complete and accessible datasets; and adopting and running model transitions across sites to capture value."

For instance, Arora reported that one life sciences manufacturer recently reimagined its plant-floor operations, applied a holistic set of Industry 4.0 technologies, including digital automation, digital production management (DPM), AI and generative AI. It focused on asset and labor productivity, capital expenditure (CapEx) avoidance, and reducing the cost of poor quality. The manufacturer deployed digital and advanced analytics (AA) at more than 10 sites, increased its overall equipment effectiveness (OEE) by 15%, reduced its cost of poor quality (COPQ) by more than 30%, and benefitted more than 200 plant-floor staffers. In fact, DPM was added to 3.6 million datapoints, which enabled daily data extractions, and allowed realtime production transparency.

"This pointed out high variability in process parameters, shifted bottlenecks, identified 15 alarms driving losses, allowed root-cause analyses, and improved OEE by 10%," said Arora.

Likewise, Luse reported that a specialty chemical company started digitalizing three years ago to transform its networks in 15-20 of its more than 100 plants. Through employee training in digital methodologies and deployment of multiple digital and AI solutions at scale, the company increased throughput by 15-20%, trained 120 people as digital practitioners, and created AI solutions that could improve the run rates of more than \$100 million in production.

"The keys to scaling are standardized solutions, modularization (including code for reuse), collaborating early with IT, and working with ecosystem partners up and down the technology stack. Because no one can do these projects by themselves," added Luse.

Arora added that, "Scaling champions must master three must-have skills: building a clear vision and strategy, investing in people, and setting up the right governance and ways of working."

Leveraging PlantPAx

Scheduled for release in mid-2024, Rockwell Automation's PlantPAx 5.3 will feature enhanced scalability, scope and security, said Arvind Rao, vice president of industrial solutions, Rockwell Automation. It will include a firewall by Fortinet, industrial demilitarized zone (iDMZ), real-time threat detection from Claroty, and endpoint protection via OPC UA communication protocol and some added policy-management software.

"We just launched FLEXHA 5000 Universal I/O, which can work with PlantPAx via FactoryTalk Optix edge connectivity to enable closed-loop prescriptive analytics," said Rao. "We also launched the FactoryTalk DataMosaix data platform in July for integrating information from Rockwell Automation's devices and also from components from other suppliers. This gives users multiple improved opportunities for designing, simulating, optimizing and maintaining their process operation from end-to-end and at every layer up to the cloud."

Beyond open data integration, Rao reported that Rockwell Automation and PlantPAx are enabling AI at the edge-computing level with the recent launch of FactoryTalk Analytics LogixAI, which can provide setpoint or closed-loop recommendations for process optimization. Likewise, asset optimization is further aided by out-of-the box AI for anomaly detection.

"More data is generated now than ever, but more is also getting stuck in silos. Plus, 70% of the effort in building analytics and other software applications is the data engineering," explained Rao. "We're aiming to have PlantPAx and FactoryTalk DataMosaix take away that burden, so users can get away from single-point solutions, and build their applications quickly and at scale."

PLEX SUMMIT

PLEX CONNECTS PEOPLE TO PROCESS, PRODUCTIVITY AND PURPOSE

By David Greenfield

ust over two years ago, Rockwell Automation acquired Plex Systems' software-as-a-service (SaaS) manufacturing platform featuring manufacturing execution system (MES), quality and supply chain management applications. At the company's Automation Fair event this week in Boston, Plex hosted an array of training and insights sessions and outlined the platform's path forward.

A central aspect of the development path for Plex involves connectedness.

"There are five components to our strategy as we work to build the connected enterprise," said Anthony Murphy, vice president of product management at Plex. "Connected workers, connected industries, connected manufacturing, connected data operations and connected technology,"

For the connected worker, Murphy said the key is in providing technology that enables employees who are new to a company to be as safe and productive as someone who's been at the company for 30 years.

"It's not just about hiring and onboarding or even doing the work—it's about retention," he said. "That's why it's imperative to connect the person to the purpose through culture and key performance indicators. You also have to connect person to person through collaboration and mentorship and connect person to productivity through guided instructions and a general awareness of what's going on in the business and through the use of smart tools to make it easy for them to do their work. And it's also important to connect person to process by helping them understand the broad context of the business and how the work they do is impacted by the business and their own influence on the work."

An important enabler of the person-to-productivity connectedness is Plex's partnership with Canvas GFX around its ability to ingest 3D model data of existing equipment so that it can be interacted with through Plex. Detailed work instructions can also be delivered within Plex via videos and 3D animations.

"Providing access to detailed instructions in the Plex application without having to go somewhere else ensures critical actions are done correctly—step by step by step. The connections this creates in the application can be used to drive continuous improvement because workers know what to do, when to do it and how to do it," said Murphy.



"You get retention by connecting people through collaboration, training and mentorship. It's easy to quit a task or a job. But it's hard to quit a team." Anthony Murphy delivered the Plex Summit keynote address at this week's Automation Fair 2023.

> This level of connectedness is becoming more critical as a component of employee retention in the manufacturing industries. "You get retention by connecting people through collaboration, training and mentorship. It's easy to quit a task or a job. But it's hard to quit a team."

> To help drive corporate culture through real-time collaboration, Murphy pointed out that Rockwell Automation's partnership with Microsoft enables Plex to embed Microsoft Teams' collaboration functions, such as notifications, tasks and chat into the Plex interface. "We can deliver collaboration and provide enterprise-level visibility, security, governance and control so you don't have rogue chat applications in use on your shop floor," said Murphy. "And for those who don't use Teams, there's also an application programming interface (API) layer that allows you to integrate any collaboration tool into Plex."

Supply chain planning meets AI

Ara Surenian, vice president of product management at Plex, highlighted how Plex is reacting to the growing use of artificial intelligence (AI) in supply chain planning. He cited recent Gartner research that showed supply chain planning leaders rank AI and machine learning (ML) as their top digital priority among all the technologies they plan on piloting going forward.

Surenian said supply chain planners are increasingly reliant on AI/ML to "help manage all the variables that make their everyday decision-making process more complex."

Referencing Plex DemandCaster Supply Chain Planning as the first Plex application to apply machine learning to demand forecasting, Surenian said that, on average, users saw between 5% and 30% improvement in forecast accuracy compared to traditional exponential smoothing methods. "This is significant because every 1% improvement in forecast accuracy has a direct impact on a company's ability to increase their revenue, while decreasing the amount of inventory needed to meet that demand," he said.

Surenian pointed out that demand forecasting is only part of the equation, however, as the supply side also plays a significant role due to the internal and external factors that make it difficult to determine how much inventory is really needed to meet fluctuating demands. Machine learning helps by harnessing all the supply variables along with actual performance and a forward-looking forecast to establish the level of inventory needed to meet customer demand at the lowest possible inventory carrying costs.

"We are in the very early phases of this initiative and we're working with Rockwell's artificial intelligence team to begin testing soon," he said.

The next area of focus for Plex around AI in supply chain is in finite scheduling, which helps determine how much can be produced in a specific time period considering resource limitations.

One of the biggest reasons finite scheduling implementations fail is due to incorrect input parameters around run times, setup times and changeover times. These are all necessary inputs that determine how your products are going to be scheduled on a factory line and many are incorrect, he said, resulting in a garbage in/garbage out effect.

"But if we apply machine learning to real-time data and real production history to correct those inputs, the result is a more accurate schedule that drives throughput and more accurate schedules to reduce the cost of labor and drive revenue," said Surenian.

He added that Plex is "currently building a new finite scheduling solution with a planned availability to Plex customers in late summer or fall of 2024."

AUTONOMOUS ROBOTS

OTTO MOTORS NAVIGATES FAMILIAR INDUSTRIAL TERRAIN

By Mike Bacidore

Robotics and its Otto Motors division, Clearpath Robotics and its Otto Motors division, made its debut at last week's Automation Fair 2023 in Boston. Clearpath's Matt Rendall, chief executive officer, and Ryan Gariepy, chief technology officer, who were also founders of the autonomous-mobile-robot (AMR) manufacturer, spoke about how the company started and where it's headed with Rockwell Automation.

Designed to create safer and more productive workplaces, AMRs are fast becoming part and parcel of warehousing/ distribution center operations. However, Clearpath Robotics has focused on manufacturing operations, which was one of the reasons Rockwell Automation found it to be an attractive addition.

"Ryan and I and two other co-founders met at University of Waterloo, studying mechatronics," explained Rendall. "We joined the robotics club, and we spent evenings building autonomous mobile robots (AMRs) to compete against other teams around the country and around the world. That's where we got the robot bug." AMRs to detect and clear mine fields. That's where the name Clearpath came from."

The young company quickly changed its focus from land mines to manufacturing. "Mine detection is complicated, and so is the business model," explained Gariepy. Despite the new market direction, they never changed the company name. "In 2008, if you weren't developing an iPhone app, investors weren't interested," recalled Rendall. "We were in the R&D environment, so we started talking with research professors to see what they were working on next. That became our first market—helping innovators to innovate faster at a lower development cost and with mitigated risk. We became the market leader in AMR development, mostly with universities and then into government and then industrial R&D. We had a frontrow seat of every industry looking into this technology."

One of the formative experiences of Gariepy's career was during his time interning at Kiva Systems, one of the early AMR manufacturers. On his first day at Kiva, Gariepy was one of just three people in the building because the majority of the company's workers were attending

From minefields to manufacturing

When Rendall and Gariepy graduated in 2008, there was no AMR market yet. "How do you pursue your passion when the job doesn't exist?" Rendall reminisced. "We continued doing what we were doing as new graduates. In the very, very early days our business plan was to use AMRs to detect and clear mine fields. Land mines are a big global problem. We saw an opportunity to deploy a swarm of

"If you look at where Rockwell Automation is strongest and where we've been developing, there's natural overlap." Otto Motors' Matt Rendall explained why the company's acquisition by Rockwell aligns with user needs.



a packaging-machinery exhibition. "There was a huge amount of industry interest," he said. "The technology we've built is very extensible into different operational domains, but we're focused on doubling down in the manufacturing space."

Because of its ability to view the AMR future, Clearpath saw autonomous material handling and autonomous logistics beginning to gain a foothold 10 years ago. "We saw this coming way before any others," said Rendall. "That led to the creation of our Otto Motors business. We focus on manufacturing environments to help the world's manufacturers solve material-handling challenges."

From warehousing application to production platform

"In the manufacturing world, every delivery route is different," explained Rendall. "It's difficult to find the route. The way that Toyota moves tires in one plant is different from the way it moves tires in another plant. We are a platform AMR company, not an application AMR company. We work with lots of system integrators that specialize in certain industries. The rigors of manufacturing make for a high barrier to entry."

On the manufacturing side, there are a small number of AMR companies, compared to the highly populated warehousing AMR market. "We focus on the largest manufacturing plants," explained Rendall. "That leads to the largest fleets of vehicles with the deepest integration. We operate in the highest cost-of-failure environments."

Clearpath Robotics' first vehicle was the Otto 1500. "We knew it was a deep domain with a steep learning curve," explained Rendall, who decided to focus on moving pallets because it was the closest thing to a universal standard in a manufacturing environment. Clearpath has become strong in the heavy-class AMR category because of high demand. The Otto 100, which is designed for more humantype loads, and Otto Lifter, an autonomous fork truck, are also part of its offerings.

"If you look at where Rockwell Automation is strongest and where we've been developing, there's natural overlap," explained Rendall. "The next frontier of automation is in material handling. They're hunting for AMR solutions. We're seeing lots of traction in that space. We have strength in automotive and tire. Rockwell does, too."

In automotive, you've got 10,000 parts per automobile and an automobile being produced every minute, explained Rendall. "There is so much material handling, it's our biggest application by a large margin. And our customers are seeing return-on-investment (ROI) cases under 12 months."

CYBERSECURITY

A LIFECYCLE APPROACH TO SECURING NETWORKED ASSETS

by Jim Montague

hile there's much to be gained from network connectivity, connections also mean taking on more vulnerabilities, cyber-probes, possible intrusions and potential attacks.

To protect against and mitigate these risks, Rockwell Automation and its equally well-known partners offer a comprehensive and growing portfolio of defenses that its customers can use on their digital transformation journeys. Mark Cristiano, global director of networks and cybersecurity, and Brian Deken, North America commercial manager for networks and cybersecurity, both of Rockwell Automation, updated industry media on the company's latest cybersecurity initiatives at Automation Fair 2023 this week in Boston.

"Much of the equipment in many process applications is decades old and has flat networks, which is the same as no network, so we've spent a lot of time segmenting networks by using switches to establish demilitarized zones," said Cristiano. "However, when the NotPetya and Wanna-Cry attacks happened in 2017, that's when investment in cybersecurity really began to take off." Cristiano and Deken advise following the five cybersecurity directives formulated by the National Institute of Standards and Technology (NIST), which are:

- Identify assets,
- Protect networks,
- Detect attempted probes and intrusions,
- Respond, and
- Recover.

Using these directives as a guide, Deken reported that Rockwell Automation's version includes:

- Segment networks into subnetworks to protect them and the devices in them;
- Identify and document assets;
- Prioritize vulnerabilities;
- Develop an incident response plan; and
- Implement a real-time intrusion detection system (IDS).

To-do list based on NIST

However, despite these famous cyberattacks and others in more recent years, Cristiano states, "We're still seeing that everyone is still not doing enough on cybersecurity. Everyone is seeking an answer, but there isn't one answer. There are lots of answers. In addition, cybersecurity still doesn't reach down to many legacy and device levels, which is where many vulnerabilities persist."

"Rockwell Automation can help customers mitigate their vulnerabilities, and deal with whatever comes next." Rockwell Automation's Mark Cristiano discussed how the company and its partners can help end users manage the cybersecurity lifecycle of their OT assets.



Assess, plan, protect—and repeat

"The reason we do asset and vulnerability identification is that we can then do risk scoring, and then make recommendations for users to mitigate those risks," says Cristiano. "This shows us where basic networks segmentation is needed, so we can isolate a subnetwork if it gets hit, as well as monitor threats by taking snapshots of normal activities that let us identify deviations that might indicate possible problems or intrusions."

These initial identifications and assessment measures form the basis of the incident response plan that needs to be developed next. These plans include recruiting an expert cybersecurity partner, conducting penetration testing, and performing tabletop exercises to simulate breaches. "We just need to know what to do with something happens," adds Cristiano. "Continual monitoring is needed to refine risk scores, and assessments are also helpful in generating funding to comply with NIST and ISA/IEC 62443 cybersecurity standard requirements."

Cristiano added that Rockwell Automation can help customers consistently address their cybersecurity issues in multiple locations and reduce the individual sources of ambiguity they may be facing. "We can meet customers wherever they are thanks to NIST's recommendations," he said.

For example, Cristiano and Deken reported that Rockwell Automation has been developing its managed security services, so it will be a preeminent provider of cybersecurity capabilities in conjunction with its partners Claroty, Dragos, Fortinet, Cisco and Verve, which it acquired most recently. "All of these can be integrated into a comprehensive security operation center (SOC) solution," added Cristiano. "This is how Rockwell

INDUSTRIAL SUSTAINABILITY

WHY A HOLISTIC VIEW ON SUSTAINABILITY IS REQUIRED

By David Greenfield

he intersection of industry's digital transformation and sustainability is a centerpiece of Rockwell Automation's message at Automation Fair 2023. As Andrea Ruotolo, global head of customer sustainability at Rockwell Automation, said during the event's ESG Summit: "Making the move to an integrated sustainability approach—where sustainability initiatives are not treated as a stand-alone goal but as part of the manufacturing process—can be done by merging two megatrends: sustainability and digital transformation."

Looking closely at this merging of digital transformation and sustainability initiatives, Rodrigo Alves, manager at Kalypso (a Rockwell Automation consulting business), noted that a recent survey by Rockwell Automation of more than 60 sustainability leaders at various industrial companies showed that 96% consider digital transformation important to the achievement of sustainability goals. Forty-three percent of those respondents categorized this connection as not just important, but vital to their success. In response to these findings, Alves said Kalypso looks at the connection across five points: product development (designing for sustainability and a circular economy), manufacturing (AI-powered energy management, closed loop control, waste reduction and carbon capture and storage), distribution (supply chain traceability and emissions management), preventive maintenance (smart connected products to deliver maintenance insights) and end use along with scrap and re-use (waste traceability).

"We have to think of the whole product lifecycle and factor in the effects of the process from distribution to materials use," said Alves. "That's why we developed this set of services and offerings to enable digital transformation across each one of those pillars."

He added that, as part of this approach, Kalypso will be bringing Rockwell Automation's FactoryTalk Energy Manager to "leverage AI to deliver data-driven recommendations for remediation of energy losses on the shop floor." "Every industry has different challenges, but there are lessons for all across each industry." Kalypso's Rodrigo Alves, together with Rockwell Automation's Tom O'Reilly, discussed industry's progress toward ESG goals this week at Automation Fair.



FactoryTalk Energy Manager was released at the end of October 2023. This industrial energy monitoring software features dashboards highlighting areas for improvement and optimization. It coordinates FactoryTalk Innovation-Suite components, such as FactoryTalk Smart Objects and the PTC ThingWorx platform. Rockwell Automation says the result is "a unique energy monitoring application that provides energy and production information based on an energy model of a plant's underlying process."

In addition to the use of FactoryTalk Energy Manager, Kalypso's overall energy management approach includes energy consulting; design and implementation of building/utility management systems and process optimization; energy distribution through load shedding, demand management, cogeneration and renewables integration; and energy optimization through the use of AI, model predictive control and closed-loop algorithms.

Applying this strategy enables industrial users to "understand if a machine is consuming a certain amount of power compared to its throughput so that a baseline can be developed with which companies can save energy and positively influence production scheduling," Alves said.

Industrial application examples

Based on Kalypso's work with an array of industrial companies on their various sustainability goals—whether driven by overall market interests and demands or specific regulations—Alves noted that there isn't one industry segment he would consider as being ahead of others when it comes to sustainability.

"I think every industry has different challenges. For consumer-packaged goods companies, their focus on Scope 3 emissions tends to be higher than other industries [Scope 3 relates to effects a business is indirectly responsible for, such as materials from suppliers and customers' use of their products.]. More energy-intensive industry segments will, of course, focus more on energy management in their manufacturing operations. So, it's a matter of priorities. There are lessons to learn from each industry."

In his presentation, Alves highlighted Kalypso's recent sustainability work across five industry sectors:

- Enabling a construction equipment manufacturer to achieve energy related goals and reduce emissions using a Kalypso-generated roadmap that identified and prioritized sustainability initiatives for the company.
- Helping an energy supplier predictively monitor emissions using continuous emissions monitoring software with machine learning to granularly calculate NOx emissions. This enabled the energy company to comply with environmental reporting requirements and achieve cost savings without the implementation of hardware analyzers.
- Designing an Internet of Things application for a food and beverage manufacturer that aggregated digitized documents and external data sources across more than 60 sites, allowing the company to monitor and manage plant floor energy use.
- Installing an end-to-end system that enabled real-time data acquisition, monitoring and analytics of emissions, effluent discharges and ambient air for a metals and mineral manufacturer. This helped the manufacturer implement environmental, social and governance monitoring across its value chain.
- Optimizing an energy- and material-intensive process for a global tire manufacturer using a machine learning control model. This reduced the manufacturer's energy consumption by 5%-10% and increased scrap recovery by 15%-20%.

HOW TO ADDRESS THE WORKPLACE SKILLS GAP

by Jim Montague

any industries—including process control and automation—are starving for people. Millions of skilled jobs are going unfilled, and many employers are at their wit's end about how to fill them.

To help alleviate this persistent crisis, Rockwell Automation reports it has several remedies. These include applying labor-saving automation to reduce manual tasks, but also employing advanced digitalization including artificial intelligence (AI) to enable less-experienced staffers to succeed in technically sophisticated jobs where they likely didn't have the tools to succeed before.

"Automation has been changing the nature of work since the 1860s, and it's not stopping because we're seeing even faster proliferation now," said Kyle Crum, director of advanced technology, Rockwell Automation. "When spreadsheets were introduced in the 1970s, there was lots of talk that accounting was dead. However, while there was less bookkeeping, even more jobs were eventually created. Likewise, manual parts-checking on production lines is shifting to having the person calibrate the machine that checks the parts and do other value-added activities

instead of repetitive work. So work isn't collapsing, it's just changing again."

Tessa Myers, senior vice president of intelligent devices at Rockwell Automation, added that every company and executive she meets with is concerned about the skilled workforce shortage. "Automation technology can enable workforces, so our path is to develop and attract talent to fill the gaps in those skilled workforces," said Myers. "We're also investing in the communities where

"Team leaders need emotional intelligence and the ability to work well with others, so they can get their teams aligned to solve complex problems." Rockwell Automation's Tessa Myers on the persistent need for not only technical skills for industrial professionals but interpersonal ones as well. we and our customers work and live, and supporting students in Science, Technology, Engineering and Math (STEM) programs such as For Inspiration and Recognition of Science and Technology (FIRST) Robotics."

Myers and Crum presented the "Why the manufacturing workforce is more important than ever" press conference this week at Automation Fair 2023 in Boston.

Retraining, people skills crucial, too

Beyond finding new people, Crum reported that many companies also need to retrain their existing personnel and give them the skills that U.S. manufacturing operations will require in the future. "For the past several years, Rockwell Automation has partnered with the Manpower Group in an Academy of Advanced Manufacturing (AAM) program to train and retrain U.S. military veterans in the skills they need to work in smart manufacturing," explained Crum. "This is a 12-week course, and so far we have placed all of its graduates with companies across the nation."

Similarly, Rockwell Automation also operates its own workforce development and enablement program. It puts



employees on the pathway to gaining the skills they need, which has also proven to be a good way of retaining them.

"There are concerns that the skills that will be necessary in the future are mainly hardcore, technical competencies, but people skills are essential for coordinating all the other competencies," Myers said. "Many manufacturing problems are very complex, with multiple facets, and draw on many disciplines," she said. "This means that many soft skills are necessary, too. Team leaders need emotional intelligence and the ability to work well with others, so they can get their teams aligned to solve those complex problems." Crum added that Rockwell Automation also plans to emulate some of the micro-certification and reeducation efforts that many IT-based companies already practice. "These are similar to the nursing programs that provide training as stackable credentials," he said.

"We think AI can also enable these types of performance and workforce improvements, and make personnel more effective," added Myers. "For example, AI can help people learn our FactoryTalk Design Studio software-as-a-service (SaaS) design tool, or apply FactoryTalk Guardian AI software to their assets for better predictive maintenance."

MEDIA PANEL

WHY FACTORIES CARE ABOUT OUTCOMES, NOT AI

by Mike Bacidore

hat's the difference between an automated system and an autonomous one? The answer may seem obvious, but the distinctions are many.

An automated system is programmed to perform tasks in the absence of human intervention, while an autonomous system learns to perform tasks and adapts by learning in environments of uncertainty, explained Cyril Perducat, chief technology officer, Rockwell Automation, who spoke privately to the press during Automation Fair in Boston. "Automated systems are programmed, and autonomous systems are learned," he continued.

Autonomous systems are dynamically adaptable with continuous learning, compared with manually reprogrammed adaptability in an automated system. The differences continue. Data scientists collaborate with engineers in an autonomous system because domain knowledge is combined with a high volume of data. This allows applications in an autonomous system to include multi-variable nonlinear, dynamic practices. Automated systems handle simple linear problems with few variables because they're limited to first-principles domain knowledge. The idea of a system that learns and adapts could be at almost any level, said Perducat. "It could be at the equipment level, sensor level, control level, operation-management level or business-planning level," he explained. "You could be doing condition monitoring of motors."

The applications of a learning system could be almost anywhere in the manufacturing value chain. "AI and autonomous systems will change the industrial-automation landscape the way autonomous vehicles have changed the automotive landscape," predicted Perducat. "Customers don't care if it's AI. They care more about outcomes."

Rockwell Automation's own AI innovations are taking place in five core areas:

- Research and development (R&D) programs that inspire new product innovations—these are focused on the intersection of AI, control theory and operations research.
- AI that supercharges legacy products—this includes added features that enhance product differentiation, performance and pricing opportunities.



"When you talk about material movement in a facility, you think of driving automation through that." Rockwell Automation's Gregory Gernert, Jr., explained how AMRs can literally deliver AI at Automation Fair in Boston.

- New products made possible by AI—these will include accretive capabilities in the portfolio and the unlocking of new business models.
- AI implementation and managed services—these could include end-to-end technology consulting to deliver digital transformation.
- AI in operations and internal systems—these include the delivery of efficiency in financial systems, supply chain and customer engagement.

Large enterprises are probably further along the AI path than small to mid-size companies, explained Perducat. "The ones that are successful have a real problem to solve and the ability to solve the problem by using the right amount of technology at the right place," he said. "We need to do AI that is invisible and that can be used by customers who benefit from one more tool."

High productivity, low cost and reliability have been traditional expectations of end users, but the customer of the future will demand the right product at the right cost at the right time, plus sustainability, agility and resilience in the face of cyber-attacks and supply-chain disruptions, predicted Perducat. Minimal energy consumption will drive sustainability through production choices. The production systems of the future will include an augmented worker, autonomous operations, integral machine vision, autonomous control and integrated robotics. "Ultimately, this is about augmenting people," said Perducat. "You are empowered with access to knowledge."

Intelligent edge devices collect data, and they have the ability to program and re-program, explained Gregory Gernert, Jr., vice president and general manager, motion, Rockwell Automation. Autonomy in the process or between the processes makes them adaptable and resilient. Mobiletransport devices are potential purveyors of automation throughout the facility, and this can enable that autonomy.

"When you talk about material movement in a facility, you think of driving automation through that," said Gernert. "There are a lot of manual processes." The acquisition of Clearpath Robotics and its OTTO Motors business, for example, has brought autonomous mobile robots (AMRs) to the Rockwell Automation portfolio. "This brings mobile transport to the line, through the line and away from the line," he explained. Six inches off the floor, these AMRs have a camera that's looking at everything around the factory. It could be collecting data for inventory management, building defects or ambient temperature monitoring, offered Gernert. "The possibilities for data capture and application are nearly limitless."

SUPPLY CHAINS RECEIVING AI ATTENTION JUST IN TIME

By Mike Bacidore

arly is on time, on time is late, and late is unacceptable." This famous phrase, coined by Eric Jerome Dickey in his book, "Sleeping with Strangers," and made famous in the movie of the same name, has become a mantra of industry. But a global interruption in supply chains has forced manufacturing to hit the pause button and reinforce logistics dependability.

"How do we build a resilient supply chain? What have we been doing to accelerate our recovery?" asked Bob Buttermore, senior vice president, chief supply chain officer, Rockwell Automation, during a press conference at Automation Fair 2023 this week in Boston. Buttermore cited three categories of supply chain resilience that Rockwell Automation has identified:

- Design resilience. "We've redesigned our product lines to incorporate redundancy and created a design-forresilience process," said Buttermore.
- 2. Supplier resilience. "We've put inventory and redundancy in place," he continued.
- 3. Enterprise capacity. "Inventory needs to be kept at a healthy stock level, and we're building out our distribution-center network," Buttermore added.

Five elements—engaged team, customer drive, connected supply chain, sustainability and resilience—are at the forefront of Rockwell Automation's vision for reimagining the supply chain, explained Buttermore. "The engaged

"One of the technologies we're bringing to market is AI-powered solutions for the production supply chain." Rockwell Automation's Brian Shepherd, together with colleague Bob Buttermore, discussed the company's own pandemic supply chain learnings, and how its new Finite Scheduler offering will reroute plant materials at Automation Fair in Boston. team is how we create an environment where people think it's the best place to work," he said. "Customer drive is for superior service levels. The connected supply chain means building out a global design optimization network, digital transformation and connected workers. Sustainability programs focus on scopes 1, 2 and 3."

Of course, resilience is critical. "We continue to build out capacity," noted Buttermore. "We're building out our infrastructure. And we're working with our suppliers to manage the next generation of what the market gives us."

Rockwell Automation has spent a lot of time talking about and innovating in supply-chain improvement, explained Brian Shepherd, senior vice president, software and control, Rockwell Automation. "One of the set of technologies we're bringing to market is artificial intelligence, or AI-powered solutions for supply chain," he said. "It started in 2022 with the release of AI-powered demand planning in Plex, our manufacturing-execution-system (MES) solution. It's the most popular, most widely used software as a service (SaaS)based solution in the world. We implemented machine learning (ML)/AI to help our customers do a better job



of forecasting demand, which improved between 5% and 30%." This first step is the Plex DemandCaster.

Up next: Finite Scheduler

"We're now working on a Finite Scheduler to optimize plant-floor scheduling; it's how routings work through the factory," explained Shepherd. Finite Scheduler is targeted at discrete and hybrid industries, where changeovers and startups are common, and is due for release in 2024.

Finally, Rockwell Automation's acquisition of Clearpath Robotics' OTTO Motors will bring smart production flow and autonomous integration with Finite Scheduler. To prove out its capabilities, Finite Scheduler is being implemented in Rockwell Automation's low-voltage motor-control-center (MCC) plant in Richland Center, Wisconsin, which contains seven factories. "It takes our customer requirements and hands them off to the factories to build," said Buttermore. "It's the most complex material routing in our network, bringing all of those assemblies together at the right time to deliver on the promised customer delivery date. This will help us fine-tune our scheduling for faster flow, higher inventory utilization and shorter lead times for customers."

GENERATIVE AI BY DESIGN

FACTORYTALK DESIGN STUDIO ACCELERATES WITH GENERATIVE AI

by Jim Montague

ust like the proverbial "kid with a new toy," everyone is playing with generative artificial intelligence (AI) and ChatGPT to see how their applications and businesses can take advantage of it.

"We're bringing generative AI to process automation via FactoryTalk Design Studio, and developing case studies we want to do because this is still a prototype solution," said Adam Gregory, platform manager for FactoryTalk Design Studio at Rockwell Automation, during a press conference at Automation Fair 2023 this week at the Boston Convention and Exhibition Center. "I began learning about generative AI last year and started by asking it to build images and write simple code. We also saw many opportunities when we looked at the GitHub copilot beta and the introduction of OpenAI's ChatGPT in November 2022. Rockwell Automation builds tools, so we wanted to know if generative AI could help."

Released in October 2022, FactoryTalk Design Studio is Rockwell's automation design solution that also lets users simplify and streamline their collaboration and productivity. It's a natural platform for exploring and experimenting with generative AI and ChatGPT because it's a cloudnative solution for building control and related software.

Snippets and queries

Gregory reports the Rockwell's initial goal for generative AI and ChatGPT was just to have it generate some small snippets of code, and then query it about the best way to produce code for a device, such as a pump. Next, Gregory and his colleagues did some general question-and-answers, such as one might ask a coworker, and did it with Chat-GPT's natural-language prompt.

"This allowed us to create a foundation that we could build on and iterate with," explained Gregory. "We use the code snippets and question-and-answer results to gather more input, which could be used to do bigger and better tasks, such as automated creation actions based on each user's data and libraries. It could also tell us what a project was doing, help with related tasks, inform us about what's routine or not, and run comments from other users."

Gregory added that Rockwell's FactoryTalk Design Studio team collaborated with Microsoft Azure's OpenAI





design service, and got help with cloud-computing, analytics functions and improving prompting.

"This is still a prototype, so it's not available to users yet," explained Gregory. "But we did develop a FactoryTalk Design Studio copilot, which uses the natural-language queries. This is possible because all of ChatGPT sits on large-language models (LLM). We're now trying to incorporate Rockwell Automation's domain know-how with them."

Code and alternative code

Despite some initial hiccups, Gregory also reported that generative AI and ChatGPT successfully produced the code snippets his team was seeking about how to run a pump, and even accommodated additional user requests.

"The initial snippet recommended using latching and unlatching in ladder logic to control the pump, but we decided we didn't want to do that, and asked if there was different code for another option," added Gregory. "The copilot removed the code we didn't like and suggested using an output-energized method that it subsequently added. This means users can keep working with this software to find new options and alternatives. It also means we can teach models how to do automation by defining engineering prompts and sending them to a static LLM. It really is a copilot, and not an auto pilot."

A CASE FOR ACTION

SUSTAINABILITY EFFORTS DELIVERING TANGIBLE BENEFITS

By David Greenfield

Specific actions by industrial companies to become more sustainable have grown exponentially over the past decade. Yet there is often more talk than action around industrial sustainability.

To show how Rockwell Automation's partners and customers are making industry more sustainable, Rockwell invited three companies to share their insights about the sustainable services and technologies they offer and how they are being used to change industry.

Those companies were:

- Energy Drive, which uses variable frequency drives (VFDs) to reduce industrial energy use, thereby reducing carbon emissions;
- LanzaTech, a carbon recycling company that transforms carbon dioxide emissions into ethanol for re-use; and,
- Triple Helix, which recycles end-of-life chemicals and materials for re-use by industry.

James Hynd, CEO of Energy Drive, explained how the company uses core automation devices—such as VFDs,

controllers and human-machine interfaces (HMIs)—and applies its own data analysis to the data derived from these technologies. We optimize motor use to produce carbon offsets through OpEx and CapEx avoidance, Hynd said. Energy Drive can scale its approach over hundreds of systems at a company through its focus on motors, which are used widely to power pumps, fans and various pieces of equipment.

Referencing an Energy Drive project with Sebinye-Stillwater gold mining in South Africa, Hynd said they focused

Representatives from LanzaTech, Triple Helix and Energy Drive (I-r) stressed that the technologies needed to deliver appreciable sustainability gains are not just available, but widely in use by industry today. on the motors that power the circulation vents, which are critical to providing air to underground mining operations. The vent fans' baseline energy use of 1720.3 kW has now been reduced to 605.75 kW.

Scott Kongkitisupchai, technology advancement director at LanzaTech, noted how the company, whose large-scale plants can process 50,000 tons of ethanol a year, depends on core automation technologies to control motor energy use and monitor vibrations on compressors and pumps to predict equipment health. LanzaTech recently announced a collaboration with Dow Chemical around the use of LanzaTech's CarbonSmart technology to develop Dow's EcoSense 2470—a recycled carbon-based surfactant for home cleaning uses.

"Most discarded polyurethane products—such as mattresses, furniture and car seats—are incinerated," said Steve Peleman, CEO of Triple Helix. "In Europe alone, the amount of mattresses disposed of each year, if stacked, would be 800 times the height of Mount Everest." Triple Helix's Antwerp, Belgium, facility recycles polyethylene terephthalate (PET) and polyurethane foam (flexible and



rigid) with a typical output of 30 kilotons a year but is designed to run as high as 80 kilotons.

The real sustainability challenge

Though achieving significant sustainability goals can seem like an insurmountable challenge using available technologies, the three companies participating in this roundtable discussion stressed that the technologies needed to deliver appreciable sustainability gains are not just available, but widely in use by industry today. The biggest roadblocks to sustainability tend to be attitudes and culture around funding.

"It's sexy to talk about sustainability and the circular economy, but less so when you try to get people to do something," said Peleman. "A key factor is getting rules to change around funding mechanisms for sustainability, because you can't just throw everything into a pile and see what works. It costs significant money to organize waste sources for reuse. For example, in Europe it costs 65-70 million euros to start up a materials recycling operation."

Hynd added that while it's not difficult to change mindsets about the capabilities of the underlying technologies, it can be difficult to convince them of substantial sustainability results. "When we develop a technical proposal, we get an average of 45% annual return on investment," he said. "But most companies think that's too good to be true."

For those companies that don't believe Energy Drive's numbers, Hynd said they send them a report each month

detailing the carbon offsets they've lost out on that month by not using Energy Drive's service.

Technology wishes

Despite the lack of issues with current technologies, the roundtable participants noted a few technological capabilities that are on their wish lists.

Kongkitisupchai said LanzaTech's converting operations need to close the sustainability loop with suppliers' materials from which they derive ethanol. To better enable this, he said higher levels of security for data sharing between companies along with artificial intelligence applications to improve predictions based on those data would be helpful.

When you're converting waste to raw materials, you have to know what's inside them, said Peleman. A real-time view at the molecular level of what's in there without having to go to a lab would fill a technology gap for Triple Helix.

"Supply chain lead times are still a challenge," said Hynd—a fact that underscores Rockwell Automation's focus on supply chain planning with its Plex software as a service. Despite this gap, Hynd added that sustainability's technology problem isn't with any specific capability or lack thereof, but because "there's so much out there—it's almost too much. With all the technology now available, companies can be tempted to reinvent too much and lose focus. They key is to focus on controlled innovation with help from partners."

CYBERSECURITY: PEOPLE ARE YOUR FIRST LINE OF DEFENSE

By David Greenfield

ybersecurity discussions tend to focus on software and hardware technologies to detect and isolate threats. But there's are growing awareness that people can be the most effective cyber-attack deterrent if they're informed about the importance of their actions.

At Rockwell Automation's Automation Fair 2023, a panel discussion focused on this issue and explained how companies can build a human firewall to protect their operations.

Drew Rose, chief security officer and co-founder of Living Security (a provider of training to address cyberthreats) noted that workers don't need to know everything about cybersecurity to be effective. "But they do need to know when to ask for help or raise a red flag," he said.

To teach workers how to do this, Rose said you need to make your communications about cybersecurity fit who the workers are. For example, if you're speaking to employees who work with automated machines, you should explain what an attack on your business means to the machines they work with.

Internally, Rockwell Automation stresses that cybersecurity is everyone's business. "Our motto is 'cybersecurity

starts with you," said Paula West, IT marketing and engagement manager at Rockwell Automation. "We also show how the things we teach them about cybersecurity can protect them and their families—not just their workplace."

The language you use is also important, added Alex Panaretos, director of professional services at Proofpoint (a cybersecurity platform provider). "There's a difference between asking someone to 'report' something and asking them to

"Updating teams with short, regular messaging updates can be very effective. Move away from those 60-minute training classes every year to a 30-second video every week or two." A panel of specialists on the human side of cybersecurity discussed how important people are to ensuring the integrity of operations. 'notify' you," she said. "When you ask people to report something, interaction tends be low. But if you ask for a notification so that someone else can handle it, we've seen engagement increase by 60%."

Keep training up to date

The cyber threat landscape is constantly changing. While the core tenets of good cyber practices will continue to protect a company's systems, workers need regular updates to keep abreast of the latest tactics.

West said Rockwell uses real world examples to keep employees up to date. "Talk about what's actually happened at your company," she said, including attacks that were avoided or suspicious activities that have been detected. It's also key to understand the day-to-day realities of different workers' roles and the threats they may face in their work to help tailor your communications with them.

"We've had success with enterprise messaging," said Rose. "Updating teams with this method via short, regular updates can be effective. Move away from those



60-minute training classes every year to a 30-second video every week or two."

Rose added that it can help to talk about how the cyberattacks they hear about in the news could impact your organization. "Your message has got to be more than: Ransomware is bad," he said.

"Build relationships between employees and your cyber help desk," advised Panaretos. "For decades, cybersecurity has been about technology and processes without recognizing there's a person involved in everything. To build those relationships, it's important for organizations to realize they have neurodiversity and cultural differences in their workforce.

"Try to understand why people are doing something," she said. A loss of focus can be caused by caregiver stress experienced by the worker or other at-home issues. Having this level of interaction "creates a human connection," she said. "People need to know they can make a mistake and recover from it. You need open dialogues. A silent organization is a dangerous one."

REGENERATIVE MANUFACTURING

INSIDE THE ARMI HUMAN TISSUE FOUNDRY

By Mike Bacidore

ow do you give life to a new industry? There's a short list of individuals experienced in parenting a disruption of such magnitude. Elon Musk, Mark Zuckerberg, Steve Jobs and Bill Gates come to mind immediately. Dean Kaman, founder of FIRST Robotics and Segway, as well as Deka Research and Development, is an equally disruptive force.

"I pointed out to President Barack Obama that the difference between scientific research and industry is huge," he explained, during a tour of BioFabUSA, which he spearheaded, in Manchester, New Hampshire. "We don't even have the real roots of the industry that is going to take the science out of these labs and bring it to industry," he told Obama.

The Advanced Regenerative Manufacturing Institute (ARMI), a member-driven, 501(c)(3) nonprofit organization, created BioFabUSA, one of 16 Manufacturing USA institutes, born from a federal initiative that originated during the Obama administration. BioFabUSA integrates cell and tissue cultures with advances in biofabrication, automation, robotics and analytical technologies to create disruptive tools and scalable FDA-compliant manufacturing processes. "When we first started ARMI, I said the dynamic range of people getting involved was going to be unprecedented. We grew to well over 100 members in a few years," said Kaman. "To get an industry up from nothing, we're going to need standards. We're going to need systems. We need to create that substrate. We need this massive infrastructure to turn this into a high-volume business."

Staffed by 67 employees, as well as embedded employees from more than 200 member companies, BioFabUSA has grown quickly since its inception in 2017. ARMI began with an \$80 million grant from the U.S. Department of Defense and a handful of member companies. Kaman's vision is to not only facilitate the ability to grow human tissue for organs, but to automate the process and then democratize it to the point of providing machinery small enough to place in a doctor's office.

"I told the Department of Defense I have mechanical engineers, system engineers, controls engineers," explained Kaman. "I don't have a single MD in my company. We know nothing about the world of synthetic biology. We know the engineering side of a lot of these things we do."

Kaman set to work on recruiting leaders to steer the institute into disruptive waters. "I called John Abele, the co-founder and director of Boston Scientific," he



The BioFabUSA human tissue foundry at the Advanced Regenerative Manufacturing Institute (ARMI) in Manchester, N.H., is automated with Rockwell Automation technology and was a tour destination of industry media in Boston this week for Automation Fair 2023.

said. "I called Martine Rothblatt, United Therapeutics CEO and the founder of Sirius Satellite Radio. The third person I called was Blake Moret, the CEO of Rockwell Automation. I knew him through FIRST Robotics." Along with Dr. Jim Weinstein, senior vice president for Microsoft Healthcare and former CEO of Dartmouth-Hitchcock, these five became the Bio-FabUSA board of directors.

Automation fills important role

Among the embedded people at ARMI/BioFabUSA are Rockwell Automation employees including Wayne Charest, bio manufacturing automation specialist, and John Hatzis, global industry technical consultant, life sciences. "When we first came onboard, we were among the first to join ARMI in 2017," said Charest. "The first year, ARMI was a manufacturing institute, which was made up by its members. We spent a lot of time the first year trying to teach the members about automation. We created a program called Automation 101."

After the first year, Charest helped to create the tissue foundry, which was the first automated tissue line. Rockwell Automation supplies the technology that automates the tissue foundry. "Then we decided to build an experience center. We couldn't have gotten those done in the first five years without John Hatzis."

Hatzis works with a variety of life-sciences companies. "We are getting to see the beginnings of an industry right here in New Hampshire," he said. "It's been a great experience building these tissue factories."

Rockwell Automation's technology has become an integral driver of the scalable, modular, automated, closed (SMAC) system that's taken shape under the

leadership of Tom Bollenbach, ARMI/BioFabUSA's chief technology officer.

Biofabrication is the industrial production of biological tissues that can be used for infinite therapeutic applications, including for burn injuries or damaged vasculature, in toxicology screening to test the safety of drugs under development and to develop therapies to cure diseases including renal failure and diabetes.

Generating cells is relatively easy, compared with the complexities of regenerating three-dimensional organs, such as kidneys, livers, hearts or lungs, all of which are in the works by ARMI member companies, explained Bollenbach. "How do you quality-control living tissue?" he asked rhetorically. The challenges come specifically in determining how to transport fuel—nutrients and oxygen, for example—to interior cells and how to subsequently remove waste products.

Data has become a key enabler for finding correlations that help to predict behaviors in cells that need to accomplish these types of goals. Digital technology keeps moving the needle. "Fifty years ago, people scoffed at what you would need a computer for," explained Kaman. "We've digitized the world in a way that people wouldn't have predicted in the days of transistors."

Kaman compared the potential impact of democratized organ regeneration to the way wireless communication has changed our lives. "There are 2 billion transistors in a cellphone," he explained. "There are about 2 billion cells in a pancreas. What would you pay for a new pancreas for your child? The United States is going to spend 21% of its GDP on healthcare, mostly on chronic treatments. If we build an industry that allows people to replace organs, it will be more impactful on people's lives than cellphones."

PLEX CASE STUDY

DOWNEAST CIDER REALIZES DOUBLE-DIGIT COST REDUCTIONS

By Mike Bacidore

Placing a final accent on Automation Fair week, Rockwell Automation's Plex manufacturing execution system (MES) was highlighted during a tour of the Downeast Cider House in Boston, where its blends are made and packaged. "The facility produces about 125,000 beer barrels of craft cider every year," said Grainger Flint, director of supply chain. That translates into almost 15 million liters of cider. "For context, there are 13 states in the United States that produce less than that in craft beer."

Pat Welsh, director of manufacturing enterprise resource planning (ERP) consulting at the Revolution Group, an IT and enterprise-resource-planning integrator in Columbus, Ohio, guided Downeast through the Plex implementation process. "We kicked that off in October 2022," said Flint. "After about six months, we got to April of this year, and we were able to go live with Plex here in this plant without shutting down and without skipping a beat. Our operators were able to just start up on a Monday morning and just run with Plex. We haven't stopped since. And now seven months later, we've been able to really achieve some awesome milestones. We've been able to reduce our carrying

cost of inventory by 10%, and we've been able to reduce our cost of goods sold by 17%. That's great for a small business, especially one that's trying to grow about 20% each year, as we've done in the past."

Before Plex, Downeast was running its entire facility using Google Sheets and running its accounting software using bill.com. "These are great tools for small businesses," said Flint. "But as Downeast has grown to be the No. 1 cider in New England and the No. 1 craft cider in the

"We've been able to reduce our carrying cost of inventory by 10%, and we've been able to reduce our cost of goods sold by 17%." Downeast Cider House's Grainger Flint explained how Plex MES has benefitted the growing company during last week's Automation Fair 2023 in Boston. United States, we needed a better tool for what we were using. So now we use Plex."

Apples are sourced from all over the country and pressed locally before they're sent to Downeast as tankers of juice, sometimes twice a day to keep up with demand. The apple juice is fermented and then turned into a kind of apple wine. "Our product is not like beer," explained Flint. "With beer, you're going to be fermenting grains and all that jazz. We don't do any of that. We are more like a winemaker. We take apple cider, and we mix it with yeast. We make more of a wine-like product."

Apples are harvested throughout the year and stored, explained Flint. "The characteristics of those apples and the mix of those apples will change throughout the year," he noted. "That gives us different characteristics to the base cider. Those different characteristics are something that we have to control, so that we can always produce a consistent product at the back end all year long. We'll make different adjustments to our blend to make sure that we're getting the right notes."



The facility runs one can line on which every can of Downeast cider travels. "Every can gets loaded into the depalletizer, and it's automatically lifted onto the line," explained Flint. The cans descend and enter the twist-rinse, where they're cleaned out, sanitized and then prepared for packaging. Once they come through this twist-rinse, the cans enter the filler before being topped by the seamer machine.

"You need to make sure that they're not sticky with any residue around them, so we clean them off," explained Flint. "We then get checked one more time by an X-ray. That X-ray makes sure that we have the right fill level and that there are no particles in the cider."

After the cans are filled and checked, they move to the accumulation table for predetermined packaging configurations. Mixed packs, for example, can include different blends, which must be preloaded with other flavors that are picked by the facility's Fanuc robot. The trays of mixed packs are then palletized automatically with a TopTier palletizing machine. "All our operators have to do is pick up that pallet and then load it into the pushback racks, where our finished product sits," explained Flint. Pallets are then loaded onto trucks through the single-bay door, and then they're taken to Downeast's off-site warehouse.

"We use Plex at every step of the way in our process," said Flint. "As soon as the raw material comes through the door, we're going to have a check sheet for it. We're going to receive it within Plex and then it's tracked at each step of our fermentation process each and every day. We have a check sheet that our quality team fills out within Plex to then track the fermentation. Each fermentation is different for its own characteristics, so we need to track each data point. We can use trends to make sure that we're making the right adjustments at the right time using the correct data for each and every fermentation. That then helps us build the right sweetness levels and the right alcohol levels for our finished product."

The fermentation process takes seven to 10 days. "We track each and every day, which permits us to determine if we can use it earlier or have to let it sit longer, depending on the attributes of the apples and the sugars within those apples, as well as our alcohol by volume (ABV) target," explained Flint. "Sometimes we're targeting a higher ABV ferment for some of our higher-ABV ciders. After 10 days of fermenting, we then put it into our bright tanks, which are where we make blends."

Downeast uses a sort-of apple wine as its base and then flavors it with different fruit juices and concentrates to create the desired flavors. "That process takes about 24 to 48 hours," Flint said. "Within that process, we track all through-production within Plex. We're tracking all of our stability steps within Plex to make sure that it is a clean and safe product before we can send it out the door."



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