

PLANT SERVICES

NOVEMBER
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2024

Smart Solutions for Scalable Operations

SHAPING THE DATA STORM

How system integrators are helping maintenance teams overcome a widening skills gap

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Stop The Drift Away From Standards

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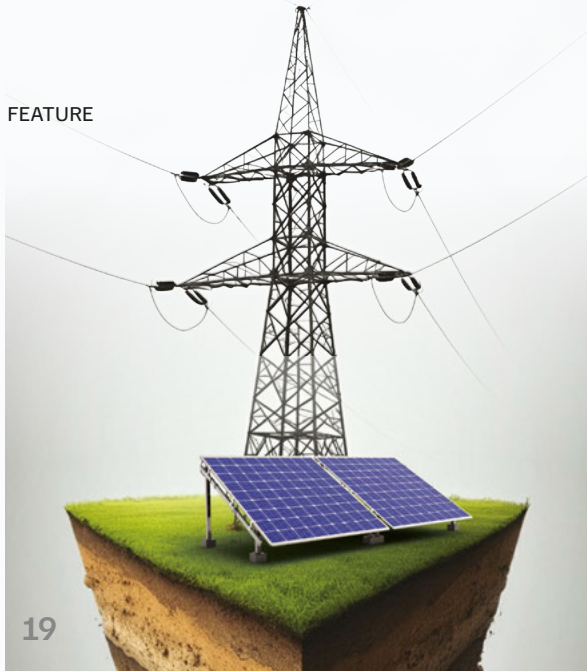
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Shaping the Data Storm

How system integrators help maintenance teams overcome a widening skills gap

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THOMAS WILK
From the Editor

McRIGHT TO REPAIR

According to Quartz, in October “the U.S. Copyright Office issued a key exemption that allows restaurants to sidestep digital locks, granting them the ‘right to repair’ machines embedded with software.” Many are noticing that the ruling specifically enables non-OEM technicians to repair McFlurry machines without the constraints imposed by Taylor, the manufacturing company responsible for their upkeep.

This is no small thing for both McDonald’s and industry. According to Wikipedia, as of 2021 the Taylor C602 was being used in more than 30% of McDonald’s restaurants worldwide, and in 2000 an internal McDonald’s survey revealed that a quarter of restaurants were reporting that the machines were nonfunctional. And the ruling specifically permits the repair of retail-level food preparation equipment, not just the infamous McFlurry machines, so you can expect better menu availability across the entire fast-food sector.

In general, the Right To Repair movement in the U.S. has been picking up steam, and is centered on three kinds of consumer equipment: vehicles, electronics, and farm machinery. Probably the most notable progress in this area came in early 2023, when John Deere agreed to give customers in the U.S. the right to fix their own equipment. As part of the agreement signed between the American Farm Bureau Federation (AFBF) and Deere & Co., equipment owners and independent technicians will not be allowed to “divulge trade secrets” or “override safety features or emissions controls or to adjust Agricultural Equipment power levels” while giving equipment owners far more latitude in accessing information about their machines.

Currently, right to repair legislation has been passed in four states – California, Colorado, Minnesota, and New York – and is pending in many others. Also, several right to repair bills are currently being considered at the federal level, including one that is focused on equipment used by the U.S. military (even the DoD is constrained in this area).

As for the electronics market, repairing your own devices definitely will prolong their lifespan and reduce the expense of ownership, as well as help reduce the very high levels of e-waste currently being generated (currently estimated at 16 lb of e-waste per person in 2023, with only a fraction of this waste [17%] collected and recycled correctly). It still isn’t easy to make many of these repairs, but at least it’s possible, as plenty of YouTube videos illustrate. Now let’s see how many McFlurry machine videos pop up out there. **▲**



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JOE KUHN

Leadership in Action

STOP THE DRIFT AWAY FROM STANDARDS

When it comes to effective process management, maintenance lags far behind operations

Process management is the key tool in management to realize efficient processes with predictable results. In my 38 years in manufacturing nothing has had more business impact. It is worthless to know a best practice and not have the organizational discipline to execute it consistently.

Following standards is a massive organizational challenge. Most fail. Failure does not occur with an intentional decision to not follow a standard; rather, organizations “drift” from a standard over time.

Procedures and standards are often tribal knowledge in an organization but employees change due to attrition, change roles within the organization, or seek shortcuts to save time/eliminate waste as knowledge of the “why” of a procedure/standard fades into history. Management does not escape blame for drift; they stop auditing, training, or commenting on a process standard.

What does this have to do with maintenance and reliability? In my experience, maintenance is 30 years behind operations in controlling drift. Who is tracking your lubrication compliance to the standard? The right lube, at the right time, applied with precision, and in the right quantity. Is this being audited by a second party? Are you sampling the grease to ensure it continues to meet specification? Is your “audit” just a checkmark on a PM sheet?

Excellence comes from discipline, and discipline emerges from a process that is audited to prevent drift. Examples of application to maintenance: the planning process, kitting process, outage execution process, preventative maintenance tasks, wrench time, motor management, bearing and belt installation. Management must decide which processes are to be managed to deliver the business goals.

We are overworked now; how can we find the time to audit standards? This is the trap! The work you are doing not to standard today

is causing tomorrow’s failures. What could your employees be innovating or improving if they were not moving from crisis to crisis every day?

Doing a job right and holding these standards through time will rapidly deliver long-term stability and a lower cost. The key to process management is to strive to have everyone be the owner of a process by segmenting the critical practices down to very small yet critical processes. In this state, everyone is “watching” their small slice of the business highlighting problems and opportunities.

PROCESS MANAGEMENT DETAILS

I’m going to use the example of a car wash business for simplicity.

Process Manager - this is the person in the organization that is tasked with the responsibility to control the selected process. Process managers have lots of freedom to act and create, but all follow the same outline.

Process Manager Accountabilities:

1. Document and graph output measures (results) critical to your process. Calculate statistical upper and lower control limits and place these on the graph. Place internal specifications on the graph. Completing these tasks, the system is graded “RED” – tracking output measures. (Car wash examples: first time through clean cars; % of windshields with no bugs; dollars of car damage per month.)
2. Document and graph which plant input variables impact or determine the output variables above. Calculate statistical upper and lower control limits



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and place these on a graph. (Car wash examples: pressure drop across water filters; concentration of soap solution.)

3. **Training:** Create, maintain, and communicate to all stakeholders all documents outlining work procedures required to maintain process control.
4. **Execute and record critical weekly (or appropriate frequency) shop floor audits** to ensure craftsmen standard work is being completed on time and with precision. (Car wash examples: the PM observes soap concentration three times a week; the PM verifies the rinse solution pressure three times per week.
 - To achieve “YELLOW” status – tracking input variables complete steps 1, 2, 3, and 4, .
 - To achieve “GREEN” Status – short-term process control: three months in a row with 100% output measures and 100% input variable graphs being in control and in specification.
 - To achieve “PURPLE” Status – long-term process control: 12 months in a row with 100% output measures and 100% input variable graphs being in control and in specification.
5. **Change Control** - The PM is accountable for getting approvals for all process changes. (Car wash example: PM wishes to change the soap concentration from 5.1% to 4.9%.)
6. **Corrective Actions** - The PM is accountable for documenting all corrective actions to the process from non-compliance to standards to performance numbers being out of control or company standards. (Car wash example: random PM audit

found 2 of 3 process variables not in compliance.)

Quality System Manager (QSM) - this role owns and has expert knowledge of the process management system in total, and acts as a coach and guide to creating robust process managers. This role also conducts routine audits of the managed systems to ensure integrity and compliance; typically, monthly. The results of these audits are summarized each month and communicated to the plant leadership team.

QSM Accountabilities:

- Own the standards (which are documented) for process management, as well as standards and systems for document control, change control and corrective actions. This includes requirements for advancing a managed process from BLANK (no progress) to RED (tracking output measures) to YELLOW (tracking input variables) to GREEN (short term process control) to PURPLE (long term process control).
- Act as a teacher and coach to all process managers.
- Act as an auditor of all managed processes.
- Own summary reports to sponsor(s) of the status of all managed processes.

Sponsor - this role is at least one layer higher in the organization than the assigned process manager, such as Production Manager. This is an active role where the process management system is discussed in meetings, emails and in performance reviews/expectations. The sponsor also audits process manager systems at least once a quarter.

Specific Sponsor Accountabilities:

- Know and communicate the business case for the process to be managed.
- Consistently support the actions of process managers.
- Participate in periodic audits of managed processes (each process once per quarter recommended).
- Knock down barriers to success for PMs.
- Set expectations for QSM.
- Work with the QSM to develop a routine process to recognize the best process managers.
- Make organizational changes necessary to create a process discipline culture exist at the plant.

Be careful not to make the processes too large and complicated. Just 30 minutes to two hours a week is the total time required per managed process. Car wash examples:

- Good - “Windshield not cleaned on the 1st pass.”
- Bad - “Car cleaned first pass.”

See the difference? The latter is too vague. It includes all quality issues with a car wash: dirty wheels, bugs on bumpers, cleanliness of all windows. Right size the process to be managed to make an impact to the business without overwhelming the process manager with problems.

I detailed a plant-wide process management system above. However, you can implement this yourself in your department or as an individual. Hoping tomorrow will be better is not a plan. Stability begins with managing one process; how about yours? **Δ**

SHEILA KENNEDY

Technology Toolbox

CAN YOU HEAR IT?

Subtle signs of reliability risks are revealed with ultrasound technology



Ultrasound technologies increase site safety, productivity, and cost savings by detecting conditions such as compressed air and gas leaks, vacuum leaks, and lubrication and flow problems. The latest ultrasonic instruments and solutions improve upon their predecessors with earlier and more precise condition monitoring results.

ACOUSTIC CAMERAS

Locating and analyzing leaks and partial discharge are the focus of the new H-series high-performance acoustic camera from **FOTRIC**. It is designed with heightened sensitivity enabled by up to 162 digital MEMS microphones and provides built-in analysis for on-site decision making. Acoustic Focus Mode filters out background noise and interference to better diagnose subtle and localized issues while Leak Evaluation Mode quantifies the financial impact of leaks to improve maintenance prioritization.

The H-series camera “is compact, yet the sensitivity is absolutely remarkable,” says Fernando Rico, regional manager at FOTRIC. “What really sets it apart are the advanced features like partial discharge diagnosis and leak cost evaluation, which typically come at a steep price with other brands.”

SonaVu+ is the newest model in **SDT Ultrasound Solutions'** SonaVu line of acoustic imaging cameras. It includes improvements to performance, quality, UI design, and reporting. SonaVu uses 112 digital MEMS sensors and an optical camera to detect and visualize sources of airborne ultrasound signals produced by turbulence. “One of my key focuses is finding quick and easy wins for reliability teams. The SonaVu+ speeds up finding leaks with its ability to scan large areas for the specific ultrasonic turbulence frequency we are targeting, while filtering out background noise. Improvements to its multipoint detection allow us to accurately sweep over larger zones, without worrying about

competing signals,” explains Robert Schell, reliability program manager at SDT Ultrasound Solutions.

The Si2-series of acoustic cameras from **FLIR**, offered in partnership with **UE Systems**, is built to accurately detect and measure the most sensitive equipment issues, even in the noisiest areas. Improved picture quality and battery life and new on-screen gas leak quantification are among the advancements.

Aside from air, gas, and vacuum leak detection, “using the camera’s ‘mechanical mode’ feature, the Si2-series easily distinguishes potentially faulty bearings at a distance and measures the sound pressure level (SPL), sound crest, and kurtosis,” notes Rob Milner, global business development director at Teledyne FLIR. “The Si2’s new Mechanical Sound Indicator analyzes and confirms the slightest sounds from mechanical faults, empowering plant professionals to evaluate conditions, identify problems, and implement solutions rapidly.”

The FLIR and UE Systems partnership combines their respective strengths for the benefit of reliability maintenance programs and energy conservation across the world, starting with the Si2-series of acoustic imaging cameras, according to UE Systems VP Blair Fraser.

The SONASCREEN 2 acoustic camera from **SONOTEC** is distinguished by its high number of microphones and fast acoustic framerate. “Its 176 microphones allow for finding even smaller leaks than before, while the 100 frames-per-second acoustic refresh rate makes it easy to quickly scan areas for leaks and partial discharges. It is also the first device with a built-in GPS and has a laser range finder and thermal camera included,” says Brian Kavanagh, product manager at SONOTEC US.



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ULTRASOUND SOLUTIONS

To better detect bearing and lubrication faults, the new UDK-CM Ultrasound Condition Monitoring Kit from **Wilcoxon Sensing Technologies** includes an ultrasound receiver, solid probe set, headset, one-year subscription to a cloud-based condition monitoring app, and an industrial carrying case. It is differentiated by its ease of use and expansion capability, according to Senior Applications Engineer Peter Eitnier.

“With no complex tuning requirements, the receiver is a simple point-and-shoot device that will immediately provide feedback on nearby sources of ultrasound, with the twist of a knob enabling easy gain adjustment for low- or high-amplitude signals,” observes Eitnier. The kit can also be combined with additional accessories to detect

other sources of ultrasound, such as gas or compressor leaks, or to perform valve and steam trap inspections.

The new 39DL PLUS ultrasonic thickness gauge from **Evident** saves time in precision and corrosion thickness inspections. With its 60 Hz update rate, it delivers the scanning speed of a flaw detector in a more affordable instrument.

The gauge’s high signal quality, stable waveforms, optimized algorithms, and rugged design enable accurate, reproduceable measurements in industrial environments.

And by integrating Wi-Fi and Bluetooth capabilities directly into the handheld gauge, we’re empowering inspectors to work smarter and faster. **Δ**

VIDEO REFERENCES



FOTRIC Inc

➔ https://youtu.be/jL_Ba01GH34



FLIR

➔ <https://youtu.be/JnX6j7N6qT8>



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DOC PALMER

Palmer's Planning Corner

5 HIDDEN OPPORTUNITIES TO GIVE YOUR TEAM A COMPETITIVE EDGE

Become aware, take advantage, and become a best performer

I was blessed to attend the 2024 RPM Symposium hosted by HECO. I presented on why planning and scheduling is not simply a best practice, but also gives a company a competitive advantage. Proper planning and scheduling takes advantage of hidden opportunities. Because even good companies do not see them, these opportunities offer a competitive edge for you. Become aware, take advantage, and become a best performer.

The world's foremost quality guru Dr. Deming¹ tells us "the big problems are where people don't realize they have one in the first place." This declaration rings especially true for planning and scheduling. We find many true aspects of planning and scheduling simply hard to believe: The purpose of planning is actually not to tell people what to do. The purpose of scheduling is not to complete the schedule. Wrench time is only 35%. Management settles staffing for maintenance just to the point where we can keep up with breakdowns. And finally, first line supervisors think their "mission" is to "Take care of operations and otherwise make sure everyone is busy." Are you aware of these truths?

First of all, planning's real purpose is to help us improve the quality of field execution. We have skilled craftspersons that have been with us fifteen or twenty years. We want them to exercise their skill and judgment. We do not want anyone ever to blindly follow a job plan. The plan is a "head start" where planners perform a triage of requests and assemble the best plans they can within the time they have to plan all the new work. After job completion, planners do post-mortems especially with craft feedback to improve plans for better head starts in the

future. Thus, proper planning runs a cycle of continuous improvement over the years to have better guides to help skilled craftspersons. The common notion of telling craftspersons what to do simply leads to frustration both from planners who cannot be perfect and craftspersons who resent being told what to do.

Second, scheduling's real purpose is to help us complete more work than we would normally complete. Our enemy is Parkinson's Law², "the amount of work assigned expands to fill the time available." We must fully load weekly schedules or else the work we do assign will take longer than it should, and we will not complete as much as we could have completed. (Sounds almost like a tongue twister.)

Yet, most people errantly think the purpose of scheduling is somehow "to complete the schedule." They underload the weekly schedule to allow for reactive work so they can have great schedule compliance. They have great schedule compliance, but do not complete as much work as they could have completed. They have failed. Consider that a good bowling score would be 200 out of 300, only 67%. And a good batting average would be .300, only 30%! Beware using a school grading system (where 90% is an "A") for schedule compliance.

Third, "wrench time" is only 35% – everywhere, across industries, continents, and cultures. Statistical studies show craftspersons spend only about a third of their time available actually moving jobs ahead. The average craftsperson only "directly works" 3.5 hours out of a 10-hour shift. They spend the other time getting parts and tools, traveling, in crew meetings and breaks, which is all part of "work" but is not time spent moving jobs ahead. Wrench time is only 35% everywhere because at this point people "feel busy,"



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“Wrench time” is only 35% - everywhere, across industries, continents, and cultures - because at this point people “feel busy,” a human nature thing. And surprisingly, best practice wrench time is only 55%, but it’s still a “50% pop” in work order completion rate (55/35 = 1.57).

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a human nature thing. Surprisingly, best practice wrench time is only 55%. But the leverage of increasing wrench time gives a “50% pop” in work order completion rate (55/35 = 1.57).

Fourth, management sets our maintenance staffing level exactly to the point where we have many breakdowns, but we manage to fix them and deliver a profitable (good) company. As we improve to where things are not breaking as much, management does not replace staff attrition. “We have ten electricians and two about to retire. Let’s see if we can get by with only eight electricians.” This staffing strategy continues until we simply cannot keep up enough and operations is screaming. Management then decides to hire a few more electricians. Unfortunately, the best maintenance strategy proactively works on assets before they break so they never break, but we simply do not have the ability to do the extra proactive work to eradicate breakdowns altogether and stay there.

Finally, first line supervisors naturally think their “mission” is to “take care of operations and otherwise make sure everyone is busy.” This mission keeps us busy fixing breakdowns and supports being a good company, but we are only at 35% wrench time.

You can leverage all of these hidden opportunities. Run planning as a Deming Cycle to make plans more helpful over time and fully load schedules to defeat Parkinson’s Law. Best planning runs a Deming Cycle to give head starts and improve plans over time, especially with craft feedback. Best scheduling fully loads schedules and accepts 40-90% schedule compliance which defeats Parkinson’s Law. These schedules change the first line supervisor mission to “try to

complete a certain amount of work, but break the schedule to take care of Operations.”

The old sense of mission gives 35% wrench time whereas this new sense of mission gives 55% wrench time. You get a 50% pop in work order completion rate. You go from completing, say, 1,000 to 1,500 work orders per month. And because you have staffed to do the reactive work, “by definition” all the extra work is proactive! You improve the quality of field execution and complete more proactive work to eradicate reactive work. Success.

Because your competitors are not aware of these hidden opportunities, you can gain a competitive edge by leveraging them. “The big problems are where people don’t realize they have one in the first place.” Thanks Dr. Deming. Don’t settle for good. Be great! ▲

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Industry Perspective



Aaron Merkin is chief technology officer (CTO) of Fluke Reliability Solutions. His responsibilities include developing and executing the Industrial Internet of Things (IIoT) strategy and leading the technology team in the continued creation of innovative solutions for customers..

MANUFACTURING 2025

What to expect in the year ahead

Plant Services recently sat down with Aaron Merkin, Chief Technology Officer of Fluke Reliability, to get his insights and predictions on where manufacturing is headed in 2025. Merkin brings more than two decades of experience developing enterprise software across a variety of industries and markets, including roles at IBM, Dell, ABB, Aclara (now Hubbell), and Honeywell. This includes positions as the CTO of ABB Enterprise Software, CTO of Aclara, and most recently, CTO of Honeywell Connected Industrial.

PS You work with a wide variety of manufacturers in nearly every industry and vertical around the globe. What are some of the key trends that you're seeing right now in manufacturing?

AM The first is the continued focus on digital transformation. Customers are looking to collect more data and use that stream of data they're getting from IoT solutions to inform their decision making. It's been challenging times, and customers are trying to decide where to invest in terms of improving operations and improving reliability. That ability to have data allows them to improve their decision making while accelerating a shift towards predictive maintenance. Customers are recognizing that by having instrumentation in their plant, they're able to better predict the health of assets and incorporate that into their short cycle planning. It's really prompting them to be much more aggressive in adopting predictive maintenance.

The second thing we've seen is continued concerns about supply chain resilience. The industry is still recovering from disruptions brought by the pandemic. There's also a lot of uncertainty around reshoring and trade headwinds, and whether you're going to be able to continue to rely on the suppliers that you've had overseas, so customers are looking at how to integrate adaptability and transparency into their supply chains. They are looking for alternate suppliers outside of potentially problematic countries, and to dual-source their suppliers for critical equipment.

We're also seeing significant efforts to integrate AI into supply chain planning for parts demand and predictive maintenance, optimizing inventory and reducing reactive fixes.

PS Many U.S. manufacturers have been waiting for the Fed to cut interest rates, and we're starting to see that happening. We hear stories about some supply chains getting back to pre-COVID levels while others are still sorting things out. What do you see specifically as the biggest challenges facing manufacturing next year?

AM One of the things we've seen with manufacturers is the pace of technology change, the amount of information around generative AI, and the idea that we've hit an inflection point where if you're not already using GenAI then you must clearly be behind.

We've seen a ton of pressure on manufacturers, particularly at the plant level, to analyze technology and create a plan to adopt it whether it makes business sense or not. We see RFPs and questionnaires asking for AI solutions, whether AI is the appropriate solution or not. Our customers are really feeling the pressure not to be left behind. We encourage our customers to resist the lure of the latest cutting-edge technology and focus instead on understanding their desired business outcomes, and how technology can help meet their business goals.

PS We're also hearing that people feel pressured to adopt "AI something." With regard to AI, what emerging technologies do you see on the horizon that actually will revolutionize or change manufacturing?

AM Over the last decade or so, there's been an evolution away from enterprise asset management (EAM),

or the augmentation of EAM with asset performance management solutions. Within those solutions there's been a shift away from first principle modeling more towards the use of AI and machine learning for modeling. That is going to hit the inflection point where customers are seeing real value in adopting these AI models versus first principle models for modeling the health of their assets. That includes not just modeling the health of individual assets, but the full adoption of digital twins and using a digital twin philosophy or approach to model the entire flow of production through their plant floor.

PS What's been surprising on a tool level, is the extremely rapid adoption of acoustic imaging. Fluke has helped lead the way with one of their devices. Have you seen that trend for condition monitoring?

AM We are seeing significant adoption of acoustic imaging, particularly for customers who are doing

occasional spot checking, or if they're still into route-based maintenance and not quite ready to deploy a continuous monitoring technology like a wireless sensor. It's also used as a good red-yellow-green initial analysis for those customers who are bringing in a service company to do intermediate inspection, or who themselves are starting to add some kind of condition monitoring program into their daily work.

PS We've been talking about the skills shortage for a while in manufacturing and everyone I've talked to in 2024 has said the same thing: the shortage hasn't gone away, but we're trying to do our best to cover up for the lack of technicians in various ways. What are you hearing from your customers, related to how they're using technology to combat whatever skills gaps they might have on their teams?

SR There was a lot of hope that post-COVID the skills shortage would go away. That has not happened, and

manufacturers now must build a longer-term plan to address this shortage.

In response, we've seen adoption of cloud-based technologies to allow a centralized workforce to more effectively monitor operations across multiple sites as one means to address the shortage.

We've also seen the deployment of wireless technologies on the factory floor to allow broader coverage of assets, so it allows a smaller group of technicians and resources to monitor the plant without having to conduct walk-around route based inspections.

We're also seeing the adoption of VR and AR capabilities to perform training. I think there's still a question of whether AR is really safe to use on the factory floor, but we see it as an opportunity to provide off-floor simulation and get people familiar with operations before they actually move on to the floor.

On the business side, there's been investment in continuous learning and upskilling to ensure teams can keep up with emerging technology trends. Companies have also established partnerships with trade schools and universities to help create a pipeline of skilled employees as they're coming out of training programs.

For example, Fluke participated in this year's WorldSkills Program to be at the forefront in educating the next generation of electricians, both from enabling them to be more productive in their daily work but also in getting them used to using our tools to perform their jobs, so when they go out into the workforce there's a preference for having us as their partner.

But I think there's been a shift away from the idea of that a university or college education is the only path to economic success in United States. Many are realizing the work is interesting, challenging, and economically rewarding. **Δ**



JEFF SHIVER

From the Plant Floor

4 COMMON HACKS TO IMPROVE PLANNING AND SCHEDULING

Proactive maintenance organizations consider maintenance planning and scheduling the central hub to drive consistent plant performance. Yet, most organizations struggle to get it right.

1. Perform Work Execution Audits. Pulling three completed work orders and walking them down with the planner, supervisor, storeroom clerk, and technicians, at a minimum, can highlight issues in the business processes and workflows. In that audit, each individual should be queried to identify opportunities for improvement, as well as help identify if there is conflict or distrust between the various roles. Were the right child asset and work scope identified in the work order? Were the materials kitted and staged? Did operations have the equipment clean and ready for work when agreed? Did the technicians correctly identify the failure codes and provide feedback to the planner to improve the reusable job plan?

2. Develop Partnerships. In some organizations, adversarial relationships exist between planning and the trades. Expectations have been set where the technicians believe (incorrectly) that the planner will provide a perfect and technically complete job plan.

However, the planner's role is to give a head start on the job by providing a minimum of the trades required, estimated hours, and necessary materials. This proactive approach, coupled with a feedback loop from the technicians, allows the plan to be improved over time. Each execution enables a more comprehensive job plan, and the technicians' input is crucial. Both groups buy into what they help create, which builds trust and rapport. The audit process helps to reinforce expectations continually.


3. Build and Manage the Work Backlog. Ideally, schedule 100% of the available labor hours. However, when starting planning and scheduling (yes, some organizations are just beginning the planning and scheduling function), it may be more advantageous to consider the level of reactivity in determining the number of hours to schedule. If 40% reactive, schedule a challenging 70% of the available hours. On hitting

85-90% schedule compliance for a few weeks, schedule 80%, and so on.

Target two to four crew weeks of ready-to-schedule (RTS) backlog and four to six weeks of total backlog. Some plants use the maintenance management system as a placeholder for all work, even envisioned future capital project wants. Those plants will often restrict the backlog reporting to the latest six months to differentiate the necessary work for maintenance. It is essential to constantly tend to the backlog, such as in a garden, pruning and prioritizing the work where the RTS backlog is prioritized and pulled to build the weekly schedule.

4. Implement the 20-Minute Rule and Improve PM Optimization. Digging deeper, I find that some sites don't have a backlog, yet they constantly fight reactive failures. In my experience, I often find some common causes for these shortfalls.

When doing an on-condition inspection task, the technician decides to make the corrective repair now, regardless of the potential failure point on the P-F curve. If the repair can wait until the next maintenance window, sending the work to be planned and scheduled enables a more proactive approach. It feeds the backlog. With a 70% self-induced failure rate, not having a corrective job plan with specifications often creates unplanned future failures.

Not raising notifications when performing PMs and incurring failures also is a clear indicator that PM optimization is needed. Often, 40-60% of the existing PM tasks don't address the likely failure modes and, therefore, are non-value-added. In addition, the PM tasks need to identify the potential for failure, not the failure. We have had tremendous success teaching maintenance technicians a process to identify the likely failure modes and optimize the PM/PdM programs. 



Jeff Shiver, CMRP, is a founder and managing principal at People and Processes, Inc. Jeff guides people to achieve success in maintenance and reliability practices using common sense approaches. Visit www.PeopleandProcesses.com or email JShiver@PeopleandProcesses.com.



Written by

Thomas Wilk
Editor in Chief

SHAPING THE DATA STORM

How system integrators are helping
maintenance teams overcome
a widening skills gap



This is the last of our 2024 look back / look ahead articles on changes in industry over the past 10 years. For this article, Plant Services spoke with three CSIA-member system integrators about how their work has changed in an era of “big maintenance data,” and what they see happening five years from now.

Dave Bader is vice president of business development (NA) for Eurotech, and his previous work includes roles at Amazon Web Services (AWS), Rockwell Automation, and Fetch Robotics.

G Brooks-Zak is a co-founder of Outlier Automation, a control systems integrator that helps manufacturers use automation and technology to improve operational efficiency and profitability.

Heath Stephens is the digitalization leader for Hargrove Controls & Automation, and has more than 27 years of experience in chemical engineering, process safety, automation, and controls.

1. In your opinion, what have been the biggest changes for system integrators and their customers over the past 10 years?

G Brooks-Zak: The biggest thing (and what we see in general with technology) is that the breadth of technology and the layers that are involved has shifted and come more into the space. For me, what that means is that there are more types of people involved in maintaining, building, and continuing these systems. There are different skill sets – networking, cyber security, software development – and we have to be able to interface with IT on the business side too.

I'd also say simultaneously, as most people know, there's a lot of in-house knowledge that traditionally had been in the operational technology space that was making equipment run and installing equipment, and those people are retiring. I think system integration is bridging that gap and playing more of a role in managing both aspects of that change, and helping manufacturers adopt new technology and keep it going.

David Bader: Infrastructure is changing, and the convergence of IT and OT is an especially big change. This shift has enabled traditional OT people to speak in ways that the IT team can understand. When I started my career, and even in more recent years, that wasn't the case – there was a clear delineation between those two teams, so I think that that's a huge change.

The other big change is the shift to pushing plant floor data to the cloud. The cloud is changing all aspects of business, and is providing the ability for us to be able to deal with the amount of data that many companies want to process. Practically, it wasn't available in the past, and even when it became possible at the edge, security was a



problem. Additionally, the total amount of compute was also not available. Now we're able to take information from the plant floor, and are able to do really special things in the cloud with increasingly larger amounts of data, as well as making it secure at the edge and to enable a secure pipeline to the cloud.

I also think manufacturers much like many other segments of business are looking to be able to analyze their operations more efficiently and are looking to do predictive analytics, visual inspections, or other highly compute intensive workloads at the edge. For example, being able to do AI model training and inference at the edge for manufacturing is a strong area of focus. As these things happen, it also expands the roles of people that are on the plant floor, who are now empowered to help provide this data.

Heath Stephens: When I started as a system integrator, the focus was really on your classic DCS/PLC-type implementations. We were working with the automation teams that the owners had. We were working with the production engineers, those sorts of roles. Now, those teams have shrunk, and because of the increased variety of projects we implement we're also dealing with a lot more types of clients and customers. We're dealing more with maintenance personnel, with reliability teams, and with people outside of the classic production roles.

We're also doing a lot more with automation – we're tying the process control system into the ERP system, we're tying it into the laboratory data system, into the reliability system. We're connecting all these different sources of information so that our clients can get a whole picture of their operations.

They need that because they don't have the people to walk the floors and do everything they used to do. They don't have time to search for information. They need information brought to them, and suggested solutions brought to them by those automation platforms.

2. The Plant Services audience includes many maintenance and reliability workers, who are being challenged to adopt digital technologies to better understand machine health in real time. How are integrators helping these teams achieve their goals?

Heath Stephens: We're doing a lot with my digitalization team to make reliability a focus and assist our clients with their proactive reliability initiatives, so we're doing things like multivariate predictive analysis for equipment downtime. Several tools are available from multiple vendors, that we can feed process data, and they will give us a big-picture look at what's going on with the process and what equipment will fail.

Instead of having a lead time of a few minutes or a few hours from that single high alarm or trip sensor in your control system, with a multivariate view, you can get a much better fingerprint of what the process should look like and whether or not that process is on course. Then you could have these systems alert you, "Hey, you're going to have a failure of this pump in two days," just unbelievable lead times compared to what we had in the past. With that information, maintenance and reliability teams can plan for downtime, get their repair teams organized, and order any spare parts they need so they can be a lot more proactive and efficient at what they do.

We also do a lot of work with reliability, availability, & maintainability tools (or RAM modeling tools), where we do statistical modeling for what are predicted to be the biggest sources of downtime in the process. Then you can either make design changes to your process, or you can make operational and maintenance changes so that you can better adapt to the equipment you have. Tools like that really take a scientific, mathematical approach to reliability. In the past, you might have depended on a lot of experienced people and their best instincts, but sometimes it was hard to prove whether they made the most effective decisions.

It does still take some time to get familiar with these tools and configure

them. All of these systems also require some ongoing care and maintenance. Otherwise, their effectiveness eventually starts to decay, and that's something that I always try to be upfront with my clients about. Just like any other system they have in their facility, whether it's a piece of equipment or a piece of software if you don't maintain it, it's not going to continue to perform for you.

G Brooks-Zak: A lot of machinery that we work on is custom equipment that might only be one of its kind or very few have been built. If it has not been maintained over time from a software perspective, people might not even know what's programmed in there, so if you're talking about trying to get data from those types of systems, it might not even be clear how to connect to it.

I think that system integrators can help there because there are communication protocols on all of this equipment that is very specific to whatever the controller was in it, or how someone programmed it. A system integrator would be able to help give that context as to what is available and what even physically might make sense to get from a data perspective and then gain insight from that machinery. You might have to add hardware in order to communicate with it, you might have to add software, or you could even add sensors on the side in order to get basic data like "is this machine running" and go up from there. If you don't have that kind of templated or consistent process control, you might not be able to get to this machine learning / AI area without a lot more effort.

David Bader: There is a new line of business available for OT integrators who are able to adopt modern practices. Cyber security and remote device connectivity is something that is underserved from an OT integrator

perspective; it's something that if it is done right and if the OT integrators are now able to give customers insights in a rapid way – by enabling the data management at the edge and providing customers with deep and secure insights into their business, while minimizing the possibilities of a cyber security attack from the OT side – then these system integrators will be in high demand.

3. What advice do you have for maintenance and reliability teams when it comes to bringing in OT equipment?

Heath Stephens: The number one thing that the production and maintenance reliability teams can do is have an open line of communication with their IT department. There was a time in my early career when there was a clear dividing line between IT and operations, and that just doesn't work anymore.

We're in a blended environment. A lot of our new applications and hardware are cloud-native, whether they're going through a VPN tunnel that the IT team has to set up to get to the cloud or whether they've got a cellular antenna and they're going straight to the cloud (which is a big risk with IT departments all over). Even if you're not going to the cloud, for most of the things we do now on the plant floor, you want to get that data to your desktop at least, and again that will require IT's involvement.

I implore all the plant teams out there to make friends with IT and collaborate with them. Whenever I go to a client, IT needs to be in the room and aware of what we need and what we're planning to do. Anything we do presents some sort of risk, and we can identify and manage risk, but let's talk about how we're managing that risk together and talk about the upside of why we want to do these things.

David Bader: Let's face it, if the IT and OT teams start a project on the same page, there's a lot less friction along the way. Using the IT team to help maintenance and reliability teams facilitate a project or help the OT team move faster is just good business. It doesn't have to be a combative kind of relationship.

4. What changes or advances in system integration do you expect over the next 5-10 years?

David Bader: I think the convergence of IT and OT will come together in an even deeper way, which will make it super important to be able to transfer information back and forth in a secure way. Even if companies do not want to send information to the cloud, any data transfer should be managed securely. Enhance your security by implementing methods like security by design, conduct a cybersecurity analysis of your network, understand where there are potential growth areas or potential vulnerabilities, and be able to mitigate those vulnerabilities using modern technology. These are big areas for growth going forward, and areas where system integrators can help.

I also think building solutions to meet regulatory compliance is another growth area, maintaining things in a way that is proven and standards-based is critical. We have ISA and IEC standards for areas control systems, but for some reason when we start to talk about cybersecurity and the convergence of IT and OT, we don't think about that in those terms. There are some really great standards out there, such as IEC 62443, a worldwide standard for ICS networks that cuts across many different verticals. In Europe, for instance, it's mandated for companies to build to those standards. The faster the system integrator community learns about this and about building solutions to that standard, it's going to make it so much easier.

I like to look at it from North America's perspective. Rather than a mandate, it is more of an ROI discussion – when an integrator deploys a job and there's a potential cyber threat or an actual cyber threat, it's going to cost somebody money and time. Mitigating these possibilities creates a really great opportunity in the next 5 to 10 years for companies to build to those cyber standards up front and by design.

G Brooks-Zak: The reality is that things are only going to get more connected. There are going to be more devices on the manufacturing floor, and more things we have to connect, so it will be more difficult to maintain and even know where things are unless there is more standardization. I recently wrote an article that focused on software-defined automation, and the concept is to be able to understand how hardware and software is laid out, and then be able to maintain that through the life cycle of creating it, deploying it, and changing it. There are things that I think that we can learn from software engineering and apply it in our space, and that will be more and more important as the complexity increases but also as the value and the capabilities of our manufacturing increases.

Heath Stephens: We're seeing a lot of changes right now with generative AI, and it's coming for your control system; it's going to be a good thing, but it's also going to be a transition. We've gone from casually speaking to Alexa at home to ChatGPT and Microsoft Copilot on our desktops at work. That sort of interaction is going to come to the process control system side, and it's going to allow many more people who aren't automation experts or full-time operators to be able to talk to their control systems and get information out of them. It will mean great things for maintenance and reliability teams and the technicians out there that aren't necessarily trained to work with a control system and don't know how to look through code, but have process questions that need answers. **Δ**

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ENERGY-AS-A-SERVICE MICROGRID: A MODEL FOR SUSTAINABLE ENERGY AND DISASTER RESILIENCE

The hurricane-proof microgrid-plus-storage infrastructure produces and stores its own energy, as well as feeds back to the grid

Written by

Anna Townshend
Managing Editor

Earlier this year, Eaton and its partner Enel North America completed a clean energy project at Eaton's manufacturing facility in Arecibo, Puerto Rico, where Eaton makes circuit breakers, which play a critical role in the supply chain for electronics in the region. Driven largely by the region's high energy costs and the risk of severe weather, the Arecibo manufacturing facility was clear choice for a microgrid-plus-storage project. The microgrid system of 5-megawatt solar photovoltaic (PV) arrays, approximately 1.1 MW of battery storage, and existing on-site generators support more than half of the facility's energy needs. The system is expected to generate more than 9,000 MWh of renewable power annually.

Eaton has undertaken a number of solar projects since 2009, as part of its own commitment to climate change and reducing company carbon emissions by 50% by 2030. In 2017, Hurricane Maria devastated Puerto Rico, and Eaton

took note of the value of storage in a microgrid, so the facility could stand on its own.

The Arcibo microgrid infrastructure is ultimately built to withstand a Category 5 hurricane or winds in excess of 157 miles per hour and can sustain itself as an island, if infrastructure is down elsewhere. “It can be separated from the grid, if the grid is down, and we can be self-reliant through the storage, the microgrid and the backup generators and be able to power the site,” says Richard Gorzé, senior global energy manager at Eaton.

POWER AS A TWO-WAY STREET

As a power management company, Eaton understands the infrastructure for producing power, from building the equipment that supports electrical, hydraulic and mechanical power to solutions and approaches for reducing the cost and environmental impact of energy at its own facilities and its customers.

“Everything as a Grid” is Eaton’s approach to the future of energy, putting its stamp on reinventing the way power is distributed, stored, and consumed. The power grid traditionally has run in one direction, where power from the utility is produced at a centralized source and flows in one direction to consumers. Now, with microgrid infrastructure, consumers can produce and store their own energy and send it back to the grid, creating a two-way street for power. Eaton says this decentralization of power creates challenges but also decarbonization potential.

The company’s 2030 climate change targets also include lowering product and supply chain emissions and certifying all manufacturing sites as zero waste to landfills.

“At Eaton, we’ve been helping customers safely add more renewables,

storage, and electric vehicle infrastructure to their energy mix—to become more sustainable and resilient while lowering energy costs. By helping create these flexible energy systems, we’re ensuring power infrastructure can meet the needs of today and tomorrow while accelerating decarbonization, boosting resilience, reducing energy costs, and creating new revenue streams,” Gorzé says.

ENERGY-AS-A-SERVICE MODEL

Initial plans for an on-site solar microgrid project with storage at Arcibo were announced in 2020. “With a microgrid system incorporating solar plus storage, as well as our existing on-site generators, we were able to create a robust energy infrastructure that’s prepared to withstand the impact from extreme weather events,” Gorzé says. The complex project did take significant time to get the proper approvals from many parties, including Luma, the host utility in Puerto Rico, local government approvals and an agreement with Enel North America.

“In a project like this, again, it doesn’t happen overnight, so there’s quite a bit of work once you get the internal approvals from leadership to move forward on a project,” Gorzé says. “This being the first of its kind type of project, with solar storage and microgrid, even the utility still needed to understand all that was involved, because it was new to them.”

Clean energy developer and operator Enel North America worked with Eaton to create the long-term financial agreement, or power purchase agreement (PPA). Eaton noted Enel’s flexibility as a key to the project’s success. For facilities that don’t want or can’t make a long-term capital expenditure (Capex), as-a-service models can be a different way to structure

investment from Capex to Opex (operational expense).

“Enel North America built, owns, and operates the system on our behalf. We were able to shift our investment in the microgrid from a capital to an operational expense,” Gorzé says. Eaton also provided installation expertise and key technologies for the microgrid system, including its Power Xpert microgrid controller, switchgear, and other power distribution equipment.

The primary challenge during installation was ensuring the microgrid system’s control architecture is optimized, and all components are working in sync. “Post-commissioning tuning is essential to support system sensitivity and synchronization,” Gorzé says. “Maintenance includes evaluating and upgrading decades-old switchgear to ensure compatibility and reliability. For example, we replaced existing switchgear at the site to handle the solar input, and the equipment costs can be rolled into the PPA financing.”

To manage the intermittency of renewables, a solar-plus storage microgrid integrates solar PV generation with energy storage systems and microgrid control over energy supply. Eaton’s microgrid controller balances electricity consumption by analyzing real-time energy needs at the facility, in deciding between using or storing solar energy. Those systems and components all need fine-tuning or sensitivity analysis, Gorzé says. “We have to do some of that fine tuning to make sure the systems are all communicating and working together,” he adds. “There are a number of tests we do to qualify it after it goes live, as well as how it interconnects with the utility.”

Eaton says the project is projected to reduce energy consumption at the plant by 45%, cut emissions by 7,100 metric tons annually and reduce energy costs by 20%. ▲

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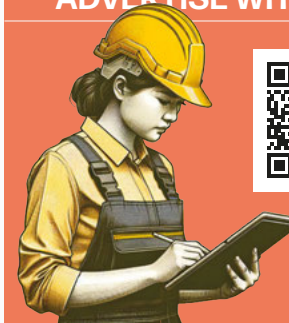
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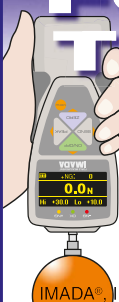
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THE CAPTAIN

Captain Unreliability

WHEN TO BEWARE THE FIRE MARSHAL

Dear Captain,

I've been plant manager for 10 years and our latest employee seems to be a go-getter that can make me look bad. Any advice?

– Patty

Ah, Patty, the perennial problem of being outshone by the new guy. Let me regale you with a tale of my dear friend Frank. Going from reactive maintenance to proactive is like going from being a firefighter to a fire marshal. Because, you know, who doesn't love comparing their job to putting out fires?

In most workplaces the idea is for everyone to be a fire marshal, because apparently if everyone is busy being a fire marshal, there'll be fewer fires. Logical, right? But, oh, let me tell you about this one manufacturing plant where the plant manager is a bit too cozy with his fire marshal hat.

In the sprawling drama of manufacturing, where being a fire marshal is the new cool, there's a special breed of fire marshal – Frank, the plant manager and self-proclaimed fire marshal. Frank isn't exactly keen on inspiring people to do the right thing. No, his hobby seems to be snuffing out any potential fires before they even spark.

With the plant's performance hitting rock bottom and Frank conveniently pointing fingers at the assets and maintenance, the last thing ol' Frankie boy needs is some eager beaver showing him up with her problem-solving skills. Little fires under your seat that can lead to a site champion can be a real hazard to a plant manager's ego, let me tell you. So, if you're in the same boat as Frank, desperate to ensure that no one lights a fire under his behind and steals your spotlight, read on for some nifty tips on how to be as obstructive as possible.

1. REMOVE ALL OXYGEN FROM THE ENVIRONMENT

Because, of course, if there's no oxygen, there can't be any fires, right? Frank's master plan involves suffocating his team with an overload of distractions. You know the classic move – too many meetings, no time on the actual floor, and a shiny new priority every day.

As soon as you see anyone take a breath and potentially work to solve an issue, immediately add a new distraction by telling her to do an inventory cycle count, or ask him to review and update an SOP, or (Frank's favorite) ask her to join an IT project. Whatever you do, keep them huffing and puffing from one pointless task to another, and they'll never have time to tackle the real issues. Brilliant, Frank, just brilliant.

2. REMOVE IGNITION SOURCES

Ah, leadership direction, the ultimate danger. Frank's solution? Keep it vague. Like, "Be Benchmark" vague, because nothing motivates a team like a mission statement that's about as clear as mud. Your goals should create confusion, beg questions, cause puzzled looks, and force people to leave the room Googling what the hell you meant. Change goals often enough to keep everyone guessing, and hey presto, nobody will even bother trying to reach them. Pure genius, Frank, pure genius.

3. REMOVE THE FUEL

Information is power, they say, but not if Frank has anything to say about it. His tactic? Hoard information like a dragon hoards gold. Compartmentalize everything within an inch of its life, and for good measure, slap on some blinders. Conferences? Books? Courses? Not on Frank's watch. Because who needs external knowledge when you've got Frank around to teach you everything you need to know? Spoiler alert: nothing.

So, there you have it, Patty. Follow these steps, and you too can be like Frank – on your merry way to becoming a corporate VP. Ah, the joys of professional mediocrity and morale deflation. **Δ**

Captain Unreliability is a satire of the state of manufacturing in 'Merica, USA, by an industry professional known for using humor to get the point across. Email him at Captain.Unreliability@ReliabilityX.com, or follow him on Twitter: @CUnreliability.



Atlas Copco



The background image shows a large industrial factory with a high ceiling, skylights, and various pipes. In the foreground, a grey Atlas Copco GA FLX compressor unit is mounted on a stone wall. The unit has a control panel with a digital display and a red emergency stop button. To the left of the unit, there is a vertical label with the model number GA 26 FLX FF. In the background, a red forklift is visible, and a worker is partially seen. A blue technical drawing overlay is present in the bottom right corner, showing a cross-section of a compressor with various dimensions and labels like '1330 [24-31]' and '1330 [24-21]'.

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