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MAY
JUNE
2024

Smart Solut rations

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# REPAIR NOT REPLACE

With supply chain and labor issues top of mind, a new study reveals how plants decide when to repair their critical motors

Increase Efficiency with a Playlist of Industry

Atlas Copco

# DEFINING VALUE IN PARTNERSHIP

Lisa Solomon, Motion

**IN TODAY'S** ever-evolving industrial marketplace, the value of a mutually beneficial partnership between customer and distributor cannot be overstated. Learning to navigate and define this collaboration will drive progress and innovation on both sides. It is a testament to the adage, "Together, we are stronger," emphasizing the countless benefits of two parties joining forces with a shared vision, mutual respect and trust.

At the heart of every successful Motion partnership lies the understanding that a distributor's value to the customer is not just created in the boardroom or on the plant floor; it is also cultivated in the space between a customer's needs and Motion's ability to meet and exceed them. In the spirit of true partnership, we must first listen to fully understand our customer's pain points to transcend the typical transactional relationship and rise to a value-driven partnership.

The value of this partnership must be multidimensional and present at every level of our customers' business. A trusted distributor listens often and asks the right clarifying questions. This approach paves the way for more personalized solutions catering to each customer's unique needs, enhancing the value we provide.

From Motion's perspective, partnering closely with our customers allows us to vastly deepen our understanding of their business and industry as a whole. This unlocks new synergies across their manufacturing landscape and returns "real value" to the customer equation. The synergy between a customer and a distributor also fosters a culture of innovation.



A trusted distributor listens often and asks the right clarifying questions, which paves the way for more personalized solutions.

Every day, Motion takes action to solve real problems that have impacted our customers. For example, as labor restrictions have increasingly challenged our customers, Motion's Storeroom Solutions Team delivers cutting-edge technology and process improvement to help solve labor issues and create efficiencies for storeroom operations.

When both parties are invested in partnership success, we can create value-driven solutions that help save time and money. This collaborative environment is rife with innovation, as new ideas are freely exchanged—building a solutions-based pipeline.

At Motion, our collaborative partnerships are essential for creating sustainable value for our customers. They are built on trust, mutual respect and a shared commitment to excellence. Working together, we can help you unlock new opportunities for improvement, bring forth innovative ideas, and navigate the complexities of the marketplace with agility and speed, delivering lasting results.



**Lisa Solomon** is Senior Vice President – Corporate Accounts for Motion. She leads all of Motion's Corporate Accounts in North America, plus other Company teams, including Corporate Accounts Support, Corporate Accounts Development, Onsite Solutions, Energy Services and International Sales.

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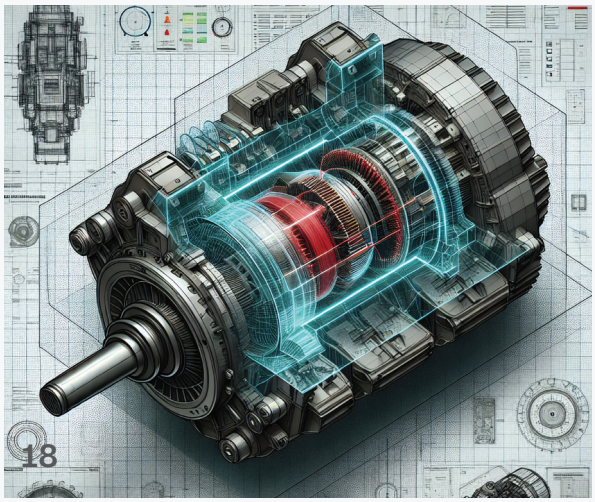
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## Repair Not Replace

With supply chain and labor issues top of mind, a new study reveals how plants decide when to repair their critical motors

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THOMAS WILK

## From the Editor

# ROBOT ROCK

The month of May was a busy one for Plant Services, with two key events to cover: A3's Automate 2024 event in Chicago, and the Leading Reliability 2024 conference in Clearwater Beach, FL.

The annual Automate trade show brought more than 42,000 attendees together with 850+ exhibitors to showcase the latest advancements in robotics, artificial intelligence, and automation technologies. There were a wide variety of pickers, sorters, and AGVs on display, but what caught my attention were the robots designed to interact with humans.

Industrial cobots are gaining ground in popularity and dexterity. As A3 President Jeff Burnstein observed, humanoid robots "are already being used in pilot programs at automotive companies and other spaces. If those are successful, you can anticipate with all the labor shortages out there and you think about the workspace designed for a human, there could be a bigger market than we all may have expected."

Of course not all automation investments are being made to help cover the technical skills gap. New research on mobile automation (i.e., material transport and order fulfillment machines) introduced at the event by A3 partner Interact Analysis identified the top drivers for investment in this area: reducing operating costs, increasing productivity, and improving operational reliability and accuracy. Lagging far behind these drivers was "because we cannot find/retain enough labor."

To return to investments that can help cover the skills gap, a key insight was delivered by Eruditio's Shon Isenhour at the Leading Reliability conference. Isenhour observed that some plants are hesitant to invest in precision maintenance skills training for their teams due to potential employee turnover. One way to mitigate that risk and secure future training investment, he argued, is "to take that precision maintenance training and incorporate it into the development of good job plans." This way, the plant retains its training investment in a standardized knowledge format that survives both worker turnover and promotion of skilled employees to more senior positions.

I was also struck by how enthusiastic the Gen Z attendees at Leading Reliability were at exploring how automation could help them drive maintenance and reliability improvements. I've seen Spot the Boston Dynamics robot at previous Leading Reliability conferences; it wouldn't surprise me if Automate 2025 or 2026 includes a full maintenance program track. Δ



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JOE KUHN
Leadership in Action

# HOW TO AVOID AN EMERGENCY MAINTENANCE CULTURE

## A step-by-step guide to move from a reactive to planned maintenance culture

Recently I received an email from a maintenance manager; let's call him Mike. He was bursting with enthusiasm about a change made at his plant. A year ago, Mike was seeking help for his plant that was essentially 100% reactive maintenance. The plant had 21 maintenance technicians. They had great PMs and even a condition monitoring team; however, every day was a new crisis requiring all resources to get involved to "survive the day."

Mike began with observation to clearly understand current state. His finding: Every work crew would be assigned a planned task(s) and then regularly get pulled off the job to complete an emergency job. Most often the planned work was not completed; best case scenario: the job was rushed and lacked precision. One of Mike's key actions was to separate work crews into planned and unplanned work. He did the same for technical support.

For confidentiality, I cannot share actual results, but while Mike led several changes during the year, he credited the separation of work crews to be the "breakthrough" they needed; the change moved the culture from hopeless to hopeful. The upfront cost of the change? Zero dollars. No personnel added; and they actually lost two to attrition and have no plans to replace.

Mike's plant results are more common than you might think. We all know best practices, but many are drowning in the daily chaos of a reactive plant. Know this: you are not alone. Have you ever heard, "Once we get caught up on all this unplanned work, we can make progress on PM compliance and make permanent repairs to equipment."

The major difference between your plant and "reliability excellence" is embracing this simple truth: **the only way to reduce unplanned downtime is to execute more planned work.** You will never emerge from the death vortex of emergency work without doing more proactive work.

Top management, managers, supervisors, and technicians are drawn to the drama of the daily emergency like moths to a flame. The hero emerges on the white horse to save the day. The following day these heroes are publicly recognized for the hard work, creativity, and unwillingness to accept failure. Sound like your culture? Are these the real maintenance heroes?

Do you think your plant is better than Mike's? Perhaps your KPIs have you at 60% planned work or even 80%. Are you just a couple of tweaks away from best in class? There's an excellent chance your KPIs are greatly inflated (and by "excellent chance" I mean 99% chance) by the reward system and reality of your culture.

Knowing the reality of your plant from observation, as well as the truth detailed above regarding the only remedy to unplanned work being planned work, is 80% of the mindset change needed at your plant.

Too simplistic you think? Let's walk through a solution with this new foundation.

- **Get your leadership team to brainstorm the critical reliability challenges you face historically year over year. For example: every year lubrication failures are the number 1 or number 2 downtime root cause; precision maintenance rebuilding pumps is always a top 5 root cause; electric motor**



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maintenance is always a top 5 failure. These challenges will become the focus of planned work crews.

- Narrow the list to four or less items. Example of focus: you may only have 10% total PM compliance, but you are 95% lube PM compliance.
- Separate your craft technicians into planned and unplanned work crews. You can begin with just one person assigned to planned work. I recommend you take more risk and strive for 20% of your resources.
- Separate your technical support staff (example: engineers) into planned and unplanned support.
- Focus these planned resources on the priorities established in number 1.
- Require plant manager approval by phone to take resources off planned work – 24/7. Setting priorities, overtime, and contractor support are to be exhausted first. Amazingly, my experience is that the plant manager will receive zero requests.
- In your morning meetings, reward and recognize the work of planned crews. Example: we completed 10 PMs yesterday or we are running at 95% lubrication PM compliance. To a far lesser degree, mention the unplanned crew's accomplishments. This will be hard. Winning by planned work is the culture you are reinforcing.
- Monitor unplanned downtime events and duration. Celebrate this progress in your morning and monthly meetings. Leadership should connect the dots of planned work and new plant results.
- Monthly, evaluate your planned work staffing; can you add one person to planned work? How about two? Secondly, discuss adding more areas of focus for planned work due to new resources.

These actions cost no money and require no more resources. If you are short staffed at present, do not wait. What is missing at plants is understanding of current state through observation, recognition of the truth that the only solution is planned work, and bold leadership. What is stopping you from taking this step on Monday? Δ

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SHEILA KENNEDY
Technology Toolbox

# VIDEO AND MOTION ANALYSIS HELP PREVENT DOWNTIME

## Modern technologies promote better decisions and faster response times

Methods to visualize events and track physical movement are becoming more sophisticated, helping to reliably detect early signs of machine failure and identify suspicious activity or intruders. Today's motion and video analysis technologies are smarter, faster, and provide more context for investigation, decision making, and corrective actions.

Vibration analysis cameras provide a non-contact means to monitor everything in view for vibration problems. Iris Edge from **RDI Technologies** brings Motion Amplification with its continuous full-field, camera-based vibration measurement into the IoT world. Using the MQTT open standard, it allows integration of the data into third-party processing systems such as SCADA, HMI, ML/AI, and the cloud.

"Iris Edge, with its pan/tilt and Power over Ethernet (PoE) capability, enables full-field measurements over enormous fields of views of the running equipment, but also unlocks more assets such as structure, supports, piping, foundations – items that typically go undetected yet may be at the root of a critical problem," explains Jeff Hay, CEO of RDI Technologies.

Metavision neuromorphic sensors from **Prophesee** support vibration monitoring and frequency analysis for predictive maintenance as well as other monitoring, safety, and inspection applications. A single HD Metavision sensor can provide a million independent measuring points and a "holistic vibration monitoring understanding, meaning many parts or machines can be viewed," says Artiom Tchouprina, senior application engineer at Prophesee.

Specifically, a Metavision sensor "can measure vibration frequencies from Hz to kHz – simultaneously in the same scene – continuously, remotely, with pixel precision, by tracking the temporal evolution of every pixel in a scene. For each event, the pixel coordinates, the polarity of the change, and the exact timestamp are recorded, thus providing a global, continuous understanding of vibration patterns," Tchouprina adds.

The new AI-based MultiSensor intrusion detection system from **Senstar** combines video analytics and motion sensors to improve detection and reduce nuisance alarms. Its embedded sensor fusion engine synthesizes data from multiple sensing technologies, from an image sensor with 180-degree field of view to short-range radar, accelerometer, passive infrared (PIR), and high-frequency vibration sensors.

"Conventional sensor technologies focus on detecting specific physical phenomena, and by themselves do not take into account the full context in which an event is occurring. With Senstar MultiSensor, we can provide complete and precise situational awareness for each event to make the best decision," says CEO Fabien Haubert.

Video management software from **Qognify (part of Hexagon)** now supports greater video flexibility and availability and a wider range of analytics. The latest release, VMS 7.4, includes a new Qognify Web Client and improved forensic search tool, and makes available for purchase a suite of smart video analytics powered by SAIMOS technology including perimeter security, counting, object detection, fire/smoke detection, face recognition, and gender/age analysis.

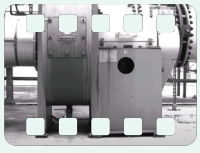
VP of Products Sunil Mudholkar says, "Qognify VMS 7.4 empowers organizations to detect, understand, and respond to security incidents quicker and more efficiently. A new web client gives users the ability to access relevant information when they need it, wherever they are. And



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## VIDEO REFERENCES

**RDI Technologies**



↗ www.youtube.com/watch?v=VF82K15pdi0

**AXIS Communications**



↗ www.youtube.com/watch?v=QqlYfjPZf1Y

new AI-based video analytics capabilities generate and leverage metadata to deliver powerful insights for aiding investigations."

Deep learning video analytics from **Axis Communications** optimize camera image quality and AI performance. For instance, its Forensic Wide Dynamic Range (WDR) reduces visible noise and artifacts. Lightfinder technology delivers high-resolution, full color video with minimal to no motion blur, even in near darkness. OptimizedIR combines camera intelligence and LED technology so that the entire field of view is always evenly illuminated.

"We ensure our deep learning systems are compatible with the wide range of products Axis offers, from fixed cameras to fisheyes, intercoms, and other solutions. As a result, customers can choose a form factor that works for their specific situation without sacrificing analytics performance," explains Steve Burdet, manager of solutions management at Axis Communications. "Additionally, we are continuing to improve ML performance on older systems to close the gap with modern deep learning devices."

For video-based smoke and flame detection, the new Aviotec 8000i IR camera from **Bosch Building Technologies** leverages AI algorithms based on deep learning and an integrated infrared illuminator to distinguish real fires from false alarms at the source within seconds. It can operate 24/7, even in complete darkness, low visibility, and environments subject to wind, dust, or humidity. It is a stand-alone unit including an IP67 waterproof housing, motorized lens, infrared illuminator, and 4-megapixel sensors. Δ



DOC PALMER
Palmer'sPlanning Corner

# DON'T LET REACTIVE WORK BYPASS PLANNING!

Even emergency work can benefit from the support of planners and schedulers

The best maintenance forces use planning and scheduling to help with some reactive work, but this process needs some helpful role clarity. Most importantly, planning and scheduling help reduce reactive work in the first place. But when reactive work does arise, the planner role can indeed plan some of that work. And schedulers can surprisingly include some of that reactive work in next week's schedule. Helping larger reactive jobs that approach project size also merits our attention.

What is reactive work? Generally, reactive work is when a situation requires a maintenance response "before the next week." Reactive situations immediately compromise or have a significant risk of imminently compromising our company mission, whether it be for production availability, cost, safety, environmental, or legal considerations.

## EMERGENCY WORK AND URGENT WORK ARE DIFFERENT

Reactive work can be broken into two categories: (1) emergencies and (2) urgent work. Emergencies require a response right now or at least this day. Urgent work merits a response this week. In both cases, this is work that cannot wait.

Formal maintenance planning and scheduling help with reactive work, sometimes helping reduce the very incidence of reactive work. First, planning runs a Deming Cycle of continuous improvement to improve the quality of execution. Planners give craftspersons head starts, and the craftspersons provide execution feedback to help future jobs: "Next time we work on this pump, it would be better if we bring extra crush gaskets so if we over-torque one, we won't be tempted to leave it there."

Secondly, scheduling increases productivity so crews complete more proactive work. Proactive work is generally work that can wait a week after its need is realized. Proactive work includes work such as preventive maintenance to keep filters clean or fixing little drips before they cause problems. Proactive work keeps reactive events from happening in the first place. The best maintenance forces help reduce reactive work with planning to improve execution quality and scheduling to complete more proactive work.

Nevertheless, even the best companies have some reactive work, both urgent and emergency. The most common strategy in industry is to let both kinds of reactive work simply bypass planning and scheduling. This strategy intends to speed response by not letting planning and scheduling get in the way of maintenance crews.

## PLANNING CAN HELP WITH BOTH REACTIVE WORK TYPES

Even in these companies, planners commonly do help with emergency work without giving a head start. For example, in a loss-of-power emergency, planning could be involved, but hopefully to help look for information that would help a crew (probably already working on it). And planners should only help if the supervisor (or craftsperson) calls for their help. For example, a boiler feed pump breaks and the spare pump is not doing very well. The crew starts on the failed pump and a planner might gather some manuals and spare parts lists.

But planning should also help with some of the urgent reactive work that is not an emergency. When new urgent work requests pop up in the backlog, the planner simply checks with the crew supervisor and asks if the crew



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might start any of them today. The planner then knocks out a quick plan only for the ones that will not start today. The planner can give a helpful head start for these jobs without telling a supervisor to wait. For example, simply by looking at the job, the planner might note the job needs a scissor-lift and a senior mechanic for five hours. That information alone will help the supervisors assign the work and the mechanic arrange for the scissor-lift. Even better, the planner might be able to attach a plan that includes a multitude of little tips saved from the past five or six years. Thus, planning runs the Deming Cycle for what might be a significant amount of the plant's work.

Weekly scheduling can also help with some of the urgent reactive work. Because setting priorities is not an exact science, some of that supposedly urgent work does not start this week after all! But that reactive work, having had a quickly made plan, is available to schedule for the next week. The scheduler makes the next week's schedule more credible by including that planned "reactive" work. The scheduler also has the ability to bundle other work (same LOTO, same area, etc.) with the now-planned reactive work. The weekly schedule is a better selection of work to help crew productivity, and we also reduce the productivity-hindering nuisance of breaking the schedule next week for this work.

Even so, these considerations for reactive work envision a fairly typical maintenance job, not one spanning 10 or 20 days. For a larger job (reactive or proactive) spanning, say, 10 or 20 days, usually a maintenance engineer or a manager is sort of leading a "project" to handle the work, whether in-house or with a contractor. Who ordered the new transformer? Their responsibility would be to lead the project to install it. Planning might participate on this project team, but not necessarily lead it. Planners do generally arrange for contractors on little jobs (reactive or not), but as the size of the job gets larger and turns into a project, a "project manager" (usually not the planner) arranges or leads everything. Planners can be on some projects, but projects must not overwhelm planners away from planning day-to-day maintenance. We do not want planners to become bogged down on projects instead of keeping up with planning the day-to-day maintenance.

Don't let reactive work just bypass planning. Leverage planning to help execution quality for reactive work that does not start the first day. Put that planned reactive work if it does not start this week into next week's schedule to help productivity. (And do more proactive work to reduce reactive maintenance in the first place.) Don't settle for common. Be great! Δ


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JEFF SHIVER
## From the Plant Floor

# GO FROM CRISIS TO CATALYST

"Defining moments" transform organizations

As a continuous improvement manager, I was responsible for the maintenance function at a large manufacturing facility. I had two maintenance managers and close to 100 personnel for whom I was accountable. And it was far from a leisurely walk in the park when I took the role. Several production lines struggled to meet the numbers, and the pressure to get things going was intense. Or at least I should say that the pressure I put on my performance was intense. I had to succeed and show significant improvements in the performance of the plant assets.

After too many late-night calls due to failed equipment, I knew there had to be a better way and began to search for solutions. Leveraging education and coaching, our team defined the path forward and implemented maintenance and reliability best practices. The team achieved substantial gains in terms of realized capacity improvements, and reduced waste and maintenance costs. It was a defining moment for me.

For maintenance personnel, "defining moments" can take many forms. It could be a crisis with a safety or environmental incident, or a catastrophic equipment failure. When a critical event occurs unexpectedly, it can cause significant downtime and financial losses. It forces you to confront the weaknesses in your current practices.

On the positive side, your moment may come like mine, from leading the successful implementation of a significant maintenance and reliability initiative. Whether it's digital transformation project or a cross-functional continuous improvement initiative, the success of such endeavors can ignite a passion for driving change and innovation. Leveraging your success, you feel empowered to take on more strategic roles, champion best practices, and become a thought leader within your organization.

I have personally witnessed maintenance professionals and organizations take this approach. In just one of the many examples, a maintenance manager and their team in a wood products plant achieved a 50% cost reduction, went from 78% reactive to 22%, and achieved a schedule attainment from near zero to 78%.

One key to this transformation is to learn from others and then teach others. Be a sponge. Seek out knowledge and different concepts. Then, actively seek opportunities to share your knowledge and experiences with peers, contribute to industry publications, and participate in conferences and workshops to inspire others.

When you take the time to share your newfound knowledge, insights, and lessons learned with others, it can have a profound impact. For example, that wood products plant maintenance manager developed ten CMRPs and eighteen CMRTs before moving to a corporate reliability manager role, where he continued to develop others.

Another vital key is a willingness to take risks and embrace adversity. You must be willing to take a leap and take the first step. When management approached that individual to take the maintenance manager role, he knew the current state of the plant. He took the role because he believed he could make a difference. View these moments as opportunities to learn and grow.

Acknowledge fear that comes from uncertainty. It's a natural human response, especially for those new to the role. When you expect and acknowledge it, you can better overcome its effects so that it does not become paralyzing.

Create an action plan for implementation. Maybe it's a digital transformation or best practices implementation, but the only way forward is to take the first steps. Having a strategy enables you to share it with others as a communication tool.

Lastly, develop measures that reflect your and your team's success. You don't want to do the work and be unable to show improvement. What will be your defining moments? Δ



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# REPAIR NOT REPLACE

With supply chain and labor issues top of mind, a new study reveals how plants decide when to repair their critical motors

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Last spring the Electrical Apparatus Service Association (EASA) partnered with Plant Services to survey our readers, the plant maintenance professionals, on a range of topics that centered on maintenance practices and decision making when it comes to electric motors.

EASA is the international association that serves and represents companies in the electric motor, pump, and rotating apparatus repair service and sales industry. The spring 2023 survey on plant maintenance decision-making generated more than 250 responses from plant professionals across a range of job titles and industry verticals.

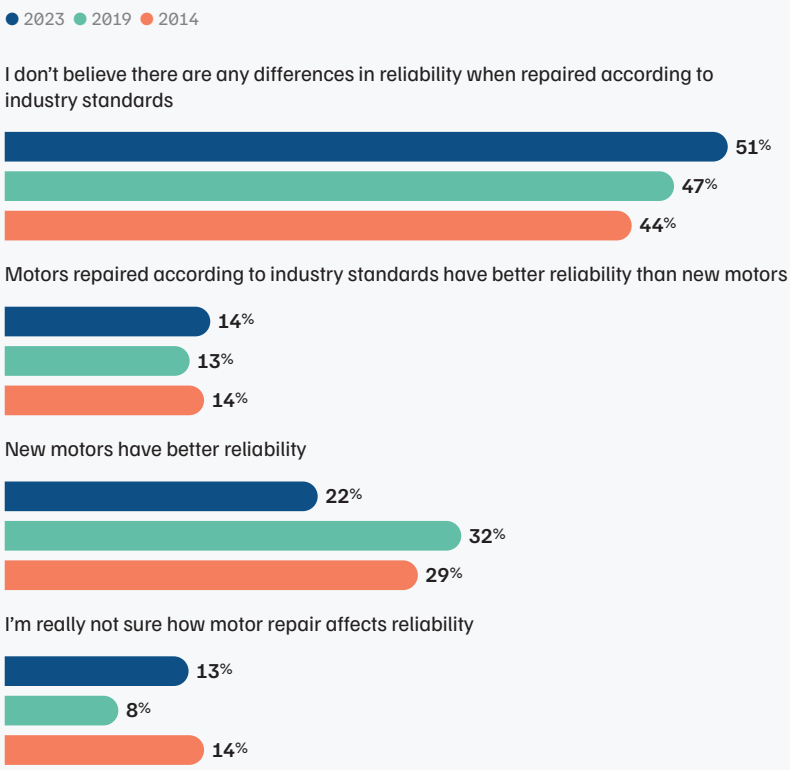
This two-part article reviews the highlights from this research project, combining a summary of key data points with analysis from two industry experts—Ron Widup and Justin Hatfield—who are also longtime EASA members.

Part 1 focuses on sustainability practices relating to electric motors including motor efficiency, reliability, and recycling; and considerations for determining when electric motors should be repaired or replaced. Part 2 will appear in the Jul/Aug issue and will focus on plant maintenance priorities and maintenance outsourcing trends.

## ENERGY EFFICIENCY AND SUSTAINABILITY PRACTICES

The first question asked respondents about how reliable they consider motors that are repaired according to industry standards, especially in comparison with a new motor, and the data were revealing (see **Figure 1**). Over the past 10 years, the number of respondents who don't see a difference in reliability has gone steadily up, and the number which believe that new motors have better reliability has gone steadily down.

**FIGURE 1**. Which statement best describes your feelings about the reliability of repaired/reconditioned electric motors in comparison to a new motor?




When the topic turns to motor efficiency, nearly half of respondents believe that repaired motors generally operate at the same level of energy efficiency as before (see **Figure 2**). Furthermore, these opinions have not changed significantly over the past 10 years. In fact, the number of people who believe that repaired motors (i.e., repaired according to industry standards) exhibit a higher level of energy efficiency than before has gone steadily up.

**Justin's take:** Reliability is definitely the number one priority that people care about, to get something running. I think that it's becoming less frequent that someone is asking for a more efficient motor because a lot of motors have been replaced over time, especially when you're talking about smaller horsepower (10-50 hp), those are being replaced a lot.

EASA has done a lot of great work to prove that if you follow best practices, the motor will maintain its efficiency standard if you repair it to the EASA standard, which is called AR-100 (also available at www.easa.com for download). In fact, an EASA rewind study tested the efficiency of motors, from new from the manufacturer versus the same motors then went out and got repaired to the EASA AR-100 standard, and the study found no efficiency change in the motor.

One thing I always find interesting is, does the same person managing motor replacement also pay the energy bill? Because if there's a different person paying the bill, they probably don't care as much about the energy efficiency of a given motor. You're really going to be able to see energy savings when you look at variable

frequency drives and process changes, because if the motor is manually or mechanically valving or dampening, that's wasted energy. With a VFD you slow the motor down, and create an output that is needed for the process. A lot of that's been done in the last 5-10 years, and there's definitely still plenty of opportunities for improvement.

**Ron's take:** If you think about the guy or gal in the plant, whether it's a paper mill or steel mill, or maybe a manufacturing facility, they are worried about the quality of the product. They tend to not be worried so much about the efficiency of the motor, so often those programs don't tend to make it to the maintenance crews for buy-in. If there were internal incentives for management, maintenance, and production to figure it all out together, I think facilities would be surprised at what they could get their people to do if they get them talking to each other more!

## BEST PRACTICES FOR MOTORS REPAIR OR REPLACE

This section of the survey addressed an evergreen question in industry: what is the right balance to strike between industrial motor repair and replacement? EASA research has tracked responses to this question over the past decade, and **Figure 3** reveals a significant upward trend in the number of respondents (27%) who have seen an increase in the number of motors being repaired. The data show a similar drop in the number of respondents (20%) who say they are repairing fewer motors than they were two years ago.

In a separate question, 66% of survey respondents admitted that they make decisions on electric motor repair/replacement on a case-by-case basis. However, the survey also revealed patterns to how those

**FIGURE 2**. Please complete the following statement.
**"Repaired motors generally operate at … "**

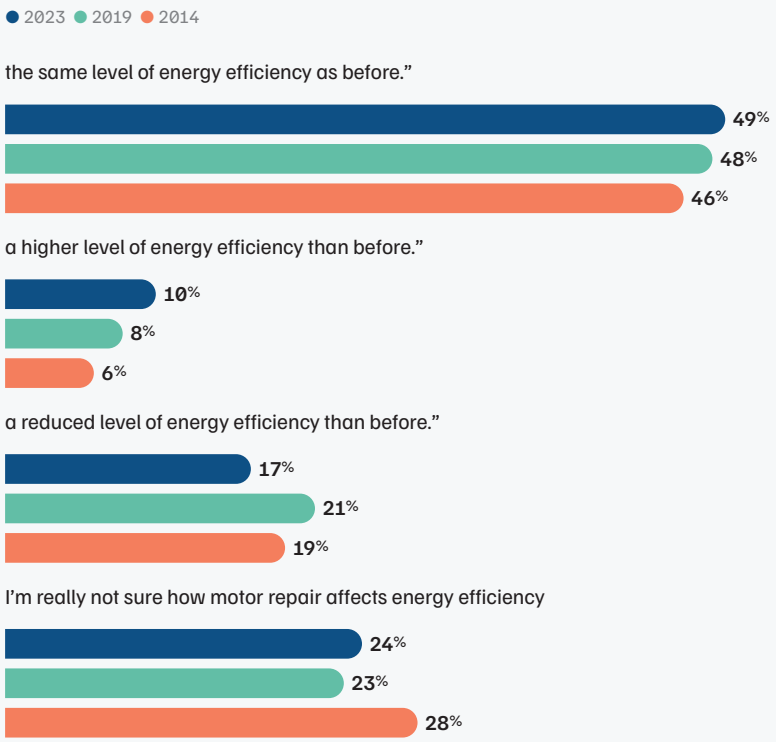
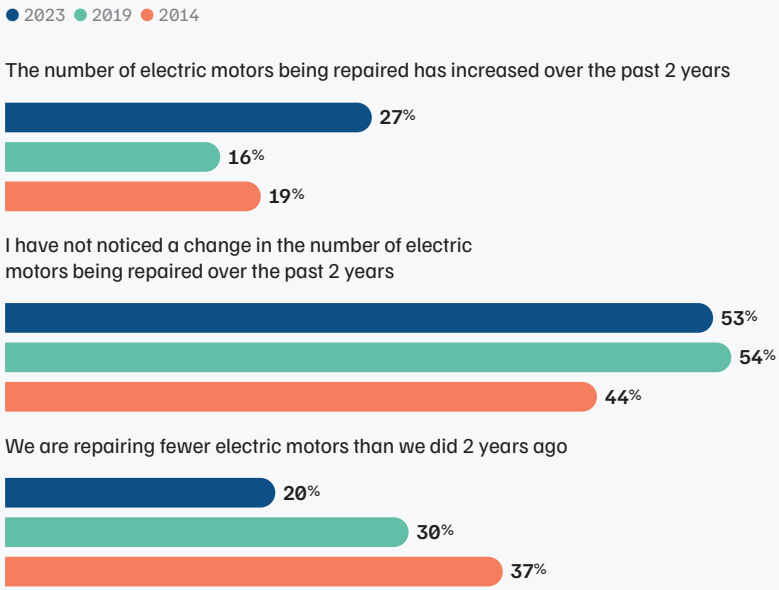



**FIGURE 3**. Which of the following statements best describes your present experiences with regard to electric motors operating in your facility?



decisions are made, with 43% of respondents automatically buying a replacement motor if the repair cost is an average 53% or higher of the replacement cost (see **Figure 4**). Also, only one in four respondents have a policy of automatically replacing failed electric motors that fall below a specific rating, and those with a policy use 30 hp as their average cut-off point.

**Ron's take:** When I saw this part of the survey, it made me think about a recent failure scenario that happened to me: I had a tire that went flat on my truck in the middle of a freeway in Dallas. The tires were pretty new, but I caught a nail in one, and of course it was a model that had been discontinued, so I had to buy a replacement tire that's a little bit different from the dealer tire. When that happens it's not a good idea to buy just one tire that's different, you have to buy two.

I think those same sentiments often happen with electric motor repairs. If you have a motor where everything lines up and fits just like it's supposed to when you need to repair or replace it, and the spare is an identical unit, you don't have to worry about adaptability or modification to any external components. Having assurances that repair or replacement can be done efficiently without much re-engineering, and you've done what you're supposed to do and have an identical spare, you can put your spare in, send the failed motor to the shop, and now you don't have installation issues.

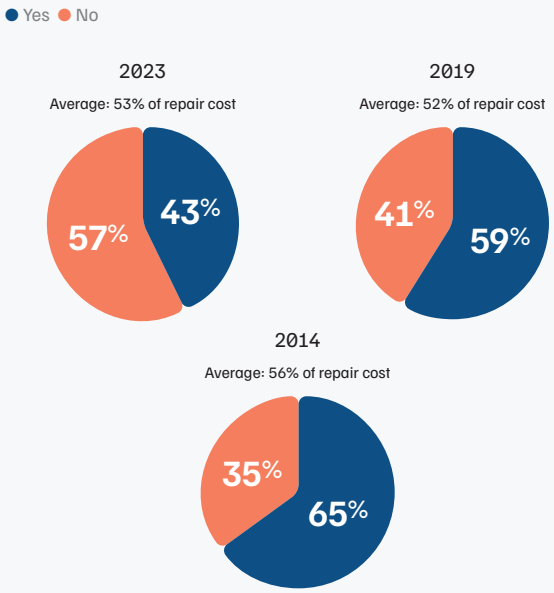
Cost will always be a factor, and supply chain issues have been a big factor in recent years – we just haven't been able to get some of the motors lately. And here's an often overlooked aspect of repairing electric motors by your local service provider: we're some of the greenest folks you could have out there because we're recycling just about everything when it comes to electric motors—the copper, the steel, the bearings, all of that. When you put all these factors together, it just oftentimes makes more sense to repair versus replace. It's a motor-by-motor decision.

**Justin's take:** If there are sustainability approaches for an organization, repair can play a big role instead of disposing of that motor. I also think there's a factor here of inflation where there have been some drastic increases of new motor price, sometimes 30-40-50% price increases. So if the supply chain keeps you from getting the right motor, and they're more expensive, you're going to end up repairing the one you have.

Ron made a good point about direct replacement of units as well. Motor connection box locations have changed a lot over the years. Where there used to be the traditional side-mounted location (called F1 or F2), a lot of motor manufacturers have switched to a more global design where the connection box may still end up on the right side or the left side, but it now may come out the top and then is manipulated to be F1 or F2. If you have conduit cemented in, that can sometimes give issues on where you can put a motor, so repairing it is a lot easier option many times because it's less headaches.

I think people have gone through those headaches where they replaced a motor and said, hey, give me the newest up-to-date efficient one. Then it comes in and it doesn't fit in the application, and they don't want to deal with all those things again. They'd rather even pay a little more to have it repaired in order to not have the headaches that happen with it, especially if the repair is done by a qualified provider, which is what the data are telling us. Δ

**FIGURE 4**. When comparing the estimated cost to repair an electric motor to the price of a new replacement motor, do you have a repair cost % above which you will choose to buy a new motor replacement instead of repairing the existing motor? If yes, what is the cut-off?




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**Justin Hatfield,** CMRP, CRL, is the President of HECO out of Kalamazoo, MI. He also serves as Chairman of EASA's Emerging Technologies Committee and a member of EASA's Marketing and Industry Awareness Committee.

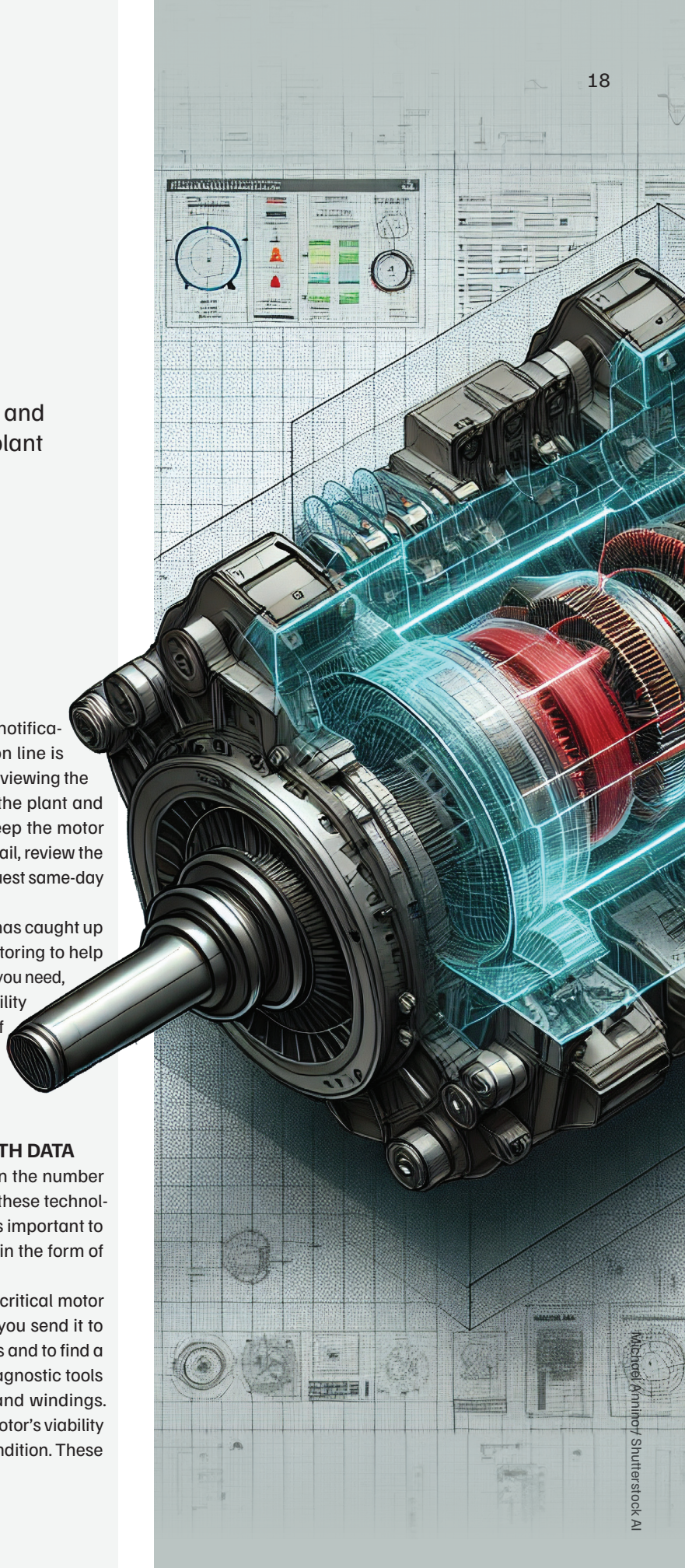
# BREAK THE CYCLE

Build a custom strategy to predict and prepare for motor failure at your plant

Written by

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Michael Anninger/ Shutterstock AI

It is 2 a.m. on a Monday. You receive a text notification that a primary motor on your production line is operating outside normal parameters. After reviewing the data on your plant dashboard, you contact the plant and get maintenance to adjust the process to keep the motor running. Meanwhile, you click on the asset detail, review the current price and availability, click "order," request same-day delivery and return to bed.

Science fiction? Hardly. The supply chain has caught up with technology; it can integrate online monitoring to help predict failures *and* connect you with the assets you need, when you need them. However, the responsibility for building a strategy that takes advantage of modern machine health technology ultimately is up to you.

## THREE KEY SOURCES OF MOTOR HEALTH DATA

There have been significant improvements in the number of facilities across the U.S. that operate with these technologies. To understand where we are today, it is important to understand the past (and present for many) in the form of three key types of motor health data.

**Offline Static Electrical Testing.** A plant critical motor has failed. If the motor is larger than 50 hp, you send it to the local motor repair shop for failure analysis and to find a replacement. The repair shop has several diagnostic tools to test the integrity of the damaged motor and windings. These include several tests to determine the motor's viability and the shop's ability to return it to as-new condition. These

static tests are primarily concerned with the motor windings and insulation system. Parameters tested include surge, polarization, winding resistance, and megohm. A high potential test will inform how the motor handles electrical loads and current.

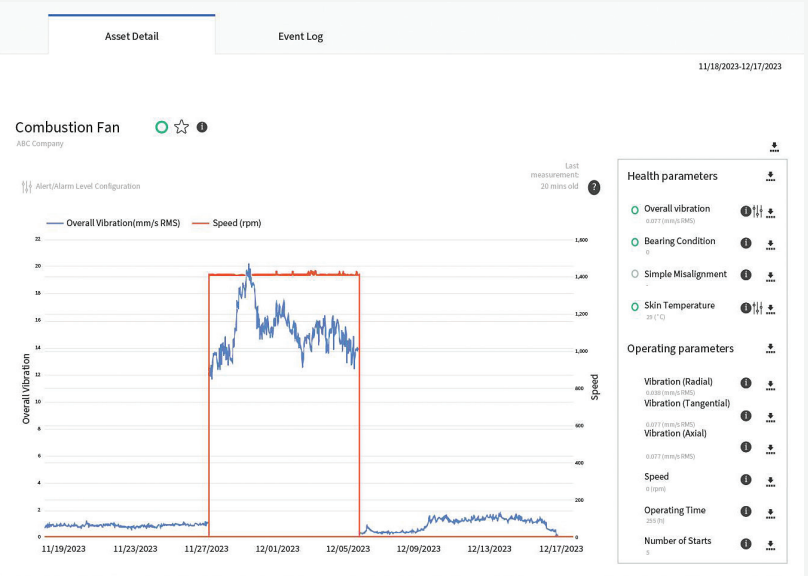
The Internet, trade journals and maintenance publications are full of advice on static motor testing procedures during planned outages and using that data to predict or stave off an unexpected failure based on current motor condition. Portable, easy-to-use tools are readily available to conduct the same offline static tests your local motor shop does.

Static testing information is useful to prepare for future issues, but do the results help explain the failure's cause? Was the cause a power spike, lightning, or a locked rotor failure? Did the motor heat cause bearing failure, or did the bearings fail due to motor heat? Reliable shops can depend on years of experience to provide some direction, but the resulting failure analysis is often more of an opinion than something verifiable.

The big savings benefit from static testing is that a replacement can be funneled into a planned outage to control or eliminate unexpected downtime. Wouldn't it be better to not only extend the motor life but address the root cause?

**Online Vibration/Temperature Monitoring.** Since about 2008, motor-mounted sensors have provided active temperature and vibration monitoring. These include simple devices that offer "red, yellow, green" outputs (determined from set min/max points) to sensors providing full wireless data output of raw information. Either way, these sensors deliver data that the maintenance engineer can use to uncover health trends as the motor wears and plan around them.

**FIGURE 1**. Example condition monitoring dashboard for a combustion fan.




Sensor technologies pave the way for more accurate identification of issues in real time, but they also introduce new concerns. Since only vibration and temperature are being monitored, these sensors cannot help monitor or troubleshoot power-related problems (spikes, surges, unclean power). Another significant consideration is that these are point-of-use devices mounted directly on the motor wherever it lives. Now, the delicate sensor must survive in the same environment as the motor.

**Online Electrical Testing.** The newest gold standard of motor analysis is electrical signature analysis (ESA). It monitors and collects data using motor current signature analysis (MCSA) and motor voltage signature analysis (MVSA). Both are "energized" testing and monitoring methods, like vibration and temperature data collection, that occur while the motor operates. Line and current voltage data are often collected inside the motor control center (MCC) using current and voltage transducers.

Data collection from these devices can add insight and identify many operational problems that lead to premature failures. Information can be viewed in real time, revealing a motor's reaction to loads, power quality, controller issues, and insulation/winding integrity problems as they develop. One of the biggest advantages of this type of data logging is that the sensors live in the MCC, out of harm's way. This is not a standalone solution, but one that gives different insight while the equipment operates.

## USING ALL THREE TO BUILD A HOLISTIC MOTOR CONDITION MONITORING STRATEGY

The solution is much more holistic if you combine data collection from all three sources: static testing, vibration/temperature, and ESA. Together, these provide all the insights possible to manage your motor assets much more effectively—but

there is yet another important issue to consider. Each sensor manufacturer has their own software ecosystem and associated monthly or annual fee for data analysis. A complete motor data collection system on a single motor could involve three or four different information providers. This means up to four reports must be compiled and reviewed at the plant level to effectively prepare and plan. Even with all these data and analysis providers, there is still no detail about the asset itself —availability, upgrades, warranty, etc.

Next-level monitoring puts that type of comprehensive solution into the palm of your hand (or directly to your phone/tablet or computer). Several standalone predictive maintenance service companies or distributors can serve as your "data warehouse" by reviewing and interpreting all of that single-source raw data for you. To illustrate how this would work, let's consider another critical motor application, but on a smaller motor (25 hp) that would typically not be rebuilt.

This 25 hp motor runs a critical combustion fan, and vibration and temperature sensors were recently installed to monitor asset condition. Data are reported to a dashboard several times daily with monitoring provided remotely. The vibration analyst identifies on a Wednesday that the motor bearings are in third-stage failure due to fan imbalance. This issue is identified early enough that you can refer to your distributor's dashboard. From there, you can order a replacement to arrive the next day. You are shutting down the plant on Friday, and the motor will be staged and ready to replace. While the plant is down, you will open, inspect and clean the fan blades at the analyst's recommendation.

On Friday, everything goes according to plan with the outage, and you start up the combustion fan and tell the analyst about the work performed. They can go into the dashboard, look at the data and confirm that the new motor is running smoothly, and that the fan imbalance is negligible after cleaning (see **Figure 1**).

## BUILD YOUR CUSTOM MOTOR HEALTH STRATEGY

Unfortunately, no one-size-fits-all strategy will work for every facility or industry. The best way to apply these technologies at your facility will depend on your assets, asset criticality, typical failure modes, and the capabilities of your maintenance and reliability organization.

For example, you may choose simple current monitoring paired with a few vibration and temperature sensors on medium-criticality assets in your facility, and increase the number of vibration sensors for higher-criticality assets. For the higher-criticality assets, you may start with periodic offline static motor testing. Another facility may follow a similar process but use ESA because some critical assets have very large motors.

Companies need to select the ideal predictive maintenance plan based on various factors, which can vary significantly between locations. The best recommendation is to partner with an experienced third-party team that can help advise on the best brand-agnostic approach for each of your facilities, keeping your unique parameters in mind. Δ

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THE CAPTAIN

## Captain Unreliability

# WHY CHASING FADS IS THE KEY TO CORPORATE SUCCESS

Tackle all of your complex problems by embracing The Next Big Thing as the solution

In the fast-paced world of business, staying ahead of the curve is essential. That's why savvy organizations are constantly on the lookout for the next big fad that promises to revolutionize the way they work.

From management techniques to productivity tools, the allure of the latest trend is irresistible. But why settle for tried-and-true methods when you can jump on the fad bandwagon and ride it all the way to the top? Here's why the next fad will be the saving grace for organizations everywhere.

**Fads are always right.** Let's face it, fads wouldn't be fads if they weren't right, right? Just because something is untested, unproven, and unsupported by any actual evidence doesn't mean it won't work. In fact, the more outrageous and outlandish the fad, the more likely it is to be the next big thing. So why waste time on boring old proven methods when you can dive headfirst into the unknown with the latest fad?

**Everyone else is doing it.** Peer pressure isn't just for high school. In the corporate world, everyone is constantly looking over their shoulder to see what everyone else is doing. If everyone else is jumping on the latest fad, then clearly you should too. After all, who wants to be left behind while everyone else is basking in the glory of their fad-driven success?

**It's the easy way out.** Why bother with hard work, dedication, and perseverance when you can just latch onto the latest fad and ride it to success? Fads promise quick, easy solutions to complex problems, and who doesn't love a shortcut? Forget about actually putting in the time and effort to develop real, sustainable strategies – just jump on the fad train and let it carry you to the promised land.

**You can blame someone else when it fails.** The best part about jumping on the fad bandwagon is that you can always blame someone else when it inevitably fails. After all, you were just following the crowd, right? It's not your fault that the latest fad turned out to be a dud – you were just doing what everyone else was doing. So go ahead, embrace the fad and let someone else take the fall when it all comes crashing down.

**The best part about jumping on the fad bandwagon is that you can always blame someone else when it inevitably fails.**

**It's more fun.** Let's be honest, sticking to proven methods and best practices is boring. Who wants to do things the same old way when you can shake things up with the latest fad? Whether it's a new management technique, a cutting-edge technology, or a revolutionary new approach to teamwork, fads promise excitement and novelty – two things that are sorely lacking in the world of business.

In conclusion, why settle for boring old proven methods when you can jump on the fad bandwagon and ride it to success? The next big thing is always just around the corner, promising to revolutionize the way you work and catapult your organization to new heights. So go ahead, embrace the fad – after all, what could possibly go wrong? 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.




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