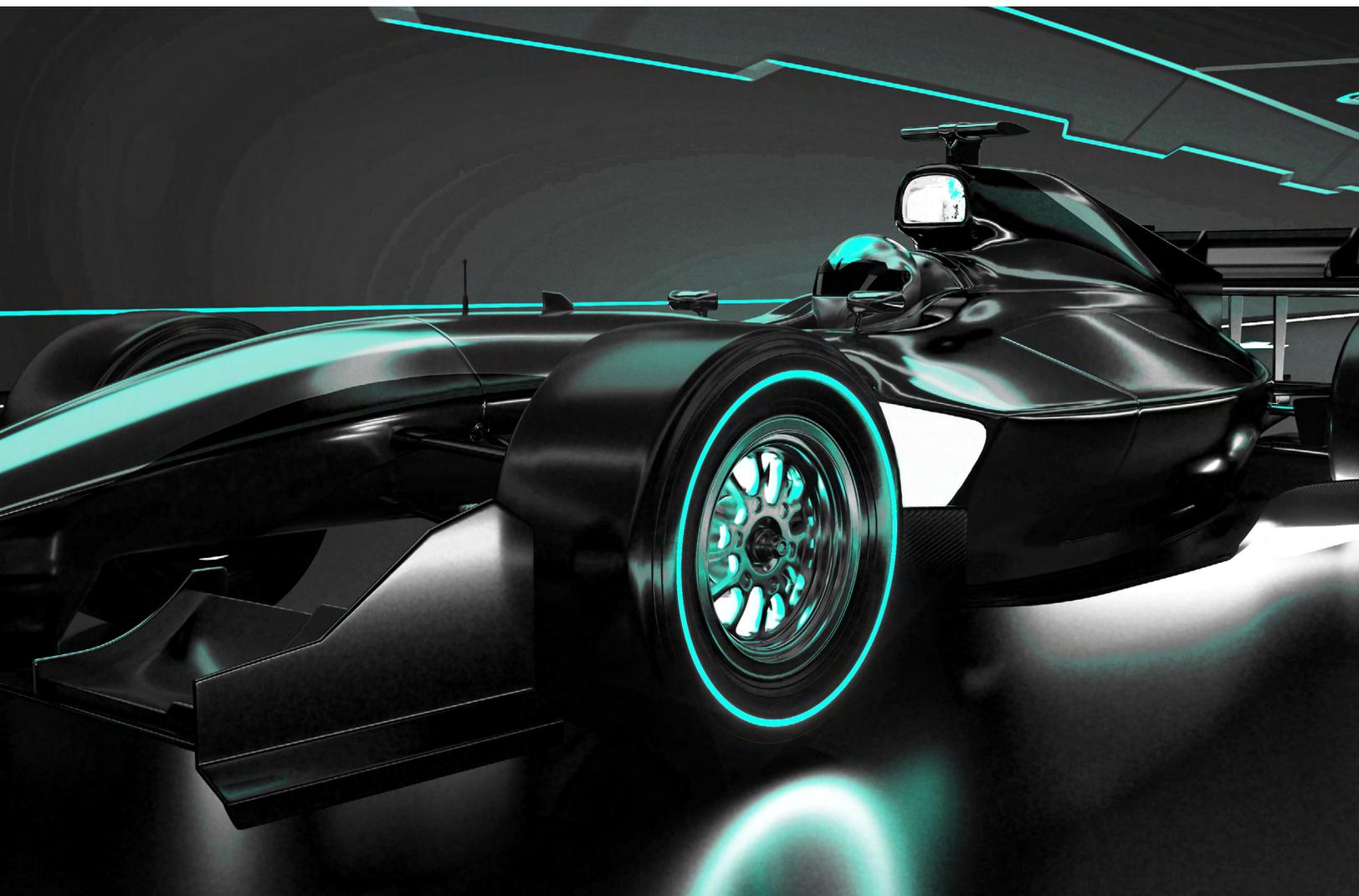


Zero Downtime Starts Here: Closing the Reliability Gaps That Cause Failure

Part I: A Closed-Loop Model For Continuous Reliability

Sponsored by:



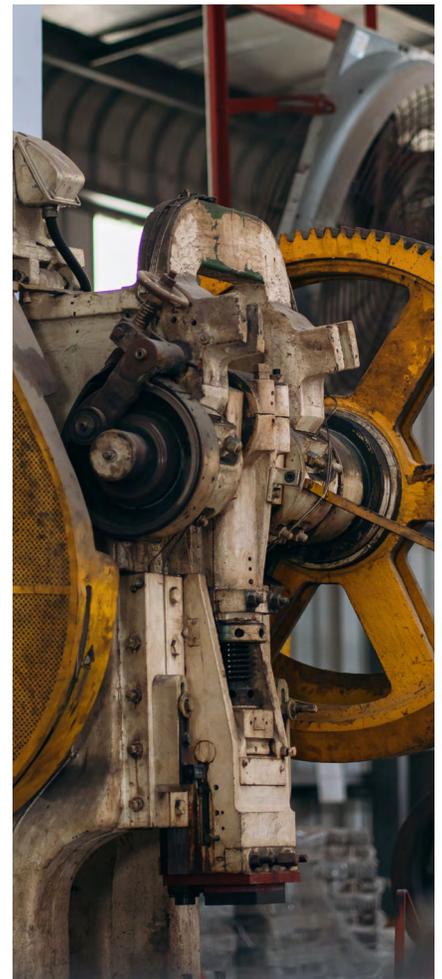
Many plants operate with invisible risk. Faults develop hours, days, or weeks before failure, yet many reliability programs only detect them after downtime occurs. The issue is not awareness or effort, but systems that leave critical blind spots.

Traditional maintenance programs were designed around periodic checks and reactive response, not continuous visibility or rapid decision making. Machine health data, when it is collected, appears in isolated snapshots, creating long gaps where faults can develop unnoticed. Diagnosing issues then depends heavily on individual experience, leading to inaccurate diagnosis and faulty recommendations.

At the same time, critical findings are scattered across disconnected tools, reports, and inboxes. Insights take too long to turn into action, accountability becomes unclear, and lessons from avoided failures are rarely captured in a way that strengthens future performance.

The impact is becoming harder to ignore. In 2025, **31% of organizations reported increased downtime costs**, reinforcing the urgency to rethink how reliability is managed¹. Downtime persists not because teams are doing the wrong things, but because they cannot see and act on the full picture in time.

This white paper introduces a closed-loop reliability model designed to eliminate these blind spots by connecting detection, diagnosis, decision-making, and learning into a continuous system. In Part II, we build on this foundation with a practical reliability maturity path that shows how organizations can strengthen capability over time, align teams across the enterprise, and turn reliability into a sustained competitive advantage.



The Four Structural Reliability Gaps: Why Downtime Still Happens

Even with skilled teams, solid tools, and established procedures, many reliability programs eventually hit a ceiling involving repeated failures and unpredictable downtime. These four structural reliability gaps explain why current programs plateau and why issues that seem “unavoidable” are often anything but.

Reliability Gap	What’s Happening Today	Why It’s a Problem	Impact on Downtime
The Data Gap Missing the Early Signals	Route-based vibration, time-based inspections, and scheduled replacements only capture periodic snapshots of asset health, create blind spots.	Early-stage faults develop between inspections and go undetected. Teams remain unaware of symptoms and miss root causes.	Faults escalate into emergencies, increasing unplanned downtime and repair costs.
The Diagnostic Gap Variability in Analysis and Root Cause	Data interpretation depends on individual experience, tribal knowledge, and availability of experts.	Analysis is inconsistent, subjective, and often delayed, especially if sensors are supplied by multiple vendors.	Misdiagnosis or slow diagnosis leads to poor prioritization and repeated failures.
The Workflow Gap Slow, Siloed Decision Making	Findings live in emails, spreadsheets, or disconnected systems with no closed-loop accountability.	Alerts do not translate quickly into coordinated action across teams.	Predictive tools still result in reactive maintenance and missed intervention windows.
The Learning Gap No Systematic Feedback Loop	Reliability lessons remain in reports, notebooks, or personal memory and are rarely reused.	Knowledge is lost with time and turnover, and improvements are not sustained.	Organizations repeat the same failures and struggle to advance reliability maturity.

1. The Data Gap: Missing the Early Signals

Most organizations still rely heavily on route-based vibration analysis and manual inspection rounds to monitor asset health. While these methods can identify existing problems, they only capture brief snapshots in time. Between inspections, machines continue to operate, and developing faults progress quietly with no visibility.

This lack of continuous coverage creates significant detection gaps across the plant. **In fact, according to the MaintainX 2025 State of Industrial Maintenance report, 44% of maintenance teams are not using sensors or IIoT devices to continuously monitor machine health.** Without always-on data, early warning signs go unnoticed, allowing minor defects to grow into serious failures.

2. The Diagnostic Gap: Variability in Analysis and Root Cause

Collecting data is only the first step. The greater challenge is interpreting it consistently. In many organizations, diagnostic outcomes vary by analyst, shift, or site. Decisions often depend on individual experience and tribal knowledge rather than shared standards, leading to subjective and inconsistent conclusions. Two people can review the same data and reach different answers.

This variability introduces risk. One analyst may identify an early-stage fault and recommend planned action, while another may downplay the same condition. Without clear diagnostic pathways and severity criteria, prioritization becomes unreliable.

Example: A vibration alert shows frequencies consistent with bearing wear. One analyst flags it as a developing defect requiring attention. Another attributes it to process noise and takes no action. With no standardized diagnostic framework to guide interpretation, the issue is deferred. Weeks later, the bearing fails, and the warning signs are only recognized in hindsight. Without standardized diagnostics, reliability outcomes depend on who is reviewing the data rather than what the data is showing.



3. The Workflow Gap: Slow, Siloed Decision Making

Reliability findings frequently stall in spreadsheets, inboxes, and disconnected systems instead of flowing into a unified action stream. Teams lose valuable time tracking down information, aligning priorities, or waiting for approvals, even when risks are clearly identified.

This creates a widening gap between intent and execution. For example, **while 71% of maintenance leaders report adopting preventive maintenance as a strategy, fewer than 35% allocate the majority of their time to preventive work. More telling, 58% of facilities spend less than half their maintenance time on planned activities**¹. These numbers expose workflow breakdowns that prevent insights or task schedules from becoming coordinated action. Teams have good intentions, but they need to be combined with the right people, mindset, and strategy.

Without closed-loop accountability from alert to work order to validation, tasks fall through the cracks. Even plants with advanced predictive tools end up operating reactively because they cannot move from insight to intervention fast enough.

4. The Learning Gap: No Systematic Way to Capture and Use Lessons

Even when organizations collect vast amounts of diagnostic and maintenance data, very little of it becomes lasting intelligence. Findings remain buried in notebooks, PDF reports, or individual memory. When experienced employees leave, that knowledge leaves with them, and when similar failures occur, teams start over instead of building on what they already know.

The Hudson Institute reported that over the next five years, as much as 40% of the maintenance workforce could retire¹.

Even advanced technology cannot close the diagnostic gap on its own. According to the MaintainX 2025 State of Industrial Maintenance report, 40% of organizations in the process of fully implementing AI across multiple processes experienced more downtime than expected¹. This highlights a critical reality: when AI is deployed without expert oversight, structured feedback loops, and standardized learning, it can amplify existing inconsistencies instead of eliminating them.

Accurate diagnosis still requires experienced human judgment. Dedicated condition monitoring expertise plays a crucial role in validating automated findings, refining fault definitions, and translating insights into clear, actionable recommendations. When this expertise works in tandem with AI-driven analysis, diagnostics become both scalable and reliable. AI handles data volume and pattern recognition, while human experts ensure context, accuracy, and practical relevance.

This human-in-the-loop approach also makes maintenance teams more effective. Instead of spending time interpreting raw data or debating severity, teams receive prioritized, validated guidance that supports faster and more confident decision-making. Over time, expert feedback continuously improves diagnostic accuracy, creating a learning system rather than a static toolset.

The top challenges facing maintenance leaders represent a perfect storm of workforce pressures.

1. Lack of Resources (budget and staff)	45%
2. Aging Infrastructure	33%
3. Skilled Labor Shortage	30%



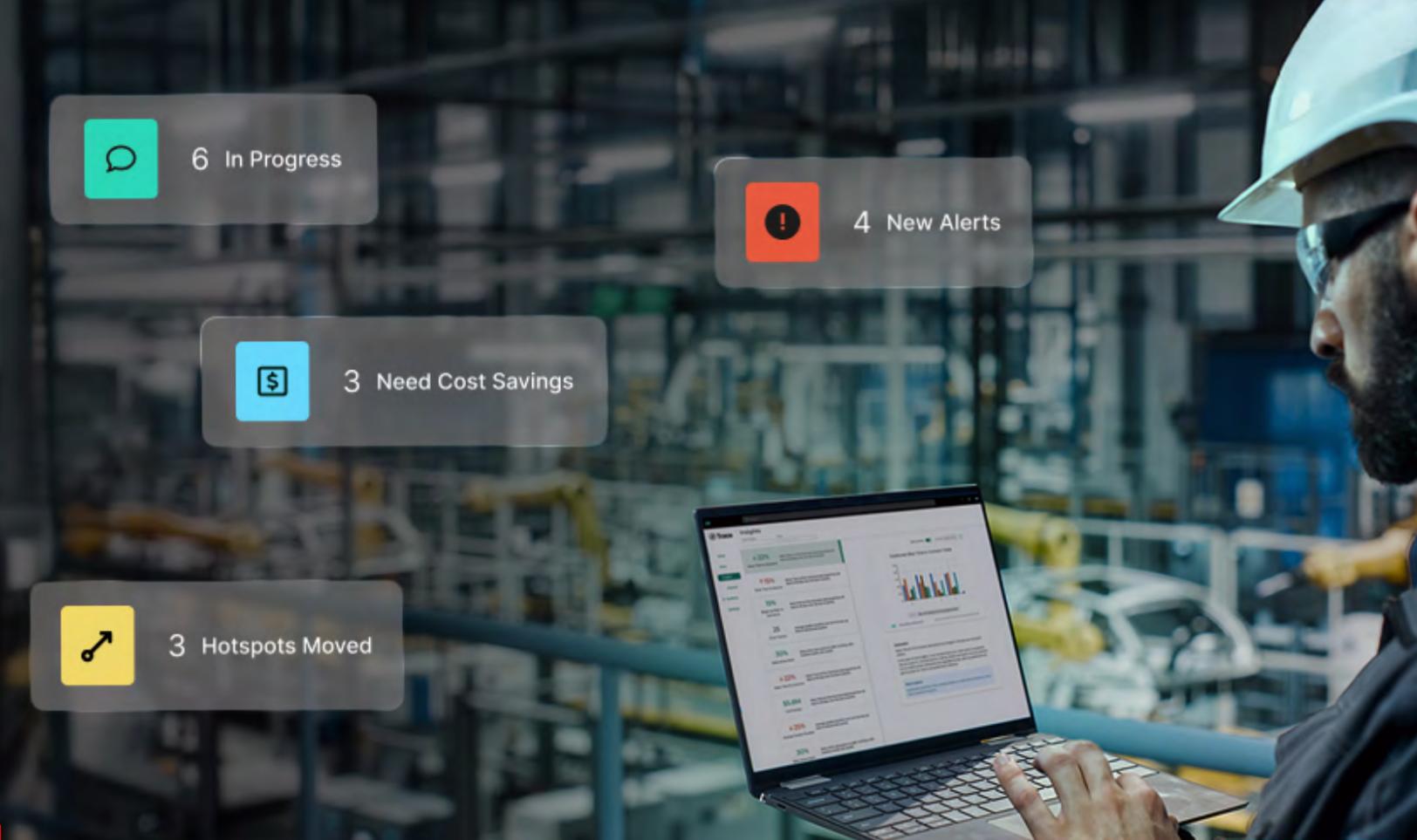
As maintenance teams face aging assets, shrinking workforces, and tighter budgets, this balance becomes essential. Without a system that combines expert interpretation, automated analysis, and closed-loop learning, organizations are pushed back into reactive maintenance even when advanced sensors and analytics are in place.

Together, these four gaps explain why downtime continues even in plants that invest in people, tools, and technology. Until these structural weaknesses are addressed, reliability improvements will remain fragile, difficult to scale, and short-lived.

The Closed-Loop Reliability System: Eliminating Blind Spots End-to-End

Closing reliability gaps is not a matter of adding more tools or asking teams to work harder. What is needed is a strategy that connects data, diagnostics, decisions, and learning into one continuous flow. A closed-loop reliability system eliminates blind spots by ensuring that every signal is detected, every insight is clear, every action is aligned, and every lesson strengthens the organization over time. Reliability becomes a process that continuously improves rather than a series of isolated efforts.

Closed-Loop Stage	What It Does	How It Eliminates Blind Spots	Reliability Impact
Detect	Uses always-on monitoring and broad asset coverage to capture early-stage fault development.	Shrinks detection latency and removes “unknown risk” created by periodic inspections and data gaps.	Faults are identified weeks earlier, enabling planned intervention instead of emergency response.
Diagnose	Applies consistent diagnostic pathways using AI guidance and defined fault signatures.	Eliminates variability caused by tribal knowledge and individual interpretation.	Faster root cause identification, clearer severity scoring, and better prioritization.
Decide	Connects alerts directly to work orders, priorities, and execution plans.	Prevents insights from stalling in emails, spreadsheets, or disconnected systems.	Decisions happen faster, accountability is clear, and action aligns across teams.
Improve	Captures outcomes from every event, repair, and save as reusable intelligence.	Ensures lessons are retained, institutionalized, and applied consistently.	Reliability compounds over time as the system becomes smarter with each cycle.



1. Detect: Continuous, Complete, High-Frequency Data

The first step in closing the data gap is ensuring assets are monitored with enough frequency and coverage to reveal early-stage faults. Continuous sensing and always-on monitoring significantly reduce detection latency, replacing periodic snapshots with real-time visibility into developing risks. When data is complete and consistent, hidden failure modes surface earlier and emerging issues can be addressed before they become disruptive events.

That said, continuous monitoring of every asset is rarely practical or necessary. This is where a structured [criticality assessment](#) becomes essential. By evaluating factors such as safety impact, production risk, repair cost, and failure history, organizations can identify which assets carry the greatest operational and financial risk. These critical assets are the ones that benefit most from continuous monitoring, where early detection delivers the highest return.

Less critical equipment can continue to be monitored through route-based inspections or lower-frequency methods, ensuring resources are applied where the need is greatest. When continuous monitoring is guided by criticality rather than convenience, teams gain full coverage of meaningful risk without overwhelming budgets, data volumes, or personnel. This forms a detection strategy that is both comprehensive and practical, providing early insight on critical machinery and eliminating blind spots that lead to costly surprises.

A comprehensive approach that can best safeguard critical assets:

- **Vibration Monitoring:** Detects mechanical issues such as bearing wear, imbalance, misalignment, and looseness.
- **Temperature tracking:** Adds context on lubrication health, load conditions, and abnormal friction.
- **Oil analysis service:** Adds another layer of insight by detecting wear debris, contamination, and lubricant degradation that vibration alone cannot reveal.
- **Data correlation:** Combining oil analysis with vibration data improves early fault detection and diagnostic confidence.

By combining sensor data with targeted oil analysis and a criticality-driven monitoring strategy, teams gain the visibility they need to detect developing issues earlier and act with confidence.

2. Diagnose: Guided, Standardized, Accurate Analysis

Reducing variability in diagnostics requires more than better data. It requires consistent, repeatable pathways for interpreting that data. AI-driven guidance and clearly defined fault signatures help standardize the diagnostic process so that every issue is evaluated using the same structured approach, regardless of who is on shift or which plant is involved. This consistency accelerates root cause identification, reduces reliance on tribal knowledge, and produces clear severity scoring that enables confident prioritization.

At the same time, human expertise remains critical. Experienced analysts provide context, validate findings, interpret complex patterns, and translate insights into practical recommendations. In effective closed-loop systems, [AI and human intelligence work together](#) rather than in isolation.

AssetWatch pairs AI-driven analytics with a dedicated CME (condition monitoring engineer) assigned to each plant. This analyst continuously monitors asset data, validates AI-identified issues, and communicates clear, actionable recommendations to the site. This combination ensures that diagnostics are both consistent and credible, blending the speed and scale of automation with the judgment and experience of a trained reliability professional.



Maintenance recommended for Motor 430s



- ! The 1x turning speed has increased and is now at 0.72 in/sec at 29.7 Hz.
- Please inspect the condition of the base bolts of the motor and ensure there is no looseness present.



Torque base bolts down to 245 ft/lbs this morning. Found a few that had loosened up a bit. Are the readings better?



Yes. Back to normal at 0.2 in/sec.



By standardizing how problems are identified and diagnosed, while keeping humans in the loop, organizations eliminate guesswork and subjectivity.

Reliability Success with AssetWatch

“ AssetWatch isn't just some monitoring system for equipment. It's an extension of your maintenance department that comes with a highly trained team that helps grow your company. We have had a lot of other vendors try and supply a good monitoring system for different assets, but none came with the convenience of real-time, live feedback and a team of trained professionals to assist with troubleshooting, field service support, etc. This is a system I recommend for any company trying to be more preventative and less reactive. ”

– Maintenance Planner, Mining and Aggregates Industry

3. Decide: Integrated, Cross-Functional Action Workflows

For reliability to translate into results, information must move seamlessly from detection to action. In a closed-loop system, alerts don't stop at dashboards or reports. They flow directly into work orders, priorities, and execution plans, ensuring that identified risks trigger timely and coordinated responses.

[Integration with the CMMS](#) plays a critical role in closing this workflow gap. When reliability platforms connect directly to maintenance management systems, recommendations become executable tasks rather than static insights. For example, an AssetWatch integration with a plant's CMMS automatically facilitates work order creation, prioritization, and tracking. This eliminates manual handoffs and ensures that the right work is scheduled at the right time.

With shared data and automated workflows, decisions happen faster and with greater confidence. Accountability is embedded in the system itself, not dependent on individual follow-up or informal communication.

4. Improve: A Feedback Loop That Strengthens Itself

Every event, intervention, and success should become part of the organization's intelligence. Over time, this creates a learning loop that drives continuous improvement. Patterns become clearer, failure modes recur less often, and maintenance teams understand which interventions deliver the greatest impact and why.

Technology and processes alone are not enough. **At the end of the day, it's the maintenance teams and operators who make reliability happen.** Capturing and applying lessons requires trained personnel who understand how to interpret data, implement corrective actions, and feed insights back into the system. It also requires buy-in across all levels of the organization, from technicians to plant leadership, so that improvements are consistently executed and reinforced. Culture matters. When reliability becomes a shared responsibility and learning is embraced as a core value, every team member contributes to strengthening the feedback loop.

A closed-loop reliability system transforms maintenance from reactive firefighting into proactive control, but it reaches its full potential only when people are empowered, processes are followed, and lessons are institutionalized. This is the foundation of truly resilient, zero-downtime operations.

What "Closed-Loop Reliability" Looks Like in Practice

To understand the impact of a closed-loop reliability system, it helps to picture how it transforms day-to-day operations inside a plant. The following scenario illustrates the difference between a traditional, gap-filled program and one built on continuous data, standardized diagnostics, integrated workflows, and systematic learning.



Before: Blind Spots, Late Detection, Firefighting, Repeat

In a typical plant, a critical conveyor motor begins developing a bearing defect weeks before the next vibration route. With no visibility between inspections, the early warning signs go unnoticed. When the issue is finally detected, the analyst flags it as concerning, but the report sits in an inbox for days. By the time action is taken, the defect has escalated into a severe failure mode.

- Detection is late and based on periodic snapshots
- Action is delayed by disconnected reports and approvals
- Maintenance responds reactively, leading to unplanned downtime

The failure is addressed, production resumes, and the incident is closed. But the lessons are never captured. A few months later, a similar motor fails for the same reasons, and the cycle repeats.

After: Real-Time Insight, Coordinated Action, Fewer Failures

With a closed-loop reliability system in place, the same asset is monitored continuously. Subtle changes in vibration are detected as soon as they occur, and the system automatically identifies the developing bearing defect and assigns severity using standardized diagnostics. The alert flows directly into an integrated workflow, triggering a prioritized work order.

- Issues are detected early with continuous monitoring
- Decisions are guided, standardized, and immediate
- Maintenance work is planned and executed before escalation

The technician confirms the issue and schedules the repair during a planned window. Post-maintenance data validates the fix. The event is captured as institutional learning, improving future detection and response. Production continues uninterrupted, and reliability improves with each cycle.

Cone Crusher Case Study

Vibration Sensor Prevents Unplanned Downtime

Observation:

High vibration at crusher speed on the motor indicating possible sheave misalignment and/or incorrect belt tension

Recommendation:

The CME recommended inspecting the sheaves for proper alignment and ensuring proper belt tension

Results:

Customer replaced the motor, belts, and sheaves. During installation proper alignment and belt tension was achieved.

AssetWatch Sensors

Downtime Saved:

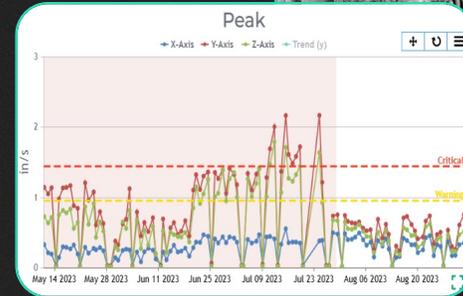
24 Hours

Customer Provided

Cost Savings:

\$240,000

Customer Provided



Confidential | 1



This case study is a strong example of what the “after” state looks like in a closed-loop reliability system because it shows how detection, diagnosis, decision, and improvement are connected end to end.

First, an issue was detected early. Installed vibration sensors identified elevated vibration at crusher speed well before a functional failure occurred. Instead of waiting for a route or reacting to a breakdown, the system surfaced the issue while it was still developing, eliminating the blind spot that typically leads to unplanned downtime.

Second, the case shows guided diagnosis and expert interpretation. The vibration data was not just flagged; it was analyzed and interpreted to point toward likely root causes, specifically sheave misalignment or improper belt tension. The CME’s recommendation translated raw data into a clear, actionable insight, reducing ambiguity and speeding decision making.

Third, this example highlights decisive, closed-loop action. The alert led directly to inspection and corrective work. The motor, belts, and sheaves were replaced and properly aligned, with belt tension verified during installation. There was no lag between insight and execution, which is where many reliability programs break down.

Finally, the outcome reinforces the value of the feedback loop. The corrective action was validated by stabilized vibration levels, confirming the fix. The avoided failure and **documented savings of \$240,000** become part of the organization’s reliability knowledge, strengthening future decision making and justifying continued investment in monitoring.

Stay Tuned for Part II

Closing reliability gaps is not a one-time initiative. It's a maturity journey that changes how teams see risk, make decisions, and work together over time. In Part II of this white paper, **The Reliability Maturity Path: Closing Bigger Gaps as You Grow**, we expand this closed-loop foundation into a practical reliability maturity model. The next installment introduces **five dimensions of reliability maturity**, each aligned to closing a specific gap, from asset and failure insight to diagnostic consistency, operational integration, stakeholder alignment, and continuous learning. It shifts the conversation from isolated metrics and tools to enterprise-wide outcomes, shared accountability, and measurable value. [Subscribe to Machinery Lubrication to be the first to receive Part II](#) and gain early access to the maturity framework, metrics, and cultural shifts that separate reactive maintenance programs from truly resilient, zero-downtime operations.

The Bottom Line

The benefits of a closed-loop reliability system become clear when teams move from periodic snapshots to continuous monitoring, integrate alerts directly into CMMS workflows, expand asset coverage, and involve operations and leadership in regular reliability reviews. These changes eliminate surprises, enable faster and more confident decisions, and ensure every action strengthens the system for the next cycle.

If your team has the data but still struggles to act, it's time to close the loop. Discover how **AssetWatch** integrates monitoring, diagnostics, and execution to deliver real reliability results.

Get started today.

Sources:

1. State of Industrial Maintenance 2025 Report | MaintainX. (n.d.). <https://www.getmaintainx.com/state-of-industrial-maintenance-report>

