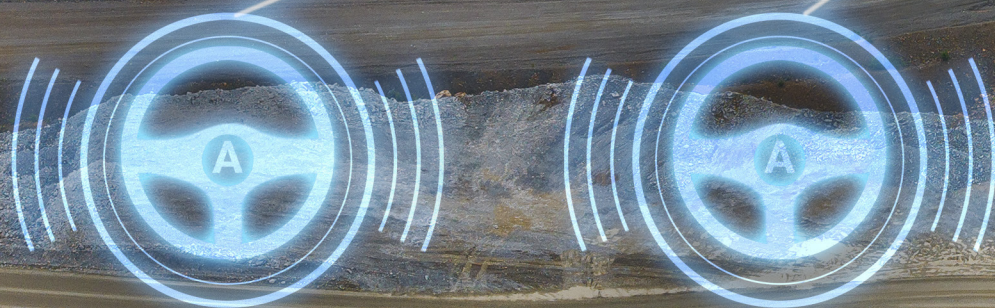


CONTINUOUS MONITORING FOR CONTINUOUS MINING



**GLOBAL
MINING
REVIEW**



Drew Mackley, Emerson, USA, explains how with downtime costs soaring and expertise shrinking, mining companies are turning to automated wireless monitoring and AI powered analytics to keep critical assets running 24/7.

Unlike many other industries, mining displays incredible variety around the globe. For example, mines operating on the surface often have very different equipment and needs than those operating underground. While underground operations deal with boring machines that are difficult to access and hard to fix, above ground sites contend with many miles of conveyors, complex electric rope shovels, and continuously moving trucks.

Yet for all their variation, all mines share two key areas of consistency: a desire for efficient, maximised throughput, and a need for effective reliability practices to maximise tonnage by keeping critical assets running continuously.

In most cases, mining operations strive for 24/7/365 uptime, but that goal is challenged by the fact that equipment is remote, expensive, and hard to repair. Moreover, as mines dig deeper and in more remote locations, while simultaneously operating more complex systems, the cost of downtime continues to rise (Figure 1).

The answer to these problems is improved reliability, but building and maintaining a successful reliability programme is difficult. Mining is hard on equipment, and expert personnel are becoming difficult to find and retain – especially if they need to work in remote locations.

As a result, many organisations are exploring a shift toward more automated reliability programmes, built around layers of continuous monitoring and edge analytics as the backbone of mine health.

Harsh operating conditions make reliability critical

In today's more complex, competitive global economy, monitoring assets is critical, but in mining it is doubly so. The equipment scale, rough operating conditions, and consequences of failure converge into a key strategy: never let critical equipment fail unexpectedly. If a rope shovel, crusher, conveyor, or other critical asset fails, the mine could be losing hundreds of thousands or even millions of dollars during the associated shutdown. If a mine's remoteness makes personnel resources scarce or there is a long lead time on needed parts, the shutdown could potentially last a very long time.

What's more, there are many ways for each piece of critical equipment to fail. Electric rope shovels require monitoring of booms, hoists, crowd, and motors. Crushers, conveyors, screens, hydrocyclones, ball mills, and more operate in abrasive, dirty conditions that accelerate bearing and gear wear, and contaminate lubrication.

Covering miles of equipment with fewer manual rounds

While mine reliability teams know their equipment needs to be monitored, turning that necessity into action is often challenging. Traditional manual vibration monitoring rounds can be inefficient and subject to personnel turnover, and they cannot feed artificial intelligence (AI) analytics with the needed data. First and foremost, mine sites often cover miles of territory. Manually checking each asset across such a span takes an incredible amount of time for even the most well-staffed teams.

However, many of today's teams are not well-staffed. For lean teams, manual rounds become even more complex. If personnel are not available, or if other priorities arise, rounds often get skipped, leaving holes in the organisation's data. In addition, many areas of a mine – particularly where heavy equipment is located – are not safe areas for humans to access. As a result, manual rounds are often highly prone to risk. Or, alternatively, equipment must be taken out of commission and operated as part of a controlled exercise to gather data, creating additional production bottlenecks.

Many of today's most effective reliability teams are navigating these challenges by transitioning to automated, wireless, or wired continuous condition monitoring. Modern wireless sensors make automated monitoring expandable across mine sites. These types of sensors eliminate cabling cost barriers and are easily deployed, industrially durable, and scalable to thousands of assets. The sensors feed semi-continuous, standardised streams of data into the hands of technicians and analysts, all without the need for human intervention (Figure 2).

From raw sensor data to actionable intelligence

As reliability teams deploy more sensors into the field, huge volumes of data from vibration, temperature, pressure, and ultrasonic sensors are created. Mechanical and process equipment each produce signals about wear, stress, plugging, faults, and more – but this can be both a blessing and a curse if not properly managed.

Raw data does not improve reliability unless it is turned into insights that reliability and operations teams can act upon, but few facilities have the on-site data analytics expertise or the free time to analyse the massive amounts of data they collect. To meet this challenge, many organisations are turning to intelligent sensing devices designed with integrated edge analytics. These asset monitoring solutions process raw data at the edge and turn that data into an intuitive asset health score. The score is then delivered along with actionable advice to mobile devices, control rooms, or remote operations centres to help speed time to resolution.



Figure 1. The mining industry faces many unique challenges as operators strive to maintain 24 x 7 x 365 uptime.



Figure 2. Digital transformation helps mining teams move away from repetitive, dangerous manual tasks toward more automated maintenance and reliability activities, helping them more easily achieve their core goals.

Additional exciting capabilities are emerging with the rise of AI. As edge analytics solutions built into sensors integrate multiple data types for better diagnostics, many now also incorporate AI to drive even faster, more targeted results. Integrated AI solutions perform anomaly detection and fault identification directly at the asset. Real-time alerts help provide early detection of faults before they escalate.

The extended warning window available provided by integrated AI is becoming increasingly essential. It provides a powerful and objective second opinion, or it can even act as a primary diagnostic source during weekends, holidays, or when experts are unavailable.

Visibility across the mine

To further increase their capability, many reliability teams also implement asset monitoring and machinery health software to further monitor and protect assets across the site. These types of software aggregate data from a mine's devices and assets to provide reliability teams with a more comprehensive view of facility health. Using a single pane of glass, teams can see, at a glance, where to best focus their attention to prioritise the site's most critical issues. Health dashboards aggregate vibration, temperature, and other process data from across the mine. Easy-to-understand green/yellow/red scoring systems flag problems, and users can drill down into each issue to receive root-cause insight.

Armed with the most advanced asset and machinery health software solutions, mines can extend asset life and reduce safety risk. Moreover, bringing everything into a single solution empowers operations teams to track conditions across equipment spread over miles of terrain, or even monitor a semi or fully-autonomous site from hundreds of miles away.

Enterprise-level reliability

Large mining companies have the potential to further improve their maintenance from local to enterprise scale. Enterprise-level reliability software can roll up the data

from multiple mines into a centralised view, enabling benchmarking and trend analysis. The software empowers companies to drive better performance through enterprise workflows that automate corrective actions, while enabling consistent reliability practices across sites.

Armed with enterprise-level reliability software, teams can more easily make decisions remotely, even from hundreds of miles away, based on real-time analytics. Today's largest and most effective mining companies are using this technology to unlock autonomous and semi-autonomous mining operations in extremely remote regions (Figure 3).

The most advanced enterprise-level reliability software can also be seamlessly integrated with the industry's best AI-powered predictive and prescriptive maintenance solutions. Armed with AI assistance, teams can predict equipment failures early and receive prescriptive guidance to improve asset reliability, eliminate unplanned downtime, and reduce maintenance and operational costs across the enterprise.

Unlocking these capabilities is not difficult, but it does require a modern approach to enterprise architecture. AI systems need fast, consistent access to contextualised data. This requires eliminating data silos by connecting sensors, edge devices, and cloud and enterprise systems seamlessly.

Today's most effective reliability teams are migrating toward integrated solutions that offer near plug-and-play connectivity via an enterprise operations platform built on a boundless automation vision. These next-generation automation solutions leverage a common data fabric to move contextualised data from the intelligent field, through the edge, and into the cloud, to provide the right data to the right people at the right time, wherever they may be.

A sustainable path forward for modern mining

Mining facilities face tight margins, remote operations, and leaner crews than ever before. These challenges demand a new set of technologies and strategies designed specifically to meet issues head-on.

Continuous monitoring, wireless sensing, and AI analytics at both the edge and enterprise improve safety and efficiency, while simultaneously controlling costs and reducing or eliminating unplanned downtime. Modern automation architectures built on a boundless automation vision of seamless data mobility make next-generation reliability automation solutions easy to install, intuitive to use, simple to scale, and fast to deliver return on investment.

As mining expands into more remote and complex environments, always-on monitoring becomes indispensable. The teams that embrace more automated and effective reliability technologies will not only deliver safer, more efficient operations, but also lock in the strategies that secure competitive advantage. **GMR**



Figure 3. Enterprise-level reliability software helps teams maintain visibility of their asset, plant, and enterprise health, even when personnel are far out in the field.