reduce downtime. Dan Gleeson looks into how widely these
ability to extend equipment life, improve performance and
Digitalisation, automation and artificial intelligence have the
While there is a well-established hierarchy in
Automation and AI
for alternatives.
Plant and fleet operators – starved of capital expenditure (capex) – were unable to splash out
expenditure (capex) – were unable to splash out
on new equipment to solve these problems like
they did in the boom. Instead, they had to look
more product.
Jani Puroranta, Chief Digital Officer of Metso,
put this in perspective: “To justify investments in new equipment, you must first demonstrate
that you are fully utilising the already existing
capacity. Running a crushing circuit at below
80% availability and total overall equipment
effectiveness (OEE) below 70% of nameplate
capacity is no longer acceptable.”
Puroranta’s statement remains true today. As,
while commodity prices have somewhat
recovered from the trough seen at the end of
2015, miners are still capex shy and opex
focused.
This mindset has them moving to condition
monitoring or predictive maintenance solutions
to provide a better understanding of how
equipment is working on site. It also has them
considering automation in several parts of the
mining process to improve performance and
uptime.
Automation and AI
While there is a well-established hierarchy in
terms of automating mine site vehicles, the
levels of process plant autonomy are less well
defined.
Metso’s Puroranta has come up with his own
five-tier system that, he feels, best displays the
automation journey.
■ Level 1: Regulatory controls
□ Operator is responsible for reacting to
turbulences and finding the optimal set-
points at each time. Maintenance is reactive
and asset availability low. There is high
variability in production rate, quality and
yield;
■ Level 2: Advanced Process Control (APC)
□ APC software finds optimal set-points and
automatically compensates for process
turbulences and variability in feed. New,
added advanced instrumentation gives
greater visibility and control over the
process;
■ Level 3: Intelligent equipment
□ Majority of operator tasks have been
automated. Minor process or feed
turbulences are autonomously
compensated by the equipment or other
intelligent actuators. Operation modes that
are harmful to equipment health are quickly
detected and corrected;
■ Level 4: Analytics and artificial intelligence
(API)
□ Predictive and preventive maintenance
practices provide high asset availability. PID
(proportional–integral–derivative) loops are
constantly analysed and optimised (eg bin >
feeder > crusher > conveyor). AI analyses
High capital costs assets, such as mills and
conveyor systems, are often the bottleneck in
mining operations, with any downtime directly
affecting productivity and return on investment
for the whole operation, according to PETRA
Data Science’s Penny Stewart
the process and advises the operator on
optimal set-points beyond what an APC is
capable of, especially in highly multivariate
and non-linear response scenarios, where
feedback or feed-forward loops are long and
complex; and
■ Level 5: Full auto-pilot
□ APC has been further augmented by
additional sensors and analysers. A highly
skilled operator is supported by AI and a hi-
fidelity, dynamic, real-time process simulator
(digital twin). Deep subject matter expertise
is constantly available remotely and can
cooperate over the same data with the
operator. Maintenance is 100% predictive
and preventative, and no unplanned
shutdowns or other major interventions are
needed.
The average miner may be closer to tele-
remote than manual operation when it comes to
mobile equipment, but Puroranta argues they
are still at level one of this process plant
automation journey.
“Maintaining Level 1 (regulatory controls) is
hard work,” he explained. “There are thousands
of instruments, actuators, controllers, PID loops,
etc in a minerals processing plant. Left on their
own, these will degrade over time. This means
wrong readings – or no measurements at all –
and hence wrong decisions.”
While some plants accept sub-optimal
performance and the risks of operating
equipment failing as “a cost of doing business”,
Puroranta says declining ore grades and
uncertain metal prices are making “proper
maintenance” and “calibration of all regulatory
controls” more crucial than ever.
Despite the assertion that miners are still at
the first of his five automation stages, Puroranta
says APC software has found its way into many
process plants in typically the grinding and
flotation lines.
This is tied to worries over ‘critical
equipment’ downtime and the need to employ
more types of maintenance software to protect
against such events, he said.
“If a difficult-to-repair catastrophic failure
happens to a piece of critical equipment, this
downtime may destroy the whole year’s
financial result,” he said. “If you lose many
months of production because a gearless mill
drive or roaster is under repair, there is little one
can do to save the full year’s production targets.
Unfortunately, plants realise the high cost of
downtime usually only after they experience a
major incident like this. After months of lost

MINE MAINTENANCE

Trust or bust

Digitalisation, automation and artificial intelligence have the
ability to extend equipment life, improve performance and
reduce downtime. Dan Gleeson looks into how widely these
innovative solutions are being applied across industry

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Unfortunately, plants realise the high cost of
downtime usually only after they experience a
major incident like this. After months of lost
production, spending a million or two million dollars in a predictive maintenance program does not feel so expensive anymore!"

Puroranta thinks the best strategy is to build out predictive maintenance solutions in certain areas, as opposed to employing them in all aspects of the plant from the off.

"Adding new instrumentation, building data collection methods, designing analytical dashboards, creating algorithms and AI across all assets would take years and cost tens, if not hundreds, of millions," he said.

"The obvious alternative is to focus on the critical assets first," he said.

Using a "jackknife" analysis, where high mean time to resolve (MTTR)-type incidents and "chronic" failure modes are identified, tells operators which equipment they should focus on, and what failure root causes to address.

"For example, if you lose two days’ worth of production every year due to a same repeating failure type, such as broken vibrating screens, building a business case to address that specific pain point is easy to make and justify," he said.

This "low hanging fruit" can expand over time into a plant-wide solution.

Metso has already taken a view on where the low hanging fruit is in the process flowsheet.

In late-2018, it launched its Metso Metrics for Mining predictive maintenance solution for mining equipment.

The Industrial Internet of Things (IIoT) solution is built on the Rockwell Automation FactoryTalk Cloud platform, powered by Microsoft® Azure™, and securely collects data from hundreds of sensors within Metso equipment all used to assess process performance, as well as predict component wear and failure.

This solution covers Metso’s primary gyratory crushers, cone crushers and vibrating screens, and is being used globally, according to Puroranta.

"We have been running pilots in plants on every continent from Australia and China to South America and USA. Right now, we are looking at almost 50 minerals processing equipment connected globally," he said.

The company is starting to gradually turn these pilots into commercial installations, backed up by remote support from experts placed in Metso Performance Centers in Chile and China.

Metso currently has 12 different algorithms monitoring the health and performance of crushers, with these algorithms capturing half a dozen incidents a month, Puroranta said. These are communicated to customers alongside recommendations on how to intervene.

"We have been able to prevent catastrophic failures, reduce the impact of unavoidable incidents, and shortened the time needed to recover. Root cause analysis has been faster and easier with real-life data at hand, rather than simulations or guesswork," he said.

The success of Metso Metrics is underlined by the fact the company plans to launch a solution for SAG and ball mills next year, which will not only seek to reduce downtime, but also improve operating performance.

"By understanding how the mills are operated and finding gaps in performance with analytics, we can help the customers to increase production and throughput,” Puroranta said.

The company is also piloting wear part analytics for both crushers and mills, he added.

**Predicting failures with FORESTALL**

Since working with Newcrest Mining’s Lihir operation in Papua New Guinea to implement some of the first machine learning case studies in the sector in 2016, PETRA Data Science’s FORESTALL® real-time predictive maintenance solution has evolved into a “platform-agnostic software application capable of simultaneously preventing four types of unplanned downtime”, Penny Stewart, Principal & Managing Director, told IM.

The online solution for near real-time operational decisions is built on four types of algorithms; three of which automatically monitor machine health and one that was built to predict the probability of failure based upon hours of operation and load, and/or environmental impacts on the machine.

These algorithms have been applied to conveyors, mill motors, valves, pumps and furnaces, according to Stewart.

Stewart said the algorithms of most value to the mining sector predict and prevent unplanned downtime by providing a probability of failure for a specified amount of additional operating hours.

While valuable, these algorithms are also the most difficult to develop, she said, requiring many historical failures to minimise the number of false positives to an acceptable level, as well as using advanced “feature engineering”.

She explained: “Feature engineering provides valuable off-line insights into the factors contributing to unplanned downtime and this, in itself, is also very valuable.”

PETRA provided an example here where a FORESTALL® algorithm for a furnace found that moisture in the feed contributed to unplanned downtime, which provided an opportunity to consider methods of preventing moisture getting into the feed.

“Similarly, in the case of valves, we found temperature variations had a significant effect on hours operating – this provided an opportunity to consider protecting the valves from direct sunlight,” Stewart said.

Like Puroranta and Baker before her, Stewart feels the value case for predictive maintenance is strongest in certain sections of the process plant.

"In mining, we typically have redundancy on lower cost assets such as pumps and cyclones, but when it comes to high capital costs assets, such as mills and conveyor systems – and high tonnage operations, like porphyry copper open pits and block cave operations – these assets are often the bottleneck in the operation, and so any downtime directly affects productivity and return on investment for the whole operation,” she said.

"There is a very strong business case for developing custom built accurate predictive maintenance algorithms for these critical assets.”

In addition to FORESTALL, PETRA has been working with customers to pilot an off-line operational decision support tool for maintenance professionals.

This solution “learns from historical decisions”, and incorporates off-line data sources, such as oil analysis, according to Stewart.

This type of operational decision-making support is particularly relevant to mobile equipment, where off-line sources of data, such as transmission and engine oil analyses, are critical to preventing unplanned downtime, she said.

“Maintenance data includes text-based comments and so, in order to develop this tool, we leveraged in-house artificial intelligence that we use to automatically classify maintenance records by automatically reading tens of thousands of comments – this literally turns months of manual and tedious labelling work into a few days’ work!”

**Integrating intelligence**

Dingo’s Trakka Predictive Analytics integrates off-line with real-time data to improve outcomes.

Another platform that leverages artificial intelligence and machine learning to predict impending equipment failures, Trakka Predictive Analytics allows customers to “proactively perform corrective maintenance actions to minimise downtime and optimise asset life”, according to the company.

The solution is powered by a proprietary machine-learning library, which enables it to predict the time until asset/component failure with a high degree of accuracy, Dingo claims.

Gary Fouché, Chief Information Officer of Dingo, said the company has a range of customers using AI to help identify and address issues on specific fleets of mobile equipment and in the fixed plant environment, but there are specific areas where these have gained traction.

"Haul trucks have been a major pain point for our customers, and we have developed failure models for final drives, rod bearings, cylinder..."
wear and fuel pumps,” he told IM.

“Another example is Dingo’s Anomaly Detection models being used to detect anomalies on data from on-board systems in a haul truck for a large gold miner,” he added.

With the wider Dingo Asset Health Process platform, Dingo is able to integrate all of these AI elements into the wider maintenance workflow, embedding work recommendations directly into the enterprise resource planning (ERP) and computerised maintenance management system, according to Fouché.

“This focus on integration into existing processes and systems helps ensure our customers can use this new information, while creating a seamless experience,” he said.

And, Dingo is already looking to advance its AI capabilities to the point where it could deploy machine-learning models to the edge or in the field.

Fouché said: “Dingo is working on several use cases where AI models are deployed onto devices that can be disconnected from the network and these models can undertake prediction and classification without a round-trip to the cloud.”

It is the integration of an AI-backed predictive wear monitoring solution and a centralised data analysis platform that has allowed Motion Metrics to help equipment operators and mine managers handle shovel tooth wear in mining operations.

As the company says, failure to accurately predict shovel tooth change-out intervals is a common cause of operational delays at mine sites.

“Shovel teeth are sacrificial components that gradually wear out as the shovel engages the mine face,” Motion Metrics said. “Because teeth must be replaced regularly, it is important to co-schedule tooth change-outs with other maintenance tasks so that operational delays can be minimised.

Moreover, continued operation with worn shovel teeth reduces shovel efficiency, can damage the bucket, and increases the likelihood that a tooth or adapter will break.”

Unplanned tooth change-outs are far more expensive than scheduled ones, according to the company, with the tooth replacement costs – direct and indirect – amounting to $41,000 per incident, according to an study cited by Motion Metrics.

“Although unplanned change-outs are sometimes unavoidable, these incidents can be significantly reduced with a tooth wear monitoring solution,” the company said.

The two most critical factors that impact the wear rate are the environment in which the shovel works and the material that it excavates.

In an abrasive environment, for example, a 50-60 cm long tooth will wear out in three days, according to Motion Metrics; the same tooth may last two weeks in a copper mine. Additionally, teeth wear unevenly depending on their placement in the bucket.

Some mines take manual measurements of the shovel teeth, but this traditional method is time- and labour-intensive, requiring mine personnel to stop the shovel and physically measure the length of each tooth with a measuring tape.

“In addition to causing operational delays, these manual measurements are not repeatable because they introduce elements of human error and subjectivity,” Motion Metrics says.

To help mines optimise tooth change-out
The traditional method of taking manual measurements of the shovel teeth requires mine personnel to stop the shovel and physically measure the length of each tooth with a measuring tape. This process is time-consuming and interrupts production. Motion Metrics developed a predictive wear monitoring solution that does not interrupt production. ShovelMetrics™ uses AI and a rugged camera mounted atop the shovel boom to provide real-time tooth status updates via an in-cab monitor, it says.

All ShovelMetrics tooth wear data can be accessed through the MetricsManager™ Pro centralised data analysis platform. With authorised credentials, mine management can view the tooth length, wear rate, wear pattern, and the estimated time until change-out, according to the company.

When used together, ShovelMetrics and MetricsManager Pro eliminate the need for manual measurements and can help personnel optimise tooth change-out intervals, Motion Metrics says.

Newtrax Technologies believes its AI-powered Newtrax IoT Hub, which will have its commercial launch soon, provides a way of integrating various data streams from multiple vendors into one platform to improve maintenance decision-making.

“It connects datasets and information in real time with a wide choice of software applications, enabling transparency of the mining processes and proactive decision-making,” Newtrax said. Newtrax told IM that there are several applications inside the IoT Hub, including an Asset Health module.

Alexandre Cervinka, President & CEO of Newtrax, said the company has seen throughout the industry plenty of examples of separate vendors selling IoT devices that only work with their own software platform, leading to the generation of “islands of data”.

“However, the real power of data can only be unlocked with the customers’ ability to aggregate the data together to make insights that would not normally be seen,” he said. “That is where the Newtrax IoT Hub comes in.”

MineWare’s CEO, Andrew Jessett, believes the integration of data into IoT platforms is key to achieving not only maintenance goals, but safety and productivity aims too.

“Mine owners, operators and contractors are all moving towards prescriptive maintenance,” he told IM. “This is an evolution from reactive and preventative practices, as available data from equipment is digitised at the edge and then fed into intelligence systems to provide insights on how to improve asset health.”

The next step in this process is to further automate these systems into IoT platforms for interoperable solutions that can “identify equipment anomalies, analyse the situation for a solution and then interact with an ERP system to order the required parts and support”, he added.

“We believe preventative and prescriptive maintenance will become more integrated into mining safety programs to ensure that operators have the safest and most reliable equipment to perform their duties,” he concluded.

Cat in the cloud
The combination of a data-based comprehensive health management platform and Caterpillar’s suite of mining technology products has led to the development of the Cat MineStar™ Health platform.

The two allow equipment managers to easily gather and analyse all kinds of data from equipment, according to the company. Cat Health provides real time alerts when a problem is detected and lets operators know what action to take – such as slowing down or shutting down – to minimise component damage, “plus it lets service people know what to expect so they can optimise the repair time”, the company said.

The system monitors critical components on a machine and reports out-of-tolerance temperatures and speeds. Cat Health is also OEM-agnostic, monitoring all equipment assets, regardless of manufacturer.

Within the Cat Health architecture is the MineStar Health Equipment Insights platform. This cloud-hosted, internet-accessible data visualisation and reporting tool comes with customisable, interactive data dashboards and drill-down functions, empowering companies to navigate, view, manage and use machine data to make informed maintenance decisions to improve equipment uptime, according to Cat.
A Cat spokesman said: “That technology is especially appealing to smaller mines and quarries who don’t want to invest in and maintain computing capacity.”

**Conveying savings**

Cloud computing has a role to play in AVA Group’s Aura IQ conveyor health monitoring solution.

Developed in collaboration with Mining3, Aura IQ is a solution for monitoring, measuring and detecting conveyor roller health, according to the company.

It uses real-time data to optimise production and on-site performance, enhance occupational health, hygiene and safety management, and introduce new predictive maintenance and support capabilities to asset management, according to the company.

By transmitting a series of short laser pulses along a single fibre-optic cable retrofitted along the length of a conveyor, acoustic disturbances from the conveyor system cause microscopic changes in the backscattered laser light that is then categorised into known parameters, AVA explained.

Data is then simultaneously gathered from every metre of the conveyor and processed by Aura IQ to pre-emptively alert operators, either on or off-site (in operational hubs or control rooms), to potential failures before they happen.

The Aura IQ Edge Server can monitor the vibration patterns of the idlers transmitted through their metal frame and detected in the fibre cable crimped to the base of each frame. When vibrations peak in certain frequencies, it indicates potential wear and tear in the bearings that form the core of the idler roller and allow it to spin freely. The system uses patented algorithms to filter out the background noise and highlight these vibration peaks and indicate when idlers are nearing the point of failure.

Andrew Hames, Group Head of Innovation, Extractives and Energy, AVA Group, told IM that since the conveyor monitoring solution was launched globally last year interest had been “very strong”.

“We have narrowed our current focus down to a qualified pipeline of 38 opportunities, across six regions (Africa, Asia, Latin America, North America, Oceania), 16 countries, across the bulk handling, energy, engineering, manufacturing and mining sectors, with the sub-sectors being bauxite, coal, power plants, conveyor manufacturers, copper, iron ore, EPCMs, platinum, ports, steel manufacturers and precious metals,” he said.

The company is in the process of organising the logistics and carrying out proof of value trials at numerous sites, he added.

In one example at an underground coal mine in the Bowen Basin of Queensland, Australia, Aura IQ substantially reduced planned and unplanned maintenance at the operation.

The reduction in man hours associated with monitoring and maintaining the 1.7 km of conveyor, the resultant increased life of the rollers and reduced operational downtime caused by implementing Aura IQ over this trial period was expected to see the coal operator save A$37.1 million/y ($25.3 million/y), according to AVA. In addition, conveyor utilisation would rise by up to 5%.

Hames said: “It is fair to say that our solution (Aura IQ) has hit on a traditional sore point when it comes to the efficiency and effectiveness of running conveyors to ensure production and site optimisation; vastly reducing the costs associated with unplanned downtime and greatly reducing the health and safety risks associated with traditional forms of monitoring.”

One aspect resonating well with customers is the company’s fully managed serviced solution approach, according to Hames.

He explained: “We eliminate any and all upfront costs (capex) resulting in an opex commercial relationship, which the market is responding to well given the constraints on available cashflow and the push for quick, smart and efficient innovation gains.”

**Lining from the outside**

Any maintenance staff to have carried out or witnessed the switching out of SAG or ball mill liners realises the complexity and risks associated with replacing these wear parts.
Synertrex specifics

Weir Minerals announced the release of its Synertrex® platform in 2018, which it described as an advanced IoT technology set to transform the mining industry.

The company partnered with technology market leaders Microsoft, Dell, Merlin CSI and PETRA Data Science to develop the platform, which, Weir says, uses edge computing to both enable maintenance alerts provided in real time and perform a high level of analysis without transferring all information to the cloud.

Weir Minerals chose the initial applications for its Synertrex® platform based on areas that would provide miners with the most value.

Available currently on Warman® pumps, Cavex® hydrocyclones, GEHO® PD pumps, Enduron® HPGRs, Enduron® screens and Enduron® crushers, the platform has been received positively, according to Group Head of Digital Technology, Development and Platforms, Ben Baker.

A recent example of the technology’s preventative maintenance ability was seen when a Weir Minerals’ pump expert, located in Australia, notified a service team 17,000 km away in the UK that one of their customers’ pumps was exhibiting an abnormality, he said.

The service team was able to proactively rectify the issue preventing this process critical pump from failure and unplanned downtime, he explained.

The Synertrex system is not only about predicting failures, Baker said. “Recently, at a customer site in Chile, within a day of the [Synertrex] system going live, the customer was able to identify and implement improvements to the process circuit, which left undetected would have caused losses in productivity and negatively impacted downstream processes,” he explained.

“We expect to see many more of these examples as the Synertrex system continues to gain traction in the industry,” he said.

Plenty more examples are likely to follow, too, with WEIR® continuing to look at opportunities to employ its Synertrex® technology across its product range, according to Baker. The company is continuously evaluating the potential to extend the capabilities of the platform across existing pump, hydrocyclone, HPGR, screen and crusher applications, he added.

Russell Mineral Equipment’s (RME) personnel have been effectively carrying out these jobs for more than three decades, with the company continually innovating to improve the process.

Russell told IM that RME’s MILL RELINE Technology is the name given to a suite of advanced technology processes that complement SKYWAY and facilitate relining to be performed from outside the grinding mill.

RME Managing Director, John Russell, said: “Our two first SKYWAY and INSIDEOUT Technology customers are leading the world by recognising that by performing relining from outside the mill, they remove the risks for personnel typically surrounded by suspended loads during traditional relining activities. In addition, Northern Star Resources are implementing INSIDEOUT Technology at their Kanowna Belle site after a number of INSIDEOUT trials, providing relining productivity and safety improvements.”

THUNDERBOLT SKYWAY is a purpose-built structure external to the grinding mill to support and position THUNDERBOLT Recoiless Hammers and elevating operator work platforms, according to RME. It consists of fixed and mobile plant.

Fixed plant, which includes SKYWAY’s structural towers and rails, is permanently installed according to a pre-designed installation schedule. Mobile plant elements include the SKYWAY elevating work platforms and THUNDERBOLT Hammer modules. These modules are designed to be shared between a site’s SAG mills and, between relines, are stored in specially designed storage frames adjacent to the mill. Both module types are easily transported by overhead crane and are designed for ease of transfer.

Russell told IM that RME’s MILL RELINE DIRECTOR Discrete Event Simulation modelling predicts a reduction in the duration taken for relining compared with conventional relining. He spelled out three key attributes that sped up the process:

1. SKYWAY’s elevating working platforms and elevating THUNDERBOLT Hammer modules facilitate greater reach height for THUNDERBOLT Hammers around the grinding mill, thereby reducing the number of time-consuming mill inching cycles by up to 60%.

To illustrate, a typical Twin Tube Monorail solution for mill relining enables an effective reach height of 2 m, whereas a typical SKYWAY system provides up to 4.3 m;

2. SKYWAY is programmed with exact bolt hole and knock in hole coordinates. Hammer operators can perform semi-automated liner bolt knock in from some distance away from the Hammer module, using a remote operator’s console. Bolt to bolt movements are around 75% faster than manual handling methods. Further, the alignment of the THUNDERBOLT Recoiless Hammer, with the bolt axis, is automated, making the average alignment time 85% faster than manual handling methods used in conventional relining; and

3. The carriage for the THUNDERBOLT Recoiless Hammer provides a constant 500 kg pre-load when knocking in the bolts and worn liners. This results in fewer blows to knock-in each bolt, and better enables the liner to be knocked in if stuck against the shell, which is a source of significant delays in many sites, according to RME.

While relining external to the mill can be achieved independently of SKYWAY investment by using INSIDEOUT Technology – with RME having developed a staged INSIDEOUT Technology implementation to allow sites to access reline-by-reline safety uplift – Russell said the company has also been working on fully automating the mill relining process.

“A highly progressive brownfield site has implemented RME’s full advanced technology suite in one project, installing SKYWAY and a RUSSELL 7 Mill Relining Machine equipped with...”
AutoMotion,” he said. “This machine is the world’s first robotic Mill Relining Machine and it’s been developed, designed and manufactured completely by RME.”

He explained: “These two advanced technologies – SKYWAY and the automated RUSSELL 7 – provide significant productivity benefits and the automated RUSSELL 7 is operated by personnel outside the grinding mill, delivering a relining safety world first.”

Russell said the company’s research indicated SKYWAY will be favoured by larger miners with significant anticipated mine life. “High altitude sites, in particular, will benefit due to the personnel fatigue management that SKYWAY affords,” he said.

“Automated RUSSELL Mill Relining Machines provide three levels of operational redundancy and we anticipate that these ‘supermachines’ will become the industry standard for large SAG mills.”

In 2019, MIRS, a subsidiary of HighService Corp, launched a robotic solution to automate the process of changing wear liners in mills without any human intervention.

The company said a team of its experts executed the change of liners “at a speed never before achieved, with high standards of quality, efficiency and safety”.

MIRS launched the robotic solution, fully developed in Chile, for the lining of SAG and ball mills at an event that took place in September at the industrial testing facilities owned by the company, in San Bernardo.

Major players in the mining sector had the opportunity to witness the operation of the EMMR (External Mill Maintenance Robot), a fully automated system that performs this operation autonomously and without human intervention, at the event, MIRS said.

“Minimising the time to execute the lining of the mill is a condition that the industry has always demanded,” Igor Elias, Manager of the Commercial Area of MIRS Mill Reline, said. “This innovation in plant maintenance reduces maintenance times and increases worker safety.”

The MIRS automated system increases the quality, safety and speed of the operation by replacing the workforce with the action of robots weighing up to 6 t, which operate in parallel at a speed that reaches up to 2 m/s. This reduces the total lining time, compared with conventional lining, by around 40%, according to the company.

During the launch, a demonstration was made of how complementary technologies for EMMR – such as the IMMR (Internal Mill Maintenance Robot) automatic manipulator – aid the relining process. Designed to operate in parallel with the EMMR, IMMR automates the extraction of linings and bolts from the interior, as well as its subsequent installation, and performs other activities such as automatic cutting and high pressure washing, according to MIRS.

**Trust in the tools**

Even though the tools to automate more and more maintenance functions through robotics and AI are coming into play, there is nothing to say all miners will leverage these capabilities.

As has been continually observed by outsiders, the mining sector is historically conservative when it comes to applying new technology and is slow to take advantage of innovation.

Understandably – and in keeping with trends seen in the automation of plant and machine operation – miners’ maturity level is varied in terms of applying innovation in a maintenance environment.

Dingo’s Fouché said the company has a wide range of customers at different stages of maturity and advancement in both their maintenance practices and level of ‘trust’ in new technologies, such as machine learning.

“Some of our customers are using the AI models to dip their toes in the water and test the accuracy and potential benefits of the technology, whereas other customers are utilising AI to augment humans making decisions,” he said.

But, the company does not yet have any customers that have implemented fully automated processes that let AI models “make the decision”.

This can be seen across the industry and is a point observed by Weir’s Baker. “Prediction of maintenance events is an evolving area and is still some way from establishing confidence in applications across the process plant,” he said.

“In the short term, insights into future maintenance requirements are probably more likely to augment existing maintenance planning activities rather than drive them.”

But, looking further ahead, Baker ended with a positive:

“The larger mining companies have been seen to pursue these areas more aggressively in the last 12 months or so and there is significant progress being made at the extraction and transportation stages of the operation,” he said. Some of this progress has already been documented.

Baker continued: “While activities have to date been less focused towards the processing plant, it is just a matter of time and there is certainly engagement from within the industry in this space.

This engagement is likely to increase if commodity prices remain range bound, the pressure to improve performance endures and successful case studies detailing innovative maintenance procedures continue to be publicised.”

**Following the official opening of its North America headquarters in September 2018, CDE is continuing to invest significantly in its flagship aftersales support offering, CustomCare service.**

An investment of over $6 million has recently been made in its North America headquarters in Cleburne, Texas, with the aim of maximising the efficiency and uptime of its customers’ plants.

CDE’s investment included the development of fully stocked and managed stores to house high-wearing consumable plant components, with the company’s pre-emptive approach seeing thousands of replacement parts, valued at almost $4 million, readily available for immediate dispatch.

The company said:

“Responsive on-the-ground support and locally sourced parts means CDE is better equipped to strengthen its direct relationships with customers and supply or fit replacement high-wear parts to ensure a plant is running at optimum efficiency to boost return on investment.”

Sean O’Leary
CustomCare Manager, CDE North America, said:

“Durability and reliability are key attributes of CDE technology, and our Customer for Life model outlines our commitment to taking preventative measures to enhance productivity, maximise uptime and profitability.

“For our customers, this is indispensable. They are reassured by our proactive approach which is achieved through regular preventative maintenance inspection site visits, detailing recommended parts lists, outlining time required to fully fit replacement parts and stocking common wearables locally for rapid dispatch.”

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