



# Embedding expertise

*Weir's new Cavex 2 hydrocyclones, equipped with Synertrex, are automatically alerting operators to roping or blockage conditions ahead of time*

having to place their monitoring equipment onto a bearing housing to determine its condition, for instance, we are putting in place the ability to do that from a centralised online location."

This is where Synertrex is enabling plant personnel to change their maintenance processes, shifting teams away from the reactive routines they are used to into a proactive environment that can result in improved equipment uptime and performance.

The first two remote centres – set to open in the March quarter – will be in South Africa and Chile.

## COVID-19 may prove to be the catalyst to move more maintenance oversight into the cloud and beyond, Dan Gleeson reports

**T**he influx of digital solutions into the mine maintenance space has come with excitement as well as trepidation.

For mine owners and operators, the potential to react to near real-time information from equipment presents a massive opportunity to reduce downtime and, therefore, boost productivity.

For mine maintenance professionals, the concern is that digitalising the maintenance workflow will cut jobs and put control into the hands of machines.

Yet, the underlying reason many of these solutions have gained traction in the sector is that the industry is short of the skills needed to efficiently maintain process plants on a 24-7 basis. These hardware, software, cloud- and edge-based solutions are trying to emulate the tasks personnel across the plant have previously carried out to fill these gaps.

The solutions are embedding the expertise mine maintenance professionals have routinely exhibited to 'fire fight' or prevent situations from occurring, allowing those same people to concentrate on analysing bigger datasets to make more fundamental changes to the mineral process plant workflow.

**IM** found more than a few examples to back that opinion up.

### Enabling equipment efficacy

"Synertrex® is an enabler for our customers to run their equipment better, for our service teams to offer improved service and maintenance cycles, and for operations to run with increased process performance."

Stephen Marshall, Head of Engineering Operations at **Weir Minerals**, has seen these qualities first-hand over the last two-and-a-bit years,

as have the miners that have subscribed to Synertrex.

Since its launch in 2018, Synertrex's use has provided many high-profile accounts of equipment failure prevention, improved service interval consistency, process performance boosts and more on a variety of Warman® pumps; Cavex® hydrocyclones; GEHO® PD pumps; and Enduron® high pressure grinding rolls, screens and crushers.

Using a combination of Microsoft Azure-backed cloud computing, smart sensors and a tailored digital interface, Synertrex continues to evolve, with Marshall keen to reveal the latest developments when speaking to **IM**.

The company is busy leveraging the platform's three core elements to monitor equipment at multiple sites and provide advanced warnings about impending issues to customers, especially those in remote locations or where personnel may not be on hand to troubleshoot issues.

This capability has become even more important during the pandemic and – catalysed by COVID-19 – Weir is investing further in its remote monitoring service offering.

"We're in the process of planning and rolling out, in 2021, control centres where we will have full-time staff monitoring regions and sites," Marshall said. These staff will interact with Weir service teams to make sure maintenance cycles are correctly scheduled and followed, while identifying potential issues that might affect productivity or performance on individual items of equipment should they go untreated.

"This goes as far as developing detailed dashboards for online condition monitoring," he said. "Instead of a person walking up to a site and

"The experience we gain from setting up and configuring those two will form the basis for a broader rollout across all the main mining regions, probably over the balance of 2021," Marshall said. "This will provide equipment monitoring visibility that would otherwise have been provided by site visits we were carrying out prior to COVID-19."

The enabling qualities of Synertrex go beyond this, providing an entry into a process plant's existing data handling and distribution infrastructure on site.

"Hand-in-hand with the sensors and the digital infrastructure we are putting in place to carry out remote monitoring, we are naturally providing the capability of feeding all of that data into the customers' local DCS (distributed control system) or SCADA systems," Marshall said.

This allows mine sites to leverage the data Weir maintenance personnel have to hand to troubleshoot equipment performance through their own localised control system protocols.

Such integration uses industry-standard communication procedures and benefits from Synertrex's high-speed data transfer, according to Marshall.

This option is already in use at certain mine sites, and Marshall says it continues to evolve with the help of more sophisticated and affordable sensors that, when combined with that high-speed data transfer, provide condition monitoring updates at more regular intervals.

"This will enable us to gain information about how our equipment performs, not only from a predictive maintenance cycle point of view but also from a process performance perspective," he said.

Weir is using this process performance data to improve the operation of its Cavex hydrocyclones.

Its new Cavex 2 hydrocyclones, equipped with Synertrex, for example, are automatically alerting operators to roping or blockage conditions ahead of time, ensuring the hydrocyclones continue to run under optimal operating conditions.

Debra Switzer, Global Product Manager for Hydrocyclones at Weir Minerals, explained recently: “To minimise the amount of bypass that is produced in any hydrocyclone, it is favourable for it to operate in the semi-roping condition. This is often difficult to do continuously because any upset in the hydrocyclone’s feed conditions could move it into the roping condition but, with Synertrex, this balancing act can be closely managed.”

Marshall says this type of analysis on hydrocyclones is also evolving.

“At the moment, the output of the Synertrex system is an enunciation back to the control room saying ‘hey, you have a problem, you need to do something about this’.

“We are now moving towards automating that feedback and having an automated system that corrects the operation of the cyclone cluster. We’re calling that cyclone loop control.”

As well as this advanced Synertrex control optionality, the company is working on developing entry-level systems for the wider market.

It is in the process of testing a small ‘smart’ sensor that can be fitted to the likes of transfer pumps and flotation circuit pumps for offline condition monitoring purposes.

“These are less critical items that will benefit from having some monitoring capabilities, but not necessarily with cloud ingestion and full online condition monitoring,” Marshall explained.

These new sensors will allow field service technicians and key account managers to walk up to sensor-equipped pumps on site, scan the sensors and download the operational history of the pumps from the sensor via Bluetooth or a wireless connection.

“That gives the technicians a log of what has happened with that pump, cyclone, screen, etc over time,” Marshall said. “When they get back into the office and have connection to the internet, the data will be uploaded to the cloud to help form a database of the equipment at that particular customer site.”

Marshall says the ambition is that all smaller-scale equipment that comes out of Weir’s plant will be equipped with these smart sensors, but they will also be offered as a retrofit option for the company’s suite of equipment already out in the field. This offering could be released to market towards the end of the first half of 2021.

### Major maintenance breakthroughs

COVID-19 has also acted as a catalyst for others in the mine maintenance game, such as **Dingo** and its **Trakka**® maintenance software.

The company recently signed a global agreement with Newmont that saw the leading gold miner expand the use of Trakka to manage the workflow



generated from its Operations Support Hubs in Perth, Western Australia, and Denver, Colorado. Dingo will provide continuous support to seven connected sites and hundreds of users, the company said in the press release.

While Dingo has a partnership with Newmont that dates back more than 20 years, the global Trakka part is a sign the miner has confidence in the Brisbane-headquartered company’s ability to not only deliver condition monitoring solutions for its fleet of mobile and fixed machinery, but also advanced predictive maintenance insights for its operations.

Discussing the wider issues associated with fixed and mobile machinery maintenance, Chuck Tollman, Dingo’s VP of Customer Success, said condition monitoring of haul trucks continues to be a focus area for miners.

“There are significant industry pain points around haul trucks,” he told **IM**. “There is just a lot more opportunity for cost reductions in that area, particularly from a parts/asset cost perspective.”

Whereas in the fixed plant environment, monitoring solutions are employed to increase production and reduce downtime, the focus for mobile machinery operators is typically about how to reduce sustaining capital spend.

“On the mobile equipment side, the haul truck engine might be more of a cyclical maintenance concern, but it represents a very high cost component in the \$400,000 range,” he said. “It is also sent out for a rebuild much more often than, for example, a gear box in a fixed plant environment.”

The number of companies able to provide fixed plant digital maintenance solutions are vast, but the mobile equipment monitoring market is far less crowded, according to Tollman.

“The applications and technology in the fixed plant environment advanced much quicker thanks to a number of manufacturing solutions,” he said. “This has made it much easier to maintain as there is broader utilisation of and access to sensor-based

*“On the mobile equipment side, the haul truck engine might be more of a cyclical maintenance concern, but it represents a very high cost component in the \$400,000 range,” Dingo’s Chuck Tollman says*

solutions across the mining industry.

“However, the mobile environment is starting to catch up with more sensors, on-board data, etc but it has a big gap to close.”

Dingo has historically been known for its fluid analysis on mobile machinery, but in the last decade it has taken a more holistic view of mine maintenance, according to Tollman, providing dynamic monitoring of onboard machine health data, operational data, visual inspections, and work history.

It is this dynamic monitoring expertise that is differentiating Dingo from the rest of the market, according to Tollman.

This agility goes beyond just its monitoring capabilities. Dingo has also been able to adapt to the new environment created by COVID-19.

“There wasn’t an established remote implementation process for Dingo in the past, but we quickly adapted,” Tollman said of the way the company continued to execute new business in the face of COVID-19 restrictions.

“We gathered all the materials needed to on-board new customers, and made it a virtual offering,” he said. “We conduct the same training modules as if the customer was there, face-to-face, but by remote video.”

With a string of Trakka implementations across the Spanish speaking market, Tollman estimates the company has already surpassed the growth expectations set out at the start of 2020.

Dingo is continuing to adapt to the reality of minimal staff at site, recognising the need to create more remote and mobile tools for its customers.

“A portion of our product roadmap has been focused on developing tools that can be utilised for special inspection applications, for instance,” Tollman said. “These tools work perfectly for sending critical

For the six months prior to Modular Mining’s involvement at the coal mine site in South America, the excavator in question averaged 62.4% availability. In the six months following, the excavator averaged 84% availability, representing an 11.6% increase

data to remote, centralised teams managing operations. That could be with us relaying the data to our customers at a centralised location, or us providing the services from one of our own support hubs in the USA or Australia.”

The company has already developed a suite of mobile Asset Health apps that are growing in demand with this market evolution.

On top of remote deployment and assistance, Tollman sees COVID-19 acting as a catalyst for further automation in the sector; a development Dingo is prepared for.

“What I do see in the industry is an increased focus on autonomy and removing people from site, with more autonomous trucks, shovels, etc,” he said. “In this environment, typically, an operator is one of your best predictive maintenance tools. If you do not have an operator, you need a robust set of systems and sensors in place, and somebody monitoring the output on an ongoing basis to check on these machines and components.

“We can do that already.”

This transition is likely to be aided by edge-based predictive maintenance models the company is building to consume data and continuously learn about maintenance needs from on-board mobile equipment sensors.

“We have to start by identifying the model and the accuracy of this model before it can be plugged into the system for the continuous input and learning,” Tollman explained. “A lot of the work is currently in the trial stage, but it is advancing quickly.”

For the wider market beyond the Tier 1 miners, Tollman sees the application of more basic condition monitoring solutions as providing the biggest ‘bang for their buck’.

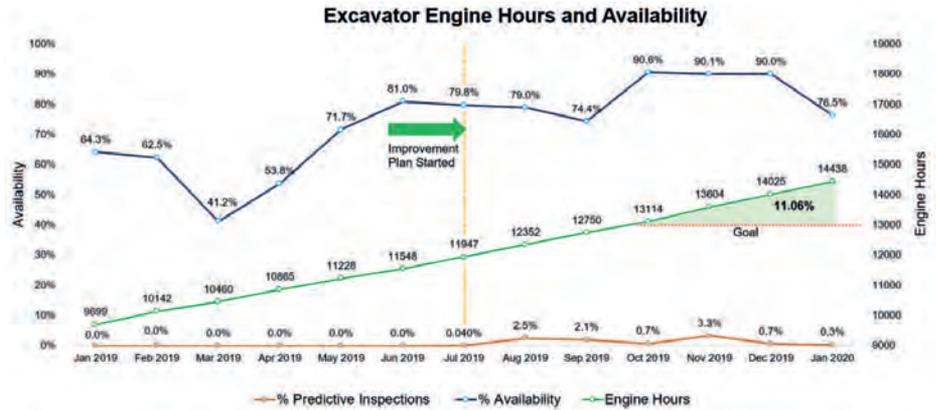
“There are still big opportunities with the typical condition monitoring applications,” he said. “These are the solutions that continue to provide the step change in performance and cost that miners are after simply by taking full advantage of their existing systems and data.”

**To OEM spec and beyond**

One such platform is **Modular Mining’s** MineCare® Maintenance Management system, which leverages sensors and advanced interfaces to track the health of a mine’s entire fleet in real time.

An example of the MineCare system’s ability can be seen at a coal mine customer in South America, which has leveraged the system, as well as a dedicated on-site team of MineCare experts, since 2011.

Prior to the COVID-19 outbreak, the mine asked for Modular Mining’s help in extending the engine life in one of its excavators, recognising the potential



opportunity to reduce or delay the excavator’s maintenance costs while safely maintaining its productivity. While the OEM specified engine

replacement at 12,000 hours, the mine wanted help running the excavator for at least an additional 1,000 hours beyond that.

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To solve this challenge, the mine's maintenance crew worked with the on-site MineCare analysts to implement a plan to safely increase engine life without risking damage to additional components. By carefully monitoring critical engine parameters, analysing the data collected, and immediately reporting anomalies to the maintenance crew for repair or replacement before failure could occur, the team was confident the MineCare system could help the mine hit their excavator longevity goals.

First, the MineCare team, together with the mine's maintenance personnel, configured the MineCare system's trend reporting functionality to monitor, among other parameters, the excavator engine's coolant temperature and pressure; oil temperature; intake manifold temperature; crankcase pressure; and exhaust gas temperature on all valves.

Using the data collected from these engine parameters – all common indicators of potential engine failure – the MineCare team established predictive inspection routines to detect anomalies that could indicate a potential or impending failure. For example, premature oil degradation, ruptured seals, damaged intake and exhaust valves, oil leaks, and other seemingly minor issues, if left unresolved, can lead to significant engine damage.

Leveraging this more proactive approach to component failure practices, the maintenance team could minimise their mean time to repair and overall likelihood of component failure, while safely maintaining excavator productivity well beyond the 12,000-hour OEM specification.

The MineCare team also conducted weekly follow-up meetings with mine personnel to evaluate results, including a detailed analysis of the MineCare Trend report generated for each tracked parameter. These meetings helped ensure not only that the activities performed while the team was on site were driving the customer's goals, but also that the mine was equipped and empowered to continue the improvements after the MineCare team left site.

For the six months prior to Modular Mining's involvement, the excavator in question averaged 62.4% availability. In the six months following, the excavator averaged 84% availability, according to Modular Mining, representing an 11.6% increase.

Additionally, by the end of the MineCare team's improvement plan, the excavator engine had clocked nearly 14,500 hours – exceeding the initial goal of 13,000 engine hours – for an increase of more than 11%.

Lastly, the mine was able to postpone having to replace their excavator engine, delaying the more-than \$400,000 labour and component cost associated with engine replacement for a more opportune time.

Modular Mining concluded: "Maintenance teams can gain more control of their practices, equipment, and budget by leveraging an asset health system that actively monitors for minor anomalies to prevent major disruptions."



### Gaining inSiTE

The ability to distil complicated and seemingly random information into powerful tools for equipment analysis has hit home with potash and salt miner K+S.

A more than three-month trial of GHH's inSiTE digital analytics solution on a 14-t-payload LF-14 LHD recently convinced the miner to complete a rollout of the platform across multiple mine sites.

GHH inSiTE, powered by **talpasolutions**, can condense information into powerful tools for analysis, according to GHH, with the manufacturer promising the integration into daily operations leads to continuously improved productivity.

In one of the first applications of GHH inSiTE in an operation in the CIS region, the customer achieved decreased downtime, increased utilisation, a 7% reduction in fuel consumption, the identification of inefficiencies in cycle time, and a 12% boost in overall equipment efficiency, according to the company.

K+S, acknowledging these results, initially agreed on a technical pilot of the platform on the GHH LF-14 operating at one of its sites.

This technical pilot and the promising opportunities regarding data analysis and visualisation must have been convincing because, in July, K+S signed up for a commercial deployment of GHH inSiTE. This will see the platform used on 150 machines across its mine sites.

Andreas Walczyk, Program Manager, Digital Transformation, at K+S, told attendees of *The 2nd International Conference on High-Performance Mining* in November that the trial was a chance for the company to not only gather machine data, but also leverage it to make improvements in its maintenance, production and training processes.

"The main reason for this pilot was to figure out if we were on the right path regarding data logging, network, WLAN and more," he said. "The answer is yes; the pilot was and is very successful because all of our expectations were met."

The company came away with around 3,500 operating hours and 27 GB of data to play with and analyse.

*GHH inSiTE can be used on any OEM equipment, with the system collecting, analysing and presenting data independently of the manufacturer of the machines or retrofitted sensors*

It acquired this by connecting to the on-board CAN BUS and engine control systems on the LF-14, logging the machine data over that three-month period, creating a "data buffer" at each site, displaying said data on customisable dashboards, and connecting it all through a cloud-based WLAN system.

K+S has already started the rollout of GHH inSiTE across its operations, with Walczyk keen to see how the machine-to-machine connection can allow loaders to, for example, pick up data from scalers to further improve the operations' data analytics.

Dr Jan Petzold, GHH Group CEO, says the GHH inSiTE system does not discriminate between mobile or fixed machinery, with operators and supervisors able to customise their dashboards to monitor the data and key performance indicators most important to them.

"Owning data is not good enough, you need to know what to do with the data," he said. "There is now a tool available to help you improve your maintenance intervals, your mean times between failures, and you have the chance to store this data for review afterwards. We also enable our customers to integrate the data in existing workflows to take better actions based on actionable insights."

Following the rollout of GHH inSiTE across the 150 machines at multiple operating sites – taking four to six months to complete – Walczyk says one of the next steps by K+S will be to create an SAP interface solution.

Also included on the K+S roadmap is a plan to leverage GHH inSiTE for a move into the predictive maintenance arena at its sites, using the platform for spare parts and resource inventory management, performance benchmarking and innovations for targeted product development.

Already in use at mines in Greece and Russia, GHH

inSiTE not only increases transparency for the mine operators, it also enables GHH engineers to remotely diagnose machines and provide service teams with the necessary information before they arrive at the site, the OEM said.

“Today the software of talpasolutions is used for more than 125 assets and machines worldwide – the numbers will increase strongly in the coming months, not only due to the use at K+S,” it added.

GHH inSiTE can be used on other OEMs’ equipment, too, with the system collecting, analysing and presenting data independently of the manufacturer of the machines or retrofitted sensors.

“It ensures for the machine owner a clear data integrity over the whole diversified fleet of machines from different manufactures,” GHH said.

The company added: “GHH inSiTE is embedded with world-class security controls, processes and kept ahead of potential vulnerabilities through a proactive security software development program.”

GHH inSiTE is also helping collision avoidance system (CAS) suppliers and end users by detecting incorrectly installed CAS solutions. In this example, unnecessary maintenance costs are alleviated by a brake wear sensor identifying the difference between a worn brake and the housing just heating up.

This sensor sampling, data logging, data analytics and visualisation capabilities go even further, helping inform supervisors about operator skill and performance.

Simple operational aspects like understanding if operators are driving straight into the muck pile when loading – which can result in the no-spin differential not locking or operating incorrectly, and more spin and subsequent wear/damage to tyres and steering cylinders – can also be monitored.

“Through identifying operators and tracking and managing performance, GHH and their customers are able to identify underperforming operators and help them improve through specialised training,” the company said. “This then leads to improved overall performance, increased tonnes per hour and a reduction of unnecessary maintenance costs.”

### A customised approach

When Metso and Outotec merged last year, two leaders in the mine maintenance arena joined forces.

Their decades of aftermarket and service experience – much of which includes applying sophisticated digital tools at site or remotely – came together as **Metso Outotec** to cover the whole process flowsheet.

This offering includes not only solutions to reduce downtime, but also improve process performance with platforms such as the cloud-based Connected Analytics, which is a combination of Metso and Outotec’s legacy platforms Metrics and Asset Analytics. This solution is designed to provide global mining customers with improved visibility and new insights into their equipment and processes through analytics, condition monitoring and predictive maintenance.

Annami Toukoniitty, Senior Vice President, Integrated Service Solutions at Metso Outotec, says the company’s service roadmap is currently focused on the maintenance-related part of the process plant as it continues to offer the biggest potential gains for customers.

The company, since the merger, has prioritised digitalisation throughout the business, with emphasis on developing improved connectivity and remote monitoring; digital customer engagement; connected field experts; and digitalisation of the entire consumables value-chain – from customer operation to the production and even recycling of used materials.

The flagship solution within this offering is the Performance Centers, which are currently based in Santiago, Chile; Changsha, China; and Espoo, Finland. These centres integrate Connected Analytics support, gearless mill drive monitoring, and remote process

optimisation experts into a new collaborative environment, which allows the company to better service its global customers in real time.

This is helped along the way by more than 1,000 active and connected pieces of equipment including crushers and filters, the implementation of over 600 Advanced Process Control and automation projects, as well as more than 315 installations of specialised process optimisation instrumentation. All these on-premise tools can be connected to the Metso Outotec Performance Center for remote diagnostics, troubleshooting and more.

According to Toukoniitty, COVID-19 has strengthened the case for using these remote services.

“The requirements from the industry have changed, and there is more and more willingness to accept technical support remotely,” she said. At the same time, there is an underlying need to deliver



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