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MODERN MINING

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For people who are serious about mining

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- Portable sizer solution for small to medium operations
- Varistem stemming plugs winning the day for mines in SA

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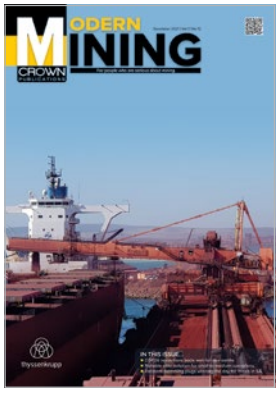

ON THE COVER

Amid an increasing trend to 'sweat' existing assets, mines are leveraging thyssenkrupp Industrial Solutions South Africa's proven expertise in turnkey refurbishment/ revamp projects, allowing them to extend the lifetime of their existing bulk materials handling assets at a reasonable cost, with minimal downtime. See story on page 8.

COMMENT

Talking points for 2021

Munesu Shoko

While the COVID-19 pandemic has had a range of impacts on mining companies, the one thing the past year has taught industry is the value of building resilience to navigate uncertain futures. In what PwC terms a year of doom and gloom on so many fronts in its *SA Mine 2021 report*, the mining sector however delivered a sterling performance with value delivered to all stakeholders.

As supply and demand jostled to find their way back to pre-pandemic levels, demand and prices were the outright winners. With record rand prices for gold, the platinum group metals basket, iron ore and more recently, coal, it was no surprise that the industry's financial performance exceeded expectations on most fronts.

Apart from the industry's proven resilience amid volatility, for me there were several other talking points that shaped the mining industry in 2021. First and foremost was the renewed focus on environmental, social and governance (ESG). There was a time when the industry's stance on ESG issues was a public relations tactic. However, in today's rapidly changing business climate, attention to ESG issues is becoming critical to long-term competitive success.

There is a common understanding that ESG represents one of the mining industry's most significant opportunities for long-term value creation, building trust and sustainable growth. Miners are making significant strides to engage with their stakeholders and start to 'bake' ESG into the core of their strategies. To meet their ESG commitments, mining companies are getting serious about decarbonisation, while they are also working hard to overcome the trust deficit.

Driven by external pressure to reduce greenhouse gas emissions and a strengthening business case for diesel replacement and electrification, many mining companies have been making strides towards decarbonisation. With at least some of the renewable energy sources approaching price parity, the cost of taking action is also said to be decreasing. While the costs of transitioning must also be taken into account, operationally it is now much cheaper to replace fossil fuels with renewables and, in many cases, attain significant economic benefits.

Anglo American Platinum, for instance, recently announced that it had selected a preferred supplier to build a 100 MW solar photovoltaic (PV) plant at its Mogalakwena mine in Limpopo Province, South Africa.

As part of its overall renewable energy strategy, Exxaro Resources Limited, through its wholly-owned renewable energy subsidiary, Cennergi, is developing the 70 MW Lephalale Solar Project that will supply renewable energy to the Grootegeluk Complex, the integrated coal operations owned by another subsidiary of Exxaro, Exxaro Coal, in accordance with a long-term power purchase agreement.

Elsewhere, Gold Fields is forging ahead with the construction of its 40 MW solar plant at South Africa's South Deep mine, west of Johannesburg, following board approval in May this year. This follows the granting on February 25 this year of a licence by the National Energy Regulator of South Africa.

Another key talking point is how the COVID-19 pandemic has further accelerated the digitalisation of work processes in mining. The mining industry is increasingly making use of innovative and cutting-edge technologies to run more efficient operations, to manage risk, to improve health and safety, reduce the cost of maintenance and extraction, as well as bringing about a skills uplift. The COVID-19 pandemic has further accelerated the digitisation of the work process, as well as the adoption of automation and other innovative tools in the mining industry.

At the height of the COVID-19 pandemic, the importance of good health and safety management at mining operations cannot be reiterated enough as the industry presses ahead with its goal for zero harm. Mining companies have strongly shown their commitment to continually evaluate their operating practices to work towards a workplace with no injuries or illnesses. Like most industrial work, mining involves a lot of risk – and getting as close as possible to eliminating that risk and protecting workers always has to be a key priority.

Looking ahead, industry figureheads have this year reiterated how demand for most minerals is projected to be high in order to achieve the energy transition. While fossil fuels have helped to improve living standards around the world for a long time, their associated greenhouse gas emissions have led to global warming.

For instance, a 2021 study by Wood Mackenzie has noted that efforts to limit global warming to 2 °C would require the development of 23-million tonnes of new supply of copper by 2035. To put it in context, this new additional supply is similar to current global production levels.

The study also predicts that the increase in copper demand will last longer than the increase during the super cycle of 2005 – 2015, when the growth was largely due to Chinese demand. The difference is that today copper is essential for the entire planet and does not depend on a single country. The development of this new supply of copper will require an investment of more than US$500-billion. ■

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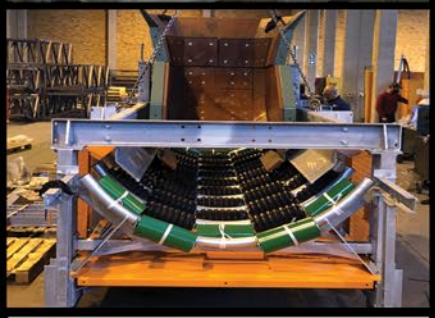

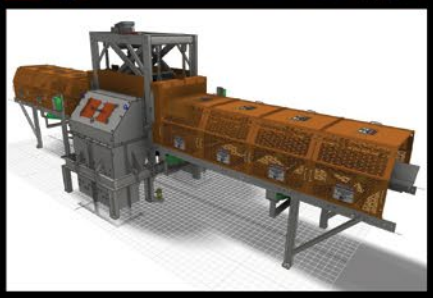

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New investments to extend life of Kangra mine beyond 2031

Coal mining company Kangra, a subsidiary of mining investment company Menar, is nearing the completion of the construction of the Twyfelhoek Adit, which forms part of the Kusipongo coal reserve. Construction started on 6 April 2021 and is on course to be completed by mid-December 2021, with the first coal expected by the first quarter of 2022.

Twyfelhoek has met all the regulatory requirements. The company has allocated a capital budget of R153,6-million to establish the shaft and the project is progressing very well. The access road to the Adit was completed on 13 September 2021 and the powerlines and the water reticulation connection will be completed by mid-December 2021.

Agreements were reached with affected families living within 500 m of the mine to be relocated, and Kangra is in the process of building the families new homes using local contractors. The construction of the new homes will be completed by the first quarter of 2022.

Kangra also invested in new and reconditioned mining equipment to the value of R45-million to mine the Kusipongo reserves. As part of the mine's Social and Labour Plan commitments, a project will commence in the first quarter of 2022 to supply water to the Donkerhoek community. Kangra will invest approximately R20-million into the Social and Labour Plan commitments for the next five years.

"The Kusipongo reserve is located to the west of the existing mining operation and is a natural extension of Kangra's current coal resource. It has a coal reserve of around 41,9-million t and could potentially extend the life of the mine by more than 20 years," states Kangra GM Pierre Louw.

He said that the underground reserves will be accessed through three adits namely: Twyfelhoek, Balgarthan A and B. There is a capital budget of approximately R58.2 million for Balgarthan A and construction will start as soon as all authorisations are approved.

With a mixture of both low and high volatility coal, the Kusipongo reserve will be mined from three sections using a board and pillar method. Kangra is targeting a production rate of 1,44-million t per annum from the underground mining sections and 360 000 t per year from the available opencast areas for the duration of the life of mine.

Once mined from the various shafts, the coal will be trucked/conveyed to the Maquasa East shaft. From here, it will be washed and trucked to the Panbult Rail Siding, which is around 30 km from the mine where it will be railed to the Richards Bay Coal Terminal (RBCT), in KwaZulu-Natal.

Moreover, Louw pointed out that in February 2021, Kangra started mining the Block C opencast section. The Block C opencast pit production will be ramped up to around 40 000 t a month of run-of-mine coal once the establishment of the Twyfelhoek shaft is completed.

"The last couple of years have been challenging for our staff members and the community, particularly when the mine was placed under care and maintenance owing to the onset of the COVID-19 pandemic and the ensuing collapse of the coal price. Many of our employees have been uncertain about their jobs," he says.

He adds: "This was one of the most testing periods in the mine's 64-year history. However, the reopening of the mine in January 2021 and our continued investment in extending the life of mine is indicative of the Menar's commitment to all Kangra's stakeholders including our valued employees, community members, traditional leaders, local authorities, suppliers, and customers." ■

The Block C opencast pit production will be ramped up to around 40 000 t a month of run-of-mine coal once the establishment of the Twyfelhoek shaft is completed.

Successful capital raise to fund DFS work at Dugbe

Hummingbird Resources plc (AIM: HUM) has confirmed that Pasofino Gold Limited has entered a non-brokered private placement of its common shares for gross proceeds of up to US$5,5-million, of which approximately US$4,5-million has been subscribed for by ESAN, a leading Turkish mining company.

Dan Betts, CEO of Hummingbird Resources plc.

The funding provides sufficient capital for Pasofino to complete the feasibility study on the Dugbe Gold Project in Liberia, which is on track to be delivered in Q2 2022. The fund raise follows the Mineral Resource Estimate (MRE) update announced by Pasofino on 22 November 2021 on Dugbe, which confirmed NI 43-101 compliant Measured and Indicated gold resources of 3,4-million ounces.

Pasofino has an earn-in agreement for a 49% stake in the project, with Hummingbird maintaining a controlling interest of 51%.

Dan Betts, CEO of Hummingbird Resources plc, comments: "Pasofino's successful capital raise enables them to complete the DFS work on the Dugbe project and finish their earn in conditions as per our JV agreement. We are particularly encouraged by the material uplift in the Measured and Indicated Resources recently announced by Pasofino, which should pave the way for a robust DFS showcasing solid project economics. Also of particular interest is the material investment by Turkish mining group ESAN who are known to us and who I am sure will add significant value to the project as it gathers momentum from here." ■

Exxaro maintains commitment to United Nations' Global Compact

Exxaro Resources has fulfilled its annual obligations as a signatory of the United Nations Global Compact (UNGC), the world's largest corporate sustainability initiative.

Exxaro recently delivered its UNGC Communication on Progress (COP) document which is a requirement to maintain its status on the voluntary leadership platform which focuses on the development, implementation and disclosure of responsible business practices.

The UNGC is a call to companies worldwide to align their operations and strategies with 10 universal principles in the areas of human rights, labour, environment and anti-corruption and to act in support of UN goals embodied in the United Nations Sustainable Development Goals (SDGs).

Exxaro CEO Mxolisi Mgojo.

Exxaro has been an active signatory to the UNGC since 2007 and every year affirms its commitment in implementing the UNGC principles. In its 2020/2021 COP report, Exxaro reiterates in detail its policies and commitments to the principles of human rights; labour; environmental; and anti-corruption measures aligned with the SDGs.

The COP report points out that Exxaro features in the latest Vigeo Eiris ranking of the 100 Best Emerging Market Performers for its approach and ongoing dedication to social responsibility. The Vigeo Eiris ranking is updated every six months, in June and December and the top 100 performers are selected from over 850 companies in 32 sectors of 31 countries.

Exxaro also ranked third in the Transparency and Corporate Reporting: South Africa 2020 Report among 100 South African companies under scrutiny for transparency and implementation of anti-corruption programmes.

"We take our commitment to the UNGC very seriously. As one of the thousands of participants of the UNGC across the 160 countries, we are pleased to be part of this growing movement to more conscious environmental and social business practices," says Exxaro CEO Mxolisi Mgojo. "We believe and stand for responsible ways of mining and building inclusive partnerships that benefit from responsible mining activities."

As one of South Africa's largest black-empowered resource companies, Exxaro is dedicated to sustainable mining and finding new ways of mitigating negative mining processes as part of its ethical business ethos.

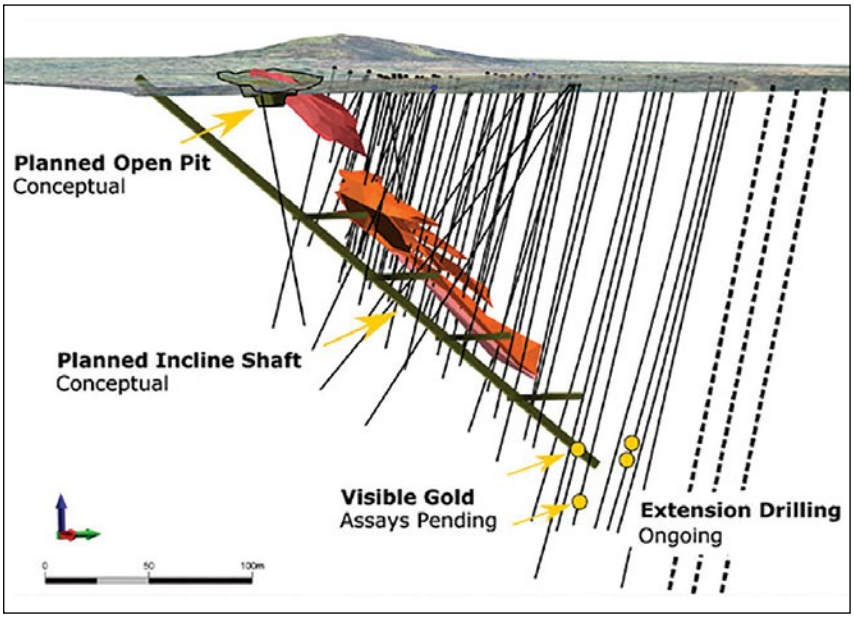
"The SDGs are particularly relevant in South Africa with our many socio-economic challenges. We want to be part of the solutions that create a more just and equitable society which meet the needs of all its people. This vision drives our thinking around all issues of sustainability and making a difference in our host communities, where we have mining and renewable energy operations, and the country at large," says Mgojo. ■

Akobo Minerals maintains its fast development pace at Segele

During the first half of 2021, Akobo Minerals' Segele project in Ethiopia was accelerated by the resource estimate, award of the mining licence and the scoping study. Since receiving the mining licence, resource extension drilling, surface exploration and multidisciplinary project development work has been ongoing to advance the project towards gold production. The fast pace of development has continued since.

Here is a summary of all the results achieved thus far:

- The Segele project has so far an Inferred Mineral Resource of 52 410 ounces gold with an average world class grade of 20,9 gram gold per ton – industry average of 2 – 4 g/t
- The Segele scoping study envisages a very high-margin operation with an operating cost (AISC) estimated to be US$243 per ounce of gold produced – industry average of US$1 000 /oz
- Ground breaking mining license agreement awarded with right to hold funds offshore and repatriate profits from the same accounts
- Since the SRK Resource Estimate a total of 4,739 m in 28 holes of deep core drilling has been completed
- High assay results from 370 samples from artisanal pits around the resource estimate have shown 88,0 g/t, 8,9 g/t, 12,9 g/t and 6,15g/t. New drilling is planned to follow up these results



A conceptual design of the planned mine shaft.

"From the ongoing core drilling we continue to intersect visible gold deeper than the samples used in the Mineral Resource Estimate. Also mine planning is underway to establish optimum ways to extract the mineralisation. From the illustration we see a conceptual design of the planned mine shaft and also an indication of where the latest visible gold has been found," the company says.

The April 2021 inferred resource estimate was calculated using a total of 32 holes of a total length of 3 159 m of drilling at relatively shallow depths. Because the extension drilling campaign now targets mineralisation at much greater depths, the current resource extension drilling requires longer holes to reach the same mineralisation. Going forward the focus will be more on exploring new and shallower mineralized targets instead of only drilling deeper holes. Newly analysed data from artisanal pits indicates possible new targets to the South of the Segele Mineral Resource estimate.

The positive assay results from artisanal pits is an exciting development for the company geologists who have been anticipating the discovery of new gold mineralisation. The reliability of these grab sample results is relatively diminished when compared to the drilling. To upgrade our understanding of these new targets, scout drilling has been scheduled for drilling within the next 2 – 3 months. If the scout drilling and related mining studies is found to be successful, these new targets may provide additional ore to the planned Segele processing plant.

In an important step towards production, Akobo Minerals has started the selection and contracting process for potential contract mining firms. It is anticipated that the contract will be awarded in two stages; underground access and stoping (ore extraction). The first process plant quote has been received and it is anticipated that additional quotes will be received before the end of the calendar year.

Looking forward it is anticipated that there will be two rigs working on Segele extension drilling and infill drilling, and a third rig drilling at new Segele mineralisation. Upon receipt of infill drilling results, resource estimation and mine planning will be carried out – major parts of the delivery of the Prefeasibility study. Within Q1 of 2022, the company intends to award contracts for mining activities and processing plant production. ■

Sibanye-Stillwater SA gold and PGM operations accredited with ISO 45001

Sibanye-Stillwater (JSE: SSW and NYSE: SBSW) has announced that all its South African operations have been accredited with the International Organisation for Standardisation's (ISO) 45001 certification (ISO 45001). The ISO 45001 is an international standard for occupational health and safety certification designed to protect employees and visitors from injury and ill health, as well as to ensure their continued health and safety in the workplace. It provides a framework to increase safety, reduce workplace risks and enhance health and well-being at work, enabling an organisation to proactively improve its occupational health and safety performance.

Commenting on the achievement, CEO Neal Froneman, says: "We are pleased to have achieved ISO 45001 accreditation at both our SA gold and SA PGM operations, which confirms that our safety and health management systems are in line with global best practice. The adoption of global industry best practice certification demonstrates our unwavering commitment to maintaining a safe and healthy environment and community through the implementation of world-class systems. Nothing is more important than the safety, health, and well-being of our employees. We believe that everyone has the right to a safe working environment and that every employee should go home safe and unharmed, every single day." ■

Pan African Resources to list on A2X

Pan African CEO, Cobus Loots.

Gold producer Pan African Resources plc (Pan African) has been approved for a secondary listing on A2X Markets, bringing the number of instruments available for trade on A2X to 58. Its ordinary shares will become available for trade on the stock exchange from 13 December 2021.

Pan African will retain its primary listings on the Alternative Investment Market (AIM) of the London Stock Exchange and on the Johannesburg Stock Exchange (JSE) and its Level-1 ADR programme in the United States (ADR). Its issued share capital will be unaffected by the secondary listing on A2X and its ordinary shares will be available to be traded on the AIM, JSE, its ADR programme and on A2X from 13 December 2021.

Pan African is a mid-tier African-focused gold producer with current production capacity of approximately 200 000 oz of gold per annum. The company owns and operates a portfolio of quality, high-margin operations and projects in South Africa.

Pan African CEO, Cobus Loots, comments, "Pan African has a track record of pursuing innovation and new technologies to generate efficiencies, compelling returns and long-term performance, and our listing on A2X is another example of this. Our investors will now enjoy the benefits offered by A2X, including added liquidity, lower exchange fees and narrower spreads."

Kevin Brady, CEO of A2X Markets says, "We welcome Pan African to A2X. We will help them increase value for shareholders through lower exchange fees and price improvement as well as provide their investors with more choice in trading venues."

Pan African joins mining companies Exxaro, Tharisa and African Rainbow Minerals, which are already listed on A2X. This listing will boost A2X's combined market capitalisation to about R5-trillion.

Implats makes offer to RBPlat shareholders

Impala Platinum Holdings Limited (Implats) has announced its firm intention to make an offer, in cash and shares, to acquire a majority shareholding in Royal Bafokeng Platinum Limited (RBPlat).

The offer amounts to R150 per RBPlat share and comprises a cash amount of R90 (60% of the offer consideration) and 0,30 ordinary shares in Implats (the value of which equates to R60 at the three-day Volume Weighted Average Price (VWAP) of Implats as at the close of business on 24 November 2021).

The offer represents a premium of 80% to RBPlat's 30-day VWAP of R83,51 prior to RBPlat and Implats' joint cautionary announcement on 27 October 2021. Implats currently holds about 70,9-million RBPlat shares, constituting approximately 24,5% of the RBPlat shares in issue. These shares were acquired from existing RBPlat shareholders in terms of permission granted by the Takeover Regulation Panel (TRP) on identical terms to the offer launched on November 29, 2021.

Implats CEO, Nico Muller, says: "The overwhelming response and support of these shareholders is particularly validating of our confidence in the value proposition this offer provides for both RBPlat and Implats shareholders."

Breathing new life into old bulk materials

Amid an increasing trend to 'sweat' existing assets, mines are leveraging thyssenkrupp Industrial Solutions South Africa's proven expertise in turnkey refurbishment/revamp projects, allowing them to extend the lifetime of their existing bulk materials handling assets at a reasonable cost, with minimal downtime, writes *Munesu Shoko*.

As mining companies pore over their balance sheets and all aspects of the business to find every competitive edge, many have found solace in extending the lifetime of their existing assets due to their business and operating circumstances.

Corné van Rooyen: regional GM, thyssenkrupp Industrial Solutions Sub Sahara Africa, Service Mining & Minerals Sales, says there is an increasing trend in the industry to sweat existing bulk materials handling assets, including stackers, drum reclaimers and other stockyard machines.

"We have had many enquiries for mid-life refurbishments, when in fact some of the machines in question are already way past their midlife. Due to the cost and the long lead times associated with new capital projects, customers are choosing to extend the lifetime of their existing machines, and in some instances even look for opportunities to increase capacities," says Van Rooyen.

Some of the machines operating in the field were designed as far back as the 1980s, and because over-engineering was the order of the day back then, most of these machines have room for capacity increase, thanks to more refined engineering practices today.

Centre: thyssenkrupp recently completed a mid-life refurbishment on two 10 000 t/hour shiploaders operating at Saldanha Bay.

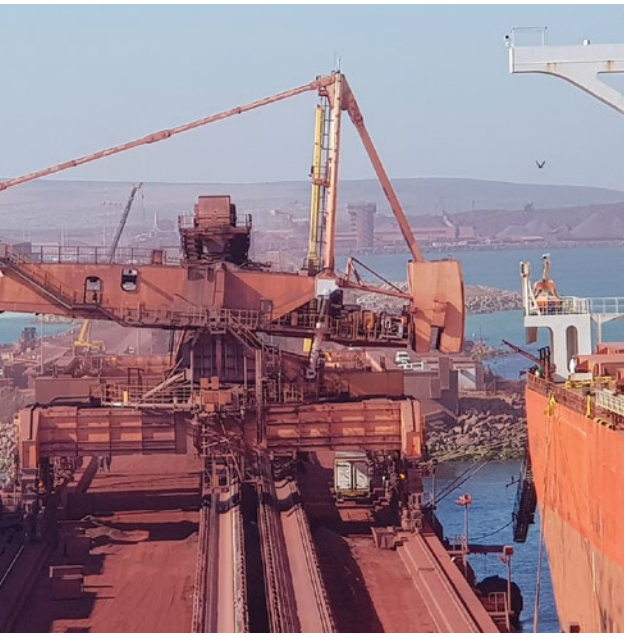
Below: thyssenkrupp recently successfully completed a drum reclaimer refurbishment project.

Capabilities and processes

For a typical refurbishment/revamp project, thyssenkrupp works closely with the client to develop the scope through an initial full audit/inspection on the machine. "It's quite a detailed inspection which looks at every aspect of the machine, including electrical, mechanical and structural, from top to bottom," explains Van Rooyen.

From there, thyssenkrupp will generate a full report that details all that needs to be done on the machine. "It's normally quite a lengthy process, and in some instances it can take as long as three years because you have to do the inspections, develop a scope and then agree with the client on the scope,

handling plants



the costing of the project and finally the client's internal approval process for funding," adds Van Rooyen. He says there is, however, room for clients to shorten the process, if need be, but that is dependent on the clients internal approval processes.

One of the key advantages of dealing with thyssenkrupp is the company's modular approach to revamp projects, says Manshil Singh, area manager Gauteng/KZN/Mpumalanga Region, Service Mining & Minerals Sales. The risk-based approach allows for execution of the refurbishment project in phases, thus limiting machine downtime and reducing the capex pressures on the customer.

"Following an audit/inspection, the findings are categorised according to risk. We would typically remedy issues that are categorised as high risk during the first phase of the revamp. We find that many customers are receptive to this approach because, apart from the limited downtime, there is no large capital outlay for the customer compared with a full-fledged revamp in one go," says Singh.

In terms of value proposition, adds Singh, everything from basic and detailed engineering to manufacturing and supply is done in-house. The competent revamp team executes its work in line with the project management Institute (PMI) guidelines. "We have several members within the organisation who are PMP® certified. Our competitive edge is that we offer a full turnkey solution in-house, with very few functions outsourced. There is a tremendous amount of value that we offer and our customers can attest to the capabilities that we have," says Singh.

Value proposition

Compared with new capital projects, the main benefits of going the revamp route are the reduced lead times and costing. The price advantage, explains Van Rooyen, is as a result of the fact that customers don't have to replace all the structural equipment of the machine, but can only do some necessary repairs on it. In most instances, only a non-destructive test (NDT) would be necessary to check for any stress points or specific items that need immediate attention. For organisations that require a mid- to long-life extension on their equipment, thyssenkrupp would also introduce elements of tribology and Finite Element Analysis.

"It's also an opportunity to address all the electrical system issues and institute modernisation tweaks needed to improve efficiency. A lot has changed since these plants were manufactured," says Van Rooyen.

thyssenkrupp Industrial Solutions South Africa has proven expertise in turnkey drum reclaimer refurbishment/revamp projects.

One of the key advantages of dealing with thyssenkrupp is the company's modular approach to revamp projects.

Flagship projects

Two recent flagship projects undertaken by thyssenkrupp in South Africa, says Van Rooyen, are testimony to the company's expertise and precision in executing large-scale revamp projects.

At one of the projects, the company successfully completed a mid-life refurbishment on two 10 000 t/hour shiploaders operating at Saldanha Bay. Owing to the extreme environmental conditions on the quay where the shiploaders are in operation, explains Francois de Villiers: thyssenkrupp Industrial Solutions area manager – Western Cape and Namibia, extensive structural repairs were done together with the application of a three-coat corrosion protection.

Unpacking the scope of work, De Villiers explains that all the mechanical drives on the shuttle inside the boom, on the slew system and the travel bogies were replaced, as well as the respective variable speed drives (VSDs) as these items were outdated, with limited support from the respective manufacturers.

Latest-technology safety sensors were installed to ensure a safe working environment for both personnel and equipment. No limitations were put to the scope, from software upgrades and the machine control system, to replacing the hydraulic luffing cylinders on the main boom and the cooling systems for the main conveyor belt gearboxes. Consultation with the Saldanha Bay maintenance team prior to the refurbishment resulted in improvements to the design of transfer chutes. Additionally, a cable festoon was also replaced with an energy chain.

De Villiers explains that machines of this nature normally have a first life expectancy of 20 – 25 years, and the Saldanha Bay shiploaders had already clocked 20 years of operation. "The refurbishment work that we did guaranteed 10 more years of operation. Additionally, the phased approach to our revamp project meant that the customer had minimal operational downtime," he says.

Reiterating the importance of uptime on a project of this nature, De Villiers explains that a new shiploader generally is double the cost of a refurbishment. However, the loss in revenue due to a major breakdown of the machine can easily be equivalent or even more than the cost of the refurbishment or revamp.

A second project thyssenkrupp recently completed was a run of mine (ROM) bridge reclaimer revamp project for Sasol's Twistdraai Export Plant. The order was secured in January 2021 and the project commenced by mid-June 2021. Owing to thyssenkrupp's experience and knowledge, expert capabilities, thorough planning skills and understanding of mitigating downtime, the reclaimer was back in operation on time in September 2021.

thyssenkrupp shares a longstanding relationship with Sasol, dating back to 1979 when the first stackers and drum reclaimers were supplied. The bridge reclaimer was first commissioned at Sasol's Twistdraai Export Plant during the mid-1990s in response to a growing export demand for high quality thermal coal.

Costa Hormovas, account manager (Mpumalanga Province) at thyssenkrupp Industrial Solutions South Africa, details the revamp project: "The scope of work was initially determined by our project engineers with the assistance of our field service technicians and finalised in collaboration with the customer. We supplied new parts including chain guides and liners, chain link assembly, scraper blades and guide rollers. We also refurbished the travel guide bogies,

chain drive, take-up assembly, rakes and towers. Once the parts were installed, the equipment was commissioned and the machine was put back into operation on time."

Service and training

thyssenkrupp has over the years established close relationships with its customers, enabled by not only its workmanship, but a strong aftermarket regime. From an aftermarket point of view, the company has a strong regional focus. In South Africa thyssenkrupp has offices in Gauteng, eMalahleni, Lephalale and the Western Cape. This is complemented by regional branches in Zambia, Ghana and Mozambique.

"We try to be as close as possible to our customers, which reduces response times. We have service capabilities across these areas and in case of any issues, we can respond quite quickly. We also try to keep consistency in terms of who goes to see the client from a technical standpoint – this builds history and knowledge at customer operations," explains Van Rooyen.

The company also strives to integrate into its customers' communities. Apart from its technical and aftermarket capabilities, one of the ways it has achieved community integration is through its training regime. In November 2018, thyssenkrupp officially opened its nearly R20-million Technical Training Academy at its Chloorkop, Gauteng base, which not only develops the technical skills the company needs, but has also been central to helping clients meet their skills development initiatives in areas where they operate.

"We have had some instances where customers have asked us to help train artisans from their communities. They are trained in our Technical Training Academy. Once they have gone through our apprenticeship programme, they can be fully employed in the client's business," concludes Van Rooyen. ■

Key takeaways

- There is an increasing trend in the industry to sweat existing bulk materials handling assets, including stackers, drum reclaimers and other stockyard machines
- thyssenkrupp Industrial Solutions has seen an increase in enquiries for mid-life refurbishments
- Compared with new capital projects, the main benefits of going the revamp route are the reduced lead times and costing
- thyssenkrupp recently successfully completed a mid-life refurbishment on two 10 000 t/hour shiploaders operating at Saldanha Bay
- The company also recently completed a run of mine bridge reclaimer revamp project for Sasol's Twistdraai Export Plant

George Bennett, CEO of Rainbow Rare Earths.

COP26 resolutions bode well for rare earths

The resolution that follows the discussions of COP26 will be a crucial factor in the dramatic increase of sustainable forms of energy production. With its Palaborwa Rare Earths Project in South Africa, Rainbow Rare Earths is well positioned to meet the anticipated demand and supply gap for rare earth elements used to make compact high-strength permanent magnets used in the motors of hybrid and electric vehicles, as well as wind turbines powering the 'greener' electrification era for the international community. By *Munesu Shoko*.

The 2021 United Nations Climate Change Conference of Parties (COP26) recently closed with the adoption – by consensus of nearly 200 countries – of the Glasgow Pact, which seeks to increase climate ambition and action by keeping the target of 1,5 °C alive, as well as finalising the outstanding elements of the Paris Agreement.

Importantly, the deal struck has codified new rules to reduce greenhouse gas emissions, including the gradual phasing down of fossil fuel consumption and the reduction of the global carbon market. Key to achieving this will be the advancement of the green revolution, which aims to massively curtail the use of Internal Combustion Engines (ICE) and facilitate the greater utilisation of renewable energies and widespread adoption of green technology. These low-carbon greener technologies, however, have an intensive mineral demand.

Central to demand

Central to this demand are Rare Earth Elements (REE) – in particular, Neodymium and Praseodymium ('NdPr') and Dysprosium ('Dy'), which are used to make compact high-strength permanent magnets used in the motors of hybrid and electric vehicles (EVs) and wind turbines powering the greener electrification era for the international community.

The permanent magnets are also used in aerospace and the defence industries' satellite technology, and, across their varied sector uses, directly impact between US$5-trillion to US$10-trillion in global GDP. As a result, with the projected demand for REE expected to increase as much as 10 times between 2030 and 2040, they have been designated as critical and strategic metals by the US Federal Department of the Interior, the Government of China, and the EU Parliament, as they promote a drive toward greater raw material security and sustainability.

To put this into the UK context, in their letter to the Committee on Climate Change, leading UK scientists noted that, in order to replace all UK-based vehicles with EVs, at least 7 200 tonnes (t) of neodymium and dysprosium would be needed, requiring a 70% increase in annual production.

While rare earths are not rare from a geological perspective, they are not commonly found in economically viable concentrations, and, in addition to being generally low grade, often have high levels of radioactivity owing to the presence of thorium, which increases processing requirements and heightens

The gypsum stacks at the Phalaborwa Rare Earths project.

Rainbow Rare Earths is well positioned to meet the anticipated demand and supply gap for rare earth elements.

safety concerns both operationally and environmentally. Furthermore, 85% of the world's REEs are currently produced by China, which has a significant impact on global supply and demand dynamics.

Meeting anticipated demand

With its exciting project-in-development in South Africa, Rainbow Rare Earths is well positioned to meet the anticipated demand and supply gap. In particular, the high grade and low-cost nature of the Phalaborwa Project, coupled with its anticipated utilisation of the latest, state-of-the-art processing technology, sets Rainbow well apart from its peers in its value and environmental proposition. Rainbow has the near-term opportunity to develop an independent, western rare earths supply chain and become a significant, responsible producer of NdPr, with regulatory oversight.

"The resolution that follows the discussions of COP26 and the affirmation of the Paris Agreement six years in the making to adhere to net-zero carbon emissions, is a crucial factor in the dramatic increase of sustainable forms of energy production. Rainbow Rare Earths is in a pivotal position to provide the foundational materials required to advance this clean technology and the green revolution," says George Bennett, CEO of Rainbow Rare Earths.

"The Phalaborwa project can be brought into production quickly, with low capital and operating expenditure, in an environmentally responsible manner to deliver a high-grade oxide. In the processing of material from the existing gypsum stacks at

Rainbow Rare Earths has announced the commencement of work on the Preliminary Economic Assessment for the Phalaborwa Rare Earths Project in South Africa.

Phalaborwa, we aim to deliver a clean rare earths project, removing environmental liability and redepositing benign gypsum on a new stack, built according to International Finance Corporation (IFC) Performance Standards and Equator Principles.

"The codification of international net-zero carbon targets cements Rainbow's position as company working towards a green future, directly contributing to the alleviation of climate change through a responsible, sustainable, and independent supply chain for REE."

Palaborwa project in detail

The project comprises 38,3-million t of gypsum resulting from historic phosphate hard rock mining and containing rare earth elements with an estimated average in situ grade of 0,43 – 0,45% total rare earths oxide (TREO), based on previous sampling campaigns and supported by assay results, of which some 29,1% comprises high-value NdPr.

Bennett says the rare earths are contained in chemical form in the gypsum stacks, which he expects will deliver a higher-value rare earth carbonate, with lower operating costs than a typical rare earth mineral project.

The project is an earn-in agreement with Rainbow Rare Earths earning 70% on completion of a successful prefeasibility study. The company will enter into a joint venture with Bosveld Phosphates (Pty) Ltd.

The 38,3-million t of gypsum residue resulted from around 60 years of hard rock mining of a phosphate deposit by South African government-owned mining company Foskor (PTY) Ltd. There are trace elements of RE's in the hard rock deposit but not in economic quantities.

The phosphate rock was concentrated via a flotation process to produce a phosphate concentrate slurry (also concentrating the rare earths) which was pumped to a nearby phosphoric acid production plant run by energy and chemical company Sasol Ltd.

"In the production of phosphoric acid, which is used in the fertiliser industry, a lot of heat and sulphuric acid were added, thereby effectively 'cracking' the rare earths in their mineral form to now be found in the gypsum residue (the waste stream of the phosphoric acid production process) as 'cracked' rare earths in chemical form," says Bennett

He says the gypsum residue went through three stages in the phosphoric acid production process to concentrate the rare earths further, before final deposition as gypsum waste on the two stacks at Phalaborwa, now in economic rare earth grades.

"These elements of the asset lead us to believe that we will have a unique low capital intensity project at Phalaborwa compared to other rare earths development projects. We also benefit from very good infrastructure – situated in a large mining town with airport access five minutes away, hard-top freeways to Phalaborwa from Johannesburg, skilled labour force on our doorstep with three operating mines within a 5 km radius; grid power available at the base of one gypsum stack, machine shops and OEM suppliers on our doorstep, and two operating rail sidings at the site."

He says Bosveld Phosphates has made available to the project the existing mothballed phosphoric acid plant. "We have use of their admin offices, workshops, machine shop, storerooms, laboratory buildings, acid storage tanks and more, all of which represents about 20% of the capital for a new process plant infrastructure."

Independent test work carried out to date at ANSTO has confirmed that the phosphogypsum at Phalaborwa is amenable to direct leaching with sulphuric acid for extraction of the contained rare earths. The resultant pregnant leach solution after acid recovery will be a suitable feedstock for purification and separation of the rare earths.

The Preliminary Economic Assessment (PEA), which has already commenced, will compare a conventional route to produce a cerium-depleted mixed rare earths carbonate with an alternative flow sheet that bypasses the carbonate stage and delivers three higher value products, comprising neodymium-praseodymium (NdPr) oxide, terbium (Tb) oxide and dysprosium (Dy) oxide. The results will then dictate the direction for development of a pre-feasibility study.

The scope of the PEA was enlarged from the original plan to include a downstream processing step, as an alternative to the original flowsheet, which will produce a mixed rare earth carbonate.

"This is possible at Phalaborwa as the rare earths contained in the phosphogypsum are in a cracked chemical form. We expect further downstream processing to separate and purify individual oxides to deliver substantial benefits compared to the

traditional flowsheet developed by Sasol and piloted in their pilot plant."

He says the enhanced flowsheet is expected to deliver a higher-value product as it delivers the full value of the separated rare earth metal oxides. By comparison, Rainbow's Gakara project in Western Burundi produces a high-grade mineral concentrate, which has been sold to China for further downstream beneficiation and processing, so realising approximately 30% of the contained rare earths metal oxide value.

"The traditional flowsheet developed by Sasol, on the other hand, would produce a mixed rare earth carbonate, realising between 60 and 65% of the contained metal oxide value, compared to the 100% of the metal oxide value we would achieve by going further downstream to produce separated, individual oxides as a per the enlarged PEA scope of work."

Bennett expects Capex and Opex savings compared to the initial traditional flow sheet to produce a mixed rare earth carbonate for further processing in a dedicated separation facility.

Only the high value rare earths (dysprosium, terbium, neodymium and praseodymium), which represent 95% of the Phalaborwa rare earths basket value, will be separated and recovered. This will enable the company to capture the full benefit of additional value from downstream processing without superfluous capital and operating expenditure which would be needed to separate all the individual rare earth elements present in the stacks.

The outcome of a successful trade-off study will enable Phalaborwa to deliver the increased value of the separated rare earth oxides through a single, low capital-intensity processing plant at the project site.

"Owing to the unique nature of Phalaborwa, we are already able to progress to the downstream beneficiation process by producing a mixed rare earth carbonate, rather than a mineral concentrate," says Bennett. ■

Key takeaways

- ❑ The deal struck at COP26 has codified new rules to reduce greenhouse gas emissions, including the gradual phasing down of fossil fuel consumption and the reduction of the global carbon market
- ❑ Key to achieving this will be the advancement of the green revolution, which aims to facilitate the greater utilisation of renewable energies. The low-carbon greener technologies, however, have an intensive mineral demand
- ❑ Central to the mineral demand are rare earth elements – in particular, Neodymium and Praseodymium and Dysprosium
- ❑ With its exciting project-in-development in South Africa, Rainbow Rare Earths is well positioned to meet the anticipated demand and supply gap

Portable sizer solution for small to medium operations

In line with government's push to empower junior miners and in a move to provide these miners with the premium equipment used on large mines, MMD Mineral Sizing Africa offers a range of mobile sizing solutions that can be deployed to remote locations by standard road trucks. This makes them ideal for small to medium-scale operators in the mining, aggregate and recycling sectors. By *Mark Botha*.

The MMD NaviCore 500.

According to MMD Mineral Sizing Africa's director Janis Lombard, this drive to support junior miners also extends to the coal mining market. He says that, as mines become depleted, it becomes unfeasible for large mining houses to exploit them further, although there is still some life left in these mines, which are generally sold to smaller mining concerns.

"Large mining companies are divesting from coal mining because of the growing preference for renewable energy sources, and financial institutions are becoming reluctant to grant loans for fossil-fuel projects."

He says large mining companies dispose of their coal assets while Eskom, on the other hand, still requires coal to keep the electricity grid operational.

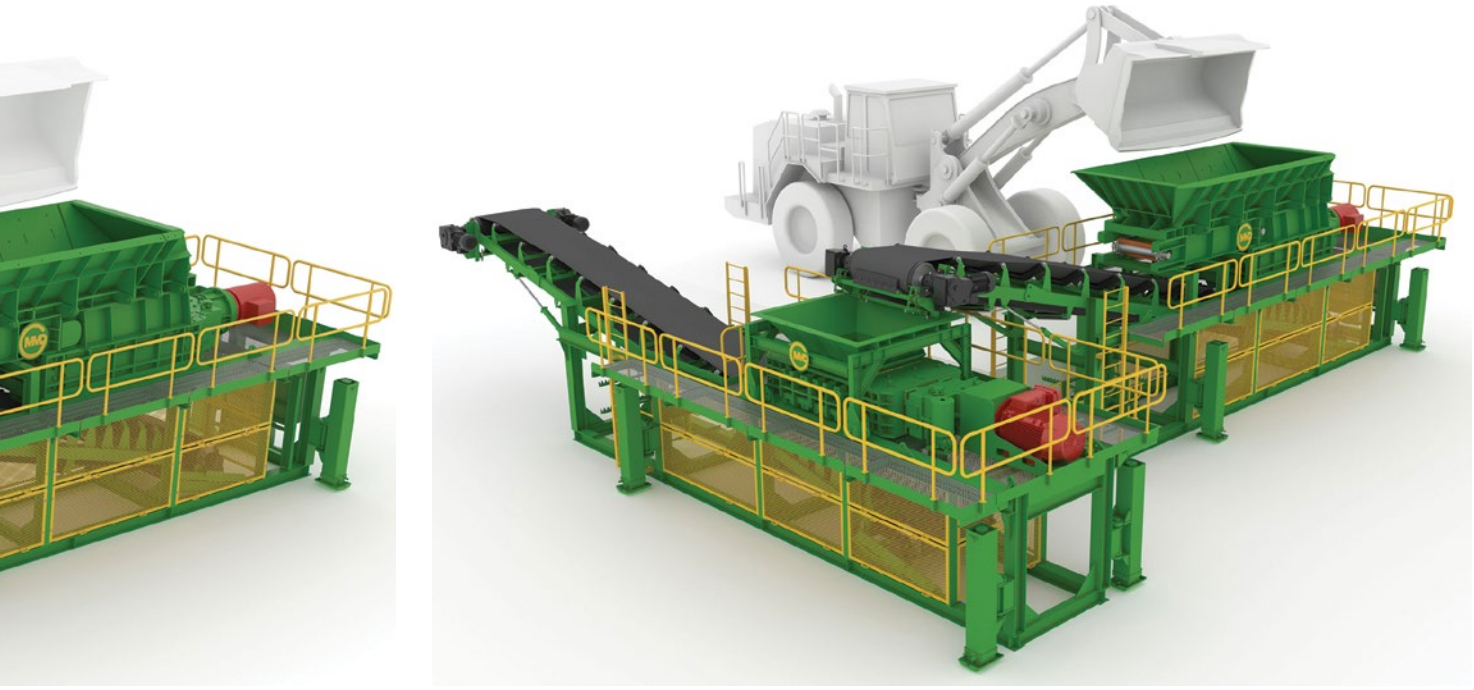
"South Africa's energy sector relies on coal even as we distance ourselves from its use," says Lombard. "This is the void which junior mining companies fill.

"South Africa will be dependent on fossil fuels for a good number of years to come and junior miners don't necessarily have the means to afford proper sizing solutions."

According to MMD business development manager Mark Peeters, "the capex for a mineral sizer is sometimes inhibitive, "so we look to use a different business model where we considered a rand-per-tonne 'contract crushing' basis.

"The idea was to make the solution as cost-effective as possible while having access to premium equipment. All the bells and whistles are stripped out, leaving a lean machine with only the necessary safety requirements."

The MMD NaviCore 150.



The directly-fed unit requires no pre-screening and features a durable, heavy-duty design.

NaviCore 500

To minimise cost, exposure and risk to junior miners, the 500 tph maximum throughput NaviCore 500 mineral sizer is a compact unit featuring a primary sizer able to process any combination of wet, sticky and hard, dry material.

The directly-fed unit requires no pre-screening and features a durable, heavy-duty design; optimised throughout with a variable-speed chain feeder; optional folding walkways for safe inspection and maintenance, and optional hydraulic legs for faster setup times without the need for an installation crane. The 36 t unit (including all optional equipment) with its operating height of 4,65 m, produces accurate product size with limited fines production.

"When partnered with a conveyor system, this sizer unit enables efficient conveyor haulage directly from the mine face," says Peeters. "It works directly with the excavator while sizing and delivering conveyable material on to the conveyor haulage system, so eliminating the cost of running trucks."

At the core of the unit is the fit-for-purpose twin shaft mineral sizer featuring only elementary auxiliaries to size the ore to specification.

He says the NaviCore 500 with its feed size of up to 500 mm and nominal product size of between 100 mm and -180 mm (depending on the material) is intended for use with front-end loaders on smaller operations of up to 500 tph.

"In terms of primary selection, 500 mm rocks are sized down to 150 mm after which a secondary NaviCore 150 can be used to size the ore to -50 mm, which is in line with Eskom's specification," says Peeters.

Where only primary crushing is needed, a single unit will suffice but where secondary crushing is called for, either a single secondary crusher or both systems can be used in tandem for primary-secondary crushing.

"We are looking at various financial models for the NaviCore fleet," says Lombard. "It can be sold as a unit for either contract mining or for use by the junior miner themselves.

"A second option is a build, own, operate and maintain solution whereby the client makes the financial investment but MMD supplies operational support. We can also provide an operator together with the unit." The third option, says Peeters, is for the client to own and operate the unit while MMD takes care of the maintenance.

The NaviCore system features a variable-speed chain feeder to lower cost and increase compactness. The feeder, which can be fed from either side, eliminates material surges and provides a point of control as it can be sped up or down.

The unit also features an MMD 500 Series primary mineral sizer and a hydraulic folding conveyor which facilitates quick setup, take-down and relocation. ■

Key takeaways

- ❑ The NaviCore System of mineral sizers is a compact unit featuring primary or secondary sizers, able to process any combination of wet, sticky and hard, dry material
- ❑ The unit also features a proven MMD Mineral Sizer and a hydraulic folding conveyor which facilitates quick setup
- ❑ The 36 t unit (including all optional equipment) with its operating height of 4,65 m, produces accurate product size with limited fines production
- ❑ With its feed size of up to 500 mm and nominal product size of between 100 mm and -180 mm (depending on the material), the NaviCore 500 with is intended for use with front-end loaders on smaller operations of up to 500 tph

The New Astec: from decentralised business

Until recently, Astec operated a number of businesses under a decentralised business model. Over the past several months, the company has introduced a centralised approach, taking 19 different companies serving a variety of markets, commodities and applications, and bringing them together under the Astec name. By *Mark Botha*.

Malachy Gribben, commercial director at Astec brand Telestack says, "We want to bring a consistent approach to the marketplace for our stakeholders. Dealing with any of these 19 companies brings the same experience in terms of client interaction and engagement with Astec."

Astec has regional offices in South Africa, Brazil, Chile, Australia and Thailand.

"Our regional structure brings a local approach to our businesses around the world and brings us closer to our customers while retaining our global expertise," says Gribben.

Materials handling

One of the groups within Astec Industries is the Materials Solutions Group, a number of companies specialising in crushing, screening, washing, classifying and material handling equipment which, in the past, was a value-added feature of the company's materials processing platform.

"We have seen, especially through Telestack over the past few years, a shift in how customers handle their materials in the mining, aggregate, seaport and terminal markets, which we serve. In the past, traditional earthmoving equipment such as haul trucks and way loaders were used at mines and quarries while, in the seaports and terminals industry, stationary cranes and mobile harbour cranes were used to move and handle material. In all sectors we serve, there is a greater focus on handling materials using conveyor solutions. Astec capitalised on that by investing heavily in material handling solutions."

Using conveyor material handling solutions from Astec involves fewer people in the material handling process, as fewer or no trucks are needed or being driven on site. Instead of having drivers for each individual vehicle, a conveyance system requires one operator only.

"Many customers, especially in the mining and aggregate spaces, are working to maintain their environmental, social and governance (ESG) responsibilities. Our conveyance systems are a move away from diesel-hydraulic technology and the reliance on diesel for fuel. Our electric conveyors are much quieter and produce fewer emissions than diesel-hydraulic earth moving equipment.

"We believe that much of the materials handling focus over the next few years will be based on ESG strategies and the need to perform well in terms of ESG. This is one of the reasons why Astec

The Titan T1800-6 Bulk Reception Feeder – the largest mobile bulk reception feeder in the international market. Fed by a CAT777 payload truck, the Telestack unit loads barges at rates of up to 2 000 tph.

model to one consolidated company

Telestack drew upon its expertise in the mining sector to provide a custom designed heap leaching solution for Sary Arka without the high upfront or running costs typically found in more traditional methods of heap leaching.

is enhancing its material handling offering. While material processing still constitutes the lion's share of our business, material handling is becoming more prevalent," says Gribben.

Telestack

Telestack started in 1985 as a manufacturer of equipment for the asphalt concrete patching industry in Ireland and the UK. In 1999, the company's owners explored new telescopic conveyor technology, which was accepted in North America at the time but relatively unknown outside the USA.

In 2008, the company was part of a management buy-in and experienced subsequent growth. The business was sold to Astec in 2014 and accelerated its growth.

Telestack primarily focuses on material handling in a diverse range of market sectors with similar applications. A large part of the business, says Gribben, is focused on seaports and river terminals where the equipment is used to stockpile dry bulk material with free-flowing characteristics such as aggregate, coal, copper, bauxite and manganese, reclaim it from the stockpile and to load it on to seafaring vessels.

"We've invested heavily in mining over the last four to five years," says Gribben. "We received enquiries from small mines and large mining companies alike and we realised that we had some unique products that would benefit the mining industry."

He says the solutions for mining are centered around reclaiming the commodity onto overland conveyor systems or from stockpiles onto mobile link conveyor systems to build larger stockpiles – the first step in the 'pit to port' chain.

"The mining commodities that we handle in Africa are largely for export, so Telestack's solutions are used at both the mining site and at the port to get the commodity onto seafaring vessels," says Gribben.

In Africa, Telestack has installed a conveyance system for South African railway company Transnet, to handle primarily iron ore and manganese for export from the country.

"In Nigeria, we have a large project with the Dangote Group, which is using our equipment as part of a new facility for importing and exporting dry bulk material," says Gribben.

Products for Africa

He adds that Telestack views Astec as a "huge opportunity" for its solutions for the mining industry, in terms of both processing and materials handling.

"With the regional structure in Africa and the Middle East, we are a lot closer to our customers," he says. "In the last ten years, we have sold equipment into the Democratic Republic of Congo, Egypt, Gana, Guinea, Ivory Coast, Liberia, Libya, Mauritania, Morocco, Nigeria, Sierra Leone and South Africa."

"To us, Africa is a fast-moving emerging economic power. Our solutions are beneficial to the African economy because its capital and operating costs are low, giving clients a more competitive cost base to allow them to compete on the international market when they're selling their product."

He says that, when funders see that a small mine in Africa wants to use a Telestack solution, and they see the same solution being used by Rio Tino in Australia, for instance, they have the confidence that the client is buying a proper solution for their business. ■

The HF24 hopper feeder from Telestack is a 3 000 tph heavy-duty unit suited to stockyard management of specifically iron, copper, gold or bauxite ores.

Customised conveyor solutions to suit individual applications

With full conveyor design and project execution capabilities, NEPEAN Conveyors, a privately-owned Australian company specialising in the design, in-house manufacture, installation and servicing of overland, underground and surface belt conveyor systems and bulk materials handling equipment and projects, can provide customised conveyor solutions to suit individual client requirements. By *Mark Botha*.

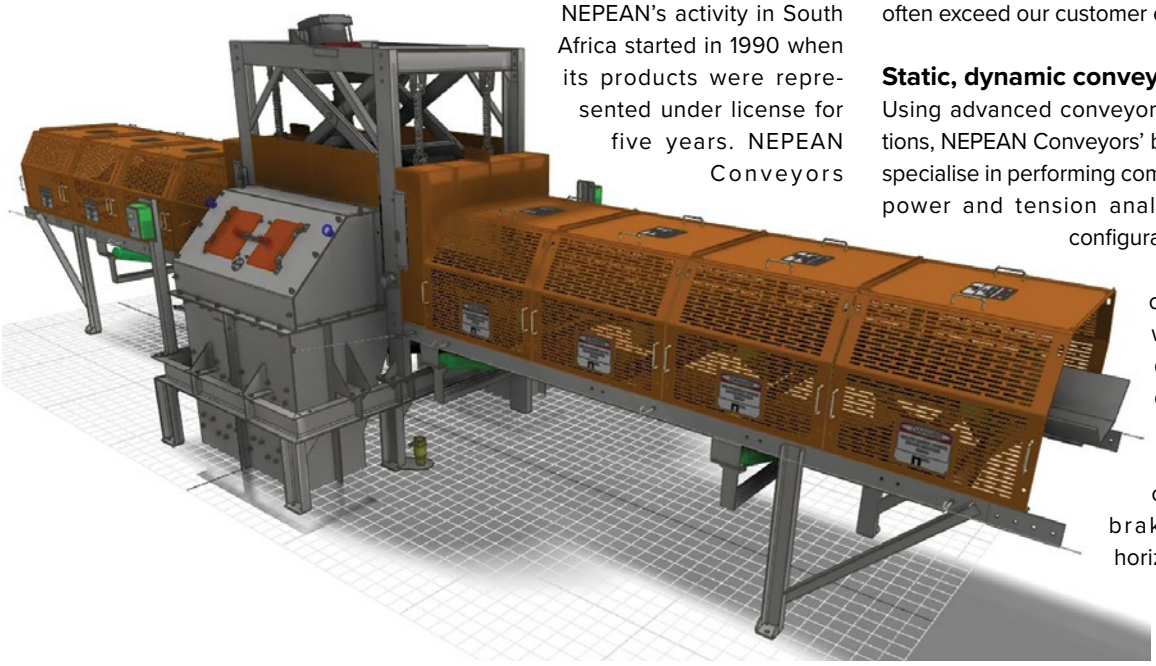
NEPEAN Conveyors South Africa GM Willem Niemandt (left), and sales manager Jacques Steyn.

The company's divisions comprise General Engineering Services, Building & Infrastructure Products, Transport Equipment and Mining Products and Services, of which NEPEAN Conveyors is a subsidiary.

According to NEPEAN Conveyors South Africa GM Willem Niemandt, the company acquired the Sandvik conveyor component business in 2017. Subsequent to the acquisition, the Prok, Gurtek and Roxon component brands, which had been traded as Sandvik brands, were rebranded as the Australian Prok, German Gurtek and Finnish Roxon brands respectively.

Other subsidiaries under Mining Products and Services include NEPEAN Longwall, NEPEAN Power PROK, GURTEC AND ROXON. The company's Johannesburg-based South Africa office focuses on conveyors, including overland, plant, surface and underground, belt and conveyors, belt feeders, constant tension winches, as well as belt maintenance equipment such as belt clamps and splicing stations. It supplies markets in Australia and Africa.

A 3D model of a diverter plough.



NEPEAN's activity in South Africa started in 1990 when its products were represented under license for five years. NEPEAN Conveyors (Pty) Ltd. was founded five years later and is now well established in coal and hard rock mining in both surface and underground applications.

"We have full conveyor design and project execution capabilities and, given our experience and proven designs, we're able to provide customised conveyor solutions to suit individual client requirements," says Niemandt. "Our local drawing office uses the Autodesk Suites, and is supported by experienced and certified engineers."

He says all work is followed up with an in-house quality system that fully integrates with the client's needs. The company's plants in Australia are ISO 9001 listed companies while NEPEAN Conveyors South Africa is ISO 9001 accredited.

"Our systems engineers are constantly improving standard and specialised products through close interaction with customers and suppliers, and by adopting industry best practice," says Niemandt. "With all facilities accredited to relevant ISO 9000 quality standards, our processes and practices conform to ensure products and services meet and often exceed our customer expectations."

Static, dynamic conveyor calculations

Using advanced conveyor design software solutions, NEPEAN Conveyors' belt conveyor engineers specialise in performing complex static and dynamic power and tension analysis for all conveyor configurations.

"Our team has decades of design experience with some of the most difficult and complex conveyor systems in the world, with an intimate knowledge of transient loads, braking, regeneration, horizontal curves and intermediate (tripper) drives for long overland, surface and underground

conveyor systems," says NEPEAN sales manager Jacques Steyn.

Conveyor engineering design

He says that, in terms of discreet element method (DEM) material flow analysis, the company uses state of the art DEM technology, and its engineers can simulate the motion and effect of a large range of small particles quickly and accurately.

"Our bulk flow analyst software is extremely flexible and can handle a wide variety of material properties and geometries including conveyor transfer chutes, feeders, bucket elevators and others. When combined with good engineering knowledge and design experience, this provides a reliable tool to predict material flow," says Niemandt. He says the bulk flow software is used to identify potential problems before full implementation, thereby minimising chute blockage and spillage, as well as belt and chute wear.

"It is troubleshooting by simulating the product behaviour by means of a visual representation of how product may flow."

Key project

The company was approached by a South African client to design heavy-duty belt feeders for a gold mining application. According to Niemandt, the longest belt feeder was 12 m in length and 2,1 m wide for the heavy-duty run of mine gold application.

"This was a one-off project designed and built to spec in order to operate at -35°C," says Niemandt. "All primary structures and the materials used had to be tested to ensure we meet the required impact strength at low temperatures and we had to reassess the gearboxes, pulleys and the types of lubricants used, among others."

The feeders, which were designed, manufactured, fully assembled and tested at the Johannesburg facility, are to be sent to Kazakhstan where a NEPEAN supervisor will oversee their construction.

"In terms of customer support, we are part of the commissioning and hand-over and we do maintenance and inspection on site after the installation, depending on the client's requirements. We have dedicated technicians for OEM parts on standby."

Niemandt says that, regardless of the project size or nature, NEPEAN provides dedicated project managers for contracted projects to provide the most timely and effective response to demanding and changing project requirements.

"Our project managers work with the client and develop a strong relationship, which is paramount to project delivery. Our project management team has a successful track record when it comes to client satisfaction. Project managers are given full authority for the overall management of the project including scope control, schedule, cost, risk, planning, communications and deliverables.

A feeder built by NEPEAN.

Other projects

Other projects recently completed by NEPEAN Conveyors include multiple underground trunk conveyors for one of the collieries in South Africa's Mpumalanga province, including transfers, drives, take-up systems with winches, loading and non-loading tail ends.

"We also designed and supplied twelve in-plant conveyors for a crushing and screening plant for a local quarry," says Niemandt. "With our standardised conveyor approach these conveyors were pre-assembled in our workshop and erected on site by the client's subcontractor in just seven working days, using a single mobile crane and a crew of five.

"We completed the designs and are currently manufacturing a series of conveyor belt diverter ploughs, head ends and tail ends for NEPEAN Australia."

He says the company manufactured a series of extendable conveyor modules for one of the big opencast coal mines where it made some design changes to improve the manufacturing processes and also allow improved galvanising quality.

"Our parts and service department continues to service and refurbish components such as our Eddy Current Winches and BOSS couplings – some of these having been in service for 15 and even 25 years." ■

A NEPEAN standard plant conveyor.

Key takeaways

- ❑ NEPEAN Conveyors is a privately-owned Australian company specialising in the design, in-house manufacture, installation and servicing of overland, underground and surface belt conveyor systems and bulk materials handling projects
- ❑ The company acquired the Sandvik conveyor component business in 2017
- ❑ Using advanced conveyor design software solutions, NEPEAN Conveyors' belt conveyor engineers specialise in performing complex static and dynamic power and tension analysis
- ❑ The company's project managers work with the client and develop a strong relationship, which is paramount to project delivery

Varistem stemming plugs winning the day for mines in SA

Having initially experienced a slow uptake in the South African mining sector, Varistem® stemming plugs have seen an amplified adoption rate since ERG Industrial secured distribution rights in mid-2019. With mines fast realising the massive benefits offered by this technology, Eugene Preis, MD of ERG Industrial, tells *Modern Mining* that the rate of adoption has increased tenfold in the past two years, despite the documented COVID-19 challenges. By *Munesu Shoko*.

Of the various products that have come to market to improve blast performance, flyrock control and downstream productivity, stemming plugs have been looked upon with some scepticism. However, ERG Industrial, a young company that in 2019 acquired the distribution rights of the Varistem stemming plug range from United States company, MOCAP, has for the past two years proven that the technology is an opportunity to increase blasting efficiency for mines and quarries.

"Initially, the uptake of Varistem stemming plugs in the local South African market was slow. Since we started supplying Varistem to the South African market in mid-2019, the rate of adoption of the product has increased tenfold, despite the challenges of COVID-19," says Preis. "Stemming devices have generally been met with great scepticism, largely due to past products not delivering on their promises, as well as the market's general aversion to 'new' technologies," he adds.

Local quarries were the first to adopt the technology and quickly saw the benefits – significant reduction in flyrock and secondary breaking, as well as the significant improvement in fragmentation and total operating costs. "After several Varistem trials at various sites proved the technology's worth, mines started following suit," says Preis.

ERG Industrial has seen an increased uptake of its Varistem stemming plugs in the SA mining sector.

Case studies

ERG Industrial has already proven the benefits of the technology on several South African mines. For example, from November 2019, the company has been supplying Varistem stemming plugs to a coal mine in Mpumalanga, South Africa, where the customer initially contended with high airblast. ERG was mandated to reduce airblast by using Varistem to improve containment of the shockwave energy that causes airblast. The 165 mm-sized Varsitem plugs successfully reduced airblast by between 61% and 71%, resulting in better legal compliance for the customer and less damage to surrounding infrastructure.

In September this year, ERG was approached by yet another coal mine in Mpumalanga to help improve cast by using Varistem to optimise energy retention. Using the 171 mm Varistem plugs, cast improvement of up to 87% was achieved, resulting in a reduction in total costs to expose coal.

In March 2021, ERG successfully supplied its Varistem plugs to a metalliferous project in the Northern Cape. At this particular project, the customer struggled with poor fragmentation, and turned to Varistem to reduce fines and oversize. Using the 171 mm Varistem plugs, ERG was able to reduce topsize by 35% and fines by 10%, while improving uniformity of fragmentation through improved energy retention.

At the same project, ERG in March 2021 supplied

Eugene Preis, MD of ERG Industrial, at one of the mines where the Varistem stemming technology has been adopted.

its 171 mm Varistem plugs to help the mine reduce the cost of mining waste on site. Key performance indicators for ERG included the reduction of direct drilling and blasting costs by expanding the drill pattern and using the Varistem to improve energy retention. In the end, drilling and blasting costs were reduced by 11%, translating into a net saving of R28-million per annum.

How it works

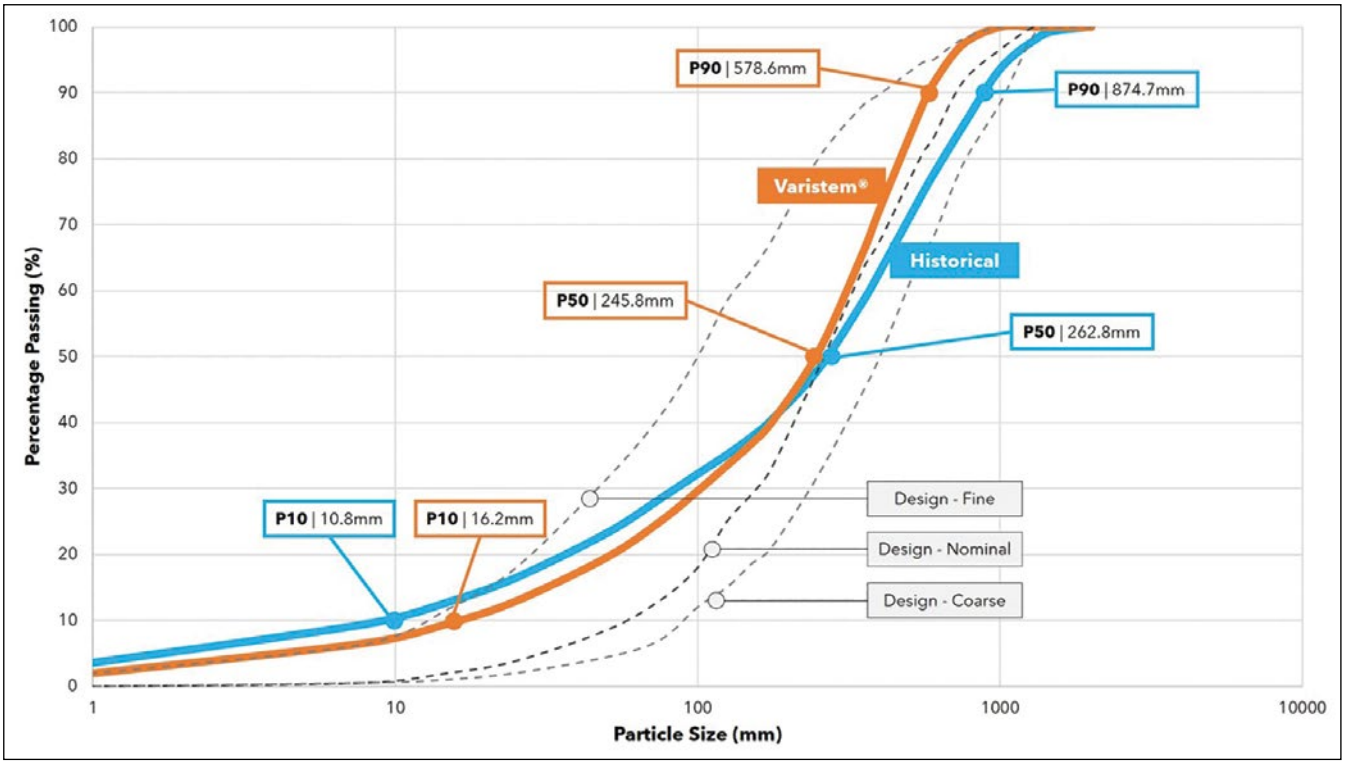
Plugs work by creating an additional blocking effect within the drill hole when blast energy is released, directing more energy into the block and less energy upwards out of the drill hole. Upon detonation of the explosives, the plug is forced upward into the stemming material and "locks up". The explosives gases and energy are prevented from travelling (venting) up through the drill hole.

Typically, the loss of explosive energy through stemming ejection reduces the performance of the blast. The fundamental theory promoting the use of blast-improvement and containment plugs is that they improve the effectiveness of stemming material in the blasthole. As a result, this better contains the explosive energy within the rock mass and yields a more controlled and efficient blast.

The plugs contain blast energy for longer, resulting in a range of benefits depending on how they are incorporated into the blast design. Preis says better blast energy retention results in improved fragmentation, and this has a significant positive knock-on effect on downstream productivity, costs and profits.

Getting your fragmentation right is substantially

The plugs contain blast energy for longer, resulting in a range of benefits depending on how they are incorporated into the blast design.



Historical versus Varistem particle size distribution curves.

cheaper than having to do secondary blasting or mechanical breakage," he says.

In some cases globally, Varistem has achieved up to a 25% increase in fragmentation, which in turn reduces crushing costs and increases crusher throughput. Independent studies also show that the Varistem can increase blast pattern spread by 10% or more, with the same fragmentation for major savings in drilling and explosive costs.

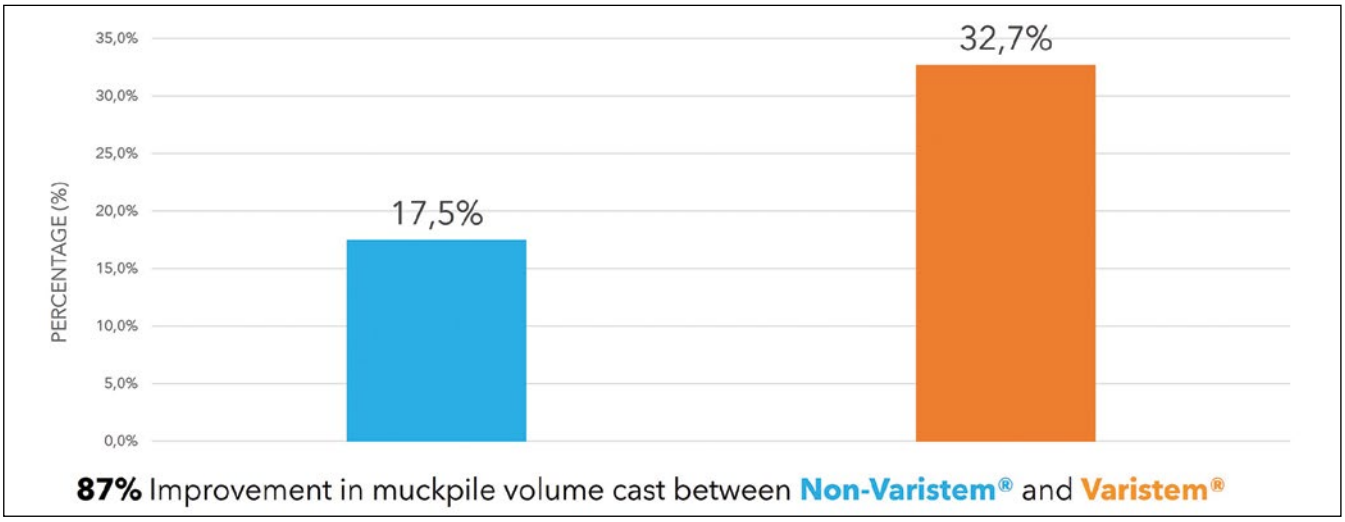
Key takeaways

- Since mid-2019, ERG Industrial has seen increased uptake of Varistem stemming plugs in the South African mining sector
- Local quarries were the first to adopt the technology before mines followed suit
- In September this year, ERG helped a Mpumalanga coal mine to improve cast by up to 82% using the 171 mm Varistem plugs
- Using its 171 mm Varistem plugs, ERG was recently able to reduce topsize by 35% and fines by 10% at a metalliferous project in the Northern Cape

Outlook

Looking ahead, Preis sees the uptake of Varistem increasing exponentially over the next couple of years as the general sentiment on stemming plugs changes and the significance of proper energy confinement moves to the fore.

"Results speak volumes, and consistently delivering results is the only real way to get rid of a historically negative perception on stemming plugs/devices. Varistem is consistently producing the results for an ever growing list of customers (in South Africa, Africa and across the world), and this is the start of widespread adoption of devices that improve energy retention," concludes Preis.



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Ralf Hennecke, MD of BME.

Blast innovator keeps its eyes on the mining efficiency prize

As the quality of blasting improves with evolving digital and emulsion technology, Omnia Group company, BME, notes that mines become more efficient, competitive and sustainable.

Ralf Hennecke, MD of BME, says that as a key early step in the mining value chain, better blasting means better mining and processing. Hennecke highlights how electronic detonators have transformed the blasting process – paving the way for digital technologies that have brought blasting into the Fourth Industrial Revolution. The digital journey has included a revolution in blast planning and execution, where sophisticated software can now create complex blasts which optimise both volume and control.

"These blast plans leverage the power of electronic detonators, which can be precisely detonated to within milliseconds of each other for optimal impact," he says. "Such plans can take into account each ore body's detailed geology as well as the mine's preferred blast outcomes."

These might include catering for the social environment beyond the mine, and even nearby infrastructure, as controlled blasting is able to reduce impacts such as vibration, dust and fly-rock. To enhance safety and reliability, the software also allows blasts to be simulated before they are applied on the bench. Various checks and improvements can be applied to fine-tune the design and achieve a perfect blast. The application of digital tools also means that more data related to each blast can be gathered, stored, and analysed.

Electronic detonators provide precision, reliability and flexibility of blast timing.

Ongoing improvement

"The ability to analyse blast data opens the door to more effective continuous improvement – as we can review results in detail and assess how well the blast plan met our expectations in practice," he says. "This principle applies to various on-mine processes; as a result, the impact of good blasting practice on mineral processing, for instance, can also be analysed more readily through detailed data from both processes."

Through the precision, reliability and flexibility of blast timing ushered in by electronic detonators and initiation systems, each blast can be optimised. By achieving good fragmentation and clearly separating ore from waste, mines can make their loading, comminution and extraction functions more efficient.

"Mines consume a high portion of their energy needs in loading, hauling, crushing and milling," he says. "Better fragmentation leads to lower energy consumption in these phases – which reduces the consumption of electricity and diesel, while also reducing the mine's carbon emissions."

Modern electronic accessories and digital tools also create the opportunity to use more detonators in a single blast, and to energise larger volumes of explosive. These large blasts –where BME regularly breaks world records – are themselves an efficiency booster, says Hennecke. The fewer blast cycles a mine can achieve, the less downtime it must endure; overall productivity can be raised, with positive bottom-line impacts.

Real-time data

"Digital technologies have also improved our ability to measure our performance in real time – such as exactly how much emulsion is being pumped into blast holes," he says. "Data from our smart mobile manufacturing units, for example, can be gathered

feature

and transmitted immediately from the field."

Cloud storage facilitates the feeding of a data stream into analytical platforms, giving mine management instant access to valuable information – thus improving the quality of decision-making and speeding up response times. This does imply, however, that the digital systems used in blasting are compatible with the related systems that mines have already chosen to monitor and control their operations.

"This high level of integration has become a priority to leading companies like BME," he says. "To integrate our digital systems with our customers', we have developed a depth of in-house technical expertise in developing and adapting digital technology."

The company's integrated software portfolio, Blast Alliance, is an indication of this. It includes its BLASTMAP blast planning software, its XPLOLOG data capturing solution and its Blasting Guide app.

Safety, environment

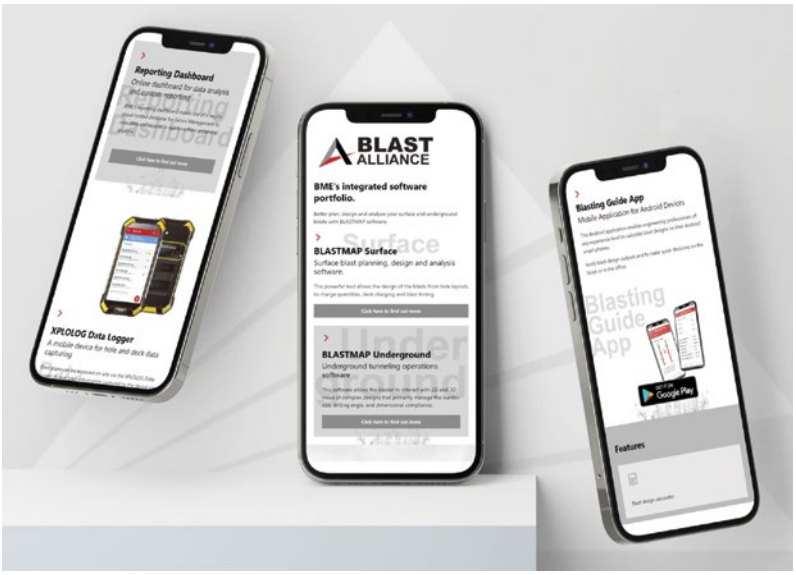
Innovation in emulsion products also continues, with both safety and environmental sustainability front-of-mind. With emulsion explosives now the dominant blasting medium in opencast mining in most parts of the world, mines are looking to gain a range of benefits. Hennecke notes that emulsions have long been the safer option to store, transport and manage – as they are inert until sensitised in the blasthole.

"Mines have recognised the safety and logistical benefits of moving and storing emulsions around their sites," he says. "A safer environment makes for a more streamlined and efficient operation, with less risk of harm and stoppages."

Having pioneered the production and application of cold emulsions in South Africa, BME has continued to evolve its growing range of emulsions. The dual salt emulsions pioneered by BME are less carbon-reactive – so formulations can be adapted to minimise the carbon fumes generated by the explosion. This gives the product clear environmental benefits for mines looking to reduce their carbon footprint.

BME also incorporates used oil as the fuel agent in its emulsions – thereby disposing safely of customers' used oil on site and ensuring that this oil does not contaminate water or soil. This saves mines the cost of specialised waste companies regularly disposing of their used oil from machinery and equipment.

"Emulsions also do not dissolve in water like ANFO does, so emulsions are much less likely to contaminate the water it encounters," he says. "There is also an energy-efficiency benefit that emulsions bring, as they have a high energy factor, allowing for less product to be used to achieve the same rock breakout force."



BME's Blast Alliance allows users to better plan and analyse their blasts.

Beyond opencast

While the opencast sector has been the dominant user of emulsions and electronic detonation systems, there are many underground applications – particularly where massive mining methods are employed – which have shifted away from ANFO and cartridge explosives. The large-diameter, deep blast holes in opencast mining certainly enhance the economies of scale, says Hennecke, but using emulsions underground has safety and operational benefits.

"In addition to the safety of handling emulsion underground, it can also streamline the mining operation if it is applied with the right infrastructure," he says. "A dedicated, closed-loop system for transporting emulsion from surface to the underground workings has already shown itself to be successful."

BME has developed and installed such a system in a South African gold mine, where a vertical pipeline transfers the emulsion directly from surface. This means it does not take up any shaft time and can be stored underground and transported to the face by special equipment.

Innovations in blasting are continuously being developed, he concluded, with a focus on digital capability that drives productivity – as well as emulsion technologies that enhance safety while helping improve the mining industry's environmental performance. ■

Key takeaways

- ❑ As a key early step in the mining value chain, better blasting means better mining and processing
- ❑ Electronic detonators have transformed the blasting process – paving the way for digital technologies that have brought blasting into the Fourth Industrial Revolution
- ❑ Through the precision, reliability and flexibility of blast timing ushered in by electronic detonators and initiation systems, each blast can be optimised
- ❑ Innovation in emulsion products also continues unabated, with safety and environmental sustainability front-of-mind

Differential GPS brings much needed

AECI Mining Explosives' new, high-accuracy (sub-1 m) Differential Global Positioning System (DGPS) brings autonomy to the blast hole tagging process, thus maximising efficiency by eliminating potential human error on the bench and ensuring integrity of drill and blast operations.

AECI Mining Explosives' product manager Ashlin Pillay.

Safety and good fragmentation are two parameters of principal significance in any blasting process. With AECI Mining Explosives' DGPS, a new addition to the IntelliShot system, potential human error from incorrect blast hole identification or incorrect delay assignment can be a thing of the past.

The timing process is predisposed to human error, with incorrectly marked blast holes resulting in incorrect delay assignment. The process of identifying the location of the unconnected hole is thus time consuming, while incorrect timing may compromise fragmentation and downstream operations.

By introducing an increased level of autonomy to the blast hole tagging process, explains product manager Ashlin Pillay, DGPS enables faster blast deployment, greater accuracy and increased efficiency. Although the system is currently still semi-autonomous, AECI Mining Explosives envisages that the technology will enable fully autonomous

The addition of the DGPS to the already proven IntelliShot electronic initiation system thus brings the industry a giant leap closer to autonomous blast hole identification and loading.

feature

autonomy to blasting

deployment and tagging in the near future.

The significance to the customer is improved safety and fragmentation. Uniform fragmentation to the customer's desired size contributes massively to efficient blasting and offers increased efficiency throughout the beneficiation process.

High precision

The system's major talking point is its high accuracy. Conventional global positioning systems (GPS) use fixed point receivers, where the location is directly calculated, whereas DGPS requires a GPS receiver to be set up at a known location as a reverence. Coordinates of the fixed point are then surveyed and marked from where a much higher level of accuracy can be achieved.

DGPS is capable of achieving sub-1 m location accuracy. The high level of precision is a result of the inherent design that mitigates signal degradation. The addition of the DGPS to the already proven IntelliShot electronic initiation system thus brings the industry a giant leap closer to autonomous blast hole identification and loading.

Benefits abound

Increased safety, through its ability to protect against human error, is another major value addition of this technology, says Pillay. Blast hole coordinates along with the respective detonator delays are downloaded onto the Tagger to prevent the user from incorrect delay assignments on the bench. The response to blast hole location and fault-finding are made simpler, faster and safer. Additionally, the tagging process does not need to follow a specific tagging path.

The DGPS module can be retrofitted onto existing AECI Mining Explosives CE4 Taggers, while the company foresees the extension of this capability in that DGPS modules could fitted to other equipment such as drill rigs or a Mobile Manufacturing Unit's auguring arm. This provides end users with accurate position data that can be fed back electronically via AECI Mining Explosives' IntelliShot control equipment.

"Multiple uses of DGPS can be achieved on sites where survey suites are not readily available to track drilled holes. Users can create an accurate blast plan by logging hole positions and uploading to ViewShot 3D for detonator delay design. Another key value proposition of this system is data availability, allowing for reconciliation of planned versus actual blast holes, thus enabling continuous improvement on site," says Pillay.

The DGPS module can be retrofitted onto existing AECI Mining Explosives CE4 Taggers.

The system will enable customers to integrate future fully autonomous wireless detonator tagging or blast hole coordinate logging. DGPS will assist in bringing large-scale mining into the digital era and enables new mining methods and blasting techniques to increase productivity and reduce blasting costs.

In conclusion, AECI Mining Explosives is focused on providing its partners with systems that have technological advancements to promote Smart-mining applications. Mines will reap quantifiable benefits on their surface operations, including high levels of safety, improved operational flexibility and better ore recovery, all of which are crucial parameters in their quest to operate sustainably," concludes Pillay. ■

Key takeaways

- ❑ With AECI Mining Explosives' Differential Global Positioning System, a new addition to the IntelliShot system, potential human error from incorrect blast hole identification or incorrect delay assignment can be a thing of the past
- ❑ By introducing an increased level of autonomy to the blast hole tagging process, explains product manager Ashlin Pillay, DGPS enables faster blast deployment, greater accuracy and increased efficiency
- ❑ DGPS is capable of achieving sub-1 m location accuracy – the high level of precision is a result of the inherent design that mitigates signal degradation
- ❑ The system will enable customers to integrate future fully autonomous wireless detonator tagging or blast hole coordinate logging

Collaboration to drive modernisation of the mining sector

South Africa's mining industry has made substantial progress in its journey towards digital transformation in the last decade, but partnerships and collaboration will be key to shift the mining sector into the Fourth Industrial Revolution. The role of collaboration in driving mining modernisation was explored by industry delegates at Huawei's Mining Summit in Johannesburg on 28 October 2021. By *Mark Botha*.

Gys Malan, Huawei vertical solutions manager.

Addressing the summit, Huawei vertical solutions manager Gys Malan said that, when integrating digital solutions into their businesses, the mining sector needed to be cognisant of fitting the right technologies to the right processes for the best impact.

"What businesses often do is to find a solution that has been successful in a specific environment and then try to apply it to all their business requirements, only to discover that they cannot achieve their business goals."

He says the objective is to take the correct solution and fit it to the relevant business requirements.

"You need to challenge yourself to think of ways to achieve your business intent without sacrificing any outcomes. In terms of mining solutions, you must bear in mind the operational environment. That requires you to challenge yourself to find solutions for this operating environment."

He notes the importance of companies like Huawei, who offer a large array of technologies, to invest in research and development (R&D). "When a company like Huawei invests between 14 and US$16-billion in R&D annually, you can expect innovation and massive forward movement from a technology point of view."

Malan describes Huawei as "by far the leader" in wireless local-area network (WLAN) technology. "It is not good enough to simply supply WiFi; we want to provide an integration with the operational environment, to bring the IT and operational technologies together. We've therefore designed our access points to have multi-service gateway functionality for WiFi, Bluetooth, Zigby RFID and others, built into a single access point. This allows you to bring in several other operating technology components in the mining environment into the same access point."

Partnerships and collaboration will be key to shift the mining sector into the Fourth Industrial Revolution.

Collaboration

Huawei partner Royal Bafokeng Platinum's information management manager Karina Geyser adds that innovation doesn't happen in a siloed space.

"Innovation is enabled by collaboration. It's facilitated when people share ideas with one another, which is why Royal Bafokeng Platinum has built partnerships with companies like Huawei."

She says technology partners working with clients in the mining sector must have a clear understanding of the environments their clients work in.

"If you haven't been underground as a

Karina Geyser, Royal Bafokeng Platinum information management manager.

Jean-Jacques Verhaeghe, Mandela Mining Precinct programme manager.

Mark Williams, Huawei 5G marketing manager.

partner supporting clients in the mining space, you know nothing. You need to understand what modernisation in mining actually means, and what the drivers and barriers of evolution in the industry are."

Mandela Mining Precinct programme manager Jean-Jacques Verhaeghe agreed, saying that technology partners must put themselves in the shoes of the mining companies they want to work with.

"With all these shiny new technologies available to us, it can be easy to lose focus on what is really important to a mining company when embarking on digitalisation. Partners must look at what difference these technologies are going to make in moving crucial benchmarks forward. Ask yourself how this technology is going to help the mine make progress in its quest for zero harm or how it will help the mine by giving it that extra one metre advance per shift."

During the summit, the Mandela Mining Precinct (MMP) and Huawei signed a memorandum of understanding (MoU) that allows the Minerals Council South Africa, through the MMP and Huawei, to install and test Wi-Fi 6 kits in underground mines, in pursuit of a digitalised mining industry. Planning is also underway that will enable research teams to define and test various scenarios at a suitable mine in South Africa.

Digital strategies at corporate level

Royal Bafokeng Platinum's Geyser also stressed the importance for the mining sector to develop robust corporate-level digital strategies to provide direction on their digital transformation journeys. She noted that, when plotting digital strategies, companies must conduct SWOT analyses, understand their internal and external barriers, and lay out concrete steps for how to overcome them.

"We often make the mistake of only employing pockets of excellence regarding digitalisation but you need to understand your business throughout the entire value chain to really enhance it with emerging technologies," she said.

Data analytics

The event also touched on the growing importance of data in digital transformation. Data, said Huawei 5G marketing manager Mark Williams, is an increasingly valuable commodity in today's digital economy. In a capital-intensive industry like mining, data analytics can generate immense value by improving productivity, efficiency and effectiveness.

"Data is the key to smart mining and your ability to use and exploit data will be a key market differentiator. Mines already generate vast amounts of data, but the challenge is that they don't have access to it in real time.

"Any device without connectivity means nothing. 5G enables you to extract data from the source to the destination in real time so you can use all these emerging technologies to conduct predictive and prescriptive analysis, which will completely change your operations." ■

Quick take

- ❑ When integrating digital solutions into their businesses, mines need to be cognisant of fitting the right technologies to the right processes for the best impact
- ❑ Technology partners working with clients in the mining sector must have a clear understanding of the environments their clients work in
- ❑ It is important for the mining sector to develop robust corporate-level digital strategies to provide direction on their digital transformation journeys
- ❑ In a capital-intensive industry like mining, data analytics can generate immense value by improving productivity, efficiency and effectiveness

Anton Lourens, CEO of Booyco Electronics.

At the forefront of PDS and CPS technology evolution

Mine safety has been greatly enhanced by proximity detection systems, thanks largely to the technology's evolution in South Africa – where Booyco Electronics has remained at the centre of key technological advances. Working with local and global bodies, the company has rapidly developed solutions that now promise even more flexibility and stability.

Proximity detection systems (PDS) or Collision Prevention Systems (CPS) have come a long way in the last decade, with South Africa based Booyco Electronics at the centre of key technological advances.

"When we were established in 2006, PDS was an exciting technology helping address mining companies' heightened concern with health and safety – arising from incidents of collisions between vehicles and pedestrians on mines," says Booyco Electronics CEO Anton Lourens. "Our equipment began as essentially a pedestrian detection system only, but has fast grown into much more powerful solutions for mines."

PDS offerings have also become more than just a range of disparate product lines from various producers, he says. Rather, the whole field is now increasingly integrated into global efforts to enhance interoperability – in the interests of applying PDS and CPS solutions more effectively on various mobile equipment and trackless mining machines.

"We began by developing a very low frequency (VLF) solution for underground operations, as this technology was based on a magnetic field that could travel through the rock between tunnels or haulages," he says. "Initially, our CWS500 system – focused on 'collision warning' – would simply alert the operator that there was a pedestrian located in a potentially hazardous position, close to the machine."

More functionality

As this technology rolled out to the industry, it quickly became clear that customers were looking for more functionality. This led Booyco Electronics to develop the next level of PDS – the CWS800 range that included vehicle-to-vehicle interaction. The company's first five years saw the rapid evolution of features on the CWS hardware platform, including the addition of global positioning system (GPS) technology to make it applicable in surface mines.

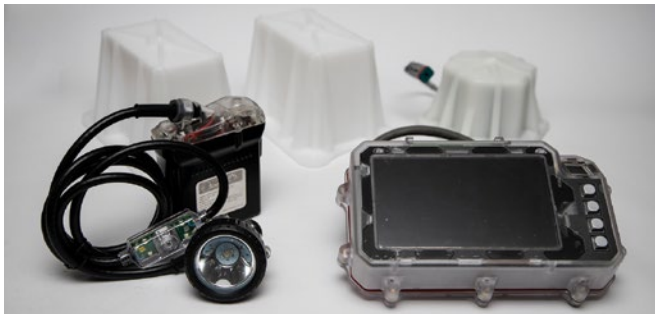
"This also created the basis for us to develop the ground-breaking CWS900 system in 2010, which went beyond being a warning system to actually stopping a vehicle automatically in the event of danger," he says.

"This opened the door to developing 'collision avoidance' systems, and was a breakthrough in terms of our ability to begin meeting the Level 9 requirements of best practice as formulated by the global Earth Moving Equipment Safety Round Table (EMESRT)."

EMESRT is a global initiative involving major mining companies including Anglo American, BHP, Glencore and Rio Tinto. It engages with key original equipment manufacturers (OEMs) in mining to advance the design of equipment to improve safe operability and maintainability. Booyco Electronics has been integrally involved in EMESRT initiatives from as early as 2014.

"South Africa had also been leading the way with safety legislation, which encouraged the take-up of PDS technology in our local mining sector," says Lourens. "This placed the country's PDS suppliers in a good position to put equipment into action in the field, and to continuously improve our solutions in response to real-life mining conditions."

PDS or CPS have come a long way in the last decade, with South Africa based Booyco Electronics at the centre of key technological advances.



Above: The Booyco CXS has leveraged technology to achieve new levels in safety.

Left: The Booyco CXS is a comprehensive integrated response to Level 7, Level 8 and Level 9 safety levels as defined by EMESRT.

Validating equipment

Working with EMESRT and Minerals Council South Africa, Booyco Electronics was also the first supplier to validate its equipment through the agreed simulation model developed by Vehicle Dynamics Group at the University of Pretoria. This independent verification process was an important step in the PDS and CPS development, creating a quality benchmark against which all the market players could be assessed.

Progress in technology continued apace, with Booyco Electronics further evolving its hardware platform to new levels of stability and maturity, Lourens says.

Booyco Electronics' CXS solution is now software-driven, allowing even more flexibility and adaptability to customer's specific needs. "This is another step-change for the technology, as we can keep up with fast-changing industry requirements without replacing our equipment," he says. "The modifications can be made in the software rather than the hardware – and updates can usually be done wirelessly on site."

Among the company's over 100 mining customers in South Africa alone, Lourens highlights that each site has its own functional requirements, with some sites having more than one set of parameters. The way of the future, then, is software-based flexibility, so that mines can improve their requirements over time without having to change their installed PDS equipment. ■

Building on VLF

Very low frequency (VLF) technology allows for a magnetic field to be created around trackless mining machinery underground, which will detect a pedestrian standing too close and will alert the system. VLF's long wave-lengths can travel through rock, so can detect a pedestrian even when the operator cannot see them.

Booyco Electronics developed its first proximity detection systems (PDS) from this technology, creating an electric 'fence' around a vehicle. An alarm is triggered when a pedestrian breaks the boundary of this magnetic field.

The physics of VLF is a well-established area of science and industry; it was an important aspect of submarine development, allowing these craft to communicate while submerged under water.

Key takeaways

- ❑ Proximity detection systems or Collision Prevention Systems have come a long way in the last decade, with South Africa based Booyco Electronics at the centre of key technological advances
- ❑ When Booyco Electronics was established in 2006, PDS was an exciting technology helping address mining companies' heightened concern with health and safety – arising from incidents of collisions between vehicles and pedestrians on mines
- ❑ Booyco Electronics' equipment began as essentially a pedestrian detection system only, but has fast grown into much more powerful solutions for mines
- ❑ Working with EMESRT and Minerals Council South Africa, Booyco Electronics was also the first supplier to validate its equipment through the agreed simulation model developed by Vehicle Dynamics Group at the University of Pretoria

Verder Pumps partners with ProProcess on Anglo American project

Verder Pumps South Africa, a market leader in advanced industrial pumping solutions, has been selected as one of the preferred pump suppliers for Anglo American Platinum's new Modular Fines Flotation Pilot Plant and supplied 16 pumps for various applications within the mobilised plant.

In August 2020, the modular process plant supplier ProProcess was awarded an engineering, procurement, and construction contract for Anglo American Platinum's new Modular Fines Flotation Pilot Plant. As a preferred Anglo American vendor, Verder supplied peristaltic pumps to ProProcess on the project.

This test facility for platinum concentrate flowsheet optimisation had to be designed with maximum road transportability in mind, as it is earmarked to be moved around various concentrator sites owned by Anglo. To this end, the entire plant was fitted onto 16 road transportable ISO frame skids conforming to 40 foot marine container dimensions. The plant consists of more than 40 flotation cells (including a high intensity flotation cell), a mill, approximately 30 tanks (some agitated), approximately 50 pumps (including centrifugal slurry, peristaltic, and vertical spindle), blowers, compressors, and other items.

Multiple pumps installed on site.

Verderflex peristaltic pumps are manufactured in the EU within ISO 9001, ISO 14001 and ISO 18001 accredited facilities. The Verderflex positive displacement pumps are used with a large variety of fluids. The liquid is totally contained within a flexible hose or tube fitted inside the pump casing. The hose or tube is the pump's only consumable part. This makes the Verderflex peristaltic hose and tube pumps the ideal solution for "difficult to pump" liquids or demanding applications. These range from smaller vending machine OEM pump modules and precision metering tube pumps to the world's largest high-pressure hose pumps pumping dense, solids-laden, mining thickener slurries and highly abrasive, viscous or corrosive liquids.

The pumps selected on this project included the Verderflex VF65, Dura 25, Dura 35 and Dura 45. "Pilot plants have much less stringent equipment requirements than production plants and this needs to be taken into consideration to avoid over designing the plant, thus unnecessarily escalating the capital outlay. This required a lot of out of the box thinking and many new ideas and concepts were explored to ensure a built-for-purpose plant," says Stefan van Dyk, project manager at ProProcess.

According to Kean Southern, mechanical lead at ProProcess, the firm applied its specialised modular approach to the design of this plant for simplified site installation and ease of transport.

"All equipment is pre-mounted, piped up, and tested at our workshop before shipment to site. Once testing is complete, all that is required is for flexible, interconnecting piping between the frames to be disconnected - which is made easy with the use of flanges and claw couplings. Given the numerous pipe sections run between frames, each connection of flexible hose needed to be tagged to ensure the correct hoses were reconnected during assembly. Since the plant arrives on site already partially assembled, site installation is a breeze," says Southern. ■

BME wins industry award for safe disposal of used oil

Omnia group company BME has been recognised by the Chemical and Allied Industries' Association (CAIA) for its contribution to a cleaner environment – winning the CAIA Responsible Care initiative of the year award, in the company projects: Category A segment, during an online award ceremony last week.

From left: BME marketing manager Michelle Fedder, BME MD Ralf Hennecke and Ramesh Dhoorgapersadh, BME's SHEQ GM.

The award was for BME's incorporation of used oil as a base product for its emulsion explosives, removing the risk that this oil could contaminate water or soil. According to BME MD Ralf Hennecke, the initiative is part of the company's ongoing environmental, social and governance (ESG) commitment.

"On the environmental side, our treatment and disposal of used oil in this way reduces risk and improves regulatory compliance," says Hennecke. "The positive social impact is through our engagement of small independent enterprises to collect the used oil."

He adds that the used oil initiative also included a strong governance aspect, by meeting stakeholder requirements in terms of responsible waste management systems.

Ramesh Dhoorgapersadh, BME's GM for Safety, Health, Environment and Quality (SHEQ), said the initiative reflects the company's close collaboration with customers – where used oil from large mining customers was also collected and utilised for repurposing and responsible disposal through the blasting process. These partnerships have been initiated in Africa and are being rolled out to BME's global network of operations. ■

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Looking Forward VEGA

African cranes for African mines

Condra has announced that it is to supply six cranes, one portal and five double-girder overhead machines, to a South African mine belonging to an unnamed mining house.

Delivery of the cranes will satisfy three separate orders placed consecutively in September, the same month that Condra commissioned a large, custom-designed jib crane for consultants contracted to the same customer.

The mining house has been operating Condra overhead cranes and hoists since the late 1990s, employing them in a spread of mines and applications across west and southern Africa.

Of the six cranes ordered, four are identical 10-t overhead machines with spans of 6,5 m, and two have already been delivered. The first was installed underground and commissioned on November 24 for maintenance duty on pumps, motors and other equipment. The remaining two 10-t cranes will be completed this year to join the third on site early in 2022.

A fifth crane, a 15-t portal machine, is earmarked for receiving and dispatch duties, while the biggest of the six cranes ordered will be a 25-t electric overhead travelling workshop unit.

Condra's tenders for the three orders proved successful against multi-company competition. Their prices were not the lowest, supporting growing evidence of a trend toward buyers valuing lower overall lifetime costs over price, these lower costs being achieved through supplier commitment and an ability to deliver ongoing, reasonably priced after-sales service and maintenance.

A similar trend can also be seen in the market for second-hand cranes, where almost-new machines manufactured by companies unable to deliver effective maintenance lose value faster than much older cranes from more reputable firms.

"If a crane cannot be maintained, then it has no long-term value," explains Condra MD Marc Kleiner, commenting on the six-machine orders. "Some brands carry risk of rapidly escalating maintenance costs after the guarantee period. Project consultants are not liable for these after the warranty expires, so when a customer needs service at the end of that time, he sometimes finds the cost higher than projected. Our customers face no such doubts."

Kleiner emphasises that Condra continues to be prepared and ready to support African mining: "We have been supplying cranes to meet mining's needs for fifty years. We manufacture our cranes locally, and our supplier network – the people who make our gears, our wheels and other complex parts – they are also local.

"So we are an African company with a lot of experience of the different climatic and working conditions found on this continent. We are committed to and ready for any type of mining, manufacturing or machine servicing requirement from any African customer anywhere on the continent," Kleiner says. ■

Typical Condra portal crane.

DRA appoints Bronwyn Baker as chief people officer

DRA Global Limited (ASX / JSE: DRA) has appointed a seasoned people and culture executive, Bronwyn Baker, as chief people officer.

Baker is a future-focused and highly regarded industry professional who joins DRA with extensive experience gained across large and complex organisations in Australia and overseas.

With a strong track record in human resources, organisational development, and building high-performing teams, Baker most recently specialised in supporting boards and executive teams to develop and operationalise strategy and to drive business and culture transformation.

Welcoming Baker to the company, DRA MD and CEO Andrew Naudé says the appointment was the next logical step in DRA's current strategy and growth trajectory.

"People, leadership, and culture are all extremely important focus points for DRA. I look forward to working closely with Bronwyn to elevate and dif ferentiate ourselves in how we approach these areas."

Commenting on the appointment, Baker says, "My passion is to bring a tangible, science-based approach to people and culture. I am excited to work with DRA as it is an organisation filled with capable, technical people, and I know this approach will resonate here. If we understand the neuroscience, we can create an environment for employees and teams to grow and thrive." ■

Gates expands MegaSys hydraulics line-up

Gates (NYSE: GTES),), a leading global provider of application specific fluid power and power transmission solutions, has introduced its MEGASys MXT with XtraTuff Plus cover (MXT-XTP), a universally applicable hydraulic hose, featuring Gates' patent-pending wire-braid technology.

MXT-XTP offers all the benefits of Gates' industry-leading MXT hose – compact size, light weight, flexibility and high performance – with added durability from the company's proven, industry-leading XtraTuff Plus (XTP) cover.

"Gates is known for innovation driven by materials science and process engineering expertise, and pairing that with the voice-of-customer and an ability to anticipate the needs of future applications sets us apart," says Mike Haen, vice president, industrial global product line management.

"MXT-XTP maintains the advantageous performance of our popular MXT hose line with the field-proven XtraTuff Plus cover. We continue to revitalise our premium MEGASys hydraulics portfolio by providing solutions for our customers' most challenging applications."

Gates' lightweight, high-performance MXT hose is proven in the factory and field, around the world, being specified in by OEMs and used repeatedly by replacement channels. It's 25% lighter weight than conventional hoses, making it easier to lift and handle, plus MXT is up to 49% more flexible, allowing faster and more ergonomic installations.

MXT-XTP offers all the benefits of Gates' industry-leading MXT hose.

Gates has enhanced the MXT hose with the optional XTP cover, maintaining MXT hose performance while adding 25 times the abrasion resistance and enhanced ozone resistance, as validated by a rigorous 800-hour ozone exposure test.

The XTP cover was previously introduced as the standard cover on MXG 4K. MXT-XTP hose meets or exceeds relevant ISO, SAE and EN performance standards, is MHSA-certified for flame resistance, and is certified leak-free per SAE J1754 when used with Gates MegaCrimp couplings.

As a universally applicable premium hydraulic hose, MXT-XTP is suitable for the most demanding fluid power challenges across a broad array of industries and applications, including construction and mining, material handling, machining and metal processing, injection molding and other stationary machinery, agriculture and forestry, aerial lifts and more. Its broad applicability allows customers to simplify and consolidate inventory with a standardised, multi-use hose. ■

TOMRA Mining appoints Kai Bartram as global sales director

Kai Bartram has been appointed global sales director of TOMRA Mining. He joined the company on November 1, 2021 and will be based at the offices in Wedel, Germany. In his new role, he will be responsible for managing and coordinating the Tomra Mining's sales teams globally and will be part of TOMRA's Mining Management Team.

Albert du Preez, senior vice president and head of TOMRA Mining, states: "I am delighted that Kai is returning to TOMRA and joining our management team. He started his career with us as a graduate engineer, and over the past two decades he has acquired vast knowledge in the mining industry. With his experience, he will strengthen our sales team and help shape our approach to market."

Bartram comments on his appointment: "I am excited about returning to TOMRA and looking forward to working with our global sales teams to further grow our sensor-based sorting market in the mining sector."

Bartram worked for the company from 2000 to 2010, first in R&D and applications then in sales, where he was tasked with introducing sensor-based sorting to the mining sector. When he left TOMRA, he furthered his career in the mining industry, in roles of increasing responsibility at international level. He holds a Master's degree in Electronics from Hamburg University of Applied Sciences. ■

Enhanced Cat technology maximises value of the Cat MD6310

New MD6310 rotary drills integrate Caterpillar electronics that leverage automated features and technology to improve drilling accuracy and efficiency. Drill Assist executes all major functions or cycles of the drill and automatically adapts drill power to match ground conditions. Automated features such as jack levelling and retraction, mast raise and lock to desired angle, and auto pipe handling for multi-pass auto drill-to-depth improve operator drilling efficiency on the bench.

Cat MineStar ready, the drill's electronics infrastructure provides a gateway to exclusive Caterpillar technologies that further advance drilling automation and safety. Terrain for drilling uses high-precision GPS guidance to deliver accuracy down to the centimetre, ensuring holes in the pattern are drilled in the right place and to the designed depth.

As a building block to autonomy, Command for drilling offers scalable technologies ranging from line-of-site remote control to autonomous operation to meet the mine site's needs for safety and productivity. The remote operator's station removes the operator from the bench and now allows one operator to manage drill operations and run up to five machines simultaneously.

Advancing sustainable operation while lowering owning and operating costs, major components for the MD6310 – engine, undercarriage and rotary head gearbox – are built to be rebuilt, giving the machine multiple service lives. Common components and consumables across the Cat drill family reduce parts inventory needs and simplify service.

Onboard health monitoring and Cat Electronic Technician makes troubleshooting quick and convenient to increase drill uptime availability. Uniform hose and wiring harness routing increases machine reliability in the field. Grouped service points and simplified access to maintenance items reduce service time, allowing the MD6310 to spend more time in the field and less time in the shop.

Designed to improve safety and operator comfort, the next generation cab features floor to ceiling windows to improve line-of-sight to the drill deck and offers ergonomic display and control layouts. Closed-circuit cameras with additional mast camera help to improve operator visibility. Its FOPS-rated cab, standard drill window safety cage and operator-present conditional safety interlocks help further improve safe operation. ■

Ideal for high-production drilling on 12 and 15 m bench heights and capable of drilling up to 311 mm hole diameters, the MD6310 offers up to 30-degree angle hole drilling for cast blasting.

Business as usual as Kwatani/Sandvik transaction closes

Kim Schoepflin, CEO of Kwatani.

Business as usual is how Kim Schoepflin, CEO of Kwatani, describes the news of the closing date of the transaction whereby Sandvik Rock Processing Solutions and Kwatani signed an agreement for the multinational Sandvik Group to acquire the shares of the 45-year-old leading vibrating screen and feeder original equipment manufacturer (OEM).

Schoepflin says when the exciting transaction, which was subject to regulatory approvals and customary conditions, was made known to the mining and materials handling industries earlier this year, it was exceptionally well received by the markets, from both potential and existing customers.

"Kwatani has operated its world class production facility in South Africa for more than 45 years, and both Sandvik and Kwatani are technology leaders so bringing our combined resources to customers will be of enormous benefit," she says.

"What is most significant for the South African industry is that the collaboration is aligned with our government's industrialisation strategy. Furthermore, Kwatani is known for its commitment to compliance with the South African Mining Charter and we are a proudly Level 2 B-BBEE company."

Add to this, and a game changing move for the South African economy is that the Kwatani facility is set to become the global engineering and manufacturing base for vibrating screens and feeders for both local and international customers. The internationally recognised Kwatani brand, with its promise of being engineered for tonnage, will remain unchanged and the Kwatani brand will continue to be used across Africa while products sold internationally will be sold through the Sandvik sales channels under the Kwatani product name.

Schoepflin says that also exciting for the market is that Sandvik will further develop the Kwatani vibrating equipment brand globally. "This will see increased access to the Kwatani product through Sandvik's global distribution network and customers will benefit by having access to a vastly increased customer service network." ■

Tough conditions call for Grindex drainage pumps

The ideal drainage pump is one that performs reliably in the toughest of conditions, so that operators do not need to waste time checking constantly on its performance. The Grindex range from Integrated Pump Technology offers just this, and more.

The Grindex range of drainage pumps handle water with abrasive solids up to 12 mm in size, and with high pH values from five to eight. Distributed locally by authorised southern African agent Integrated Pump Technology, Grindex submersible pumps have a heritage going back over 60 years – with more than 400 000 pumps delivered.

Drainage pumps are most suitable when users need to pump large quantities of dirty water, but still need to achieve heads of up to 200 m, or flow rates of up to 350 litres a second. These Grindex pumps deliver all that, and convenience besides.

This is according to Integrated Pump Technology sales manager, Jordan Marsh who say the unique valve on Grindex drainage pumps enables air cooling of the motor so they can run dry without a problem – and therefore don't need babysitting.

On the small end of the range – comprising the Micro, Milli and Mini models – these pumps are compact, lightweight and ultraportable. The Micro model's low power consumption makes it ideal when running on a generator. The Milli looks similar to the Micro, but enables low suction down to only a few millimetres, thanks to the unique non-return valve.

In the medium section of the Grindex range are the Minex, Minette, Minor, Major, Master and Matador. The revolutionary hydraulic design ensures high wear resistance and dramatically reduces any performance drop that may result from long-time wear.

"With their internal starter, SMART motor protector and optional level regulator, these pumps provide fully automatic protection and control without the need for external starter," Marsh says. "The soft starter means smoother motor acceleration, thereby protecting the pump while reducing equipment wear and mechanical stress."

Grindex drainage pumps offer heavy-duty performance at low total cost of ownership.

There are two large Grindex drainage pumps – the Magnum and the Mega. The Magnum is relied on for the toughest jobs, with high quality, reliable design combined with the ease of maintenance. Made of cast iron, the Mega is ideal for operating in deep excavations where very high-head pumping is needed. Designed to handle pH levels from six to 13, it can also be fitted with zinc anodes for extra protection. ■

MK-42 dump truck strikes gold again

The MK-42 dump truck from GHH has been well received in the market. Design prizes such as the Red Dot and, most recently, the Good Design Award show that even aesthetes are impressed. The award from Good Design Australia came as a surprise to the German machine manufacturer. The MK-42 had taken part in the competition for 2021. Australia is one of the most important markets for GHH, one of the leading brands of heavy machinery for mining, tunnelling and special civil engineering.

The international jury was reviewing 933 projects this year. They commented: "GHH creates excitement with a more sleek and sophisticated look than we're used to seeing in this category. The operators' compartment is comfortable and ergonomically designed and there are a number of excellent safety features (multiple fire extinguishers, low slip surfaces and strong LED lighting). The fact it also has best in class power, turning radius and tipping angle indicates a clear focus on designing a product that sets new class standards. Overall, this is a really impressive example of design and engineering and a standout project."

GHH presented the MK-42 a year ago. The prime dump truck in the manufacturers product range carries 45 tonnes of payload with a volume of up to 24 m^3. The economic aim during development was high productivity paired with low operating costs, told GHH. Indeed, if you put a lot of effort into it, you almost inevitably create a result that exudes recognisable competence. A clear design has become kind of a trade mark for GHH: everything is exactly where you can find it immediately, even in the harsh and hectic daily routine. ■

How the C-factor impacts mining output

American leadership consultant Kevin Eikenberry says that the there is a direct correlation between our ability to do a job, and our assuredness that we can do that very job. He has dubbed this the 'Confidence/Competence Loop', which he believes are interconnected in a "chicken and egg sort of way." By *Arjen de Bruin*, MD at OIM Consulting.

Eikenberry maintains that success accelerates when we are confident. As head of OIM Consulting, which specialises in building front-line leader capability within the mining sector, I see this very scenario played out in real life every day – and the impact it has on a mine's output.

We recently conducted research into the operations of some of the country's largest mines, and found that without any specialised training, the vast majority (78%) of supervisors were unstructured and reactive in their role execution, while less than 20% demonstrated the required proficiency in their role. And bear in mind that 'proficiency' is measured as the execution of daily tasks with more than 50% effectiveness - a far cry from 'excelling'.

Why am I singling out supervisors, specifically? Because they are the front-line leaders - the heart and hub of a mine's operation. They are responsible for executing your strategy. They lead and motivate team members to deliver on production targets. They are the "hands" that carry your culture.

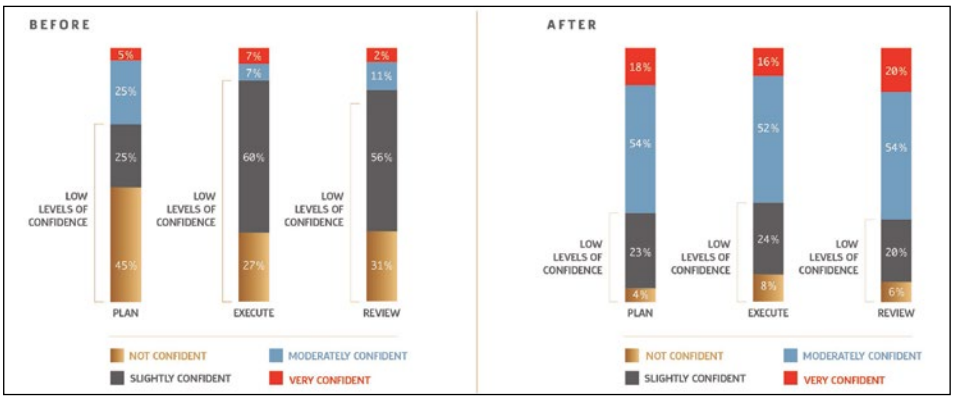
Uptick in production

The impact that inefficiency has on a mine's bottom line is somewhat harder to quantify as there are a variety of factors that may contribute to and compound poor performance; however, in those instances where a mine engages us to train their front-line staff, we have seen a sharp uptick in production. One of our mines even reported a staggering 35% increase in the number of tonnes of gold produced per employee.

The reality is that most mine supervisors have experienced a top-down management style, where they are expected to simply carry out instructions, and do what they are told. This results in a sense of reactivity – we see our supervisors waiting for instruction rather than proactively managing their workload. When we start to shift their approach to one of ownership, it becomes clear that our supervisors fear their own capability.

This is reiterated by Eikenberry, who says that "without confidence we revert to fear, and when we are fearful we don't take any action. We get tentative, we delay and we procrastinate. When you are able to let go of fear, you take action more quickly and easily."

Indeed, as we become more skilled, our competence grows. And as our competence grows, so does our confidence, demonstrating this chicken-egg relationship. One medical study aimed to examine the relationship between confidence and competence in the development of surgical skills. Conducted among 150 medical students who completed a two-year programme, the study assessed participants both pre- and post-training for confidence and competency.



OIM trains for competence and confidence through supporting supervisors with coaching and mentoring and giving them the correct toolsets for the job.

Some 88% reported improved confidence after the training. Younger medical students exhibited lower pre-training confidence scores but were just as likely to achieve competence after training. However, it also clearly demonstrated that above-average confidence – without the necessary training to underpin it – did not equate competence. However, increases in confidence levels post-training were associated with demonstrated competence.

Coaching and mentoring

So how do we train for competence and confidence? Through supporting our supervisors with coaching and mentoring and giving them the correct toolsets for the job. Once these skills and tools are entrenched, we see a sharp rise in confidence/competence and ultimately production.

OIM has identified eight drivers of supervisory performance, with one of these being 'lack of confidence.' This factor, among others, is addressed through our programme, which, in turn, breeds confidence in critical role functions including planning, executing and reviewing.

"Coaching to Performance" marries problem-solving, competency development, classroom training and on-the-floor coaching, with a focus on driving daily productivity whilst measuring real operational improvement. Upon completing this training, we have seen the percentage of competent supervisors jump from 19% to 56%.

We have experienced first-hand the bottom-line impact of boosting confidence through training, proving how an integration of competencies and theory through real-life coaching has the potential to lift performance. ■

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