



Drifting along

The bolter Roof Master 2.0 AR D/E is now working in a copper mine of KGHM and was developed in co-operation with Mine Master's long term partner JH Fletcher. It is used for bolting in a wide range of seam heights

the Korbalkhinskiy Rudnik mine of UMMC.

Russia will also be a destination for the new drilling rig Face Master 2.8 ATEX launching later this year. Made in full flame proof configuration, ATEX-certified, it is equipped with 6/12 telescopic feed and is designed to be stripped and slung down the shaft to be reassembled for operation. The machine will be used for drilling blast holes at the face as well as drilling holes/installation of Split Set friction roof bolts including in locations where the presence of methane is very likely. Again the operating regime is 24/7 so reliability and robustness are crucial.

Some Face Master 1.7 drilling rigs are heading to Oreks Metal Mining Co in Turkey. These machines, planned to replace the existing fleet, are standard rigs with a robust design proven already in many other locations in the world – Mine Master has sold more than 170 machines of this type.

Moving to Africa, Mine Master has been working closely with one of the key platinum mines in Zimbabwe on increasing safety standards by improving the headings of its mine. The successful customer collaboration resulted in a specialised machine, which will serve as a roof scaling rig. It is a completely tailor-made Roof Scaler 2.0 SB for the specific customer applications. The machine is equipped with two booms – one consisting of a basket with FOPS canopy, allowing for an inspection of the integrity of the hanging wall, and for marking areas requiring scaling, and the second boom is equipped with a hydraulic breaker – a feature which allows scaling of the roof safely, by using remote control. The machine will be equipped with thoughtfully designed safety solutions to meet the high standards required by this customer. The Roof Scaler 2.0 SB has a low tramming height of 2 m allowing for movement between areas with low seams. At the same time it has a large coverage area of 6.2 m in height and 7 m in width. The machine is due to start operation in the mine later this year.

Another customer collaboration that resulted in a customised rig has been operating since December 2019 in one of the KGHM copper mines. A bolter Roof Master 2.0 AR D/E, made in co-operation with Mine Master's long term partner **JH Fletcher**, is used for bolting in a wide range of seam heights from 2 m up to 8.5 m. It is designed to perform installation of mechanical anchors as well as resin bolts. A vacuum root pump helps to maintain a dust-free environment for the operator. The machine has been working four shifts a day for five days a week and Mine

Paul Moore reviews some developments in the underground drilling space, from the key players in the Chinese market to secondary breaking drilling and news from the global majors

As more and more mines are being developed from surface using declines developed from box cuts or worked out open pits, the importance of rapid development to get to the ore faster is as high as it has ever been, both for major contract miners and owner operators. Drill jumbos need to be extra robust to be able to operate around the clock but at the same time new innovations such as teleremote & battery technology are also entering the development drill market, enhancing safety and productivity.

Mine Master based in Wilkó, Poland is a proud member of the newly unified GHH Group, which recently brought together under this brand GHH Fahrzeuge GmbH (Germany), GHH Mining Machines (South Africa) and Mine Master, as well as various partner companies, all of which are part of Germany's Schmidt Kranz Group. Mine Master for its part has been supplying drilling machines to the global market for more than 40 years. The company designs, develops and manufactures face drills, long hole production drills, roof bolters and special application machines and has been working in close collaboration with strategic customers to further develop and improve its offering to be more fit-for-purpose than before. The company told **IM** that its core focus is on safety and productivity where the products are constantly evolving to complement the group's load and haul and utility

offering and support the direction of GHH Group being a total solution provider for various mining applications around the world.

Mine Master machines are made for underground hard rock, soft rock mining and tunnelling applications and are prevalent in low profile room and pillar and narrow vein operations as well as some mass mining operations like block caving, cut and fill and sub level stoping, from the low profile platinum and chrome operations in South Africa and Zimbabwe to mass mining operations in India, the room and pillar copper mines in Poland as well as potash and salt mines in Europe with over 1,400 machines currently operating in the field.

In 2019, Mine Master ventured into a new project in Russia where five Face Master 2.3 drilling rigs are destined to work in LLC Bashkprskaya Med copper mine, belonging to UMMC - Ural Mining & Metallurgical Company. The first two machines went through an extensive and intensive trial. The machines were used for drilling blastholes at the face, as well as drilling holes and installing Split Set friction roof bolts in the roof of the mine. The equipment operating regime was two 12 h shifts a day, seven days a week. Over a four month period the rugged machines, together with skilled operators, proved to be very efficient, complying with the pre-set stringent KPIs. Another Face Master rig series – the single boom FM 2.3-1B is currently working in

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Master says it is proving to be not only cost effective to run but, with the added value of skilled operators, extremely efficient resulting in high productivity.

Mine Master is also launching its new 20 kW class drifter, the MM 20. “Its robust and already proven design is designed to work in harsh underground mining conditions, with corrosive flushing water. The drifter’s setup allows for easy replacement of components and spares. The customers can also benefit from the reduced TCO.”

Finally, battery technology design, in the drill and bolt product offering, is also underway. “The resultant battery electric drill and bolter will focus not only on fundamentals of safety in design, but also ease of maintenance and compliance to reduced emissions standards supporting the customers and markets drive to go green. For this development Mine Master has received a grant from the National Centre of Research and Development in Poland and plans to start the rigorous trials at one of KGHM mines in Poland in the second half of 2020.”

Mine Master says it prides itself in not only developing machines that provide a low cost per tonne of production but that also provide for high performance capabilities. It says its machines are “safe, reliable, easy to maintain and simple to operate.” In a drive to follow the increased need for intelligent mining and monitoring systems Mine Master has developed the BCS (bolting counting system), BMS (Basic Monitoring system), DMS (drilling monitoring system) and the FGS (feeder guider system). All of these monitoring systems give the opportunity to monitor bolting and drilling parameters and allow for drilling to follow set drilling requirements and carry out mechanised bolting, while transmitting data via WiFi with the added possibility of remote controlled drilling or bolting. “All of these data analytics technologies assist in driving continuous improvement and helping customers improve operations, performance and ultimately productivity.”

Hybrid miniDriller from Aramine

Last year **Aramine** started to complete its equipment range for narrow vein mines with the introduction of its diesel-electric hybrid miniDriller DM901 HDE drill rig. The compact machine uses the diesel engine for tramming and electric motor for drilling, according to Aramine, while it can be operated tele-remotely, removing the operator from potential hazards. The DM901 HDE has a low centre of gravity for optimal stability. Despite its narrow width, the two front stabilisers offer perfect drilling conditions, according to the company. This allows for both face and vertical drilling, Aramine said.

Aramine says the DM901 HDE only requires a

400 V electric connection and a water supply to operate and is designed with modular elements for easy assembly/disassembly in a mine. It “sneaks wherever our L130 and L150 miniLoaders go,” Aramine said. This means the new machine is ideal for sections between 6 m² and 12 m². With an existing partnership between Aramine and Epiroc, the company can offer an exclusive optional version with an Epiroc Feed and Drifter, Aramine said. “As most of Aramine machines are, the DM901 HDE complements perfectly the Epiroc range,” Arnaud Paul, Aramine Equipment Sales Director, said. Aramine said at the time it was preparing its fully-electric battery-powered version for 2020, with innovations at all levels of the machine.

Byrnegut achieves automation first

Contract miner **Byrnegut Australia** has recently become the first underground operator in the world to successfully use a new automation and teleremote package for **Sandvik** development drills. Byrnegut introduced a Sandvik DD422i development drill featuring the package to OZ Minerals’ Prominent Hill gold-copper mine, southeast of Coober Pedy, South Australia, in March. With COVID-19 travel restrictions preventing Sandvik staff from attending site, Byrnegut, OZ Minerals and Sandvik experts collaborated via phone, teleconference and email to complete remote commissioning of the rig.

The two-boom rig, which can be monitored and controlled from the surface and features a sophisticated boom-collision-avoidance system, has now been in operation for three weeks, according to the companies. Byrnegut Australia Managing Director, Pat Boniwell, says the new automation features allow for enhanced drill operation across shift changes – a period when, historically, development drilling has stopped or been significantly reduced. “We’re conservatively looking at a 10% increase in productivity with this machine through being able to drill extra holes and the machine being used more consistently,” he said. “It picks up on the deadtime, and if it does stop for any reason we’re able to remotely reset it.”

The new boom collision avoidance system means both of the rig’s drill booms can be left in operation during shift change – something that was previously not possible. In the first few weeks of operation, the drill has been able to drill 60-70 holes while being operated autonomously and remotely from surface, the companies said.

Byrnegut Drill Master, Noah Wilkinson, says a



Contract miner Byrnegut Australia has recently become the first underground operator in the world to successfully use a new automation and teleremote package for Sandvik development drills

solid working relationship with Sandvik and good communication contributed to the success of the commissioning. “People from the Sandvik factory in Finland were able to remote into the machine over the internet and adjust settings that were stopping some of the functions from working,” he explained. Sandvik’s Global Account Manager for Byrnegut, Andrew Atkinson, paid credit to Byrnegut’s openness to adopting autonomous technologies in areas including development drilling, loader operation, production drilling and ore trucks, which are all engineered for compatibility with Sandvik’s AutoMine® and OptiMine® products.

In addition to the collision avoidance and teleremote capabilities of the DD422i, the new automation package allows for semi-autonomous bit changing. Another handy feature of the setup during the current period of social distancing has been the virtual network computing capability that allows the control panel of the drill to be viewed remotely on a tablet. This means that during operator training, the instructor need not be in the cabin with the operator.

Production drilling e-tramming

Last year, **Epiroc** said it was maintaining its leading position in the development of innovative equipment for use in mining and production drilling with the release of a new teleremote e-tramming option for its Simba series of rigs. In the Simba Automation package, multiple automation functions are available to optimise the drilling process, according to Epiroc. With the recent addition of the e-tramming function the production drilling process can be handled in an even safer and more continuous way, the company said.

This will allow a Simba rig to be operated remotely and work more productively in a continuous “ring-to-ring” fashion, Epiroc said.

UNDERGROUND DRILLING IM



Using Epiroc machines and technology, the Apatit phosphate mine saw the world's largest teleremote project for production drill rigs

"After drilling a ring and retrieving the rods, the rig can be tele-remotely trammed to the next ring, saving time and work effort. Not only does the tramping process become faster and simpler, the teleremote e-tramming function also provides a safer work environment since the operator can control the machine out of harm's way, even between rings."

Guilherme Paiva, Global Product Manager of Automation at Epiroc, said: "Our Simba drill rigs are globally recognised as the best in their class, and we continue to strive towards even smarter and faster solutions. Teleremote e-tramming makes for an easier, safer and more continuous drilling process. Fewer disruptions mean greater productivity."

Simba rigs that feature Epiroc's Rig Control System can be operated through a control panel from onboard the rig or from a remote location where potentially hazardous work conditions can be avoided. With information provided by laser sensors and cameras mounted on the rig, the operator can navigate, position and stabilise the rig to ensure drilling is executed according to plan, Epiroc said. "Mission accomplished in one ring, the operator can then tram to the next and the next."

Looking at customer applications of Epiroc's advanced automation solutions for remote underground drilling – Simba Teleremote, ABC Total and the Certiq telematics system were implemented, in 2018, at Apatit JSC's Kirovsk branch (PhosAgro group). Through the automated solutions, several risks in operators' jobs were eliminated, output of the drilling machines grew by 20% and the utilisation of one machine increased to 95%. PhosAgro is the leading producer of mineral phosphate fertilisers in Russia and one of the largest producers in the world. The Kirovsk branch of Apatit JSC (PhosAgro Group) is a closed-circle facility, with operations ranging from ore extraction to the production of apatite concentrate, a raw material used for mineral phosphate fertilisers.

"As the scope of drilling at the mine increases every year, our company has searched for ways to increase productivity, reduce costs and improve work quality. Additionally, we have set a goal to maximise safety levels for drilling machine operators, who have always faced severe working conditions. To achieve this, we decided to move towards automation of the entire drilling process, including the adoption of digital drilling datasheets. Only Epiroc has been able to offer an integrated solution which meets our requirements," says Andrei Abrashitov, Director Apatit JSC Kirovsk branch.

In 2018, Apatit installed Epiroc's Teleremote options on three Simba production drill rigs, as well as ABC Total and Certiq telematics system for remote control and monitoring of the drilling units at the Kirovsk branch. During the pilot project, a special rig control station was allocated on the surface.

The smart features and the automated platform have been enabled by 6th Sense, the Epiroc way to optimise its customers' value chain through automation, system integration and information management. With 6th Sense comes system connectivity, using interoperability to unlock the full potential of automation for production gains at lower operating costs.

Traditionally, underground production drilling has been performed with



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special equipment controlled by operators underground at each rig. With the Epiroc solution, the operation of several production drill rigs is controlled by one operator from the above ground control room along with one drill runner underground. The control room operator manages the process with the help of video cameras mounted on the Simba drill rigs. Integrated sensors on the rigs send data to the control dashboard, allowing the operator to monitor performance and status in real time.

“Instead of one machine, the operator now controls six drilling rigs at once from a control station. And starting from October 1st [2019], the second operator, who is located in the same control station, takes control of four additional drilling rigs. Today, this is the world’s largest teleremote project for production drill rigs,” shares Artyom Yakovlev, Head of production excellence department at Apatit JSC Kirovsk branch.

In addition to the safe working conditions for operators, another advantage of the Epiroc solution is that there is no longer a need to stop the drilling process to remove personnel for ventilation after blasting. Apatit estimates that the implementation of Simba Teleremote has increased the drilling units’ productivity by 20%.

Apatit’s Kirovsk branch also implemented Epiroc’s telematic system Certiq to gather, analyse and communicate vital equipment data from the drilling units. With this system, machine utilisation data is closely monitored and results for one rig holds values up to 95% and more.

“Epiroc’s ABC Total system is another important part of the remote control system. Currently, Apatit is testing remote transmission of drilling plans from the geological and mining information system directly to one of the Simba drill rigs. Thus, an unprecedented level of automation is achieved, improving drilling accuracy and minimising possible human errors. Apatit is able to perform automatic drilling of both a single drill hole and an entire ring without operator intervention.”

Apatit has decided to further outfit their Simba drill rig fleet and is now set to equip its second underground mine, Rasvumchorrsky, with teleremote drilling.

Secondary break drilling

MacLean Engineering’s secondary breakers have been proving their worth in Africa, with a number of machines safely and effectively eliminating ore flow blockages and releasing trapped reserves above the draw point. Built for the tough underground mining environment, these machines provide the solution to attacking high boulder hang-ups without endangering mine workers, according to MacLean. The HBIS-owned Palabora copper mine in South Africa, is proof of this, where three MacLean hang-up rigs have been working

underground for over 15 years. Palabora endorses MacLean’s commitment to promoting safety and productivity in the underground environment, through purpose-built, rugged and reliable mine vehicles, MacLean says. The SB8 and SB12 Secondary Breakers (993MR, previously) are part of MacLean’s Ore Flow suite, a leading ore recovery fleet in global underground hard-rock mining, and these rigs have brought down thousands of hang-ups at the operation, ensuring smooth running of both the mine and its mill, and a safe and sustained block cave operation, according to the company. For lower hang-ups in a drawpoint, or oversize rocks on the ground too large for scoops to handle and too disruptive to get rid of with concussion blasting, the secondary reduction rig, the Blockholer, solves the problem and ensures production isn’t held up, MacLean says.

The past few years have been exciting for MacLean’s branch in Africa. Petra Diamonds ordered a BH3 for its Koffiefontein diamond mine, in Free State Province, South Africa, with the company’s success showcasing increased safety used as a “proof point” to secure another order for a BH2, according to MacLean, this time from the Kimberley Ekapa Mining joint venture, in the Northern Cape. Palabora then placed an order for two secondary breakers for delivery in 2020. “Both Koffiefontein and Kimberley mines echo the same message of improved safety, increased production, and long-term savings in infrastructure upkeep due to the inclusion of MacLean secondary breaking units in their mining cycle,” MacLean said.

The two-stage process of their conventional approach to reduce oversize and bring down hang-ups (drill with one machine and manually load explosives by hand) has now been combined into a single-stage process with the Blockholers. This process eliminates the need for manually loading explosives, thus improving operator safety, and reduces damage to the draw point infrastructure.

“In addition, these units are used by both mines as utility drills to drill off cubbies as well as eye bolt holes due to their mobility and self-sustaining drilling capabilities of diesel power,” MacLean explained. “This versatility makes the MacLean Blockholers an invaluable tool to the mines.”

Moving to Australia, in its HY2020 results presentation, Orica says it is progressing with its underground automation program. The global explosives and blasting leader reports that it has already conducted successful trials of a fully mechanised and semi-automated (teleremote) drawpoint hang-up blasting solution which was



MacLean Engineering’s secondary breakers have been proving their worth in Africa, with a number of machines safely and effectively eliminating ore flow blockages and releasing trapped reserves above the draw point

described as a customer-led technology collaboration.

The trial saw an advanced MacLean Blockholer, BH3, attached with MacLean’s latest Ore Flow Innovation, Auto Explosive Loader (AEL) for loading wireless charge, and equipped with teleremote control successfully load Orica WebGen™ wireless initiating systems and explosives at Newcrest’s Cadia East underground panel cave gold mine in New South Wales. The solution eliminates exposure risk to employees by removing them completely while also improving production rates. Newcrest stated: “With the WebGen wireless technology, the teleremote unit is able to clear drawpoint hang ups in a single pass without placing people in high risk situations.”

China’s drilling market for mining

This year, the tunnelling market in China has been struggling with fewer big new public projects. That said the underground mining market has been performing well for both coal and metallic/ industrial minerals mines, which all means good demand for supply of drilling jumbos and rock drills. China is keen to ensure self sufficiency of resources while at the same time increasing the mechanisation of its underground operations and reducing manual labour for safety reasons. There is also a tendency towards using more bolting machines. This application was previously ignored, or if bolting was done, it was done manually, is now being increasingly mechanised so there is more and more manufacture of bolting/anchoring machines.

Komatsu Mining-owned Montabert is the leading supplier of premium rock drills to the Chinese market, supplying most of the major Chinese OEMs of drill jumbos including Siton, Kaishan Group, Zhangjiakou Xuanhua Huatai Mining and others. Siton told IM: “The most important characteristics of drilling and production jumbos in China are reliability,

robustness, efficiency, a low failure rate and easy maintenance. We utilise Montabert drills in our solutions as the Montabert drifters are more reliable and have a higher brand respect and recognition compared to local brands.” Siton’s key models include its two boom coal mining jumbo, and its one and two boom DW2-50 mining jumbos which are fitted with the Montabert HC50 as standard or HC109 as an option. The production drills XTDL-2, XTDL-3 and XTDL-4 all have a Montabert HC109 drill.

Sandvik operates in China via a JV with Chinese OEM Lingong known as Lingong Mining Machinery and Rock Technology Co Ltd (LGMRT) to manufacture mid-tier level mining jumbos like the UD392 Underground Drill, while Sandvik Mining also sells its premium jumbos and production drills to the biggest mining operators direct. LGMRT also makes LHDs, underground trucks and other products in cooperation with Sandvik. It states: “LGMRT is a joint venture co-established by Sandvik Group of Sweden and Lingong Group in May 2016. LGMRT makes full use of Sandvik’s advantages in mining and rock equipment products and technology, as well as the advantages of Lingong Group in the mid-end technology and mid-market operations. It provides over ten types of mining and rock equipment



Epiroc’s rock drill offer to Chinese drill rig OEMs includes the 18 kW RD 18U for 35-64 mm holes; a less complex option with fewer parts and settings which is intuitive to maintain and overhaul

products in four categories for the Chinese market, other BRIC countries, and countries along the Belt and Road, eg surface drill rigs, underground loading and hauling equipment, underground trucks and underground drills.”

Epiroc is an important player in China both with its main global range of jumbos and production drills but also through sales of its rock drills independently to Chinese drill OEMs. These are in the main RD drifters dedicated to the Chinese market rather than the COP drills. These include the RD 22U, a straightforward hydraulic rock drill for underground production drilling applications (64-102 mm) as well as the 14 kW RD 14U and 18 kW RD 18U both for 35-64 mm holes. All these drills are less complex with fewer parts and settings so are intuitive to maintain and overhaul.

Discussing Chinese drifter companies, the largest is **Zhangjiagang Free Trade Zone Yongda Machinery**, a Taiwan company, with a factory in

Jiangsu on mainland China, which has seen continual growth in recent years. Its models include the Yonda brand hydraulic drifters YHD90 (13 kW) and YHD210 (13 kW) as well as the YHD950 (25 kW) and YYG265 (35 kW). Aside from Yongda and its Yonda products there is **Lianhuashan Rock Tools (LHS)** in Huludao City, Liaoning Province with its main models of drifter being the HYD200 and HYD300. This is a traditional local company which benefitted from technology transfer from Secoma in the early 1980s, when Secoma sold the technology of its Hydrastar 200 and its two boom jumbo to China. Lianhuashan states: “In 1986, LHS imported production technology for the HYD200 hydraulic drifter from Secoma France and manufactured the first Chinese hydraulic drifter. Continuously strengthening innovation, research and development, LHS successively launched the new products HYD350E and YD150, and upgraded products of the HYD200E and HYD300E on the basis of HYD200 and HYD300. The introduction of the new products expands the product line of hydraulic drifters, and meets customers’ requirements on hydraulic drifters for different functions.” As an example, compared to the HYD200, LHS says the HYD300E has the advantages of optimised rotation structure, leak reduction, significantly improved stability, high adaptability for complicated conditions and low maintenance cost. 

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