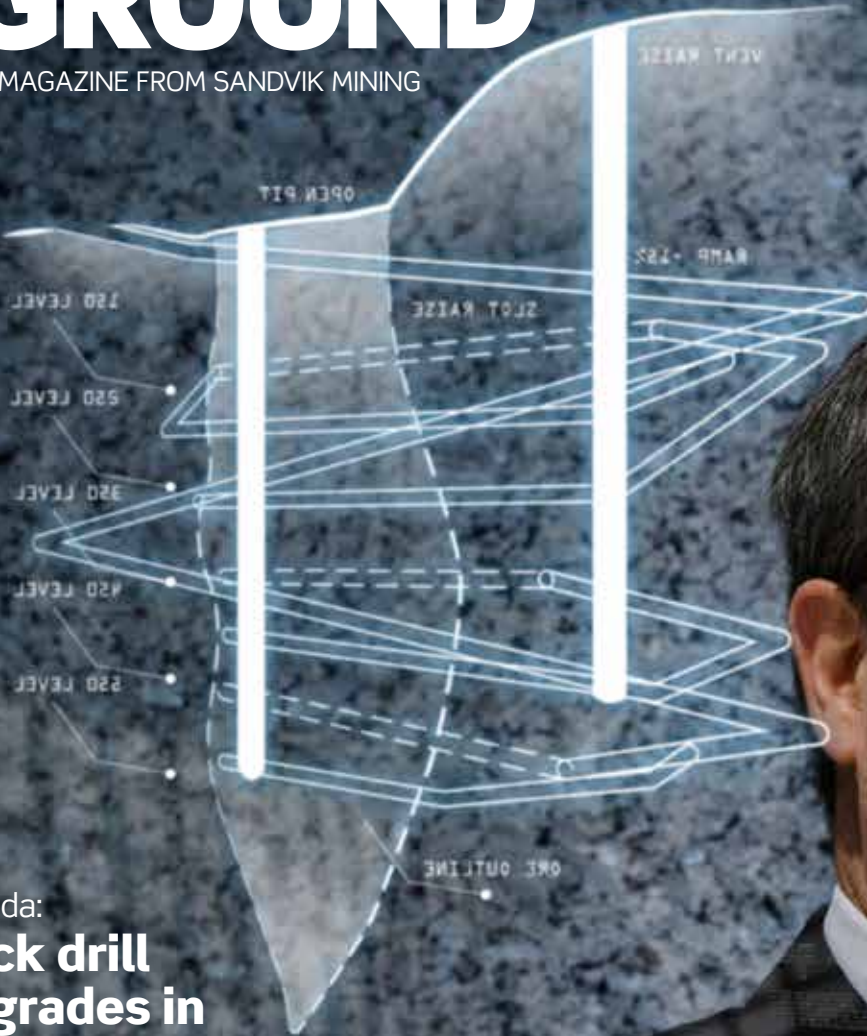


SOLID

#1.2016

GROUND

A MAGAZINE FROM SANDVIK MINING



Canada:

**Rock drill
upgrades in
Val d'Or**

Fleet management:

**Tools of the
trade**

The Expert:

**Sustainable
mining for 2050**

THE DIGITAL REVOLUTION

DPM CEO Rick Howes discusses the future and benefits of a digital mine.

SANDVIK

Dear reader,

HAVING JOINED SANDVIK Mining as its President in December, I am delighted to have the opportunity to lead Sandvik Mining at what is not only a very challenging time for our industry, but also a very exciting one as we strive to deliver what you, our customer, needs. Now, and in the future, you can count on us to do so, in ways both big and small.

Take the new Sandvik 365 iPad app, bringing the latest, detailed information on our parts and service program, customized product selector and return on investment calculator to your fingertips.

Innovation isn't just about our products and technologies, it's about our customer service, too. That's why we're investing in our Customer Support Centres around the world, helping them to make sure that you always have the parts and tools that you need to operate efficiently, 365 days a year.

RECOGNIZING THAT TOTAL cost of ownership is more important than the initial capital cost, Sandvik Mining is committed to being a true mining productivity partner. We're confident in using actual numbers to demonstrate the value that we add and the savings that we deliver: Sandvik 365.

We also know that safety is our customers' #1 priority, and that's why safety and impact on the environment play such an important part in our continuous research and development. The latest Sandvik top center rock drill bit is just one great example, bringing unprecedented improvements in durability, safety and reliability.

It's good to hear, at first hand, that many of our customers are benefiting from our pro-active technologies such as real-time data monitoring and fleet management solutions. Sandvik Mining will once again be proud to be present at MINExpo (Las Vegas, USA, 26-28 September), showcasing yet more exciting new products and innovative technologies!

You can count on us!

LARS ENGSTRÖM
PRESIDENT SANDVIK MINING

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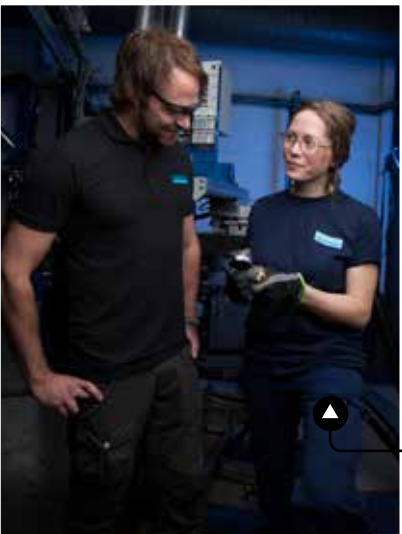
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Introducing the Sandvik 365 iPad app

An app you can count on.

When it comes to mining, you need hard facts and concrete data to be able to make the best decisions for your operation. That's why the minds at Sandvik Mining created the Sandvik 365 iPad app: to help you access the hard data you need in a personalized, eye-opening way. From in-depth and always up-to-date information on invaluable Sandvik parts and services to customized product selectors and return on investment calculators, the app has everything to help you benefit from a Sandvik parts and service agreement. Download the app for free on the App Store.

11,500

- Amount in euros donated by Sandvik Mining to the Dutch Cancer Society during the TCS Amsterdam Marathon 2015. The 21-member team set a goal to raise 10,000 euros and Sandvik Mining pledged to triple the donations, which it did.



Celebrating a decade of partnership

Top management from Hindustan Zinc Limited (HZL), India's largest and the world's second-largest zinc miner, recently attended a Mining Forum in Udaipur, India, hosted by Sandvik Mining to celebrate the two companies' successful 10-year relationship and further strengthen the long-standing partnership between the two organizations.

At the forum, Sandvik representatives presented the company's new technological offerings, competence development initiatives and services, and other topics tailored to HZL's specific needs.



MINExpo International 2016

Every four years, mining industry professionals from more than 100 countries converge in Las Vegas, USA to explore products, services and technologies that address their challenges. MINExpo 2016 is rapidly approaching and Sandvik Mining will once again showcase its latest innovations to help customers in every corner of the world mine more safely and

productively, 365 days a year.

More than 50,000 visitors are expected at MINExpo 2016, and Sandvik Mining will highlight products and services that improve safety, reduce costs, minimize environmental impact and increase productivity. For the second consecutive show Sandvik Mining will occupy booth #7309 in the Central Hall.

Supporting growth in Africa

Since opening its new facility in 2014 in Kitwe, Zambia, the Sandvik Mining support centre has upped its efficiency levels, enabling faster turnaround times for the maintenance and repair of mining fleets throughout the region of central Africa. Over the past year and a half, the facility has also seen a 60 percent increase in rebuilds received from customers, combined with the reduction of complete rebuild lead times by an impressive 45 percent to just 12 weeks. Simultaneously, the company has extended its safety record to 4,240,440 hours without lost time injuries.



At Kitwe, globally refined management systems are in place.

A novel approach to customer service

▶ Sandvik Mining has recently invested in common tools, processes and training for the Sandvik Mining Customer Support Centres (CSC) around the globe to improve service levels provided to customers, helping them to stay productive and profitable at all times.

Nowhere is this more evident than at the company's Jet Park Customer Support Centre in Johannesburg, South Africa, where the CSC team is currently implementing a combination of advanced communication solutions, information systems and training that helps them access all the required information about each customer and advise them in real time about the status of orders.

The new system is able to link customers' telephone numbers with their information, which ensures that by the time an incoming call is answered, the customer sales and support representative (CSSR) will already have the customer's details in front of them. Likewise, the system will keep track of events to prompt CSSRs to proactively contact clients and update them about back-order status or other support that will make sure the customer's equipment always has parts and tools to operate 365 days a year.

The new system will keep track of events to help CSSRs proactively deal with issues.



Sandvik and CEEC to collaborate

▶ Sandvik has joined the Coalition for Energy-Efficient Comminution (CEEC), an organization established by the mining industry to support knowledge sharing and change in an area of high energy consumption. The comminution process - size reduction to liberate the value minerals for subsequent processing/beneficiation stages - consumes large amounts of energy. Sustainability in comminution, in particular its energy efficiency, has been the subject of several innovative research and development projects worldwide.

The CEEC will increase the rate at which more energy-efficient comminution data sets, processes and technologies are developed, demonstrated, shared and applied. This is

expected to contribute directly to the industry's target of reducing operating costs and improving energy productivity while delivering shareholder value.

"By being a part of the CEEC organization, our objective is to take an even more active role in supporting and developing eco-efficient comminution solutions to support mining customers globally," says Hamid-Reza Manouchehri, global manager, Process Intelligence and Development, Sandvik Mining.



THE QUOTE

“Getman products strengthen the Sandvik offering in underground drilling and rock reinforcement systems.”

- Lars Engström, Sandvik Mining President on the global distribution agreement between Getman and Sandvik.



The final graduates

▶ The final group of Sandvik International Mining School (SIMS) students recently came together at Montan University in Leoben, Austria, for the closing days of the programme. During this time the students undertook oral examinations and project presentations, and after passing they graduated as International Mining Engineers.

Spanning four continents, SIMS is a postgraduate degree programme designed to run over two years. Sandvik Mining has led the programme since 2007, in partnership with six of the world's leading mining universities. Its content has focused on knowledge-building within the areas of hard rock, soft rock and surface mining, together with geology, project management and EHS within mining, all of which has been conducted across a truly international environment.

Q & A

FOR THE LOVE OF THE MINE

RICK HOWES has seen it all. With 35 years of industry experience, the CEO of Dundee Precious Metals (DPM) has held a variety of jobs in mining, and even though he has reached the top of his profession he wants to go farther and, as he likes to say, “take the top off the mine.” He sat down with *Solid Ground* magazine to discuss the “intelligent mining” revolution that is currently under way.

Q WHAT OPERATIONAL CHANGES HAVE YOU SEEN OVER YOUR 35 YEARS IN THE MINING INDUSTRY?

This may surprise you, but in general the industry hasn’t drastically changed the way it does things since 1980 when I got my first mining job. In terms of equipment operation and levels of automation, sure, there have been some minor changes – equipment has gotten bigger for the most part, particularly in open-pit mining, and automation has become more commonplace – but overall the changes have been minimal.

Q DPM’S CHELOPECH COPPER-GOLD MINE IN BULGARIA IS A MODEL OF EFFICIENCY, HAVING QUADRUPLED PRODUCTION SINCE ITS ACQUISITION IN 2003. HOW WAS THIS ACHIEVED?

Chelopech was a neglected, Soviet-era mine when we acquired it. It had neither the necessary business structure nor any motivation from those on the ground to succeed. What it did offer was opportunity: an opportunity to invest capital; an opportunity to change the culture of the operation; an opportunity to change the mining methods used there to get the best grades out of the ore at the site. A lot of the changes we brought to Chelopech were technological and based in innovation, and to date it’s gone through what I would call a major transformation. It allowed us to bring the best of our capabilities and cultural approach to managing the

operations there, and we're very proud of what we were able to accomplish.

Q AT A RECENT SPEECH TO MINING STUDENTS, YOU SPOKE OF THE GREAT OPPORTUNITY MINES NOW HAVE TO RETHINK THEIR EFFECTIVENESS AND INTRODUCE NEW WAYS TO VIEW MINING OPERATIONS. CAN YOU DESCRIBE THIS "INTELLIGENT MINING" REVOLUTION?

I started out as a mining engineer, and in my 35 years on the job I've spent a lot of time thinking about ways to improve efficiency and optimize performance. By the time I got to DPM, a lot of my ideas were ready to be implemented. One of those concepts is the digital mine, which is a mine that's connected via wireless communications, enabling wireless tracking and data accumulation and usage in real time. Obviously, the digital mine is only possible through a lot of enabling technologies.

At DPM, we've developed these concepts along with our strategic partners, such as Sandvik Mining, to build such a mine over the course of several years, implementing our vision of using digital and real-time information. And while we're still scratching the surface of the potential, we believe we have set a new standard in the industry for how to build a modern mine capable of optimizing its own performance.

Q WHAT ARE SOME OF THE BENEFITS OF USING REAL-TIME DATA AT THE MINE?

For us, the initial benefits we realized were the abilities to track, schedule and execute our plan. Now we can measure our expectations versus what's really happening in the mine. Real-time data enables you to see whether you are progressing on schedule, observe any disruptions to the processes in real time and intervene if things go wrong. I must say, that's where the industry really suffers today: it's mostly a paper communication system where at the start of the shift operators get told what they'll be working on, but the reality is that they fall behind schedule and management isn't aware until much later when it's too late to intervene. Our concept is to intervene on any disruption when it occurs and course-correct as quickly as possible.

Those are the initial benefits, but the next

phase involves real optimization, linking predictive data analytics and big data collection to the planning, scheduling and execution in an integrated way to make it even more dynamic. That's where we're headed, and with that type of operation we can use experts from around the world to solve problems in the field in real time using data and algorithms that are available, transforming us from being just miners to a knowledge company.

Q WHAT ARE SOME OF THE INHERENT DIFFICULTIES IN APPLYING MODERN STRATEGIES WHEN FACED WITH TRADITIONAL MINING ATTITUDES, CULTURE AND HABITS?

There can be a real lack of trust, particularly in a unionized environment, with the introduction of technology at a mine. It's often seen as a way to make people either work harder or become obsolete – hence the resistance. So we always have to start by building trust between the workforce and management. And if I'm going to be completely honest, I'd say the resistance comes more from middle management than from the workforce. These are people that are used to being "firefighters"; they require something to happen so that they can respond. The modern strategies that we employ are the very opposite of that – they are proactive and predictive. Planning and execution are everything. That's why our change-management approach works – because it involves everyone at every level. It's very inclusive and collaborative.

Q HOW HAS SANDVIK MINING HELPED DPM ACHIEVE ITS GOALS OF OPTIMIZING RESULTS?

Our dealings with Sandvik Mining have been so much more than your traditional supplier-customer relationship. There was a true spirit of collaboration and partnership established to achieve our goals and a very powerful example of what's possible between suppliers and mining customers when everyone is on the same page. All processes are fraught with challenges, and this one was no different, but having people step up and really work through these issues showed the true spirit of cooperation and collaboration. ■

RICK HOWES

TITLE: Dundee Precious Metals CEO

HOME: Toronto, Canada

HOBBIES: Skiing and golf

FAMILY: Married with three children

ABOUT THE COMPANY

DPM is a Canadian-based international mining company engaged in the acquisition, exploration, development and mining and processing of precious metal properties. DPM's business objectives are to identify, acquire, finance, develop and operate low-cost, long-life mining properties.

Can diamonds detect early-stage cancer?

▶ A team from the University of Sydney has come up with a method that uses nanoscale synthetic diamonds to detect cancers before they become life threatening.

The physicists' findings, published in the journal *Nature Communications*, reveal how to make the tiny gems light up inside an MRI machine. The manipulated diamonds are then attached to specific chemicals that are known to target cancers.

The microscopic diamonds are injected into the body and tracked as they move through the patient's system. If there is any trace of cancer in the individual's body, the chemicals will be attracted to the site and the attached diamonds will provide a "lighthouse" on the MRI scan.

An optimistic future for Latin America

▶ According to a study by the law firm Dentons, most companies based or with operations in Latin America continue to explore, develop and operate projects in the face of worldwide difficulties across the sector.

The study indicates that 66 percent of those interviewed are either somewhat or very optimistic that there will be increased investment in the mining sector over the next six months. In terms of where the money will come from, the interviewees believe North America and Asia will most likely finance Latin American mining projects. The study reveals that Peru continues to be considered a hot spot, as roughly half of respondents think it offers the most investment opportunities, while nearly a third of respondents pointed to Chile as the country that would attract the most investment over the next six months.

Top 6 Latin American nations Investment Grade Ratings

Country	S&P	Fitch	Moody's
Chile	AA-	A+	Aa3
Peru	BBB+	BBB	A3
Mexico	BBB-	BBB+	A3
Brazil	BBB-	BBB	Baa2
Colombia	BBB	BBB	Baa2
Uruguay	BBB-	BBB-	Baa2



+ The new technique makes REE extraction inexpensive and minimizes environmental impact.

PHOTO: RTIMAGES

Extracting rare earth elements from coal

▶ Researchers from Penn State University, led by the US Department of Energy, have discovered that rare earth elements (REEs) can be extracted from two coal byproducts through an ion-exchange process. The method involves rinsing the coal with a solution that releases the REEs that are bound to the fossil fuel.

REEs are important in many technologies, including electronics, computers, clean energy, health care, transportation and national defence. Despite their name, they are not all that rare, but unlike typical minerals they are rarely found in pockets or seams and are

instead dispersed in low levels of concentration.

The new mineral processing technique makes the extraction not only cost-effective, but also minimizes environmental impact.

Past research has examined "roasting," a process that is energy intensive and requires exposure to concentrated acids. In contrast, ion exchange requires less energy, the group says.

The team says they want to take a fresh look at the feasibility of extracting REEs from coal given its abundance in the United States, which could be a boon to the ailing coal industry.

US mining industry sets safety milestones

+ Fatality prevention initiatives involve enforcement, education and outreach.

▶ The Metal/Non-Metal sector of the US mining industry achieved two first-ever milestones last year: working without a fatality for 133 consecutive days - about 4.5 months - and doing so during October, a month that had never before been fatality-free. Mine Safety and Health Administration head Joe Main presented the results at a Metal/Non-Metal stakeholder meeting in January. Main noted that the multi-month accomplishment in 2015 ran from August 4 through December 14.

The previous fatality-free period record was 82 days that ended in January 2010.

MSHA launched fatality prevention initiatives in June 2014, February 2015 and August 2015. Each initiative involved stepped-up enforcement, education and outreach. Education and outreach were accomplished using enforcement officers, who discussed recent fatalities and best safety practices with miners in "walk-and-talk" sessions during inspection visits.

Towards sustainable mining

2016

The World Economic Forum published *Mining & Metals in a Sustainable World 2050*, a report outlining the current and future state of the mining industry.

1 Transition themes
The report identifies several crucial themes of transition, along with which changes are necessary and achievable between now and 2050.



The workforce
Potential implications such as different working models to attract and retain workers, fewer jobs and outsourcing will change opportunities for sharing sustainable value.



External relationships
Stakeholder groups will drive greater accountability and a more direct emphasis on strategic partnerships built on trust.



Disruptions in the value chain
Understanding end-industry and user demand shifts across the value chain will be a key success factor.



Mineral resource base
It will be increasingly important to understand where and how new frontiers will be accessed and what resources will be available; this includes metal and resource recycling.



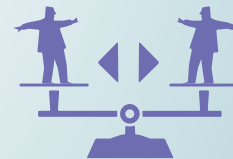
Tech and innovation
Big data and sophisticated modelling will enable more efficient planning, including reducing greenhouse gases, and potentially less intrusive mining.



Strategy
Sustainability will become even more central to investment decisions and challenge normative definitions of value.

2 Four principles of sustainability
The four principles of sustainability are not mutually exclusive, but represent the four major groupings of the principles underlying the transition to a sustainable world.

Environment and climate conservation, meaning lower carbon footprint in the value chain.



Fair value and human development, where value is shared fairly between different stakeholders.

Transparency and human rights, where trust and partnerships are key to business success.



Health and wellbeing, where the safety of workers and their surrounding communities remain a foundational value.



3 Circular economy
The concept of circularity is restorative by design. Applied to the mining and metals industry, it includes the cyclical use of the commodities and metals extracted directly from rock (**primary resources**), commodities and metals which are reused and recycled, thus not directly extracted (**secondary resources**), and **enabling resources**, such as water and energy, which are required as an input factor.

2050

EXCEEDING EXPECTATIONS

■ It's just a few days into spring but the season's first heatwave has already sent temperatures soaring into the low 30s Celsius. Adrian Short has to hold his feathered cowboy hat on his head as a wind gust sweeps across the arid outback landscape outside the RUC Mining office at Saracen's Karari gold mine.

Text: **ERIC GOURLEY**
Photo: **ADAM LACH**

AT LEAST THE wind keeps the flies away," quips Short, RUC's operations manager for mechanized mining. He and his colleagues have thrived in the more controlled climate underground at Karari, where the contractor developed an exploration drill drive and main decline ahead of schedule and initiated underground production in August 2015.

A 90-minute drive northeast of state mining hub Kalgoorlie and situated in the same prospective goldfields as some of Western Australia's most famous deposits, Karari is being developed into a cornerstone of Saracen's Carosue Dam Operations. RUC has been leading its transformation from open pit to underground mine since 2014, when Saracen awarded the company a contract to develop a short exploration decline. A hanging wall platform was

established to facilitate an extensive underground exploration programme Saracen is using to delineate and define its Karari resource.

SINCE THE EXPLORATION decline, RUC developed 3,500 metres in 11 months – 45 days ahead of schedule – and produced its first ore for Saracen several weeks early in August 2015.

"The strategy for RUC is to bring a product to the client, done on time, and as safe as possible," Short says. "If we didn't have the equipment and the backup we couldn't have done that. We have the right gear, we do the job once and we don't come back."

BARRY UPTON, A 33-year underground contract mining veteran, has



RUC Mining

● RUC Mining is a Western Australia-based underground mining contractor with an extensive portfolio of completed and current projects throughout Australia and the Asia-Pacific. A wholly owned subsidiary of the global Murray & Roberts group, RUC Mining was established in 1990 as a shaft sinking and raise drilling specialist. Today, the company offers the full range of underground development and production services, including construction, mechanized mining, boxhole boring, large excavations and specialist ground support and grouting.



**Sandvik DD421
has delivered 30
to 40 metres a
month more than
RUC expected.**

RUC developed 3,500 metres in 11 months - 45 days ahead of schedule.



357.6
Advance record, in metres, set by Sandvik DD421 in one month.

The contractor sought a versatile jumbo drill and a powerful loader to complement one another for its required development and cycle times, ultimately selecting a Sandvik DD421 twin-boom jumbo and a Sandvik LH517 loader for the project.

“The loader suits the five-by-five-metre ore drives perfectly,” Upton says. “We needed flexibility to operate in a number of different size headings without compromising productivity in the larger headings. The attraction with Sandvik loaders is the power-to-weight ratio, because of the Sandvik philosophy of using a high-tensile steel frame, and the engine is attractive, both from an emissions and a technology point of view.”

SHORT NAVIGATES HIS light vehicle into Karari’s west portal, and soon is showing off some development recently completed ahead of schedule with the Sandvik DD421. The jumbo has delivered 30 to 40 metres a month more than the contractor expected, and Short puts the extra productivity in part down to the new Sandvik RD525 high-frequency drifters on the drill rig, which bore a 4.5-metre hole in Karari’s tough ground in two minutes.

“We can virtually do a boring cycle in around an hour and three quarters, where we actually scheduled for two and a half hours for a decline round,” he says. “That really improves our cycle times, hence we get more metres.”

served as RUC’s managing director for nearly a decade. When the contractor initiated its search for a single supplier of equipment, tools and service for the Karari project, Upton prioritized criteria in the process.

“Most people would probably say capital cost is most important in equipment selection, but I think that’s secondary or even maybe tertiary to reliability and operating cost,” he says. “Over time operating cost is far more important than your initial capital cost, and we’ve had very good operating cost

and very good reliability out of the Sandvik fleet we’ve purchased for the project. You can have the best unit in the world but if there’s no service support and no reliable parts supply, then it doesn’t matter how good the unit is, it’s going to result in downtime.

“At the end of the day it comes down to cost per unit – cost per drill metre, cost per percussion hour, cost per tonne, cost per loader hour. Whatever the measure happens to be, you need to be competitive in the operating cost space, and we’ve been pleased we chose Sandvik.”





We've been looking at average availabilities of very high 80s, greater than 90 percent

safety for us at the face and is also very fitter-friendly. Everything is serviced from the ground and nobody has to climb on the rig.”

RUC RELIES ON Sandvik for more than just equipment, tools, parts and technical support. Sandvik even resharpens RUC's dull drill bits at its workshop in Kalgoorlie.

“We're getting around four to five resharps per bit, which reduces our overall costs,” Short says. “We might pay a little more up front for a quality bit, but we get a lot more out of it. We made a conscious decision to go with a single supplier of the drill rig, the loader, the drill consumables, steels, couplings and everything.

“The relationship that RUC wanted to develop with Sandvik was a long-term relationship, not just including the product. It was including the after service, which is important. If you're a contractor, you need to have a very reputable company to supply you with tools and parts very quickly or it can turn quite disastrous, and financially it can cost you a lot of money.”

Upton adds, “RUC and Sandvik are partners in many senses of the word, in terms of what a partnership involves – working together to improve performance. Our partnership is healthy and strong, and that's assisting us in delivering superior performance.” ■

▶ **IN DECEMBER 2015**, RUC achieved a monthly record 357.6 metres of advance with the lone jumbo.

“We've been very pleased with the performance,” Upton says. “We've been looking at average availabilities of very high 80s, greater than 90 percent.

Obviously the more time you've got your drill at the face, the quicker you're going to advance. It's actually close to 20 percent above our expectations when we bid the job, so it's set a new benchmark for our company. We're proud of our performance at Karari, both in terms of quantity and quality of the work.”

RUC uses Sandvik DD421 for several functions, including face drilling, handling mesh, installing intensive ground support and drilling long anchors. The contractor even uses the jumbo's feed rail to move a dewatering pump at the face, which eliminates the need for people to lift in a potentially hazardous area.

“Not only did Sandvik DD421 suit us as an underground miner, it also helped satisfy our first priority, which is the safety of our employees,” Short says. “A huge part of that is the equipment we purchase has to be to the highest standards. Sandvik DD421 improves



RUC relies on Sandvik for more than just equipment, tools, parts and technical support. Sandvik even resharpens RUC's dull drill bits at its workshop near Kalgoorlie.



See a video about the Karari gold mine at minestories.com



Text: **TURKKA KULMALA** Photo: **SAMIR SOUDAH**

RAISING THE BAR

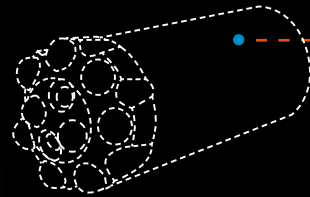
■ Designers of rock drill bits for face drilling have not scored many engineering victories over the past 25 years. An innovative design that features a new carbide grade from Sandvik Mining offers unprecedented improvements in durability, safety and productivity.



Tech spec:

Top center drill bit

- Top hammer bits for underground mining and tunnelling applications
- For face drilling and bolting
- Bit sizes: 43, 45 and 48 mm
- 2-3 raised end buttons
- 7-8 gauge buttons
- Connection: R32, Sandvik Alpha 330 and R35
- GC80 cemented carbide buttons



Suboptimal tool life is a key problem for most current standard bits.



The new 'top center' design features a raised front, which makes room for more inserts.

THE ROCK DRILL bit can be considered the 'business end' of a sophisticated engineering system that essentially converts

hydraulic energy into impact waves to break rock. Sandvik Mining set out to develop a unique new drill bit to solve persistent tool life problems experienced by a customer in northern Sweden. After three years of intensive development, principal engineer Andreas Rindeskär is visibly proud of the 'top center' design.

"We had to come up with a completely new design to be able to create the features that we wanted from the bit," Rindeskär says.

Product manager Robert Grandin was one of the key drivers of the R&D project.

"It started as a solution for an extreme customer problem, and now it's a standard solution that can be used everywhere," Grandin says. "It proved so successful we decided to apply this highly specialized technology for additional diameters and applications."

The new top center design features a raised front, making room for more inserts as well as larger flushing holes and bailing grooves. Primary applications include face drilling and bolting both in mining and tunnelling environ-

ments, where long tool life is becoming an expectation as mining customers look to cut costs and improve productivity.

Tool life improvements created by the Sandvik top center design also yield significant health and safety benefits, since operators spend less time near an unreinforced face. "The new bit design essentially delivers more drill metres per shift compared with a standard bit, thanks to less frequent bit changes and faster penetration rates," Grandin says. "Drill operators say they really like this product because they do not want to get out of the cabin to change the bit more often than they absolutely have to."

A crucial design issue was lack of space on the bit head.

"Given the designs we had had for the past 20 or so years, there wasn't much space available to do anything," Rindeskär says. "We had to come up with a completely new design idea to be able to create the features that we wanted."

THE TOP PRIORITY for Rindeskär and his designer colleague John Hammargren was to increase the service life. As the main criterion for discarding a drill bit is excessive wear on the diameter, the simplest way to lengthen service life is to add more gauge buttons. This

SANDVIK



It started as a solution for an extreme customer problem and now it's standard

can prove problematic because of the minimal space available. Furthermore, an increase in the number or size of the carbide buttons generally decreases the penetration rate: the same impact force yields a lower net force per button.

The new design solves these problems with a so-called raised front, elevating two or three front buttons a few millimetres above the gauge buttons located on the periphery of the bit. The front buttons are furthermore set at a slight angle relative to the symmetric axis of the bit. The raised front creates a slightly recessed hole bottom pattern that alters the rock-breaking action for improved performance.

The raised front makes it possible to increase the number of gauge buttons from six to eight on the 48-millimetre bit and from six to seven on the 43- and 45-millimetre bits, and yet there is still space for larger flushing holes. The top

center design also increases the flushing volume by up to 30 percent, and the larger flushing holes and their improved positioning decrease the pressure drop over the bit.

The penetration rate remains unaffected by the raised front design, or even increases due to decreased recrushing and easier passage of cuttings.

Improved understanding of the tool steel permitted higher stress levels in the bit body. The design life of the bit is around 500 metres in abrasive conditions, which means that the steel fatigue properties have been sacrificed for more wear resistance, to some extent.

A key enabler for pushing the stress limits is today's highly accurate and reliable production process. Continuous improvement of the production technology now allows extremely close manufacturing tolerances.

The top center also features a new cemented carbide grade, the GC80. "The problem with carbide is that it's either wear resistant or tough," says Grandin. "When we developed the GC80, we wanted to combine the best of those two worlds." To reach this goal designers developed a new production method that improves wear resistance on the outside while securing toughness with a soft centre.

After more than 1,000 hours of testing in extremely varying conditions and sites in countries including Australia, Canada, Finland, Indonesia, Mexico, Russia, Sweden and Zimbabwe, the response to the new bit design was enthusiastic. Operators logged more drilled metres and more holes between each regrind. Less regrinding means less wear on the drill diameter. An additional benefit is more accurate collaring, which directly impacts the accuracy of drilled holes and consequently blasting results. ■



The life of the top center bit increases significantly thanks to more gauge buttons.



Value added For mine management

- Up to 80% longer grinding intervals
- Up to 60% longer bit life

For drill operators

- Higher productivity thanks to longer service life
- Safer work environment thanks to fewer bit changes

RETROFITS REAP REWARDS

Text: **JEAN-PAUL SMALL** Photo: **SAMIR SOUDAH**

■ Exploration plans get the green light as preeminent gold miner Agnico Eagle safely and efficiently searches for gold almost 3,000 metres below the surface of the earth.



Customized modifications on Sandvik equipment are carried out on site or at the Sandvik workshop nearby.

At 90,000 metres per bolter, that's a savings of \$45,000 per bolter per year

THERE IS GOLD here in the southwestern wilds of Quebec, Canada. The ore is typically found in volcanic rocks that were deposited more than 2.7 billion years ago on what was then the sea floor. This is the home of the Abitibi gold belt, a region that has produced more than 100 mines and 170 million ounces of gold since the beginning of the 20th century. Val d'Or, French for "valley of gold," sits practically on the "buckle" of the Abitibi gold belt, and has itself produced around 45 million ounces of gold since the 1930s.

Agnico Eagle's flagship operation, the LaRonde mine, is about 60 kilometres due west of Val d'Or. The Canadian miner is an expert at extracting the glittering precious metal. Since the gold price took its more than 40 percent plunge from a 2011 high, Agnico Eagle has more than survived: it has blossomed. In the third quarter of 2015, for every dollar of gold the resilient miner sold, 49 cents was gross profit, the best performance among 15 major producers tracked by Bloomberg Business.

LaRonde is a 7,200-tonne-per-day mine. Its processing plant has produced 4.6 million ounces of gold, and the mine still has around 3.4 million ounces in proven and probable reserves. In 2015, payable gold production reached 267,921 ounces at LaRonde. The mine also produced 1.275 million ounces of silver, 10,515 tonnes of zinc and 4,997 tonnes of copper for that same period.

Operations at the mine run like clockwork. In fact, ore is processed at its mineral processing centre literally across the road from the current mine site. Agnico Eagle expects to increase gold production rates at LaRonde, but in order to do so the current mine must be extended in the only direction it can: downwards.

"After discovering and mining out the LaRonde ore body from 2000 to 2012, we planned to dig deeper," says Christian Goulet, general mine superintendent at Agnico Eagle's LaRonde mine. "It is the same ore body, but since 2012 we started mining below 2.5 kilometres, which is what we refer to as the LaRonde extension."



ABOUT LARONDE ◆◆◆◆◆

Location: Between Val d'Or and Rouyn-Noranda, Quebec, Canada
Mine type: Underground
Est. mine life: 2024
2015 production: 267,921 oz gold/1.275 million oz silver/10,515 tonnes zinc/4,997 tonnes copper
2015 total cash costs: \$590/oz gold
Designed throughput: 7,200 tonnes per day
Employees: 841



▶ “The next step for us is to generate a feasibility study for a possible LaRonde 3, which would be between 3.1 and 3.7 kilometres.”

BEFORE THEIR SHIFTS start in the early morning hours, miners mill around the well-lit staging area inside Agnico Eagle’s functionally modern facility, preparing to descend 2,800 metres and start their workday. There is a definite strut to their walk and lightness in their demeanour born of confidence in one’s abilities. Laughter rings out on the elevator ride down but comes to an abrupt halt when the alarm buzzes, indicating the elevator has reached its destination.

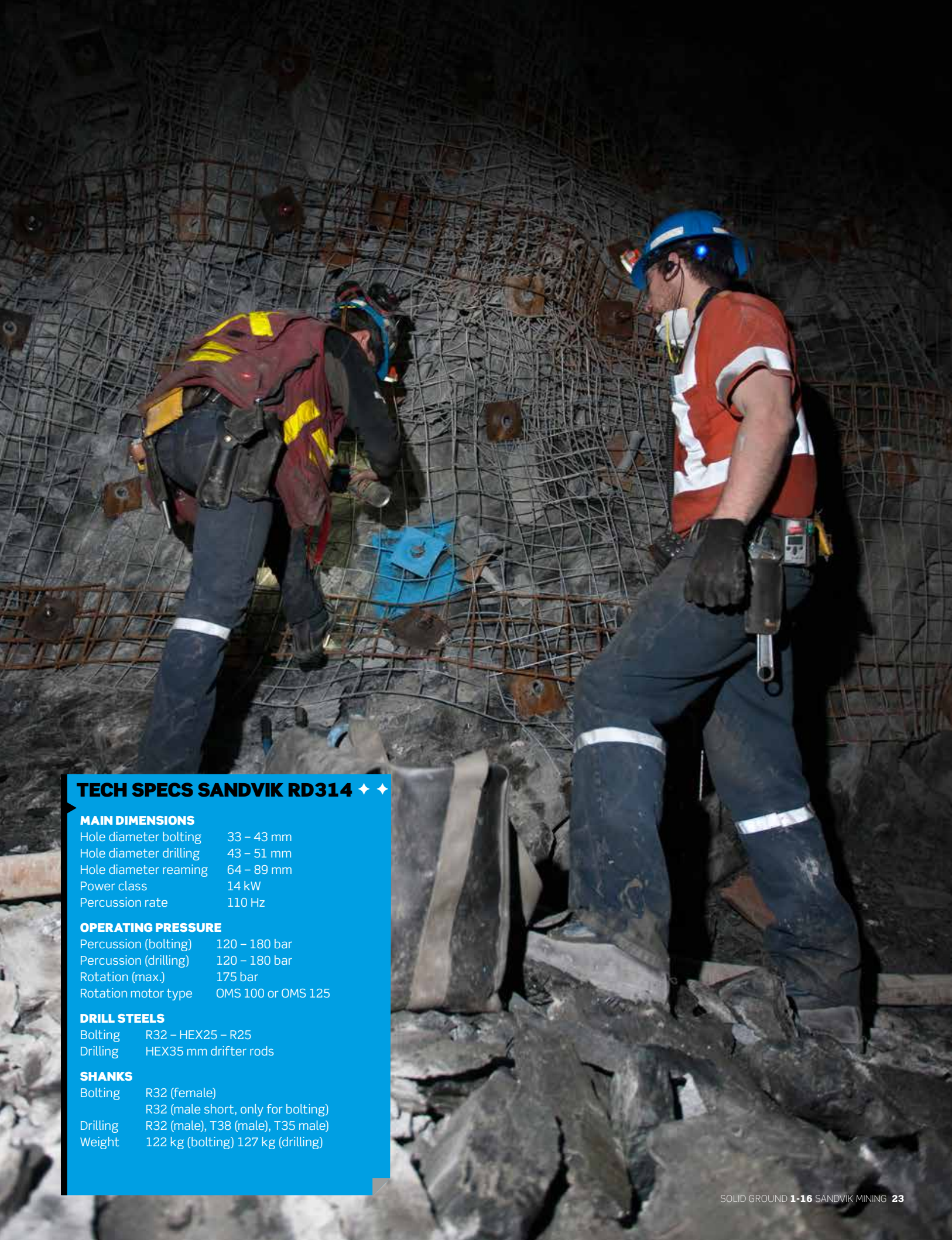
Just accessing the gold and other precious metals so far underground is daunting. At 2.8 kilometres deep, the temperature rises to around 30 degrees Celsius. Add to that the heat generated by the equipment and the conditions can be harsh, which is why the company installed a cooling unit to relieve the heat stress. And then there are the seismic events. At this depth, seismic activity is the norm rather than the exception. Every so often there is a sharp popping sound that shakes the earth and all those in it.

“At LaRonde, it is vital that we understand the conditions of the mine,” says Stephane Lacroix, Sandvik Mining field service manager. “Sometimes there are seismic events, which can be surprisingly loud.”

Goulet concurs, calling the seismicity one of his mine’s greatest challenges.

“As we go deeper, the pressure in the rock increases,” he says. “The rock also becomes more brittle around depths of 2.5 to 3 kilometres, which generates increased seismicity. So we have to adapt the ground support, put a lot of seismic sensors in place and carefully follow the safety protocol whenever we have these seismic events.”

Richard Audet, Agnico Eagle optimization specialist for drilling equipment, says the safety of the workers is paramount. His job involves continuous improvement of



TECH SPECS SANDVIK RD314 ✦ ✦

MAIN DIMENSIONS

Hole diameter bolting	33 – 43 mm
Hole diameter drilling	43 – 51 mm
Hole diameter reaming	64 – 89 mm
Power class	14 kW
Percussion rate	110 Hz

OPERATING PRESSURE

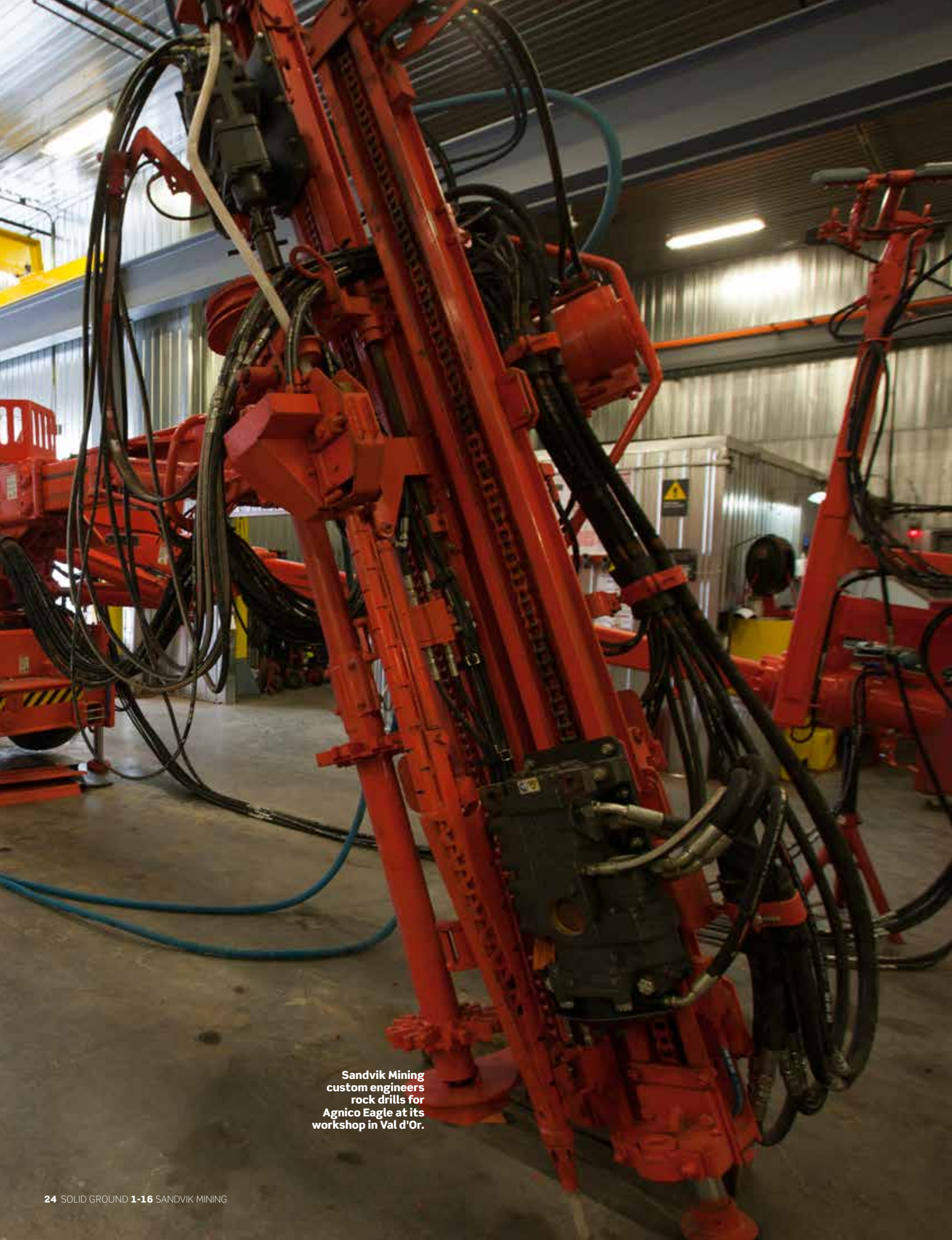
Percussion (bolting)	120 – 180 bar
Percussion (drilling)	120 – 180 bar
Rotation (max.)	175 bar
Rotation motor type	OMS 100 or OMS 125

DRILL STEELS

Bolting	R32 – HEX25 – R25
Drilling	HEX35 mm drifter rods

SHANKS

Bolting	R32 (female) R32 (male short, only for bolting)
Drilling	R32 (male), T38 (male), T35 male
Weight	122 kg (bolting) 127 kg (drilling)



Sandvik Mining
custom engineers
rock drills for
Agnico Eagle at its
workshop in Val d'Or.

operations, particularly drilling, so he is well versed on how everything works at the mine. He says that in the “muck, drill, blast” process, 60 percent of that time is taken up with bolting. Doing so efficiently reaps obvious time and cost benefits while keeping the team safe.

“Because of the make-up of the rock here, we have to use different supports than in other mines,” says Audet, “hence the importance of the drill’s performance. It’s vital that the holes are made smoothly and that ground support is easily put into place. Our miners are working hard on installations, so our challenge is to provide them with an efficient and reliable drill. Thanks to our relationship with Sandvik, we were able to do that when we implemented the Sandvik RD314 rock drill.”

Audet goes on to give a small history lesson about the rock drill retrofit solution. In 2014, LaRonde purchased some cutting tools from Sandvik to be used on competitor equipment. Among them were some Sandvik RD314 rock drills. Monitoring equipment performance is part of his job, so when Audet noticed that they increased output and reliability, he made a decision to implement sweeping changes.

“The Sandvik RD314 drills a hole in 50 to 60 seconds on average,” Audet says. “The competitor’s drill clocked in at a minute and 10 seconds to a minute and a half, which is 20 percent slower than the Sandvik RD314. Over the course of a month, that’s up to a

1,500-metre difference in drill efficiency. We end up saving about CAD \$0.50 per metre, and at 90,000 metres per bolter that’s a savings of \$45,000 per bolter per year.

“Stephane Lacroix from Sandvik was working very closely with me at the time, and so we decided to implement a change plan to get Sandvik RD314s on more rigs,” Audet says. “That was two years ago. At the moment, we have eight bolting machines out of a fleet of 12 working with the Sandvik RD314 rock drill.”

The close relationship allowed Lacroix to custom-design the rock drill, changing the feed engine for steadier drilling and a bigger water hose to flush the hole quicker.

“After this, and a few other little tweaks, we had a much better perform-

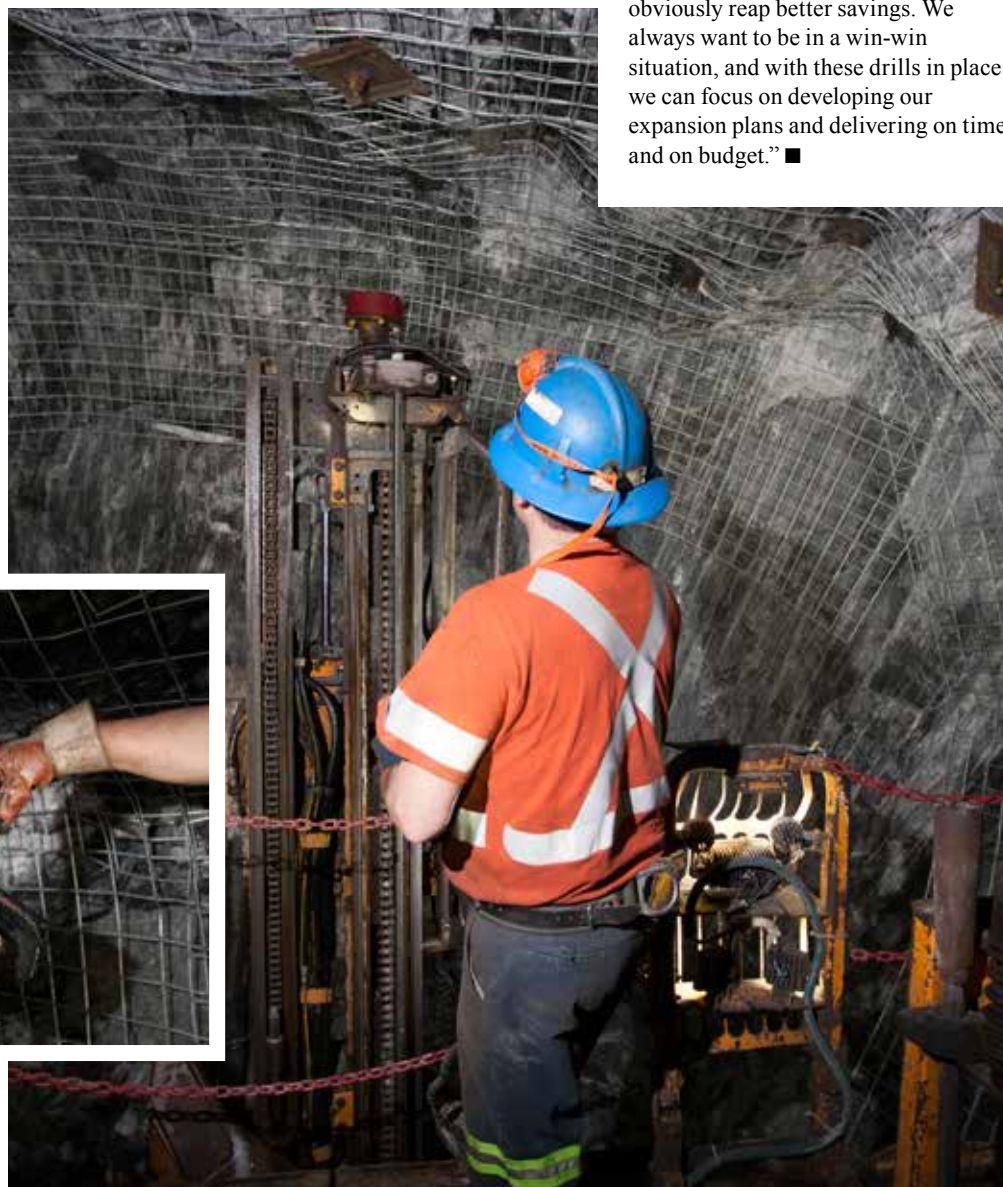
The competitor’s drill clocked in at 20 percent slower

ing drill,” Lacroix says. “This drill does 500 hours on average before our preventive maintenance schedule requires us to remove and inspect it. We make modifications according to the needs of the mine, so more than anything we need to have good lines of communication to understand those needs explicitly.”

Goulet adds, “We like Sandvik drilling units and we feel that they fit with our overall strategy. Getting those drills was a good move for us as they are faster and more available, so we obviously reap better savings. We always want to be in a win-win situation, and with these drills in place we can focus on developing our expansion plans and delivering on time and on budget.” ■



See a video about the LaRonde mine at minestories.com



Bolting efficiently reaps time and cost benefits as well as keeping the team safe.



Advantages of collecting data automatically vs. manually

- Easier to plan maintenance and spare parts forecasting, improves maintenance scheduling
- Helps preventive maintenance based on machine alerts
- Higher accuracy, 24/7/365 accessibility to trustworthy data and a comprehensive overview of the data make it easier to make decisions
- More efficient way of working, as manual data analysis is very labour-intensive
- Improves safety, saves time and effort, thereby increasing operational efficiency and uptime
- Data gives clues to possible operational improvements to boost mine efficiency
- Adjustable data collection intervals for report resolution based on the mine's demand, from minute-by-minute to hourly to daily reports (it is not feasible to gather such information by sending a person each hour)

Text: **ALANNAH EAMES** Photo: **ADAM LACH**

FLEET SUITE

■ To help mines work smarter, Sandvik has introduced a fleet management solution through a new interactive customer portal.





COMPANIES TODAY, REGARDLESS of their industry or location, need affordable and reliable solutions that

improve productivity and help them work more efficiently. The logic: it's a competitive world out there, and nobody can afford to lose time or money.

Mining companies are no exception. One golden opportunity where they can improve their operations is the way in which they collect, store and use the data from their mobile equipment. Gone are the days when it was enough to collect data manually by pen and paper and log it onto Excel spreadsheets on the mine manager's computer. Today, it's all about automating these processes.

By the end of 2016, Sandvik customers will be able to interact with Sandvik Mining via the new My Sandvik customer portal. The portal will hold all information related to a customer's equipment – operational data, order history, parts e-manuals, training manuals, bulletins and recommended parts – in one place.

The My Sandvik portal also marks the launch of a new interactive fleet

management solution called MyFleet, which will be included in the value offering to customers that operate Sandvik equipment.

For years, mining companies and their suppliers have been discussing the value of equipment operational data – such as its location, engine, idle, percussion and transmission hours – and how to use it. Often, the problem is that mines don't have a complete overview of their fleet information. Having all the operational, transactional and technical information of a unit in one location accessible via a single login makes life easier. Information about the equipment will be transmitted to a secure central database where the data is analyzed and used for reports, to schedule maintenance or to spot operators' problems with the unit. As different mines have different data needs, all kinds of reports from basic to customized detailed information can be compiled in the system.

"TOGETHER, THIS INFORMATION will give the mine a great snapshot about decision-critical information in one interface," says Daniel Gidlund, installed base programme manager at

Trust and transparency are very important

Sandvik Mining.

"It works a bit like a subscription for TV channels," he says. "You can have a basic subscription, or when you want to add more 'exclusive' channels, such as Sandvik OptiMine, you just choose a different package option." OptiMine is an integrated information management system that allows real-time tracking of manually operated Sandvik and third-party equipment.

Operational data from the equipment has many benefits for the mine. Having a comprehensive overview of the daily health and productivity of equipment can improve safety and daily operations, boost productivity and save money. Operators, for example, have a huge impact on how the mining equipment is used. Getting the data directly from the equipment, and being able to compare the data for several different units, can help mining companies to better understand the full picture of what happens during the working day and to highlight when the operator may need training or support.

THE OPERATIONAL DATA is also useful when it comes to preventive maintenance. Regular information from



the machine alerts mines to the need for maintenance before the machine breaks down and needs to be taken out of service. In addition, the data can be useful in providing an overview of the stock of spare parts for the active fleet in a certain location.

BESIDES IMPROVING EFFICIENCY in daily operations, capturing and using this data smartly has another huge benefit: safety. "Safety is the number one priority for mining, so instead of people having to gather this information manually, doing it automatically is much safer," Gidlund says.

It's easy to hook up to this fleet management service, as the technology has already been built in to new Sandvik equipment and just needs to be activated. It can also be added to existing Sandvik equipment or combined with other Sandvik automation offers such as OptiMine. The technology is suitable for all equipment operating in surface and underground mines.

Protecting this confidential data was a key consideration during the development process. Each mine will have access to its private equipment data, and all the information will be transmitted using high encryption technology and stored securely. Only the mine and Sandvik Mining will be able to access the data.

"Trust and transparency are very important," Gidlund says. "There are many benefits of sharing this information with Sandvik, as we can use it to help our customers get the most out of their equipment."

"And, on the other hand, we believe that customers who join the new programmes will gain better utilization of their machines and additional benefits such as higher safety due to well-maintained equipment, as well as perhaps even extending equipment's life cycle."

For Gidlund, the new interactive portal is just the first step of a new journey.

"The natural evolution of this service will drive us towards even more advanced and trustworthy reports, higher accuracy and smarter tools in the future," he says. ■



What is the My Sandvik customer portal?

- A single source for customer users to access, share and manage their Sandvik fleet information such as engine/percussion/transmission hours, last service date, next service date, active status, last rebuild date and warranty status
- 24/7/365 self-service capability for easy parts and tools ordering
- Functionality includes wish list and cart workflow, quotation creation, order track and trace, and viewing/downloading invoices
- More transparency and control for customers in their order process with Sandvik and good visibility of machine consumption
- Access to updated electronic parts catalogue and user manuals
- Access to safety and technical bulletins and promotions
- Creation of return requests
- Recommendations of parts and kits suitable for the customer's fleet



GET SMART

■ The Internet of Things, one of the most ubiquitous terms across almost every industry, is heralding a change in how previously inanimate objects can talk to one another, gather data and make the world of business – and mining – a little bit smarter.

Text: FRANCIS DIGNAN Illustration: LOUISE BÅÅTH

The Internet of Things (IoT) embraces devices that talk to a network and supply important, useful data based on the information received.

It's happening all around us. Take the simple home, for example. In the past it was a collection of bricks, mortar, wires and windows, but with the IoT the house you live in can become one entire connected ecosystem. Sensors in your walls detect levels of damp and let you know so you can deal with it before it becomes a real problem. You can monitor security, temperature, energy and water use all from one central location. The applications for IoT-connected devices are endless, particularly when you consider all the possible uses for the data.

Mike Wilmot, a data platform architect at Microsoft, works extensively with software to facilitate IoT devices. He's an expert on how cloud computing, which allows companies to upload data and analyze it, is revolutionizing big data usage. Not only can companies gather all this data and act on the results, but they don't need to buy the equipment or rent servers – all they need is an Internet connection.

"Big data analytics from the cloud is being enabled, so you can do real-time analytics," Wilmot says. "The fact that you can do this without an infrastructure of your own is game-changing."

40

billion USD, the predicted worldwide IoT revenue by 2018



Get predictive

Sensors within equipment can flag any potential issues before they become a problem, which helps with safety and saves money on maintenance and repairs.



Real-time operations

Companies today can get access to real-time analytics without investing in the expensive infrastructure required in the past.



Connectivity

An increasingly connected world provides a springboard for optimization, growth and sustainability.



Vehicle tracking

GPS and RFID systems are used to monitor equipment movement, fuel levels and consumption.



THE MINING INDUSTRY has been one of the most recent sectors to embrace these changes as the benefits became obvious. Bill McBeath, chief research officer at research and advisory firm Chainlink Research, has observed the changing shape of mining over the past few years.

“In mining, the areas that the IoT has affected most are safety and cost of labour,” McBeath says. He believes the biggest innovation in mining so far has been autonomous loading and hauling.

“It’s among the most mature and widely adopted technologies, and it has a big impact on both safety and labour costs,” he says.

Loaders and trucks have hundreds of sensors around the outside. Mine operators can track the equipment in real time from an offsite control centre as well as monitor conditions and control their speed, all without any personnel in the cabin.

“Safety is improved by eliminating operator fatigue and error, and by reducing the number of people at the mine site,” McBeath says. “Autonomous loading and hauling also enables more predictable, continuous, optimized operation, all day and all night, without need for lunch breaks or shift changes.”

Some companies are looking to automate their entire mining process, from drilling to delivery. This isn’t a case of replacing employees with machines, but rather a change in required skill sets. Instead of having employees in mines, operators can control it all from a centre thousands of kilometres from the mining site.

ANOTHER HUGE BENEFIT is predicted maintenance. Where mining companies used to service machinery based on a fixed schedule, now the sensors within the machines can flag any potential issues before they actually become a problem, which not only helps with safety but also saves a lot of money on maintenance and repairs.

“There’s going to be better visibility into what goes on in mines from control centres as mines become more predictable and optimizable due to this increased visibility,” McBeath says. “You can analyze and improve, and in turn this could lead to higher yields. I think that’s the direction mining is heading in.”

The mining industry is changing the way it does things, in terms of how entire organizations have embraced the opportunities presented by the IoT. But it is just the beginning, with companies now creating real value for both their employees and customers through innovating and daring to be the first in line. ■

“In mining, the areas that the IoT has affected most are safety and cost of labour



Sandvik and Data Driven Productivity

Sandvik Mining has been testing a new IoT approach called Data Driven Productivity (DDP), of which there are four pillars: Predicted Maintenance, Production Management, Individual Machine Performance and Operator Efficiency. “We’re looking at all of the sources and linking them all together, and throwing them in one data lake in order to help us look at how we can support our customers, be more productive and lower their costs,” says Martin Borst, who leads DDP for Sandvik Mining.

So what could this mean for Sandvik customers? “Our customers have changed their approaches dramatically,” Borst says. “They have all cut costs and managed to bring down productivity loss, so things are changing and our customers are fully focused on efficiency, and that’s where DDP comes in. We see an opportunity to support our customers in that.”

“We are leveraging existing capabilities. We already have all of this data and these facilities available, so DDP is about bringing all of that together. It’s about putting together all these building blocks to create exponential value out of the combination.” All data is fully encrypted, so the information is safe and secure. It allows for a holistic approach to mining with a full and clear view of how to optimize every process. “Every industry is looking at big data,” Borst says. “At first, everyone liked the visualization of data, but it wasn’t being utilized fully. Now we’re ready to make the leap and put the data to good use.”



Deeply immersed in safety

■ From a simple need to build safer equipment to an essential step-by-step standardized assessment for equipment procurement, the work of EMESRT proves safety and functionality are not mutually exclusive.

Text: ALANNAH EAMES Photo: SANDVIK

THIS IS A story about change. It's the story of how miners demanded a voice in the design of equipment, and how OEMs learned to hear that voice and take a human-centric approach to manufacturing safer products. It's the Earth Moving Equipment Safety Round Table (EMESRT, pronounced "em-erst") story, and one that Professor Robin Burgess-Limerick, from the Minerals Industry Safety and Health Centre (MISHC) at University of Queensland in Australia, is proud to have been part of.

An ergonomist, Burgess-Limerick has been conducting research on improving safety and productivity for mining equipment for the past 20 years, much of it funded by the Australian Coal Association Research Program (ACARP). During that time he has visited mines and manufacturers around the world to understand safety issues, produced books on the topic, and held workshops for miners and OEMs to discuss how they can design equipment to reduce injuries, lost-time incidents and fatalities in mining. What he found

early in his career was that mining companies weren't easily able to provide input at the design phase to OEMs about the equipment they were manufacturing – input that would make the equipment inherently safer.

"One multinational mining company, even a large one, might not be able to convince an OEM to reconsider its design, but banded together they couldn't be ignored," Burgess-Limerick says. "EMESRT arose in 2006 out of an ACARP project conducted by Professor Jim Joy at MISHC. It was an attempt by mining companies to speak in a consolidated voice to OEMs about safety considerations from a design perspective. Its vision was then and is today to eliminate injuries and fatalities associated with operating and maintaining mining equipment."

AT ITS PEAK, EMESRT comprised 15 major mining companies. Burgess-Limerick insists that EMESRT has never been in the business of dictating how OEMs should design their equipment, but he notes that design

The attributes that make equipment safe are the same ones that make them productive



► engineers at OEMs don't necessarily come from a mining background.

"EMESRT became a way to capture the knowledge of the operators and those with experience at mining companies – particularly their understanding of safety risks associated with the use and maintenance of equipment – and consolidate that information into an understandable form to be communicated back to design engineers," Burgess-Limerick says. "And because it is presented as a consolidated opinion from the members, there is one uniform perspective."

ONE OF THE first things that EMESRT did was establish Design Philosophies (DPs). These DPs reflected the collective wisdom of all the people involved in the process, aligning various hazards by putting them together into categories with other similar hazards, all of which reflected a task-based approach to risk assessment.

"Function-based design is tempting, particularly for OEMs focusing on productive equipment," Burgess-Limerick says, "but there needs to be a parallel concern about what role the person operating the equipment will play. This is the basis of a human-centred, task-based approach to equipment design."

THE AIM OF the DPs is to provide information to help OEMs design equipment that reduces the risk of unwanted events to an acceptable level. There are eight main areas of concern: access and working at heights; tires and rims; exposure to harmful energies; fire; machine operation and controls; health-impacting factors; manual tasks; and confined spaces and restricted work areas.

With those DPs in place, a task-based design evaluation process known as EMESRT Design Evaluation for

Equipment Procurement (EDEEP) was born in 2012. EDEEP provides OEMs and EMESRT members with a means to identify the degree to which newly designed equipment meets the intent of the DPs. It produces a document that provides information to purchasers of earth moving equipment showing how the OEM is working to minimize and mitigate risk through the design of the equipment.

"EDEEP differs from conventional risk-assessment techniques because it focuses on tasks rather than hazards," Burgess-Limerick says.

THE FIRST STEP is to identify priority tasks that the operator will undertake with the equipment. Next, a task flow chart is developed, after which a task-based risk assessment can begin. This involves identifying risks and offering solutions. After that comes a design evaluation, and finally the safe design information gleaned from the process is presented in a document that highlights the priority tasks, the control measures that are in place and the risks that remain partially uncontrolled. (For a breakdown of how Sandvik works with EDEEP, see next page.)

"So now, not only do purchasers have a uniform document from OEMs to measure their equipment's safety risks, the process itself can be adopted by OEMs to meet their own safe design needs," Burgess-Limerick says.

In the end, he is satisfied that the process is pushing the industry to a safer place.

"From my point of view, it's about trying to persuade everyone to get the right information so that both sides can reduce injury and health risks associated with operation and maintenance of equipment," he says. "And to remind everyone involved that the attributes that make equipment safer are the same ones that make them productive." ■

Sandvik MB650 & the EDEEP process

● The Sandvik Zeltweg competence centre for mechanical cutting in Austria focuses on R&D, engineering and manufacturing in underground soft rock and hard rock applications. It was here that the underground coal and minerals product safety team adapted the EDEEP process to work with BHP Billiton on its Sandvik MB650 bolter miner. Egmont Lammer, manager product EHS at Zeltweg, spearheaded the initiative. "One of the most important parts of the EDEEP process was to involve the customer," Lammer says. "Overall it puts Sandvik in a great position because it shows that we take the demands of the EMESRT companies very seriously and that we're prepared to implement the process."



STEP 1: PRIORITY IDENTIFICATION

- The team identified priority tasks based on all operational and maintenance activities. The 11 tasks that were ranked highest in priority were selected for flow chart and risk assessment analysis.

STEP 2: TASK-BASED RISK ANALYSIS

- The 11 most important tasks selected were analyzed in detail and checked according to the likelihood of potential unwanted events and consequences. Operators were involved at this stage, and the team discussed current design control, conducted control evaluation and suggested new design controls and administrative controls. All steps were documented with photos and video.

STEP 3: SALES DESIGN INFORMATION

- The findings for the risk assessment were transferred into a sales design information document, in which the team describes the function of the equipment, the design features and the method and features that were included to mitigate the risks of the machine.



ABOUT EMESRT & EDEEP

The Earth Moving Equipment Safety Round Table, or EMESRT, was established as a formal entity in 2006. The Minerals Industry Safety and Health Centre at the University of Queensland was invited to facilitate and coordinate the process. In 2012, EMESRT took the next step in the journey of OEM engagement, connecting the OEM equipment-design process with an EMESRT design evaluation method linked to procurement, known as EDEEP.

MINERS, MOONSHINE AND THE MONOPOLY

More than a century ago, in an attempt to make mining and society safer, Swedish mine owners started a distribution system of alcohol that is still in operation around the world today.

Text: JEAN-PAUL SMALL Photo: GETTY IMAGES

▶ WHAT DO CANADA, Finland, Qatar, Turkey, Sweden and Iceland all have in common? They are all countries with government monopolies on the sale of alcoholic beverages. While the practice has been going on for more than one hundred years, it all started with drunken miners in the town of Falun, Sweden.

Falun is known for its thick red sausage and its red paint (famously seen on farmhouses and cottages throughout the Swedish countryside today), which derive from the copper mines near the city. But to understand how today's alcohol monopoly really got started we have to go back to the reign of King Adolf Fredrik of Sweden.

After some rather unsuccessful attempts to regulate alcohol use, the king decided in 1766 to abolish all restrictions on making liquor. The resulting free-for-all was not healthy for the country as the majority of households began brewing their own booze. These "Hembränningen" or private distilleries grew to an estimated 175,000, all of which consumed huge amounts of potatoes and grain that would have been used for food. By the 1800s, some people had had enough of the public intoxication, drinking on the job and general malaise caused by a country caught in

the grips of alcoholism. Temperance movements were springing up everywhere.

Back in Falun at the copper mines, work interruptions due to alcohol-related accidents and fatalities had risen to disturbing heights, and compensation to workers' families was causing operating costs to skyrocket. Mine owners were fed up, and in order to protect their bottom line they formulated a plan. These captains of industry petitioned to form a distribution company with exclusive rights to build distilleries and sell liquor, with all proceeds going to improving the social conditions of the miners (i.e., getting them to drink less). The result was the creation of a state organization whose job involved regulating all alcohol sales in the city and ensuring it was done responsibly.

IN 1850 ALCOHOL was being regulated by the state, and by 1860 the system proved successful and began spreading to other cities in Sweden, most notably Gothenburg, where it earned the name the "Gothenburg system." Soon, age limitations were imposed and the "systembolaget", the name it has today in Sweden, was officially born. ■



Facts about alcohol in the workplace:

- A hospital emergency department study showed that 35% of patients with an occupational injury were at-risk drinkers.
- Breathalyzer tests detected alcohol in 16% of emergency room patients injured at work.
- Analyses of workplace fatalities showed that at least 11% of the victims had been drinking.

For every job, for every need

Sandvik helps make your mining operation more productive, profitable and efficient 365 days a year. With a range of aftermarket services in place to support industry-leading equipment, we'll help you meet your targets safely, on time and on budget.

Discover the solutions at mining.sandvik.com or by scanning the QR codes below to download the latest Sandvik Mining Offering Guide app.



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Android

ENVIRONMENT, HEALTH AND SAFETY (EHS)

Stay safe. Our objective is to eliminate harm to people and the environment. EHS is a fundamental consideration in all Sandvik operations, especially product development. Our ambition is to provide the safest products on the market. From our emission-reducing Compressor Management System for surface drills to fire protection, our products are designed to minimize environmental impact and reduce health and safety risks in your operations.



DRILL RIGS AND ROCK DRILLS

Know the drill. Sandvik rock drilling equipment is renowned for quality, reliability and productivity. Every drill rig and rock drill we engineer is designed to deliver the lowest possible cost per metre drilled and a low life-cycle cost. To meet the needs of all customers, we offer a wide choice of equipment, ranging from robust and simple drill rigs to semi-automated units that give extraordinary production rates and low total cost. We also manufacture a wide range of rock drills.



LOAD AND HAUL EQUIPMENT

Reliable LHDs and trucks. Sandvik underground loaders and haul trucks are engineered for safety, productivity and reliability in the toughest of applications. Rugged, compact and highly manoeuvrable, the ergonomic products offer enormous capacity for their size and return a very low cost per tonne.



CONTINUOUS MINING AND TUNNELLING

Always advancing. Sandvik continuous mining and tunnelling equipment reflects the unique advantages of total in-house control over the equipment and cutting tools alike. Optimized cutting technology and machine design result in high productivity, long service life and low total costs.



CRUSHERS AND SCREENS

Maximum size reduction.

Sandvik crushing and screening equipment is engineered for productivity. We offer advanced solutions for any size-reduction challenge, stationary or mobile. We can upgrade existing plants, deliver complete solutions and effect turnkey installations. We also supply individual crushers and screens, as well as key components and a wide range of consumables.



CONVEYOR COMPONENTS

Ready to roll.

Our complete components offering supports modern conveying practices in mining and includes rollers and frames, idlers, pulleys and belt cleaners, condition monitoring and safety control devices and loading sections. With an emphasis on performance and reliability, products are easily available through the global Sandvik network both as original components and as replacements in existing systems.



BULK MATERIALS HANDLING EQUIPMENT

Total handling.

Sandvik has the long-term experience to design, manufacture and install virtually any kind of bulk materials handling system. From mining systems on surface and underground to integrated stacking and reclaiming systems for mines, terminals and port facilities, we offer total solutions and turnkey installations. We also offer a wide range of conveying equipment and quality components for plants, as well as upgrading and modernization services.



SERVICES

Peace of mind.

Our technicians are highly skilled in best practices to safely maintain and optimize your equipment, ensuring you get the most out of your capital investment. Our primary focus is to provide support and keep you operating and more productive. By signing up with Sandvik 365, you get the capabilities of a global industry and service leader delivered directly to your site, providing peace of mind and enabling you to focus on your core business. It's service you can count on.



MINE AUTOMATION

Complete control.

The Sandvik AutoMine family covers all aspects of automation, from single equipment to full fleet control. In the safety and comfort of a control room, operators can simultaneously control and monitor the movements of a fleet of driverless loaders, trucks or drill rigs. By adding remote monitoring and process management capabilities, supervisors are able to directly communicate with equipment and operators from wherever they are working.



ROCK TOOLS AND SYSTEMS

Deep impact.

Sandvik offers the world's most comprehensive range of tools for exploration, rock drilling, raise boring, coal cutting, mineral mining, tunnelling, trenching, road grading and cold planing. As world leaders in steel and cemented carbide technology, our products have revolutionized the rock drilling industry, while our advanced tool systems for mining equipment raise productivity sharply.





REVEALING 100% BATTERY TRAMMING

We'll soon be revealing Sandvik DD422iE, our first battery-powered, automated mining jumbo. Featuring a revolutionary electric driveline system, Sandvik DD422iE produces zero emissions during tramming by using electric battery power instead of a diesel engine. This means less total fuel burn, less heat and less noise. The result is safer, healthier and more productive development drilling in your mine and significant savings in your operating and ventilation costs compared to conventional diesel engines.

The new Sandvik DD422iE. The difference is electrifying.
We're revealing even more at mining.sandvik.com/electrifying

MINING.SANDVIK.COM

