

# THE WONDER OF WIRELESS

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Digitalization is also changing the mining industry. Connecting man and machine on mine sites not only increases productivity, but also improves safety in the workplace and during rescue missions.

TEXT STEFFAN HEUER

**E**very other year, mine rescue teams from all over the world gather for the International Mines Rescue Competition to put their knowledge and skills to the test in a friendly competition over the course of several days. At the event four years ago in Sudbury, in the Canadian province of Ontario, something quite special awaited the 28 teams from thirteen different countries. For the first time, as the teams were organizing and conducting their rescue missions, they were able to use an innovative software that tied together all the capabilities of a simulated connected mine. A robust tablet not only contained maps of the ramps and shafts – the device was also the central hub for determining the location of machinery and employees, entering relevant local data, and staying in contact with the control center at ground level.

“That was a milestone,” recalls Ted Hanley, vice president of Ontario Mine Rescue (OMR), whose organization hosted the event and commissioned and codeveloped the prototype. “With this simulation we were able to demonstrate that a digital system works better than the current combination of paper, pen, and walkie-talkie, because the device shares data more quickly and reliably with the relevant people. Incident commanders on the surface who are better informed can make better decisions.” The experiment has since become a package of software and hardware that several mine operators in North America use to make the mine rescue teams fit for the 21st century. Special tablets for rescue teams are just one example of how the digital transformation process is also penetrating an established industry such as mining. The people in charge want to use new tech- →



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**MODERN  
LABYRINTH**

The Oyu Tolgoi copper and gold mine in Mongolia has a tunnel system over 200 kilometers long

**NETWORK EFFECT**

The mine rescue team can share data in real time with the control center and thus speed up decision-making

## WIRELESS NETWORKS AND HANDHELD DEVICES COMPLEMENT THE WALKIE-TALKIES AND CABLE HARNESSSES

nologies and connected processes not only to make their work more efficient and cost-effective, but also faster and safer. Mining is one of the oldest primary industries for bringing raw materials such as coal, industrial metals, and salt to the earth's surface from great depths. In the past year, for example, around 2.5 billion tons of iron ore have been mined, 20 million tons of copper, and 77,000 tons of lithium, which is used in batteries for electric vehicles, among other things.

### EVER DEEPER, EVER FURTHER

The bigger the global economy's need for resources to make products ranging from houses to smartphones the further, deeper, and thus more technically demanding and expensive the mines have become. According to the operator Rio Tinto, the Oyu Tolgoi copper and gold mine in Mongolia, for example, which has been extended since 2016 to include underground as well as open-pit mining, has a tunnel system 200 kilometers long. As one of the world's biggest mining companies, Vale S.A. is currently undertaking one of Canada's biggest ever mining project in Voisey's Bay, in the far northeast of Newfoundland, in order to extract the nickel and copper deposits from two new underground mines. Mines from Australia to South America are also digging ever deeper and further into the earth in order to compensate for dwindling yields of old deposits and keep pace with demand. And in Kiruna, the northernmost town in Sweden, the state mining company LKAB operates one of the world's biggest and most modern iron ore mines, which has been expanded from an initial depth of 775 meters to 1,045 meters, and further to 1,365 meters.

Operators must digitalize their processes and equipment to remain competitive in their quest for resources – from the exploration of new deposits to the extraction and transportation of the raw materials. “The digitalization of

the industry is driven by the desire to increase productivity and efficiency. It also provides the opportunity to improve occupational health and safety and the company's environmental impact,” explains Amily Guo, who is responsible for the customer segments fire services and mining at Dräger. “This is made possible by upgrading wireless networks in order to improve communication between vehicles, machinery, and people.”

It should enable operators to access databases and the current location and status of machinery and employees not only in the administrative offices, but also in the actual mines themselves. The first step toward such a setup involves establishing a wireless network that complements the conventional walkie-talkies and cable harnesses, either based on Wi-Fi or mobile communication networks such as LTE or the newer 5G standard. That is why operators are increasingly opting for “cloud-enabled mobility, big data-powered analytics and the Internet of Things (IoT),” according to the management consultancy Accenture in an industry report.

If vehicles and machines are connected, for example, besides allowing their data to be gathered and analyzed in real time, this data can also be sent to the crews underground to improve traffic management and the maintenance of semi- or fully automatic machinery. Miners thus can use their smartphone or tablet to view the same high-quality data that would otherwise be analyzed with a considerable time delay in the central control room before mostly being distributed on paper. At the same time, higher data density results in better decision-making when it comes to matters such as hydrology, the monitoring of dangerous gases, or the ventilation of the working face. Such development work results in the creation of a digital mine, in which intelligent software keeps a close eye on all the important aspects – from the three-dimensional



planning of a mine and the shift planning to the battery status of electric vehicles and the optimal training of the mine rescue teams. This not only has benefits in terms of safety, but can also be more efficient. The operator Vale, for instance, was able to cut its energy costs for ventilating its Totten Mine in Canada by more than half with its digitalization initiative. It now steers its huge drills and load-haul-dump machines underground from its control center so that ore can continue to be mined and transported between shifts. The experts at the World Economic Forum therefore summarize that digitalization in the mining industry not only pays off, but can also “improve health, safety and environmental impact – saving lives, reducing injuries, lowering emissions and waste, and increasing transparency and sustainability.”

### TRANSFORMATIVE TECHNOLOGIES

For mining experts like the Canadian Ted Hanley, this transformation is long overdue. “People have been mining for thousands of years and here in Ontario increasingly underground for the past 200 years. The dangers grow alongside this expansion, causing people all over the world to think about how the technology, processes, and behavior can be improved in an emergency. But mining is inherently slow at adopting transformative technologies,” says the vice president of Ontario Mine Rescue, whose employees

train and advise around 900 mine rescue volunteers in 32 mines in the province. Yet things are changing. Over the past decade, Ted Hanley has seen for himself how a growing number of mine operators have been installing wireless networks, leading to a rise in productivity as well as improved safety in the workplace. “Keeping track of machines and personnel with GPS on the surface is relatively easy, but underground it is both a technical and logistical challenge, especially when it is not a new mine, but one that has been in operation for a century and has refined its processes over the course of many years,” explains Hanley. He estimates that a third of the mines in Ontario alone now have underground networks. There may even be 100 percent coverage by the end of the decade.

One of the most important drivers is ventilation on demand (VOD). “Ensuring a supply of fresh air for the workers and technology underground is one of the biggest cost factors. Automated ventilation control used to be only available for the entire mine, which was incredibly inefficient,” says Hanley. “But when you know exactly who is working and when and where they are working, you can with VOD precisely measure the ventilation and control it accordingly. This saves a considerable sum of money, so a wireless network can soon pay for itself.”

If it is good for business, it also benefits the mine rescue team. That is why the central mine rescue services in



PHOTO: COURTESY OF VALE CANADA

**ALWAYS CONNECTED** Miners can communicate wirelessly in modern mines

Ontario took the decision in 2015 to digitalize their rescue concept based on their 85 years of experience. Instead of notepads, walkie-talkies, and folding maps, the rescue personnel should use a straightforward app to share information with the control center and even keep in contact via audio and video. That would not only ensure the provision of fast and better data, but also guarantee detailed documentation, enabling everyone to learn as many new lessons as possible from each job. “Taking just one single tablet instead of 100 folding maps to find your way around in difficult conditions in a mine that branches out in all directions – that alone is a huge advantage,” says Hanley.

**BETTER INFORMATION THANKS TO SOFTWARE**

The software was developed by Focus FS from St. John’s, Newfoundland and Labrador in Canada. The company, which was established in 2012, concentrates on applications for occupational and plant safety and for rescue teams in the oil and gas and mining industries. “One of our first applications focused on digital positioning so that all employees can be found quickly in an emergency situation,” reports Focus FS cofounder and CEO Jeff Brown. “The feedback from customers was resoundingly positive: Firstly, more detailed information in real time means that better decisions can be made and, secondly, all relevant data can be gathered so that things can be done even better next time.”

Since the successful test at the International Mines Rescue Competition in 2016, Focus FS has installed its system in various facilities in Canada and the USA, according to Brown, is now also holding talks with Australian mines. The businessman is

**GOODBYE TO PAPER AND PEN**

Focus FS specializes in software that connects industrial processes in the oil and gas and mining industries. Jeff K. Brown and Jennifer West established the company based in St. John’s in the Canadian province of Newfoundland and Labrador in 2012. Its success has proved that they had the right idea with their motto “Building Safer, Smarter Worksites”. By the start of 2020, the number of people employed by Focus FS had grown to 16. Among other things, the company has partnered with Ontario Mine Rescue to develop a system for emergency digital communication in the mining industry. It combines important data about the location with real-time information, makes that visible to the mine rescuers on a mobile device, and enables them to document new data at the scene. It also permits the wireless sharing of data and images between the control center on the surface and the rescue teams underground. In addition, it automatically archives all information for later analysis regardless of network availability. As part of the partnership with the new Focus FS shareholder Dräger, important parameters of Dräger devices, such as measured gas values or residual pressures of breathing apparatus, will also be automatically entered into the system in the future. Mine operators in North America already use the software for occupational and plant safety as well as for the training of their mine rescue teams.



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especially proud of his company’s cooperation with Dräger; the Lübeck-based company acquired a stake in Focus FS in 2019. “We had been discussing for a long time how we could work together to increase safety in the workplace, particularly in difficult environments like a mine,” says Brown. Focus FS is currently working on feeding measurements from Dräger devices (the Dräger X-am 8000, among others) wirelessly and directly into the system. This would give rescue workers on the surface and in the mine access to key values such as the oxygen content or the concentration of toxic gases – and they would be able to automatically incorporate them into their situation analysis and emergency plans. ◀