

Image courtesy of SafeSight Exploration



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The Sudbury and North Bay area in Northern Ontario is the home of the largest mining service sector hub in Canada. Although steeped in mining tradition, the modern day Sudbury Basin region is far from old-fashioned, with a high-tech ecosystem of companies producing ground-breaking technologies. One such company is SafeSight Exploration, which celebrated its one-year anniversary of an underground drone program with Newmont in 2019. "This rugged utility drone integrates the latest LiDAR technology with an open platform flight controller and has the ability to go anywhere that a human should not go. The time for collecting data is also significantly reduced with the DB3 product being able to do a complete scan in approximately 15 mins," explained Mike Campigotto, president of SafeSight, who commented that his company is evolving to become more than just an underground drone specialist: "We are becoming a company that solves problems with innovative technologies rather than limiting ourselves to one type of technology. We can essentially become the technology extension of an innovation manager in a mine."

On the subject of new-technology implementation, Campigotto acknowledged that the majority of mining companies do not want to be first-adopters, but having a high-profile partnership can lead to further collaborations once the innovation has been proven, as has been the case with SafeSight which built upon its work with Newmont to collaborate with Redpath

Mining, Wesdome Gold Mines and Barrick. "After just under three years in the field, SafeSight has already flown over 100 operational missions, so despite bringing innovation into a conservative industry, we have tangible proof that the best technologies can be adopted," he concluded. Another Sudbury-based company to have had considerable success disseminating its technology is Maestro Digital Mine, which now supplies solutions to over 130 mines world-wide, according to Michael Gribbons, co-founder and vice president. Maestro launched its Zephyr AQS solution in May 2019, a low-cost air quality monitoring station for underground mines, after studying market data to find out what its users were buying and designing a product to fit a profile that matched 75% of these buyers. "The flaw of many technology companies is to hang on to a product and fail to innovate, and the innovation cycle is slow," observed Gribbons.

When asked which factor seemed to be top of the agenda of mining companies in 2019, Gribbons replied unequivocally that productivity has been the number one focus. "A 10% reduction in energy use does not have the same impact as a 10% increase in production," he said, underlining the importance of understanding the operating principles of a mine and

how mine managers are being compensated. "The primary focus is on tonnage feeding the mill and second is health and safety. Energy is important but it is nowhere near those two parameters," he added, noting that Maestro's solutions can help dramatically in all three areas.

Revolution Mining Software (RMS) is another Sudbury-based tech company with a focus on optimization. Incorporated in 2014 for the commercialization of SOT, the Schedule Optimization Tool, the software was initially developed at MIRARCO (Mining Innovation, Rehabilitation and Applied Research Corporation) at Laurentian University. Lorrie Fava, RMS' president, explained how MIRARCO's Ventilation Constraint Module (VCM) interacts with SOT to facilitate the generation of optimized schedules: "By interacting with a ventilation network solver, the VCM automatically generates airflow-based constraints on the equipment over the course of the mine life. Using these constraints, SOT generates life-of-mine schedules with maximized net present value (NPV) that are feasible from a ventilation perspective."

On the West Coast, one of Canada's most successful mining-tech companies in the last two years has been Vancouver-based VRIFY. Stephen De Jong, VRIFY's CEO and founder, developed an app that uses 360 degree imagery to market Quebec-based gold exploration company Integra Gold, of which he was CEO before the company was acquired in

2017. In 2018, VRIFY had four clients using its platform, and by the end of 2019 the client-base had grown to approximately 110 companies. So why has this new approach to presenting information become so popular? "Mining companies have traditionally relied on two-dimensional tools to convey three-dimensional stories, but investors and stakeholders are demanding more in the current market," explained De Jong, continuing: "They want information presented in a way that allows them to actually understand where the investment potential lies. On the other side, companies deserve a chance to differentiate themselves from all the noise in the market if they have an opportunity worth considering. That's where VRIFY comes in."

When it comes to step-change technology, the potential to reduce the cost of material movement from US\$3.27 to US\$0.16 per ton is the type of impact that mining companies cannot afford to ignore, or perhaps, may find hard to believe, according to Jim Fisk, executive chairman of Rail-Veyor. Rail-Veyor's conveyor belt ore transportation technology has been implemented in mines across four continents, including Agnico Eagle's Goldex mine in Val-d'Or. Although the technology has gained traction through high-profile collaborations, Fisk commented that a resistance to change is still apparent when one does not have an engaged audience willing to consider a new process. "Many companies just look at the capital cost and forget about the operating cost, but in my experience mines shut down because of high operating costs, not because of high capex," he said.

While some innovations change or reinvent processes that have been in place for years, others enhance what is already in use. This is the case of Deep Cryogenics International, the Halifax-based start-up which addresses abrasive wear problems for mining tools and components. "Making items last longer is the eternal engineering challenge and this is what the Deep Cryogenics process does," stated Jack Cahn, founder and president, who explained how the deep cryogenics process takes the nitrogen in the air, separates and chills it to -196 C before warming back up and imparting a permanent wear resistance to the metals. "The process uses no chemicals, leaves no waste, causes no harm, is not dangerous, is environmentally neutral, infinitely renewable and recyclable," he added.

#### Toronto's mining-tech hub

The second biggest mining service hub in Canada outside of Sudbury is, surprisingly, Toronto. Despite being located relatively far from mine sites, service companies in Toronto reap the benefits of being located close to mining companies' HQs and the money markets, as well as a broader technology hub headlined by the world-class MaRS Discovery District, North America's largest urban innovation hub.

One of the mining-focused start-ups located at MaRS is Peytec, which launched its Muck Puck product in 2018, and had sold north of 1,000 units by October 2019, according to Peyman Moeini, president & CEO. Moeini explained the benefits of the Muck Puck over RFID (Radio-frequency identification) – the most commonly used quality-control product for mate-

rial handling: "RFID has a reliability of between 70% to 80%, compared with the Peytec standard of 99%. These tags also have the issue that when buried they cannot be detected, and when a problem is detected it is too late. The Muck Puck tags can send their signal through 20 tonnes of muck pile, which means drivers can know what they are carrying. In other words, Peytec's product closed the gap between automated quality assurance and quality control. This can represent savings of eight to nine figures."

Some companies move into the mining when they see their technology can be applicable to the sector, others are born from first-hand experience, noticing issues that need addressing and coming up with solutions accordingly. The latter is the case for Minetell, whose founder & CEO Michael Hartley was working as an enterprise risk manager in the mining sector and noticed that companies could not answer two fundamental questions: What is their material risk exposure and how effective are critical controls at any one moment in time? From this basis, Hartley created Minetell to gather intelligence to provide decision-makers with information that improves critical control performance and minimizes unacceptable exposure to material risks, with the vision to use performance data to change the way companies manage risk. "We see huge value in actually stewarding a project, rather than just minimizing the likelihood of events taking place. We must get away from the notion that risk management is perfect until something catastrophic happens," he remarked.



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Minetell wants companies to move from results thinking to performance thinking, in a move away from the “react, repair, repeat” philosophy that is currently prevalent, to rather seeking information that helps proactively predict and prevent failures. “The absence of failure is not a metric of success and that is the big difference between results thinking and performance thinking,” he elaborated, giving the example of the extractive industries’ obsession with a totally recordable injury rate that drives companies to fall foul of ‘Goodhart’s Law’ – when a metric becomes a target, it ceases to be a useful metric.

One of the key takeaways from our research in Toronto was the importance of developing technology with the user in mind, something Tony Makuch underlined during his fireside chat at the Northern Miner’s Progressive Mine Forum in October 2019 – you need the operator on board for any technology to be successfully adopted. Shelby Yee, CEO and co-founder of RockMass Technologies, spoke of how her company’s main Axis Mapper product was developed with users at the forefront of its philosophy: “One of our core beliefs is that success will come from building the product in the hands of users... Users want digital solutions that work, can be used every day and are not overly complicated.”

RockMass Tech’s Axis Mapper is used for obtaining real-time joint orientations and geotechnical data in underground environments, with the goal of maximizing engineers’ efficiency and providing accurate, actionable data. “Users have told us the greatest benefit is that the Axis Mapper integrates data collection very quickly with data visualization and that they have better data to work with in real time. It can turn a six-hour process into minutes whilst still generating accurate and consistent datasets,” related Yee.

Another common theme in the innovation lifecycle is the role of universities in the research and development of new technologies, a dynamic leveraged by ApoSys Technologies, which has collaborated with the University of Toronto and Princeton University to create a laser alignment device with drilling rig setup. Oliver Wang, ApoSys Tech’s CEO, shared his thoughts on the importance of practical implementation for innovative technologies: “The most important thing in technology development is not innovation but its application. It is not a question of how innovative a technology is but how useful it is and how easily it can be integrated. The product drives the market and vice versa. We need to work closely with the customer so that both parties can understand the business case.”

### OEMs leading the electric revolution

While the move to battery electric vehicles (BEVs) at mine sites is still at a relatively nascent stage, every OEM we interviewed, without exception, was keen to underline its focus on the transition to electric. At new mines, such as Newmont’s Borden operation in Timmins, electric vehicles are already the norm and, as public pressure on diesel emissions intensifies and prominent examples of the cost and environmental benefits of BEVs become more prevalent, staying with diesel power will become a risk.

“We always get asked, why go electric? I think the question should rather be, why use diesel?,” questioned Brian Huff, co-founder and vice president of technology at Artisan Vehicles, the California-based company that exclusively designs and builds BEVs for the mining industry. Acquired by Sandvik in February 2019, Artisan grew its reputation through collaboration with Kirkland Lake Gold in Ontario with its Z50 50-tonne haul truck, the latest and largest in the company’s line of BEVs. “Electric vehicles have many benefits as they increase health and safety, reduce costs and optimize operations. I would like to see the conversation change from why go electric to why use diesel,” added Huff.

At the top of the service sector food chain, Epiroc maintained its leading position in Canada in 2019, despite an industry still yet to fully crawl out of the downturn. Jason Smith, general manager of Epiroc Canada, spoke of an evolving dynamic where mining companies are requesting, rather than waiting to be convinced of, new innovations: “These days clients are coming to us asking for the latest technologies, rather than the other way round, as mining companies have seen tangible evidence of the competitive advantages innovation can bring,” said Smith, observing that new technologies must be scaled in collaboration with customers in such a way that exposure is limited during the ramp up and learning phase.

To cater for a wide market, Epiroc also offers a unique opportunity to its customers with the Battery as a Service (BaaS) solution where the end-user does not need to invest in the battery pack and only pays for their usage. “As well as the cost benefits, there is a positive environmental impact as the customer takes ownership of the “full circle of life” of the batteries, including second powering options right up to the recycling and reuse of some materials – a win for our customers, for us and the environment,” added Smith.

The Sudbury-based OEM formally known as Minecat decided to rebrand as Kovatera in 2019, to signify the company’s new direction on a number of fronts, including a more global outlook, a new lean manufacturing process, and the release of new products in the EV space, according to general manager Will Gove. “There are two green colors in Kovatera’s new logo which is symbolic of the company moving towards greener and renewable technologies,” explained Gove, who noted that while the demand for EVs is increasing exponentially, he expected diesel machinery is still going to play a role in the mining industry for at least the next two to five years.

In parallel with the move towards electrification, the move towards automation is also gathering pace, as exemplified by Finish OEM Normet, whose North American headquarters is in Salt Lake City and has a base in Sudbury, Ontario. Greg Hallett, Normet’s senior vice president for North America, expanded on how the company’s SmartSpray line was inspired by customer feedback relating that the quality of the sprayed concrete can vary critically between operators: “Normet is thus developing its products so that the operator effect to the result is minimized and productivity of spraying is increased,” said Hallett, adding: “The ultimate goal would be for our sprayers to achieve a level of automation where operator confidence becomes less important and the machine can autonomously deliver the outcome the customer is looking for.” ■

# Jason Smith

General Manager  
**EPIROC CANADA**



### How has business been for Epiroc in Canada in the past 12 months and has there been progression with the move towards electric vehicles?

2019 has been a good year for Epiroc and we remain excited about the future. In terms of BEV development, Epiroc is now on generation two and has more than 100,000 hours of operational experience just in Canada. Currently, we have implemented battery technologies in our 14-tonne Scooptram ST14, Minetruck MT42, and drill rigs, but this technology will be rolled out into Epiroc’s entire product portfolio.

### Can you explain the benefits of Mobilaris technology?

Part of Epiroc’s digitalization offering is the Mobilaris product portfolio including situational awareness, emergency support and ventilation on demand. The offering is an important part to optimize our customers’ value chain through system integration and information management. The Mobilaris product allows real-time location, tracking and monitoring of vehicles, personnel and any equipment using a mixture of technologies from various vendors. It is the best fit for homogeneous and cost-efficient solutions to track assets in the mine. To integrate planning data, machine production and maintenance data or sensor data into one decision support system will help you increase the production efficiency and safety of your mine.

### What are some of the latest products added to Epiroc’s automation fleet?

We have added more products to our automation fleet and are very excited

about Epiroc’s SmartROC D65 surface drill rig, which is making evolutionary strides and was deployed with Newmont at the Hollinger open pit mine in Timmins in 2019. This tried and trusted rig now has Epiroc’s innovative automation-ready platform as its foundation. It has the intelligence and power to consistently and efficiently drill high-quality blast holes with accuracy and precision and is loaded with smart features such as automated drilling and rod handling. Digitalization is picking up tremendous momentum here in Canada and globally within our industry. At Epiroc, we optimize our customers’ value chain through automation, system integration and information management. We call this 6th Sense and it enables a smart, safe and seamless operation. Epiroc also offers a unique opportunity to its customers with the Battery as a Service (BaaS) solution where the end-user does not need to invest in the battery pack and only pays for their usage. As well as the cost benefits, there is a positive environmental impact as the customer takes ownership of the “full circle of life” of the batteries, including second powering options right up to the recycling and reuse of some materials – a win for our customers, for us and the environment.

### With regard to innovation, miners are often risk-averse. Have you noticed an uptick in the demand for new technologies?

Generally no one wants to be the first adopter of new technologies. However, I believe that the industry mindset is changing and mining houses are start-

ing to look for technologies which can improve efficiency and productivity. For example, these days clients are coming to us asking for the latest technologies, rather than the other way round, as mining companies have seen tangible evidence of the competitive advantages innovation can bring. In collaboration with customers, we must scale new technologies in such a way so that exposure is limited during the ramp up or learning phase.

### What are Epiroc Canada’s key focus areas moving forward?

Epiroc is focused on sustainability and innovation and always will be. The biggest single driver of change in the rock excavation business is, without a doubt, the advent of automation. Additionally, the amount and quality of resources Canada gives us a positive outlook for the region. What differentiates Epiroc in the market is the technologies and solutions that we bring to the table, and we aim to be a partner to our customers so that the products Epiroc develops fit seamlessly into their mining operations. This customer-focus will continue as we constantly help them make their operations more sustainable, safe and efficient.

An example of Epiroc’s commitment to stay close to its customers is the establishment of a remanufacturing facility in Sudbury with a focus on underground equipment and operations. We hope to open the doors of the new facility by Q1 2020, which will initially service local consumption, but also the North American, South American and international markets if the demands are there. ■



## Mike Campigotto

President  
SAFESIGHT EXPLORATION



**We are starting to realize that although drones are our first love, we are becoming a company that solves problems with innovative technologies rather than limiting ourselves to one type of technology. We can essentially become the technology extension of an innovation manager in a mine.**



**Do you think the mining sector has started to embrace new technologies and innovation?**

Currently, there is a lot of noise but still not enough action. There are a few companies that want to be first and want to lead the industry, but the majority are



**What was your vision and motivation to create Safesight Exploration?**

Our collective intention was twofold. We felt that we could make a great contribution to the digital transformation platform in mining and that the technology would dramatically change the level of safety in the mining industry. All of the technology that we use in our innovations is really at the bottom of its evolutionary curve and has nowhere to go but upwards. SafeSight's team of experts have applied a passion for thinking and seeing things differently beyond the latest drone, LiDAR, battery and camera technology and toward client challenges underground. The result has led to collaborations with leaders in the digital transformation of mining and the creation of step change solutions.

**How has the company evolved through its collaborations with mining industry partners?**

We have just celebrated the one year anniversary of Newmont's underground drone program collaboration with SafeSight. Their team have been believers from the get-go and had the attitude of wanting to lead digital transformation to a higher level of production and safety. This high-profile partnership has led to collaborations with Redpath Mining, Wesdome Gold Mines and Barrick. We are starting to realize that although drones are our first love, we are becoming a company that solves problems with innovative technologies rather than limiting ourselves to one type of technology. We can essentially become the technology extension of an innovation manager in a mine. With digital transformation, mines are appointing innovation leaders, but they do not always have the infrastructure from a technology perspective to give them the tools to innovate. For a company to thrive they need to continuously innovate and Safesight is capable of being the partner that leads this march.

more conservative and take a first to be second strategy. Fortunately, SafeSight has found the people who want to embrace innovation and they have found value in our products which has enabled us to rapidly develop technologies and put them into actual practice. The mining sector is looking to digitally enable itself in one form or another.

**Can you explain the benefits of SafeSight's DB3 drone technology?**

SafeSight's leading product with the most demand is the DB3 LiDAR enabled drone technology. This product is ideal for surface or underground georeferenced LiDAR scans and has the benefit of increased safety, improved reconciliation, reduced dilution and improved block scheduling. This rugged utility drone integrates the latest LiDAR technology with an open platform flight controller and has the ability to go anywhere that a human should not go. The time for collecting data is also significantly reduced with the DB3 product being able to do a complete scan in approximately 15 mins.

We like to proliferate the technology with clients by selling them an activation model where they actually have to activate the program with intention. It usually starts with clients using Safesight for a few service calls, after which they will buy the technology and go through a training program so they can progress on their own. As we get to know a client, we start to recognize some of the challenges they run into. We have therefore developed other tools such as robots and trucks for LiDAR enabled ground support, which is ideal for high risk or high ventilation areas where drone flight may not be feasible.

**How will the company manage growth as its technologies and services continue to gain traction?**

We have become highly efficient in innovation, project development and manufacturing, using lean methods and agile project management strategies and can thus do a lot with few people. We are trying to be mindful of our resource growth and we are very selective with who we work with. We choose our clients as much as they choose us, which allows for every implementation to be successful. ■

## Michael Hartley

Founder & CEO  
MINETELL



**How did your experience in the extractive industries help form your ambition to create Minetell?**

While working as the enterprise risk manager in the mining sector, I noticed that companies could not answer two fundamental questions: What is our material risk exposure and how effective are critical controls at any one moment in time? I created Minetell to gather intelligence to provide decision-makers with the information that improves critical control performance and minimizes unacceptable exposure to material risks, with the vision to use performance data to change the way companies manage risk. We must get away from the notion that risk management is perfect until something catastrophic happens.

**Have you seen environmental and risk awareness improve in recent years?**

We are experiencing an age where wealth is being transferred from boomers to millennials. At the very time the industry needs capital, capital is fleeing because we are not giving investors what they want. They are looking for evidence-based information, founded in data, to give them the

confidence that material risks are being well mitigated.

Minetell is working to develop an ESG index that is performance-based to help decision makers understand where to allocate capital and resources. A performance-based index gives stakeholders the confidence and comfort that the associated results are repeatable. This helps to differentiate a company from its peers, and could be the difference in opening a door into a new jurisdiction.

**What are your views on the adoption rate of new technology in mining?**

Instead of implementing the technology, we are focusing on getting companies to adopt it. There has to be engagement. It has to be treated as a change-management project. The client must think about what the future state looks like and whether the technology aligns with it. If you are not treating technology adoption as a change management project you are going to fail. Unless you get the buy-in from everyone operating it, it is not going to work. A company ignores the human component of technology adoption at its peril. ■

## Michael Gribbons

Co-Founder and Vice President –  
Sales & Marketing  
MAESTRO DIGITAL MINE



**What has been the important milestone achieved by Maestro Digital Mine (MDM) in 2019?**

The Zephyr AQSTM Air Quality Station, a new product launched at the CIM Convention in Montreal 2019, has been a huge success. The Zephyr AQSTM is a low-cost air quality monitoring station for underground mines that now completes internally with the gold standard – Vigilante AQSTM air quality station.

We now supply technology solutions to over 130 mines world-wide. An important development in 2019 was entering the Argentinian market through partnerships with Newmont and Yamana Gold.

**Does MDM tailor its products depending on client and mining environment?**

Because we are permanently innovating to cater to the mining operator's needs, they value our support and are repetitive customers. The products we develop are a direct response to operator needs and we distinguish ourselves in providing ongoing support to clients. That is the key to holding a reputation and allows us to go from mine to mine.

**Which factor seems to be top of the agenda of mining companies: energy efficiency, productivity, or safety?**

Productivity, definitely. A 10% reduction in energy use does not have the same impact as a 10% increase in production. We understand the operating principles of a mine and how mine managers are being compensated. The primary focus is on tonnage feeding the mill.

**What is in store for Maestro Digital Mine in 2020?**

This year we are releasing MaestroLink™ Server. Now that we have thousands of Vigilantes on the field and several hundred of Zephyrs, managing them effectively in the field requires on-going calibration and maintenance. All of Maestro's products are fully digital and have significant information in the form of status bits to determine the health of the sensors and the complete system. To leverage this information, MaestroLink™ was developed to monitor the equipment and allow easy and quick decisions from a centralized location. ■