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FEATURES

LEADING DEVELOPMENTS

AROUND THE WORLD

This month, E&MJ *provides an extensive update on mining and exploration activities in Ontario. On the cover, Ethan Beardy, a geologist working for Clean Air Metals, inspects core at the Thunder Bay North project. (Photo: J. Kevin Palmer)*

DEPARTMENTS

Steve Fiscor
Publisher & Editor-in-Chief

Preparing for the Next Rally

"Mines never close, they just wait for metal prices to move higher." While working on the Ontario report this month, I kept thinking about that expression. Ontario is endowed with abundant resources, including base metals, precious metals, platinum group metals (PGMs) and today's prized battery minerals. The province is a mining-friendly jurisdiction and it draws much of its power from renewable hydroelectric and emissions-free nuclear power plants, which allow mines or any company carbon offsets. Larger communities are training workers in anticipation of a growing resource sector. Need some startup capital? The largest group of mining financiers are based in Toronto and they can structure deals, especially when metal prices are relatively high like they are today. Ontario knows the importance of the resource industry and it has the geology, engineering skills, labor, water, power and cash. So, what's not to like? Maybe the nine months of winter.

As it traversed the country, construction of the Canadian Pacific Railway in the 1880s exposed the geology that hosts many of the mineral deposits. Prospectors and developers followed. Mines opened and closed with the ebb and flow of mineral demand brought about by industrialization and war. A new form of industrialization is taking place and it will require many of the base and precious metals mined today along with other metallic elements, such as cobalt, lithium, etc. That has brought new attention to known deposits that didn't garner as much value in the past.

Some parts of Ontario have a rich mining history, such as the Sudbury Basin, where Canadians have been mining nickel for 130 years. In other regions, like the Abitibi Greenstone Belt and the Red Lake gold camp, mines are reopening that were closed 10 or 20 years ago due to the price swings with gold. A better understanding of the deposits and how to approach them differently with new technologies is breathing life back into the resource sector. As far as mining engineering skills, Canada has some of the brightest people. If you haven't had a chance to do it yet, visit the Glencore Canada website and watch the Building the Mine of the Future video series they recently posted on the development of the Onaping Depth project and you will see their vision for the future.

What really sets Ontario apart from other well-endowed mining districts is that they are preparing for the rally. They embrace the resource sector and they appreciate the investments and the jobs. So much so that communities like Thunder Bay are devising better ways to support the mines and prospectors working in the surrounding area. Other countries could learn from this approach. It could mean the difference between being a producer and a consumer. Enjoy this edition of *E&MJ*.

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Dominion Diamond Mines Sells Ekati Mine to Arctic Canadian Diamond

The Ekati diamond mine (above) returns to full operations during January. (Photo: Dominion Diamond Mines)

Dominion Diamond Mines has completed the previously announced sale of the Ekati mine and associated assets to Arctic Canadian Diamond Co. Ltd., a company formed and owned by funds and accounts managed by DDJ Capital Management, Brigade Capital Management LP and Western Asset Management Co. LLC. The Alberta Court of Queen's Bench approved the sale of Canada's first surface and underground diamond mine pursuant to an order issued on December 11.

Arctic has acquired nearly all of Dominion's assets, excluding its interest in the joint venture agreement and liabilities relating to the Diavik diamond mine, including assuming US$70 million of Dominion's outstanding indebtedness and the reclamation obligations of the Ekati mine.

"This transaction significantly reduces our debt obligations, and provides sufficient liquidity to fund our operations, invest in future growth and allow the company to emerge with a materially stronger balance sheet," Dominion Diamond CFO Kristal Kaye said.

In March 2020, operations were suspended at the Ekati mine due to the COVID-19 pandemic. The mine was put on care and maintenance and a minimal crew remained at site to maintain the mine. The company initiated a 10-week phased restart in November and returned to full operations on January 20. It is anticipated that the full recall of employees back to work will be completed no later than February 25.

"We are excited to have our employees back at work and to have Ekati in full production again," Interim President Rory Moore said. "We are also very grateful to our new owners for the commitment they have demonstrated to Ekati and its stakeholders. This new partnership will bring fresh perspectives to our operations and be the driving force behind our continued growth."

On April 22, 2020, Dominion filed for insolvency protection under the Companies' Creditors Arrangement Act (CCAA).

Vale Agrees to Pay $6.8B in Damages for Dam Disaster

Brazilian miner Vale signed a R$37.7 billion (US$6.8 billion) agreement with the state of Minas Gerais, the public defender of the state of Minas Gerais and the federal and the state of Minas Gerais public prosecutors offices to repair the environmental and social damage from the dam collapse on January 25, 2019, in Brumadinho, that killed more than 270 people and devastated the surrounding communities.

The settlement includes projects for the affected communities, a program of income transfer to the affected population, which would replace the current emergency aid, and projects for Brumadinho and other municipalities of the Paraopeba Basin. It also includes an addition to resources for the government of the Minas Gerais to carry out the Urban Mobility Program and the Public Service Strengthening Program.

The settlement establishes the guidelines and the governance for the execution, by Vale, of the reparation plan, as well as projects to be implemented as compensation for the environmental damage already known and projects aimed at water security in the impacted region.

"Vale is committed to fully repair and compensate the damage caused by the tragedy in Brumadinho and to increasingly contribute to the improvement and development of the communities in which we operate," Vale CEO Eduardo Bartolomeo said. "We trust that this global settlement is an important step in that direction."

The company said it has already paid more than R$2.4 billion (US$441 million) in indemnities. In all, 8,900 people have already signed indemnity agreements with Vale, through labor courts and civil indemnities.

Pebble Partnership, Former CEO Receive Grand Jury Subpoena

Northern Dynasty Minerals' wholly owned subsidiary Pebble Limited Partnership and Tom Collier, the former CEO of the Pebble Partnership, have each been served with a subpoena issued by the U.S. Attorney's Office for the District of Alaska. The subpoena requests each to produce documents in connection with a grand jury investigation apparently involving previously disclosed recordings of private conversations regarding the Pebble Project.

The company said it and Collier intend to cooperate with the investigation

and wasn't aware of any charges filed against any entity or individual.

Collier stepped down from the company back in September after an environmental group released tapes that showed him making comments about his close relationship with elected and regulatory officials in Alaska.

Collier submitted a resignation letter to Northern Dynasty Minerals Ltd. and said his comments "embellished both his and Pebble Partnership's relationships with elected officials and federal representatives in Alaska, including Gov. Dunleavy, Sens. [Lisa] Murkowski and [Dan] Sullivan and senior representatives of the U.S. Army Corps of Engineers."

The videos, which were secretly recorded by individuals posing as investors, were released by the Environmental Investigation Agency and contained conversations with Collier and others with Northern Dynasty President and CEO Ron Thiessen.

Anglo American Contributes to COVID Vaccine Rollout

Anglo American is making available up to $30 million of support toward the global availability of COVID-19 vaccines across its operational footprint. The nature of the contribution, consisting of cash and in-kind support, will differ based on the vaccine deployment models for each country. Anglo American's support is expected to include contributions toward the procurement of vaccines by host governments, as well as logistical support and health and other infrastructure required to facilitate the efficient roll-out of vaccines.

"Anglo American has a long history of supporting major public health programs to help improve the health of our employees and host communities, as well as running major health facilities around our operations over many decades," Chief Executive Mark Cutifani said. "This is in our DNA as a company — it is how we do business. We must help in any way we can."

In South Africa, Anglo American will allocate $10 million of the company's global support commitment. This contribution includes the purchase of vaccines via South Africa's Solidarity Fund; logistical support in the form of transportation and storage to help ensure safe and efficient vaccine delivery; use

Nouveau Monde Receives Go Ahead for Western World's Largest Graphite Mine

The Québec Government issued a ministerial decree authorizing Nouveau Monde's Matawinie mining project. Located only 150 kilometers (km) north of Montréal, the deposit constitutes the largest projected graphite operation in North America and Europe and is expected to become the world's first all-electric open-pit mine.

The project has a production level of 100,000 metric tons per year (mt/y) of high-quality graphite material, which will form part of Nouveau Monde's value-added anode strategy — supplying material for the electrical vehicles and renewable energy storage industries.

"Today's milestone is something we have worked toward as a team since the outset in 2011," Chairman Arne H. Frandsen said. "After a decade of meticulous planning, we can now commence the mine construction of our world-class Matawinie graphite project.

The environmental decree provides Nouveau Monde with the operational criteria and final design parameters to launch construction activities. Early works at the mining site are expected to start during the second quarter of 2021, and full construction is expected in the third quarter once permits and authorizations are finalized. Commissioning activities and startup of commercial production is planned for 2023.

Nouveau Monde said it has mastered the ore metallurgical process to reach 97% purity after simple flotation, de-risk its operation through its demonstration plant, and actively engage with the local community of Saint-Michel-des-Saints to secure a social license to operate and with the Atikamekw First Nation.

President and CEO Eric Desaulniers said the decree was a "critical element" they have been waiting for. "With this green light to launch our Matawinie project, we plan to bring to market a responsibly extracted high-purity graphite to supply EV and energy storage sectors with a local and sustainable alternative. Doing so will position Nouveau Monde as a leading anode material provider for decades to come, creating opportunities and unlocking value for all parties involved."

Nouveau Monde said it has initiated environmental parameters to limit the project's footprint and protect local biodiversity by integrating an on-site water management system; co-disposal of tailings and waste rock in line with requirements of best practices; progressive land reclamation through backfilling of the pit and a comprehensive restoration plan; and an all-electric fleet powered by hydroelectricity.

Nouveau Monde said it has launched many initiatives since the deposit discovery to align the Matawinie project with the concerns and values of the local community. It signed a collaboration and benefit-sharing agreement with the municipality of Saint-Michel-des-Saints to set out a concrete social, economic and environmental development partnership through financial and participatory mechanisms.

An autumn photo shows the future sight of the Matawinie mine located 150 km north of Montreal.

of Anglo American's operational health facilities and health professionals — in the regions of the Northern Cape, Limpopo, North West and Mpumalanga — to help administer vaccines to the more than 45,000-strong workforce, their families and host communities; and training community health workers to assist in administering vaccines.

"By supporting the South African government's efforts to roll out vaccines at speed and scale, we are making a further positive contribution to helping protect the lives and livelihoods of millions of South Africans," said Nolitha Fakude, chair of Anglo American's Management Board in South Africa. "This is a significant undertaking, which requires business, labor, civil society and government to work together for the benefit of all.

Anglo American is working with the authorities in each of the countries where it operates to best assist vaccine rollout efforts. Through its contributions, Anglo American is committed to the fair and equitable distribution of vaccines.

Cutifani said the success of the vaccinations will depend on how well everyone works together. "The more of us that are vaccinated, the safer we will all be and the more quickly we can help rebuild our economies," he added.

Swiss Criminal Court Convicts Beny Steinmetz

A Swiss criminal court convicted Israeli businessman Beny Steinmetz of bribery and forgery in connection with his company BSG Resources Ltd.'s (BSGR) procurement of valuable mining rights in Simandou, Guinea. Two Steinmetz's associates were also found guilty, one of bribery and forgery and the other of bribery. The court sentenced Steinmetz to five years of prison and ordered him to pay CHF 50 million (US$56 million).

Steinmetz was accused of paying or arranging bribes to officials to obtain exploration permits for mining an iron-ore deposit in the Simandou area.

Back in April 2019, the London Court of International Arbitration found that BSGR defrauded Vale, its former partner in the project, by concealing its bribery and corruption from Vale to secure the company's investment in Simandou. That court awarded Vale more than US$2 billion in damages. The award arose out of alleged fraud and breach of representations and warranties committed by BSGR to persuade Vale to purchase a 51% interest in concessions held by BSGR to develop an iron ore deposit in Simandou and the adjacent Zogota concession. Vale paid BSGR an initial price of US$500 million, and invested more than US$700 million, principally in Zogota, before the Guinean government withdrew the concessions when it found that BSGR obtained its rights to Simandou as a result of bribery of Guinean officials.

Vale said it will continue to pursue collection from BSGR and Steinmetz personally, including through litigation in the High Court in London, which has entered a worldwide freezing order on the assets of Steinmetz, his foundation and other defendants.

Steinmetz said he will appeal the verdict.

Nornickel Shuts Down Smelter in Nikel Town

MMC Norilsk Nickel, the world's largest producer of palladium and high-grade nickel and a major producer of platinum and copper, is shutting down the smelter in the town of Nikel in Russia's Murmansk region. It is the company's oldest production facility. This is part of Nornickel's comprehensive environmental program, which aims to significantly reduce the environmental impact at all production sites. Hazardous emissions at Russia's Norwegian border will cease.

"Today will be a symbolic event — the melting of the 'last ladle,' after which the smelting shop will be closed," Nornickel President Vladimir Potanin said. "This is a historic event for Nornickel. Following the closure of the smelting facilities in Nikel, we are modernizing our metallurgical production in Monchegorsk, including the construction of new state-of-the-art facilities. It is important for us to ensure that our own production meets modern requirements."

Murmansk Region Gov. Andrey Chibis said workers who wished to remain with the company were offered jobs in other units. For those who decided to try their hand at entrepreneurship, good starting conditions were created.

The decision to close the smelting facility was made by Nornickel in November 2019. The closure will completely eliminate sulphur dioxide emissions in the cross-border area with Norway. Due to the implementation of the program, it is planned to reduce sulphur dioxide emissions at Kola MMC by 50% in 2020 and by 85% by 2021.

Editor's note: Nikel was founded in the late 1930s to exploit the large nickel deposits in the region. At the time, it was part of Finland. The Finns began mining in the region in the 1940s with the help of Canadian miners. The Red Army invaded the region during the Winter War between Finland and Russia. Despite having superior weaponry on the ground and in the air, the Russians suffered heavy casualties. They defeated the Finns in a second attempt. The three-month Winter War ended in March 1940 with the signing of the Moscow Peace Treaty. Finland ceded 11% of its territory, which included Nikel, to the Soviet Union.

One of the oldest nickel smelters in Russia will permanently close.

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WE DISCOVER POTENTIAL

Lithium Americas Receives Record of Decision for Thacker Pass

Exploration drilling defines the Thacker Pass deposit within the McDermitt Caldera. (Photo: Lithium Americas)

The U.S. Bureau of Land Management (BLM) has issued the Record of Decision (ROD) for Lithium Americas Corp.'s Thacker Pass lithium following completion of the National Environmental Policy Act (NEPA) process. Thacker Pass, located 100 kilometers (km) northwest of Winnemucca, in Humboldt County, Nevada, is 100% owned by Lithium Nevada Corp., a U.S. corporation and wholly-owned subsidiary of Lithium Americas.

"The issuance of the ROD is the culmination of over 10 years of hard work from the Thacker Pass team, as well as the BLM and other federal, state and local agencies, all of whom worked tirelessly to ensure their respective commitments to environmental stewardship and community engagement," President and CEO Jon Evans said. "With the federal permitting process complete, our focus is on advancing the financing process, including discussions with potential strategic partners."

Receipt of the ROD represents an important milestone in the development and the permitting of the Thacker Pass project, according to the company. Applications for key state permits and water rights transfers have been submitted, with results expected later this year.

Tahltan Nation Signs Agreement With Coeur Silvertip

The Tahltan Nation and Coeur Silvertip Holdings Ltd., a subsidiary of Coeur Mining Inc., signed a comprehensive impact-benefit agreement related to the company's Silvertip silver-zinc-lead mine located in northern British Columbia. The agreement provides a framework for a mutually beneficial, long-term relationship between the Tahltan Nation and Coeur Silvertip, and supports Coeur's commitment to socially and environmentally responsible mining, according to the company.

President of the Tahltan Central Government Chad Norman Day said the nation would work with the company to fully implement the agreement immediately. "We have a shared vision of empowering Tahltan workers, entrepreneurs and companies while working together to mitigate the mine's impacts to our Tahltan Territory, culture and values," he said.

The agreement lays the foundation for a strong partnership and shared benefits between Coeur Silvertip and the Tahltan Nation by aligning interests across several measures of success at Silvertip, including environmental protection, employment and economic opportunities for surrounding First Nations communities and financial returns, among others, according to Chief Marie Quock, Iskut Band Council.

This agreement is also step toward a potential restart and expansion of operating activities at Silvertip, according to the company.

Southern Empire Finishes Initial Survey at Oro Cruz

Southern Empire Resources Corp. has completed initial surveying, including a LiDAR survey, of the historical Cross mine underground workings at its Oro Cruz Gold project, located in Imperial County, California. At Oro Cruz, about 3 kilometers (km) of existing underground workings at the Cross mine accessed high-grade, oxide gold mineralization. This zone is a key target of future exploration plans, according to the company.

Southern Empire Vice President of Exploration David Tupper said, "Mapping the underground with LiDAR and establishing underground survey points, which are now tied into surface control survey points, is a key starting point for all of future underground exploration, development and production at Oro Cruz."

Southern Empire's underground LiDAR and survey contractors, EROCK Associates LLC and Dundas Geomatics Inc. (both of Grass Valley, CA) were assisted by American Mine Services Inc. to complete this underground work in an efficient and timely manner.

The Cross mine underground ramp and sublevel developments, which extend approximately 155 meters vertically below the mine portal, were established in the mid-1990s by the American Girl Mining Joint Venture (AGMJV). Subsequent gold production from the underground mine was limited, cut short when operations ceased on November 1, 1996, because of declining gold prices.

Forest Service Issues Final EIS for Resolution Copper Mine

The Resolution Copper project in Superior, Arizona, has entered the next phase

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of public consultation in its ongoing permitting process, led by the U.S. Forest Service (USFS), with the release of its independent Final Environmental Impact Statement (EIS). The project, owned by Rio Tinto (55%) and BHP (45%), will reuse the historic Magma mine.

"The Final EIS is an important step in the ongoing permitting process, reflecting years of extensive community engagement and rigorous, independent study by the U.S. Forest Service to shape the design plan," Resolution Copper Project Director Andrew Lye said. "We are still years away from any decision to invest in developing this project."

The final EIS is now subject to 45 days of further public review and comment before the USFS issues a final record of decision. After this process, further permitting will progress with other authorities and a detailed feasibility study completed over several years to inform investment considerations on the project. When an investment decision is made, Resolution Copper is expected to take around 10 years building infrastructure to prepare for the commencement of mining, according to the company.

A day before this announcement, the San Carlos Apache Tribe filed a federal lawsuit seeking to stop the USFS from transferring sacred tribal land at Chich'il Bildagoteel, or Oak Flat, to BHP and Rio Tinto for the construction of the Resolution copper mine.

The lawsuit claimed the USFS violated the National Environmental Policy Act by failing to conduct a Supplemental EIS. The suit stated that the USFS ignored significant and technically substantial new information consisting of at least a dozen new studies and reports totaling thousands of pages that are relevant to the environmental impact of Resolution's proposed mine tailings dump.

The suit also stated that the USFS violated the National Historic Preservation Act by failing to adequately consult with the tribe about ancestral land with great historic, cultural, and religious importance to the tribe and its members.

Relief Canyon Mine Achieves Commercial Production

Americas Gold and Silver Corp.'s Relief Canyon mine in Nevada, United States, declared commercial production on January 11. Since the return of the company's large radial stacker in December, the operation has consistently met the required stacking rates, which was the final item required to declare commercial production. Full ramp-up from the operation is targeted for mid-May 2021.

"I am pleased to announce that Relief Canyon has achieved commercial production following a challenging 2020," Americas Gold and Silver President and CEO Darren Blasutti said. "The Relief Canyon team worked hard to overcome the common teething pains in commissioning a new operation, the impact of the COVID-19 pandemic, and the failure of our large radial stacker."

First gold was poured in February 2020 at the mine. The company also owns and operates the Cosalá Operations in Sinaloa, Mexico, manages the 60%-owned Galena Complex in Idaho, USA, and owns the San Felipe development project in Sonora, Mexico.

Relief Canyon achieves commercial production after repairing its radial stacker (above).

Trilogy Receives Right of Way for Ambler Road

The Alaska Industrial Development and Export Authority (AIDEA) has signed agreements for right-of-ways for Trilogy Metals Inc.'s Ambler Road Project with the U.S. Bureau of Land Management (BLM) and the National Park Service (NPS). The agreements grant a 50-year right-of-way on federally owned and managed land by the federal agencies for the future development of the Ambler Mining District Industrial Access Road.

Ambler Metals LLC, the joint venture operating company equally owned by Trilogy and South32, is also continuing discussions with AIDEA on securing a predevelopment funding agreement for the detailed engineering work for the Ambler Road Project.

"I would like to commend AIDEA for the continued positive progress of the Ambler Access Project which is a critical link in the development of the Ambler Mining District," President and CEO Tony Giardini said. "Despite the difficult times caused by the COVID pandemic, AIDEA and the government of Alaska have demonstrated effective leadership and we expect continued progress on the road during 2021."

Judge Overturns Wetlands Permit for Back Forty

On January 4, a judge issued a decision denying the issuance of a wetlands permit for Aquila Resources Inc.'s Back Forty Project in Michigan. An administrative law judge for the Michigan Office of Administrative Hearings and Rules determined that Aquila's groundwater model for the gold and zinc project did not provide a reliable identification of wetland impacts and found the permit application to be administratively incomplete. The judge also determined that Aquila did not provide a complete assessment of potential alternatives to its proposed plan.

"Obviously, we are disappointed by the judge's decision," Aquila President and CEO Barry Hildred said. "The company is evaluating its alternatives, which include the submission of an updated permit application or appealing the decision to the EGLE environmental review panel."

He added that the project will only directly impact 11.2 acres of regulated wetlands and he believes Aquila will be able to resolve the cited issues.

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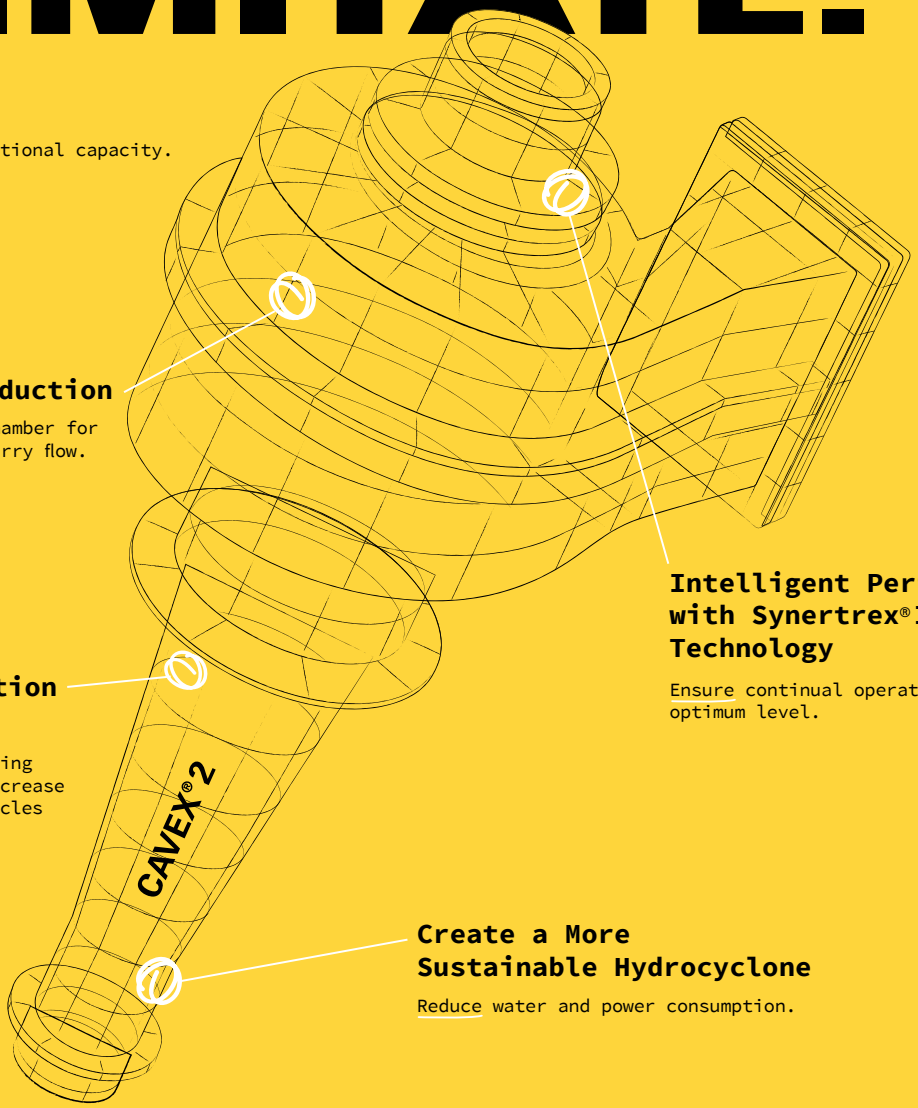

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Richard C. Adkerson

Freeport-McMoRan Inc. appointed **Richard C. Adkerson** chairman. He will also continue to lead the company as CEO.

Gold Fields appointed **Chris Griffith** as the CEO designate and executive director. Griffith will succeed **Nick Holland** on April 1. Holland, who was due to retire on September 30 after 13 years as CEO, has agreed to retire six months earlier to facilitate the leadership transition. Griffith was previously CEO of Anglo American Platinum. He resigned from this position on April 16, 2020, to pursue other career opportunities and is currently on gardening leave until March 31, 2020.


Simon Trott


Arnaud Soirat


Kellie Parker

Rio Tinto Chief Executive **Jakob Stausholm** appointed **Simon Trott,** currently chief commercial officer, Iron Ore chief executive; Copper and Diamonds Chief Executive **Arnaud Soirat** will become Group COO; and **Kellie Parker,** now managing director of Pacific operations Aluminum, will join the Executive Committee (ExCo) as chief executive, Australia.


Ewan Downie


Ron Clayton


Matthew Gili


Matthew Gollat


Ryan Snow


Brent Kristof

Premier Gold Mines Ltd. announced the anticipated management team for i-80 Gold Corp., which includes **Ewan Downie,** CEO and director; **Ron Clayton,** chairman; **Matthew Gili,** president and COO; **Matthew Gollat,** executive vice president business and corporate development; **Ryan Snow,** CFO; and **Brent Kristof,** executive vice president of projects and evaluations. Downie served as founder, president and CEO of Premier. Clayton is currently the president and CEO of 1911 Gold Corp. Most recently, Gill was the CEO of Nevada Copper Corp. Gollat is currently the vice president of business development at Premier Gold Mines. Prior to joining i-80 Gold, Snow served as vice president of finance for Nevada Copper. Kristof is currently senior vice president, operations, for Premier.


John Fitzgerald

Alamos Gold Inc. appointed **John Fitzgerald** as its vice president, projects. Most recently, he was vice president, projects and technical services at Centerra Gold.


Cynthia Carroll

Glencore plc appointed **Cynthia Carroll** as an independent non-executive director. She held various executive roles there culminating in being CEO of the Primary Metal Group, Alcan.

Aquila Resources Inc. appointed **Guy Le Bel** as president and CEO of Aquila. **Barry Hildred** will transition to the role of executive chair of the board of directors. The board has appointed **Ted Munden,** outgoing chair of the board of directors, to the position of lead director. Most recently, Le Bel was CEO and CFO of Golden Queen Mining Ltd. until its acquisition in 2020 by Falco Resources Ltd.


Guy Le Bel


Barry Hildred

Hycroft Mining Holding Corp. appointed **Jack Henris** to the position of executive vice president and COO. He joins from Stantec Inc. where he was a senior mining consultant. **James Berry** joined as vice president, exploration and geology. His previous roles have included progressively senior technical positions with successful hard rock mining companies, including Romarco Minerals Inc., Barrick and Homestake Mining Co.


Brock Gill


Simon Hille


Sylvain Lehoux

Eldorado appointed **Brock Gill** and **Simon Hille** and also promoted **Sylvain Lehoux.** Lehoux was promoted to the role of vice president and general manager, Québec. Gill will join the company as senior vice president, projects and transformation in March. He previously held the role of vice president, projects, with BHP where he was responsible for leading the multi-billion-dollar Jansen Potash Project and other key development projects. Hille joined Eldorado in November as vice president, technical services. Prior to joining Eldorado, Hille was with Newmont as group executive, technical engineering and global projects. Lehoux was promoted to the role of vice president and general manager, Québec, in early December. He joined Eldorado in June 2017 as general manager of the company's Lamaque mine.


Malissa Gordon


Brian Risinger

Piedmont Lithium Ltd. announced the addition of **Malissa Gordon, Jim Nottingham, John "Pratt" Ray** and **Brian Risinger** as senior members of the management team. Gordon joined the company in 2020 as manager of community and government relations. Most recently, she was with the Gaston County Economic Development Commission. Nottingham joined as senior project manager of concentrate operations. Ray joined as production manager of chemical operations. Risinger joined as vice president of corporate communications and investor relations.

Minera Candelaria named **Luis Sánchez Rodríguez** as its new president and executive director, effective March 1. He currently serves as CEO of Zaldívar, a joint operation of Antofagasta Minerals.


Daniel Pace

Orogen Royalties Inc. appointed **Daniel Pace** as vice president of exploration. Pace takes over from **Dave Groves,** who is retiring from the company. Prior to Orogen, Pace was the exploration manager at Renaissance Gold.


Jeremy Langford

Artemis Gold Inc. appointed **Jeremy Langford** as COO. Langford served most recently in the role of COO of Centamin Plc.


Michal J. Mankosa

Eriez Vice President of Global Technology **Michal J. Mankosa** has been selected as the recipient of the 2021 Robert H. Richards Award. This recognition is presented by the Society for Mining, Metallurgy and Exploration (SME) and funded by the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) for outstanding contributions to applied research, engineering development, and commercial deployment of advanced separation systems for the mineral processing industries. Many of his groundbreaking research projects have led to innovative developments that have helped to advance the minerals processing industry. His most recent work is focused on improving the efficiency of mineral recovery systems while simultaneously providing substantial reductions in energy and water consumption.


John Blicha

Eriez promoted **John Blicha** to the position of global senior director of marketing and brand management.

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Construction Begins on Salares Norte

About 15% of the total construction has been completed to date, including the 1,800-person mining camp (above).

Gold Fields began construction of the mining infrastructure at its Salares Norte project, in line with the project's construction schedule announced in February last year. This month, prestripping works at the mine and construction of the processing plant began.

Construction of the $860 million project is scheduled to finish in late 2022, with first gold production expected in early 2023. Once commissioned, the mine will process 2 million tons of ore per year for the production of gold doré.

Salares Norte is located between 3,900 meters (m) and 4,700 m above sea level, in the municipality of Diego de Almagro in the Atacama Region, northern Chile. The closest major city is Copiapó, about 330 kilometers (km) from the site. The project will create approximately 2,700 jobs during peak construction, while some 900 employees and contractors will be employed once it goes live.

About 15% of the total construction has been completed to date, including the 1,800-person mining camp, related infrastructure and access roads.

Max Combes, project director, said Salares Norte was good news for Chile and the economy of the Atacama Region. "A project like Salares Norte generates a very valuable production chain in the industry along with important economic opportunities in the region," Combes said.

The project will use sustainable technologies that reduce its environmental footprint, including photovoltaic solar energy and filtered tailings to optimize water use, according to Combes.

Codelco Approves 2 New Mining Projects

Chilean copper miner Codelco has approved an investment of US$1.2 billion for its new Diamante and Andesita projects. Both projects are part of the investment portfolio for the El Teniente mine, and construction is expected to be completed by 2023.

The El Teniente project portfolio, which includes Diamante and Andesita and the development of Andes Norte, is currently in the construction phase and will extend the productive life of the division 50 years. The total investment of the El Teniente Project portfolio is US$3 billion.

Progress of the three projects in their global construction has reached 64% and the peak of activity is planned for 2021 and 2022, according to the company.

The Diamante project includes the construction of 40 kilometers (km) of tunnels, one of them will be bidirectional, with a length of 2.5 km, which is equivalent to the El Melón tunnel. It will have a highway standard in terms of lighting and GPS location, which will deliver greater security and efficiency. In Andesita, they will construct 25 km of tunnels, 85 extraction points and other works to allow the circulation of autonomous loading, unloading and hauling equipment (LHD) that use electricity to move around, and which will be operated from Rancagua through the Integrated Operations Center.

The Andes Norte project has received an investment of US$1.9 billion and is being built at the deepest level of the deposit. The mine is expected to start production by December 2023.

Vale Resumes Pellet Production in Vargem Grande

Vale has resumed production at the pelletizing plant in Vargem Grande, Nova Lima (MG), Brazil, which has been idle since February 2019. With a nominal capacity of 7 million metric tons per year (mt/y), the plant is expected to produce approximately 4 million to 5 million mt/y in 2021, according to its ramp-up and pellet feed availability.

The Vargem Grande plant concentrates all of the iron ore produced in the Minas Gerais quadrangle, which includes the Tamandua, Capitao do Mato and Abóboras mines. Vale also reinforced its commitment to the safe and stable resumption of its production capacity.

Pre-stripping Equipment is Assembled at Quellaveco in Peru

Anglo American and Mitsubishi will begin the pre-stripping activities at their Quellaveco mine in Peru beginning during the second quarter of 2021. Themine will use autonomous haulage during pre-stripping.

The company also reported it has erected its first of three electric shovels for the project. The Cat 7495 shovel will load a fleet of Cat 794 AC haul trucks.

The Quellaveco copper deposit has mineral reserves estimated at 1.3 billion metric tons (mt), containing approximately 7.5 million mt of copper. Ore will be processed by flotation for the production of copper concentrate with silver and molybdenum byproducts. The mine life has been estimated to be 30 years.

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BHP Reports Record Iron Ore Production

In its second-half 2020 production update, BHP reported record production from its Western Australia Iron Ore (WAIO) mines, which increased by 6% to 128 million metric tons (mt) or 145 million mt on a 100 % basis. The numbers reflected record production at Jimblebar and strong performance across the supply chain, with significant improvements in car dumper productivity and reliability, the company said. This was partially offset by weather impacts and planned Mining Area C and South Flank major tie-in activity.

Production in the March quarter is expected to be impacted by planned ore handling plant maintenance across the mines and continued Mining Area C and South Flank tie-in activity. Guidance for the 2021 financial year remains unchanged at between 244 million and 253 million mt (276 and 286 million mt on a 100% basis), BHP said.

Tiwai Point Smelter Will Remain Open Until 2024

Rio Tinto has reached an agreement on a new electricity agreement with Meridian Energy that will allow New Zealand's Aluminum Smelter (NZAS) to continue operating the Tiwai Point aluminum smelter until December 31, 2024. Discussions with the New Zealand government are progressing to address the smelter's high transmission costs, but a new agreement was reached with Meridian Energy relating to power prices, making the smelter economically viable and competitive over the next four years, Rio Tinto said.

"We are pleased to have reached an agreement with Meridian Energy that will enable the Tiwai Point smelter to continue producing some of the lowest carbon aluminum in the world," Rio Tinto Aluminum Chief Executive Alf Barrios said. "This agreement improves Tiwai Point's competitive position and secures the extension of operation to December 2024."

The agreement will also allow Rio Tinto, the New Zealand government, Meridian and the Southland community more time to plan for the future, he added.

The extension provides time for detailed closure studies to be completed. Plans for eventual closure of the Tiwai Point smelter will include extensive stakeholder consultation, including within the Southland community, Rio Tinto said.

In July 2020, Rio Tinto announced the conclusion of a strategic review of the smelter and a decision to wind down operations by August 2021 due to high energy and transmission costs.

NZAS is a joint venture between Rio Tinto (79.36%) and Sumitomo Chemical Co. Ltd. (20.64%). It employs around 1,000 people directly and creates a further 1,600 indirect jobs in Southland.

A new electricity agreement extends the life of the Tiwai Point smelter (above) until the end of 2024.

Macmahon Secures 4-year Contract for Deflector Underground Mine

Australian mining contractor Macmahon announced its underground mining division has been awarded a four-year contract with Silver Lake Resources to perform the mining works at the Deflector gold and copper mine in Western Australia.

A Macmahon subsidiary, GBF, has been providing underground mining services at the Deflector mine since mining commenced in early 2016. Macmahon acquired 100% of GBF in 2019, and it said this business is now an important part of the company's strategy to expand in the underground mining services market.

The new contract with Silver Lake will run until April 2025, and is expected to generate approximately $220 million in revenue for the company over this period. The contract is a full service mining contract and incorporates all underground development, ground support and production activities, including the provision of all labor and mobile mining equipment.

"This new contract is an important milestone in our strategy to expand our underground business, and is a clear demonstration of the benefits we are now realizing from the GBF acquisition," Macmahon CEO and Managing Director Michael Finnegan said. "Importantly, the Deflector mine is a high-grade gold and copper asset in Western Australia, so is an attractive project in the current macro environment. We look forward to continuing to support the development of Deflector, and to achieving further scale in the underground market."

During the fourth quarter of 2020, the Deflector mine produced 23,790 ounces gold and 410 metric tons (mt) of copper from 143,139 mt of ore at 5 g/mt gold and 0.3% copper. Silver Lake said the tonnage and grade were lower quarter-on-quarter, reflecting an increase in capital development intensity with the commencement of decline development to access the Deflector South West lodes and the resulting reduction in ore drive development.

Mongolia May Pull the Plug on Oyu Tolgoi Plan

Issues for the Mongolia's Oyu Tolgoi copper-gold mine continue to pile up. Turquoise Hill Resources, operator of the mine and subsidiary of Rio Tinto, said the government of Mongolia, which owns a 34% interest in the project, is unhappy with the results of a definitive estimate of the project and significant cost increases, which now stand at $6.75 billion, higher than its original estimate of $5.3 billion.

If the project ends up not being "economically beneficial to the country," the government has said it may not proceed, according to Turquoise Hill. It is concerned the development costs of the Oyu Tolgoi project have "eroded the economic benefits it anticipated to receive."

The government said it plans to initiate discussions regarding the termination and replacement of the underground mine development and financing plan.

In 2019, Rio Tinto announced a 30-month delay in the timeline for the project and a massive cost overrun. In December, it announced an updated timeline with the underground project reaching sustainable production by October 2022.

Turquoise Hill said it is committed to engaging with the government and Rio Tinto to address the issues and revisit the sharing of economic benefits arising from the Oyu Tolgoi project in the context of agreeing on a comprehensive financing plan.

In addition, there is an ongoing tax dispute between Mongolia and Oyu Tolgoi. Oyu Tolgoi said it evaluated the Tax Act claim for approximately $228 million from the Mongolian Tax Authority (MTA), as announced on December 23, and is seeking a reduction of its carried-forward tax losses by approximately $1.5 billion.

Turquoise Hill said it is proceeding with applying to an arbitration tribunal before the United Nations Commission on International Trade Law for leave to amend its statement of claim, including issues raised in the 2016-2018 tax assessment. Many of the matters raised in the 2016-2018 tax assessment are similar to ones raised in the 2013-2015 tax assessment, so Oyu Tolgoi believes amending its statement of claim is an efficient and effective means of reaching resolution on both tax assessments.

Turquoise Hill said Oyu Tolgoi LLC has paid all taxes and charges required.

There is also a class action against the company and certain officers in the Superior Court in the District of Montreal. The claim alleged that the defendants made material misstatements and material omissions with respect to, among other things, the schedule, cost and progress to completion of the development of Oyu Tolgoi. The company believes the complaint is without merit.

The conveyor decline at Oyu Tolgoi continues to progress with 900 m completed during the last quarter.

India's Reforms are Killing Mining Industry

By Ajoy K Das

India's purported big ticket mining sector reforms more than a decade ago of adopting auction as mandatory route for allocation of coal and non-coal mineral assets to investors is falling apart in terms of resource development projects in the country.

The mandatory auction route for allocating non-coal mineral assets was adopted in 2015 through amendments to Mines, Mineral Development and Regulation Act (MMDRA) 1957. The latest data available shows that of the 154 mineral blocks offered for bidding since then, only 101 blocks have been successfully auctioned over the last five years.

Worse, of the 52 greenfield blocks of the total 101 auctioned, not even one has been put into operation over the last five years. In the case of 14 operational mines, categorized as "C category mines, where mining leases were put up for fresh bidding in the southern Indian state of Karnataka, only seven have been brought into production over the years while the other seven mines are still awaiting receipt of all mandatory approvals from the government necessary to commence operations.

"The auction process has created artificial scarcity to the extent that miners are placing unsustainable high bids beyond 100% of the sale value of the mineral and any mine secured at a premium of more than 100% would inevitably make a loss," according to the Federation of India Mineral Industries (FIMI), the apex representative body of miners, in an assessment report on current status of Indian mining industry post introduction of auctioning.

In its analysis, in the case of 103 non-coal mineral blocks auctioned, 102.87% of the estimated resources auctioned would go to the government as revenue, clearly indicating that the investor at the auction has a negative return on its investment.

Hence, with Indian mining industry being the highest taxed in the world, high bids have increased the cost of production and rendered domestic mining operations uncompetitive vis-à-vis global industry benchmarks.

The adoption of auction in allocating mineral resources has also been a dampener for exploration of deep-seated minerals. While 2,754 mining leases for non-coal minerals were executed between 2006-2010 and 494 mining leases between 2010-2014, most of which were greenfield, after introduction of auction regime post 2015, only 28 brownfield mining leases have been executed, which had pre-existing environmental and forest clearances.

Kolmar Plans to Double Coal Production

Kolmar starts construction of the second stage of the Inaglinskaya coal complex.

The Kolmar Coal Co., a Russian coal mining company in southern Yakutia (Neryungri Region), plans to double its coal production in 2021, according to local media reports. The company has set its sights on exporting more metallurgical-grade coal to China and India.

In 2020, Kolmar produced 6.7 million metric tons (mt). The company said it will double it capacity by achieving full production at the upgraded Inaglinsky mine and processing plant and through the launch of the new Eastern Denisovskaya mine. It invested 24 billion rubles ($317 million) in 2020, and they plan to invest an additional 30 billion rubles ($396 million) in 2021.

Almost 80% of Kolmar's exports currently flow to China. After the commissioning of its own coal terminal at the Port of Vanino, South Korea, Japan and even India are now promising markets. A pilot shipload was delivered to a major South Korean metals company several months ago.

"Despite the challenging economic situation, we feel optimistic about the future and continue boosting production," said Anna Tsivileva, chairwoman for the Kolmar board. "We have received an increasing number of applications from top Chinese metals enterprises for Russian coal as they reduce their share of coal purchases from Australia. And we are ready for such a step, expanding high-tech production and infrastructure for increasing coal output volumes."

During 2020, Kolmar launched what it calls the first stage of the largest Russian coal complex, Inaglinskaya, which includes mining and processing plants and the largest coal terminal in the country.

On December 20, the Denisovskaya mine was launched in test mode, which was expected to start operating at full capacity in February. It will increase the production volume at the Denisovsky GOK to 6 million tons of coal. The company has set a coal production target of 12.24 million mt for 2021.

In 2021, the company plans to build auxiliary facilities, including the main building of the second stage of the Inaglinskaya-2 mining and processing plant and the second stage of the Inaglinskaya mine, so that both facilities will be fully launched in the first quarter of 2022.

Arch Gives Viper to Knight Hawk, Closes Coal Creek

Arch Resources announced more steps in its ongoing transition toward metallurgical coal markets by contributing its Viper thermal mine in Illinois to Knight Hawk Coal, which will operate the mine going forward. As part of the transaction, Arch's equity stake in Knight Hawk increased to 49.5% from 48%, and Knight Hawk assumed long-term undiscounted mine closure liabilities totaling $21 million.

"We view the Viper transaction as a highly positive outcome in our ongoing efforts to identify and execute on strategic alternatives for our thermal assets," said Paul Lang, president and CEO, Arch Resources. "Knight Hawk shares Arch's deep commitment to safety, environmental stewardship and social responsibility, and recognizes and values the essential contributions of the Viper workforce in the mine's ongoing success."

Arch is also pressing forward with its plans to reduce its operational footprint in the Powder River Basin (PRB), even as it explores strategic alternatives for those assets. As a next step in this effort, Arch is proceeding with the accelerated closure and final reclamation of the Coal Creek mine, with a concerted focus on reducing what it called "highly inflated, state-calculated surety bond requirements." The company plans to ship on its existing contracts at Coal Creek during 2021 before beginning final closure of the mine's active pit in 2022.

Through these accelerated efforts, Arch expects to reduce the total asset retirement obligation (ARO) at Coal Creek by an estimated $40 million, or 80% of the ARO at the mine, over the course of the next 18 months. Simultaneously, Arch is laying the groundwork for systematically reducing the operational footprint at its Black Thunder mine.

Bravus Selects DRA to Build Carmichael Prep Plant

DRA Global (DRA) has won its second major contract on the Carmichael Project, the A$140 million coal preparation plant. Bravus Mining & Resources CEO David Boshoff said DRA was known for its exceptional service to the Australian resources sector, and previous work on the Carmichael Project has demonstrated their experience and capability.

DRA will carry out the design, engineering and construction of the coal preparation plant. They were already in the process of delivering a coal handling plant, which sizes the coal. The prep plant washes the coal to meet final product quality requirements.

Ukraine Puts Deposits Up for Sale

By Vladislav Vorotnikov

The Ukraine government plans to sell 30 deposits to domestic and foreign investors through competitive bidding procedures in 2021, the government agency UkraineInvest said in a statement on January 26.

The deposits currently owned by the Ukraine mineral resource agency Gosgeonedr could bring up to $10 billion to the national budget, UkraineInvest estimated.

The deposits contain a broad range of various metals and minerals, including lithium, titanium, nickel, tantalum, niobium, beryllium, zirconium, scandium, molybdenum, gold and uranium. Most of them have never been produced in Ukraine before.

The government expects foreign investors to participate in the upcoming competitive bidding procedures actively. "The direct foreign investments in the Ukraine mining industry has been steadily growing since the early 2000s, reaching $5.2 billion in 2019, or 50% up compared to the previous year," Director of UkraineInvest Sergey Tsivkach said.

The investment flow slightly decreased in 2020, but this was a temporary phenomenon, associated with the general downward trend on the global mineral resources market. The government expects foreign investments in the Ukraine mining industry to start growing again in 2021, Tsivkach added.

The authorities are eager to promote the deposits among potential investors and have already presented a map containing detailed information on all deposits planned for sale.

Ukraine plans to sell deposits through a new system and guarantee state support to all new mining projects in order to begin production of the promising minerals.

"This is expected to be the first time when mineral resources deposits in Ukraine are sold through fully transparent electronic competitive bidding procedures," Tsivkach said, adding that the electronic system was already tried in the Ukraine mining industry when it was used to sell a gold deposit in late 2020 and the second sell-off is slated for February 15, this time of a zirconium deposit.

"The electronic auctions would guarantee equal game rules for everyone and that the privatization process would be fully transparent, involving the fairest prices," Tsivkach said.

"We can no longer just speak about Ukraine's [investment] potential. We are switching from potential to pragmatism — specific projects."

The government plans to run the competitive bidding procedures have been welcomed by local market participants and lawmakers.

"The Ukraine mining industry has always had a bad reputation among businesses as one of the most corrupt. I hope that the winners of the auctions would not be one-day intermediate firms, but respectable international companies," said Musa Magomedov, member of the Ukraine Parliament, explaining that corruption in his opinion was one of the reasons why the production of some national resources was not growing in the country in the past years.

However, Ukraine must consider limiting foreign presence in some areas of particular strategic importance for the country, Magomedov said.

New projects in the Ukraine mining industry are expected to be eligible for state support. A few days earlier, the Ukraine Parliament passed a law on state support of foreign investments, under which the authorities guaranteed to subject all foreign projects with the investment cost more than 30 million euros to state support limited to 30% from their capital costs.

"The law guarantees state aid to investors who intend to not only mine mineral resources and export them, but also build processing and enrichment facilities, which would create new jobs and secure additional tax incomes for the national budget," Tsivkach said.

Previously, the Ukrainian government offered state aid only to some projects in the domestic mining industry, negotiating with investors on the terms and conditions in every particular case.

The new state aid scheme is called to encourage investors to pump money into promising minerals. According to Roman Opimakh, chairman of Gosgeonedr, both foreign and local investors were reluctant to embark on projects in some segments of the mining industry during the past few years.

"Unfortunately, the metals of the future, which are used for innovative technologies, are almost not manufactured in Ukraine, while the demand for them is growing worldwide," Opimakh said.

According to him, a similar situation is observed with the metals of "a low-carbon future for high-tech industries." Their production in Ukraine could give a strong impetus for development for some innovative industries.

"Now it is essential to increase their production, create capacities for their enrichment and primary processing. Available resources and prospects for the development of minerals of the future will pave the way for developing new modern industries in Ukraine. This indicates their strategic importance for establishing Ukraine in the international arena in a new role," Opimakh summed up.

MARCH 1-5, 2021: **SME Annual Conference & EXPO, (Virtual).** Contact: Web: www.smeannualconference.com.

MARCH 7-10, 2021: The annual meeting of the **Prospectors & Developers Association of Canada, (Virtual).** Contact: Web: www.pdac.ca/convention/attendee-info/pdac-2021-convention-goes-virtual.

MAY 4-6, 2021: **Canadian Institute for Mining (CIM), Montreal, Quebec, Canada.** Contact: Web: convention.cim.org.

MAY 25-27, 2021: **Austmine 2021 Exhibition and Conference, Perth, Western Australia.** Contact: Web: https://austmineconference.com.au/.

JUNE 1-3, 2021: **Euro Mine Expo (Virtual), Kraft Center, Skelleftea, Sweden.** Contact: Web: www.eurominexpo.com.

JUNE 7-11, 2021: **Elko Mining, Elko, Nevada, USA.** Contact: Web: www.ExploreElko.com.

SEPTEMBER 13-15, 2021: **MINExpo INTERNATIONAL, Las Vegas, Nevada, USA.** Contact: Web: www.minexpo.com.

Investment Rekindles Mining Activity in Ontario

Demand for metals empowers a mining-friendly Canadian Province

By Steve Fiscor, Editor-in-Chief

The Macassa No. 4 shaft project (above) is advancing ahead of schedule.

Much of Ontario's mining activity takes place in the mineralized zone that extends laterally in the Great Canadian Shield from the north rim of Lake Superior through the Sudbury Basin to the border with Quebec. Gold camps to the north in Timmins and Red Lake are bustling as well. Each region has its drivers and its drawbacks.

During the last two or three years, many of the mines have changed hands through mergers and acquisitions. Metal prices have improved and the new owners are making investments to capitalize on these properties. While gold mining activity in the Abitibi Greenstone Belt has always attracted attention, new mining projects are moving forward in polymetallic deposits that contain copper, nickel and platinum group metals (PGMs) north of Thunder Bay.

With a rich mining history that dates back to the 1890s, the Sudbury Basin hosts one of the greatest nickel deposits on Earth. The prices for nickel today are relatively high and heading higher with the rush for battery minerals. Knowing that nickel is mostly used for stainless steel, one could debate the sustainability of those nickel prices, but potential consumers are also talking about green nickel, which could change that dynamic.

The miners in Ontario were affected by the global pandemic and many of them found a way to work with it. The province recognizes the importance of its mining industry and quickly deemed the segment essential. Today, many operations are reporting that they have achieved guidance despite the hinderance, an achievement unto itself.

With the help of Kevin Palmer, a marketing professional and mining photographer based in Thunder Bay, *E&MJ* has produced this 14-page report on Ontario Mining, which has three sections dedicated to mining, exploration and suppliers. What follows on the next few pages is a collection of short reports on mining activities throughout Ontario.

Kirkland Lake Records Best Year

After withdrawing its guidance during April due to uncertainties related to the COVID-19 pandemic, Kirkland Lake Gold reissued a new guidance at the end of June. Gold production for Kirkland Lake in 2020 totaled 1.37 million ounces (oz), in line with the reissued guidance and a 41% increase from 2019. That increase mainly reflected the addition of the Detour Lake mine (517,000 oz in 2020), as well as the impact of record production at Fosterville in Australia. Production at Fosterville for 2020 was a record 640,000 oz, 21,000 oz more than 2019. These factors more than offset a reduction in production at Holt Complex (29,000 oz in 2020), where operations were suspended in April, as well as lower production at Macassa (183,000 oz in 2020).

"Our most significant achievement in 2020 was our extensive response to the COVID-19 pandemic, which clearly demonstrated that, at Kirkland Lake Gold, nothing is more important than the health and safety of our people and the responsible operation of our business," said Tony Makuch, president and CEO of Kirkland Lake Gold. "Looking at our operating performance, in many respects, our team had its best year ever in 2020, while faced with unprecedented challenges."

The Detour Lake and Macassa mines were significantly impacted by COVID-19, including being placed on reduced operations at the end of the first quarter. Both operations bounced back later in the year, achieving their best quarters of production in Q4 2020.

At Macassa, the No. 4 Shaft project advanced approximately 3,040 feet during 2020, reaching 4,240 ft by year end. It's currently advancing ahead of schedule on track for completion in late 2022. This project could allow the mine to more than double its 2020 production to 400,000 oz to 425,000 oz in 2023. Multiple projects are currently under way at Detour Lake to support of future production growth, including investments in mill improvements, expansion of tailings capacity, construction of an assay lab and improvements to other site infrastructure.

Alamos Gold Ramps Up Production at Young-Davidson

Alamos Gold President and CEO John McCluskey referred to 2020 as a transformational year. "Operationally, we continue to

execute and remain on track to achieve our 2020 production, cost and capital guidance," McCluskey said. For its Ontario operations, Alamos completed the lower mine expansion at Young-Davidson and began construction on the Phase III Expansion at the Island Gold mine.

Gold production at Young-Davidson is expected to increase by 41% in 2021. Underground mining rates are expected to ramp up from 7,500 metric tons per day (mt/d) early in 2021 to design rates of 8,000 mt/d in the second half of the year. Grades mined and processed are expected to increase through the year, ranging between 2.20 and 2.65 g/mt of gold. Increasing mining rates and grades are expected to drive gold production higher through the year.

Total cash costs and all-in sustaining costs are expected to decrease 19% and 15%, respectively, from 2020, reflecting higher mining rates and productivity improvements with the transition to a lower mine infrastructure. Capital spending in 2021, excluding exploration, is expected to be between $65 million and $75 million, down significantly from 2020. The 2021 budget includes $14 million of spending on a new tailings facility (TIA 1), that will be used for the remaining mine life at Young-Davidson. Construction is expected to be completed by the end of 2021.

Island Gold's gold production is expected to be in the same range as 2020. Capital spending at Island Gold, excluding exploration, is expected to be between $120 million and $130 million in 2021. It includes advancing detailed engineering on the shaft infrastructure and paste plant, procurement of long lead time items, and starting construction on the hoist house and shaft sinking setup. A number of additional surface and underground infrastructure projects are also expected to be completed in 2021 to support the expanding operation. These include the expansion of the tailings facility, the underground workshop and additional camp improvements.

Wesdome Maintains Gold Production at Eagle River

Wesdome Gold Mines has set its sights on building Canada's next intermediate gold producer by delivering more than 200,000 oz from two mines in Ontario and Québec. The Eagle River Complex in Wawa, Ontario, is currently producing gold from two mines, the Eagle River underground mine and the Mishi open pit, and a central mill. It is actively exploring its brownfields asset, the Kiena Complex in Val d'Or, Québec. The Kiena Complex is a fully permitted former mine with a 930-m shaft and 2,000 mt/d mill. The company has additional prospects at its Moss

The Future of Sudbury Lies at Depth

Glencore Canada's Sudbury Integrated Nickel Operations (INO) are reimagining the future and how to mine at depth (2,400 to 2,600 m). They have focused those efforts on the Onaping Depth project, which could provide a significant new source of high-grade nickel ore beyond year 2035. To safely and cost-effectively operate at those depths and build the mine of the future, Sudbury INO has developed an innovation program that combines new thinking with all available technology, which it is currently testing at it's other deep mines in the area.

For the last 130 years, nickel miners in the Sudbury Basin have been mining everything that was between the surface and 1,500 m and they have exhausted most of those resources. Now, they need to go deeper.

There are some very rich orebodies at depth, but they also present serious challenges, not only with safety and health issues, but also with logistics, which drives costs higher. It takes longer for the miners to reach the face and the face itself is a more dangerous place to be with seismicity issues. With an ambient temperature of 40°C, the rock will be hot to the touch and that will require more ventilation with refrigerated air. All of this will require considerable supporting infrastructure.

The Sudbury INO crews are some of the best miners in the world. If they were to just carry on the way they mine today, everything would get progressively more difficult until they reach a point where the orebody becomes uneconomic to mine and then they're finished. By making a fundamental shift as to how they approach the orebody, they are hoping to overcome those constraints by designing them out with the innovation program.

The Onaping Depth project will be viewed by deep mining professionals as a pioneering effort. The plan is to start with an existing mine, the Craig mine, and then drive development down another 1,000 m. They will be essentially building a new mine at depth under an existing operation.

To make this project work, the development teams at Sudbury INO are embracing technology like never before. A prime example would be the advent and use of battery-electric vehicles (BEVs), which would lighten the load for the fans and refrigeration units used for the ventilation system. Comparing the BEV model to traditional mining methods with diesel-powered equipment, the company will save more on development and operating costs while improving working conditions underground.

The face is arguably the most dangerous place in the mine. Sudbury INO's plan is to keep all personnel 5 m from the face, which means running face equipment on remote and using automated systems. Without a digital backbone and WiFi, this would be impossible. Mine-wide WiFi systems will allow systems to track miners and equipment. Telemetry, digital devices and data analytics need that level of connectivity.

Onaping Depth represents a complete break from the traditional idea of underground mining. The digital age will be on full display with real-time remote management, monitoring and control from surface.

The internal hoist at the bottom of the Craig mine will eventually lower miners to the 2,630 level.

A truck dumps ore at the Eagle River mine.

Lake gold deposit, located 100 km west of Thunder Bay, Ontario.

During 2020, the Eagle River mine produced 87,600 oz of gold compared to 88,600 oz in 2019. With the average head grade dropping from 23.1 g/mt to 14.2 g/mt, Eagle River milled an additional 74,000 mt to produce 1,000 less ounces of gold in 2020. Taking this into account along with COVID-19 related disruption, Wesdome's miners worked hard last year to maintain gold production levels.

The operations have successfully maintained COVID-19 free status with extensive screening and protocols since the outset of the pandemic.

"Our employees and stakeholders worked safely in the challenging circumstances of the ongoing COVID-19 pandemic, which affected quarterly and yearly results since March," Wesdome Mines President and CEO Duncan Middlemiss said. "Our performance in the fourth quarter was impacted by certain temporary operational challenges that prevented us from achieving the midpoint of guidance."

Eagle River lost six days of milling in December due to mechanical downtime associated with a cone crusher in the mill, and underground they experienced geotechnical challenges that affected the grade performance in one of the stopes. Both issues were remedied within the month; however, these events resulted in reduced gold production, Middemiss explained. "On a positive note, the company still met its original production guidance at Eagle River," he said.

Looking ahead to 2021, Eagle River's guidance is set at 92,000-105,000 oz, and the company expects to produce 15,000-25,000 oz at Kiena if they receive a positive restart decision. Wesdome Mines is also undertaking the largest exploration drilling campaign in its history ($32 million divided equally between Eagle River and Kiena). For Eagle River, the goal is to produce 600 mt/d of ore, which would be a 15% increase over 2020, once a ventilation upgrade is completed in the first quarter. Eagle River production is now approaching the 100,000-oz/y milestone, Middlemiss explained, and he considers this a base case moving forward.

Iamgold's Côté Gold Project Moves Ahead

Wood said it has received a Full Notice to Proceed, in the delivery of engineering, procurement and construction management (EPCM) services for the $1.3 billion Côté Gold open-pit gold mine for operator Iamgold Corp., supported by their joint venture partner Sumitomo Metal Mining.

Côté is a world-class deposit located in northern Ontario, with estimated contained gold reserves of more than 7 million oz. Iamgold wants to develop the site to be a model of a modern Canadian mine as it seeks to efficiently unlock the reserves. The project is anticipated to generate more than 1,000 jobs during construction and 450 permanent positions.

"We are pleased to move to construction on the Côté Gold project with our long-time engineering partner Wood," Iamgold President and CEO Gordon Stothart said. "We look forward to bringing this project from concept to reality with their team."

Over the last eight years, Wood has been working with Iamgold in every aspect of the Côté Gold project, adding value at every stage with innovative design and project delivery solutions. Wood's latest scope of work includes EPCM for the 36,000-mt/d conventional gold processing plant, tailings and water management.

"This project strengthens our relationship with Iamgold as a trusted full life-cycle delivery partner and it solidifies Wood's position as a global leader in the development of gold mines," said Dave Lawson, president, mining and minerals at Wood.

"Beginning with work on the initial scoping study in 2011, we have worked closely with Iamgold to guide the project toward successful execution, helping to identify more than $450 million of improvements in net present value," Lawson said.

Construction of the Côté Gold mine commenced in late 2020, and is expected be completed in mid-2023. When fully operational, the mine is expected to produce an average of 367,000 oz/y of gold over the course of its 18-year mine life.

PureGold Pours First Gold

The PureGold mine, near Red Lake, Ontario, poured its first gold on December 29, following the introduction of ore to the mill on December 15. "With our first gold pour, we have transitioned to producer, and delivered on our promise to build Canada's newest gold mine in the heart of Red Lake Ontario, on budget and on schedule," PureGold Mining President and CEO Darin Labrenz said. "To build a mine at any time requires a complete team effort comprised of dedicated, driven and focused individuals. To do so under the unique challenges of 2020 speaks to the quality and dedication of the entire team. With this first gold bar, we are now focused on ramping up the operation to steady state production as we continue to build a long-life growth company in Red Lake."

With the commencement of production at the PureGold mine, activities at site are now concentrated on optimizing the operation, with commercial production anticipated by the end of Q1. The company said it will also continue to pursue an aggressive growth strategy in 2021.

Battle North Gold Approves Bateman Construction Plans

Battle North Gold Corp. is advancing its Bateman gold project to become the next gold producer in Ontario's Red Lake gold mining camp. The company's board approved construction of the project and the company anticipates spending approximately C$59.1 million toward initial capital development in 2021, including underground development, construction of an ammonia reactor, upgrades to the tailings management facility, camp and mill, and the purchase of stationary and mobile equipment.

"Construction on critical path items has commenced at the Bateman gold project, with the potential to be pouring first gold by

the end of the year," Battle North President and CEO George Ogilvie said. "In addition, we have commenced drilling of highly-prospective targets on our regional Red Lake Properties and we will be providing an overview of our 2021 exploration plans shortly."

The project's feasibility study called for approximately 8,600 m of underground capital development to achieve commercial production. This amount of development is expected to enable nine to 12 months of development flexibility ahead of stope production. Nearly 3,300 m of underground capital development is planned for 2021. To date, the company has completed approximately 100 m of underground capital development.

A contractor has completed the construction of the portal and is currently advancing the ramp decline, which is between the 244-m and 183-m levels. Once the connection has been made, the ramp provides another point of access to transport equipment, personnel and material to and from the underground, as well as the project's fully operational shaft.

Based on the current construction schedule, the company is targeting the processing of ore at the project by end of 2021 and achieving commercial production by the end of 2022.

Premier Files Hardrock Technical Report

During late January, Premier Gold Mines Ltd. filed a technical report for its Hardrock Mine project, which was completed by G Mining Services. Located on the Trans-Canada Highway near Geraldton, Ontario, it's a large-scale permitted mine development opportunity.

According to the report, the Hardrock Mine project would have a $1.05 billion after-tax NPV5% based on a $1,400/oz gold price and a $1.30 CAD:USD exchange rate. With an after-tax Internal Rate of Return (IRR) of 20.1%, the project payback period would be 3.2 years. All-in sustaining costs were estimated to be $618/oz with an operating cost of $20.39/mt.

The Hardrock Mine project has 5.54 million oz of proven and probable mineral gold reserves averaging 1.27 g/mt gold with a 0.35 g/mt gold cut-off grade. With 91.2% recovery rate, it would produce 5.05 million oz. The average life of mine production would be 358,000 oz/y with 414,000 oz/y in first five years at an average head grade of 1.45 g/mt. gold. The report estimated an initial capital cost of $952 million and total life-of-mine sustaining capital of $323 million.

Generation Mining Moves Forward With Marathon

Generation Mining Ltd. recently completed Phase 2 metallurgical testing and pilot plant trials to advance its feasibility study for the Marathon project, the largest undeveloped PGM deposit in North America. The Marathon property covers a land package of 220 km^2 in northwestern Ontario. In November, the company earned an 80% interest in the Marathon project from Sibanye Stillwater.

"We are extremely pleased with the work completed in both the Phase 1 and Phase 2 metallurgical testing programs," Generation Mining CEO Jamie Levy said. "We have advanced on a feasibility design that includes an annual production rate of 9.2 million mt/y and believe the plant flowsheet and design is an improvement on prior concepts with key elements greatly derisked." The company expects to make the feasibility study available during the first quarter of 2021.

Where Infrastructure Meets Grade

The making of the Clean Air Metals management team

By J. Kevin Palmer

It was a chilly day in January 2013 when the phone rang at the Gallagher residence in Oakville, Ontario. On the one end was a senior executive with North American Palladium (NAP) on the other, mining engineer Jim Gallagher.

It seemed the Lac des Iles mine owned at the time by NAP had fallen on difficult times. The price of palladium had reached record lows, mine productivity was hampered due to problems with new shaft development, and the mine was experiencing continual employee turnover, seemingly beyond management's control. With a corporate debt bomb about to explode, times were quite uncertain.

The reason for NAP's call that day to Gallagher was quite clear — Gallagher at that point had an impressive string of wins in a mining engineering career spanning more than 38 years. With mining in his blood, having been raised by a Nova Scotia coal miner, Gallagher moved to the Sudbury area as a young child. After studying mining engineering at Laurentian, he eventually landed himself an engineering role for 30 years at Falconbridge followed by eight years with Hatch Engineering, successfully building mining operations around the world. While managing many mammoth projects over the years, he was sent to the Lac des Iles mine to help with some dysfunctional construction scenarios, which he was assigned to remediate as quickly as possible.

"I can remember being sent to the Lac des Iles property while employed with Hatch Engineering. There were various issues including lack of financing, issues with construction of the shaft itself, a backfill plant undersized for the level of productivity necessary to ensure proper workflows among others. We went to work, beginning with addressing the backfill plant issue, then on to the shaft and other issues. Over several years, we slowly began to fix the project, one flaw at a time."

In the meantime, Gallagher was approached by the NAP Board of Directors to begin as the mine's COO. Gallagher accepted and immediately went to work further reviewing the existing scenario on a much broader scope. Key operational deficiencies were identified and a plan was drafted to alleviate and mitigate areas of identified weakness and amplifying strengths, including a team of highly talented managers with extensive track records and some sharp, entry level engineering staff. The team was set, the strategy prepared and a recovery program marched forward.

History tells us that NAP did exceedingly well in the years following, revenues soared as the price of palladium shot through the roof — and eventually a suitor was found in South Africa, Impala Platinum who bought and rebranded the operations under the name Impala Canada. Today, the mine is performing at close to 12,000 metric tons per day (mt/d) — generating significant free cash flow and returning value for its new owner company-wide.

Gallagher left the company, turning down a board seat opportunity. At the close of the acquisition by Impala, he had a chance to review a promising polymetallic project called Thunder Bay North, southeast of the Lac des Iles mine with significant untapped potential. He met the incoming management team and agreed to take on the new challenge as executive chairman of Clean Air Metals Inc. He initiated resource validation and early tradeoff studies on a very promising pre-development resource in the Current Lake deposit and a second similar ultramafic magma conduit structure with longer term advanced exploration and development potential called Escape Lake.

As Gallagher tells it, "the grade profile of the Current Lake deposit was quite stunning to me. There is nothing else like it in the area. Although it seemed an abrupt transition and upended my semi-retirement plans, I recognized the enormous potential of the resource and felt it was an opportunity not to be taken lightly."

Abraham Drost, CEO, Clean Air Metals. (Photo: J. Kevin Palmer)

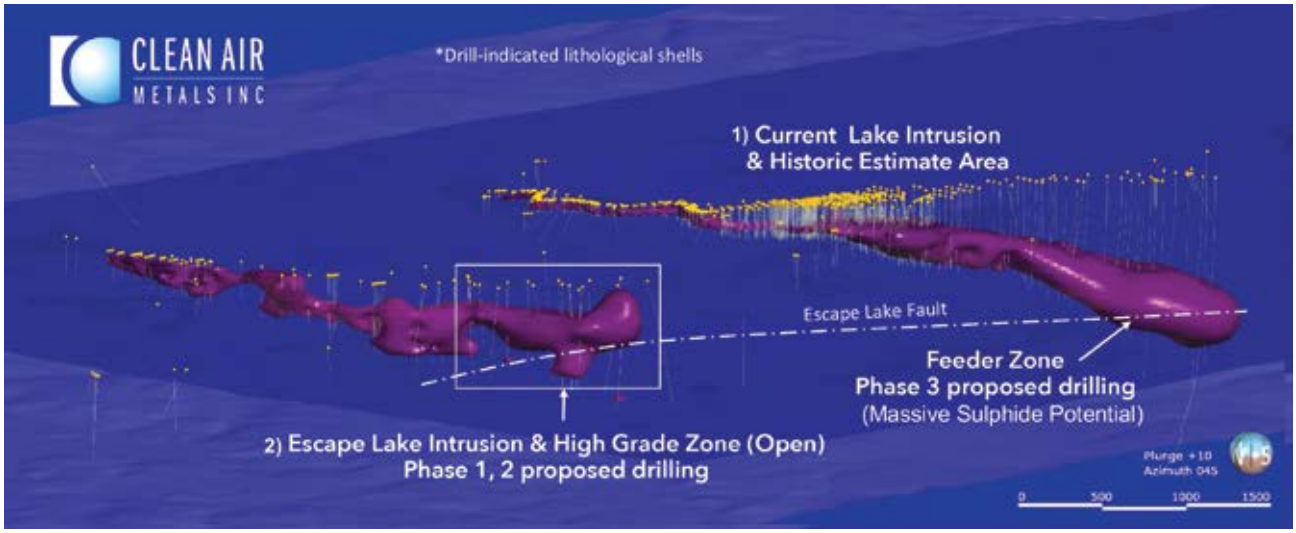


Figure 1—Current Lake and Escape Lake Twin Conduit Chonoliths.

It was a different path to the C-Suite at Clean Air Metals for CEO Abraham Drost. Drost is a seasoned exploration geologist with a geology degree from Waterloo (1984), master of science in mineral exploration from Queen's University (1987) and several discoveries under his belt. Starting his career with St. Joe Canada in 1985, Drost was crew chief of the discovery team at the Muskeg Lake Project, leading to development of the Golden Patricia gold mine near Dryden, Ontario, in 1985. A high-grade narrow vein, shrinkage stope operation, Golden Patricia produced 700,000 ounces (oz) of gold over an eight-year mine life. For Drost, Golden Patricia was a seminal lesson in disciplined exploration and rigorous sampling leading to discovery.

Next with the Canadian division of Gold Fields in 1987, Drost was exposed to a big-picture exploration approach. If it didn't have 1 million ounces or more near the surface, it was not a Gold Fields prospect. Interestingly, Drost would later pay $7 million to a Timmins prospector in 2012 for a 1% net smelter royalty on the operating Timmins West deposit of Lakeshore Gold, a prospect rejected by Gold Fields in 1988.

From Gold Fields, Drost became senior geological consultant to Corona Gold Corp. in 1995 working under former Teck exploration manager and mentor Dr. Matthew Blecha. After a stint with the Ontario Geological Survey from 1999, Drost was recruited by present Clean Air Metals Board member Ewan Downie in 2004 into the role of president of Sabina Gold and Silver Corp. The duo discovered the Bonanza gold deposit in Red Lake, which became a

Ethan Beardy, a geologist for Clean Air Metals, logs core at Thunder Bay North. (Photo: J. Kevin Palmer)

cornerstone asset in the Red Lake Joint Venture formed between Premier Gold and Goldcorp. In 2012, Downie and Drost co-founded Premier Royalty Inc. together as chairman and CEO, respectively, finding early success in the mining royalty business and vending the company to Sandstorm Gold in 2013.

In 2014, Drost joined Carlisle Goldfields Ltd. as CEO, a junior explorer with promising open-pit gold assets in Lynn Lake, Manitoba. The company entered into an earn-in joint venture with AuRico Gold, which subsequently merged with Alamos Gold. Alamos in turn took out Carlisle in an all-share deal in 2016. Drost went on to an engagement with a Houston-based private equity family office working in the precious metals space.

The circle closed in Thunder Bay, Ontario, in 2019 with the formation of Clean Air Metals Inc. The Thunder Bay North Project was formed as a result of the consolidation of two promising PGM-copper-nickel assets acquired from Panoramic Resources of Australia, and Rio Tinto under the auspices of the team at Benton Resources Inc., a junior mining project developer based in Thunder Bay. Steven Stares, CEO of Benton, introduced Jim Gallagher and Abraham Drost who quickly formed a bond around the Clean Air mandate.

The Thunder Bay North Project is located 60 km southeast of the Lac des Iles mine. The previous operators at Thunder Bay North collectively spent C$85 million on more than 180,000 m of drilling in 800 holes, predominantly on the Current Lake magma conduit "chonolith." Chasing the Current Lake prospect, 647 boreholes drilled between 2007 and 2011 defined the 2011 pit-constrained mineral resource by AMEC, now considered a historic estimate, in various zones totaling 741,000 oz platinum and palladium plus appreciable byproduct copper and nickel in 9.8 million mt at 2.3 g/mt platinum equivalent oz (Figure 1). For Drost and Gallagher, the presence of multiple massive sulphide intercepts in the Current Lake chonolith, are compelling.

"The Clean Air technical team is convinced that the massive sulphides are

injections, transported by the original magma stream and sourced from a larger sulphide source deeper in the system," Drost said. "They are vectors pointing to an exciting greenfield exploration target."

Rio Tinto made a significant discovery on a twin structure at the Escape Lake magma conduit chonolith. Originally staked for diamonds as a promising kimberlite anomaly by Rio subsidiary Kennecott, the ultramafic intrusion had other secrets to bear.

Gallagher and Drost have brought their own unique perspectives to development of the Thunder Bay North Project. The lithological and stratigraphic similarities of the Current Lake and Escape Lake chonolith bodies and presence of massive sulphides highly enriched in copper, nickel, platinum and palladium mimics similar attributes of the Norilsk mineral deposits in Russia. The team's literature review of the advanced state of development and continuing exploration at Norilsk is leading the group to mount leading-edge audio magnetotelluric geophysical methods combined with borehole EM methods to explore for deep massive sulphide deposits at Thunder Bay North.

The pit-constrained approach of previous operators at the Current Lake deposit has, under Gallagher's review, given way to consideration of a ramp access and selective high-grade extraction.

The sulphides are visible in this extensive high-grade core sample.

In early February, Clean Air Metals released an updated indicated and inferred mineral resource estimate for the Thunder Bay North Project, which includes both the Current Lake and Escape Lake deposits. Indicated mineral resources are approximately 1.33 million oz of palladium equivalent for the Current Lake deposit and 500,000 oz for the Escape Lake Deposit.

Inferred mineral resources are approximately 410,000 oz palladium equivalent for the Current Lake Deposit and 250,000 oz for the Escape Lake Deposit.

The mineral resource estimate, prepared by Nordmin Engineering Ltd., is based on an underground ramp-access constrained resource model with a cutoff value equating to 1.56 g/mt palladium equivalent using three-year trailing average metal prices for all metals except cobalt, which used a two-year trailing average. (www.cleanairmetals.ca)

Assisting Miners and Prospectors in Northwestern Ontario

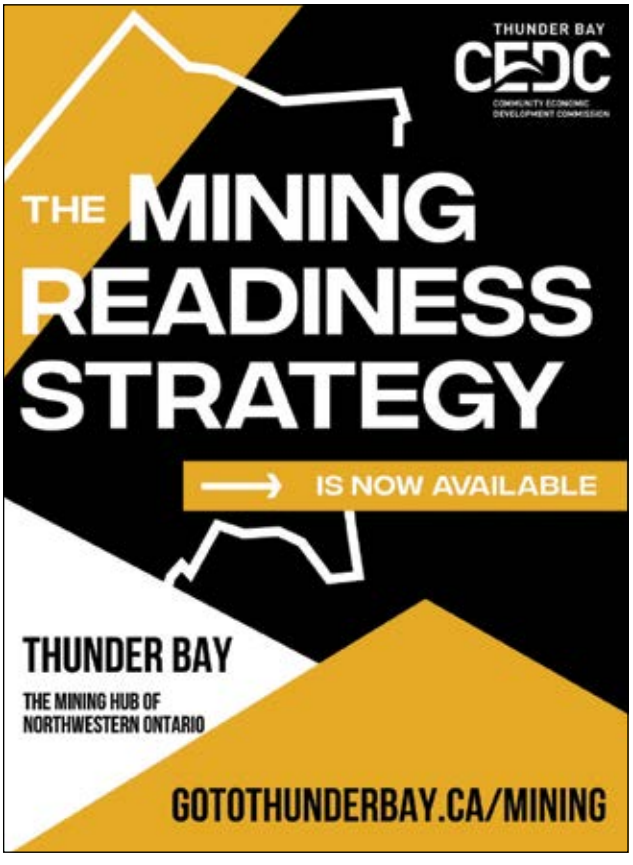
CEDC prepares a community to support a surge in mining activity

By J. Kevin Palmer

When it comes to mining, northwestern Ontario has a lot to offer. The mineral endowment ranges from lode gold deposits to magmatic copper-nickel-palladium-platinum deposits, as well as critical elements such as lithium. The region's geology and mining friendly policies are attracting miners from the U.S., Europe and Australia. Mergers and acquisitions have brought a lot of fresh faces and ideas to the region.

Foreign explorers and developers should note all the various supports available to them, including geologic databases, a solid Ontario Mining Act, high mineral potential areas that can be staked or acquired by option, and a robust land tenure system available to assist in mine readiness and more. All of this has been designed to bring mines into production in a timely fashion. While Toronto may be the financial capital for mining projects, communities like Thunder Bay have all the exploration and mining services and suppliers that explorers and developers would need.

During early February, the Thunder Bay Community Economic Development Commission (CEDC) launched its Mining Readiness Strategy. Based on input from six operating mines and 15 exploration projects in the region, the strategy outlines significant regional economic growth and their requirements as they advance. Thunder Bay's proximity to the active mines, exploration projects, critical minerals, workforce training abilities, service and supply businesses, and available land all play an essential role in being the mining hub for northwestern Ontario.



"Knowing that exploration and mining companies purchase 70% of their required goods and services locally, we at the CEDC felt it was timely to evaluate the potential economic impacts the mining sector will have on the region and city of Thunder Bay," Thunder Bay CEDC CEO Eric Zakrewski said. "Opportunities were identified by the study that can help local existing businesses and employers expand their workforce, products and services to meet the growing needs of the industry. Certainly, the new and overall employment opportunities identified are some of the best news pieces Thunder Bay has seen in some time. If conditions are favorable for projects to continue being developed, the next 10 years could be very good for our economy."

The Mining Readiness Strategy will be used as the guiding framework to support the growing northwestern Ontario mining sector and ensure Thunder Bay remains a mining activity hub. It considers procurement opportunities, workforce development (education/training) and growth, electricity and transportation infrastructure challenges, research opportunities, analyzing economic impact, and value-added opportunities.

"The exploration and mining industry, led by gold, palladium and lithium projects, will be a growing economic driver for Thunder Bay and northwestern Ontario," said John Mason, project manager, mining services, Thunder Bay CEDC. "The Mining Readiness Strategy will be an important tool to maximize benefit."

The Mining Readiness Strategy highlights significant benefits to Thunder Bay. During the peak mine production period between 2026 to 2028, northwestern Ontario is expected to see a direct economic output of $5.22 billion and total economic output (direct, indirect and induced) of $8.71 billion.

In 2023, the mining sector is expected to create more than 2,000 construction jobs with most of the 15 major exploration projects maturing to production. At the peak of production, northwestern Ontario is expected to host a workforce of more than 7,000 mining jobs between 2023-2028. "That's an additional 3,400 jobs above the 3,600 people currently employed by the mines," Mason said. "And, these new mines will generate a 180% increase in the electricity demand by 2026."

"Often drilling is a leading indicator for mining activity," Mason said. "We're seeing significant development in the Red Lake district with several dozen drills turning and there is more activity taking place in other areas like Greenstone, Marathon, Pickle Lake and Dryden. There are probably 40 exploration drills in these mining camps at the moment."

For prospectors looking to begin exploration activities in northwestern Ontario, Mason said several associations can be very helpful, such as the Ontario Prospector's Association (OPA). That group works with eight regional associations in Ontario, providing advisory service to the exploration and development industry. "They administer the Ontario Exploration Corporation Program, which provides up to $50,000 for exploration to prospectors or juniors," Mason said.

A previous program called the Junior Exploration Assistance Program (JEAP), which has been modeled by other provinces, and was highly successful in Ontario, is being promoted by the OPA for a return, Mason explained. "Early in their exploration days and prior to any drill intercepts, Great Bear Resources received funding for its Dixie project, which assisted in eventually making spectacular gold discoveries," Mason said.

"At the Provincial level, Greg Rickford, minister of Energy, Northern Development and Mines, has provided a 15% price reduction for miners, which is ideal," Mason said. "For new mines in Ontario, there is a three-year tax holiday (up to $10 million profit) and a 10-year tax break for remote mines as well."

The Ontario Geological Survey provides regional experts, at no charge, to assist grass roots to advanced exploration projects and proponents, through the Resident Geologists Program.

Explaining his role in developing mining and exploration programs for northwestern Ontario, Mason said his group is often the bridge linking supply companies to help everyone advance their projects.

Mason is part of a municipal economic development group, that works to stimulate and support the exploration and mining sector. "We now have 900 to 1,000 people living in Thunder Bay working directly in mining," Mason said. "This includes miners from the Musselwhite, Lac des Iles, Rainy River, Hemlo and Sugar Zone mines."

Supply and service companies have grown significantly in Thunder Bay, Mason explained. "We have more than 400 companies here now in that space," Mason said. "Some are building mines, erecting head frames, performing mechanical and civil engineering work. We also have safety firms as well as Indigenous training firms. Two of the local mines, Rainy River and Musselwhite, employ significant numbers of indigenous people."

The Thunder Bay CEDC also works with local institutions like Confederation College's TEC HUB and Lakehead University to train future workers as well. "We are working with trade unions, indigenous training organizations and private training organizations," Mason said. Overall, Mason believes that northwestern Ontario is the place to be for mining and will remain so for a very long time.

Enersoft Streamlines Exploration Workflow With Geologic AI

By J. Kevin Palmer

In general, sulphides do not typically present a great hyperspectral signature, but Enersoft's GeologicAI systems can easily see these sulphides with its XRF and RGB sensors. "One of the biggest things that set us apart from our competition is that we combine multiple sensors co-locating all data pixel by pixel," said David Henderson, geoscience director with GeologicAI. "And, because we use multiple sensors in our scanners, we are able to lower our sensor costs and allow more tools to help identify more minerals."

Enersoft developed GeologicAI for the oil and gas sector about eight years ago. More recently, they decided to branch out into the hard rock mining sector and the technology has proved to be incredibly valuable in this area as well.

The real value for exploration geologists with this system is that they get their geological data before they interpret the core. Because they get such great results instantaneously, sampling frequency is lowered significantly as lower volumes are sent to the lab on a weekly or monthly basis. With GeologicAI, there's never a wait for lab results — the trailer is on-site.

GeologicAI claims to be cost-neutral in a $20/m model. The largest cost savings is at the lab sampling stage and overall time spent on the core. With GeologicAI, RQD is automated, which eliminates the need to manually measure the core, Henderson explained. "Not only that but all the guess work has been removed — so geologists can interpret the core, removing the variance between geologists' opinions as to the mineral makeup of any given core," Henderson said.

GeologicAI also saves money by creating resource certainty with instantaneous results, decreased lab sampling costs. It gives geologists the ability to make quick, accurate and consistent logging decisions faster than ever.

The system also reduces assay costs. "While using it, the geologist knows precise percentages of key minerals and they only sample areas of interest, which decreases the amount of overall samples," Henderson said. "Identifying non-interpretive rock early is another huge benefit to geologists."

GeologicAI can be used to map the ore coming from the stopes, giving mill operators an early warning as to what they can expect with incoming feed. Having this information has improved recovery rates in the mills where stope mapping with GeologicAI was employed.

Current lead time for GeologiaAI is about eight to 12 weeks. The 4- x 16-ft trailers are easily transportable. This technology can be delivered anywhere within a four- to five-month time frame.

The company is currently setting its sights on properties that have a lot of drill core, who also might be a little short-handed. "We can offer a massive improvement on the workflows," Henderson said. "This isn't just scanning software. We also have logging and interpretation software built right into the system and we feel we can help those projects that are producing a ton of core." At this point, Enersoft is North American focused and next year they hope to be sending GeologicAI trailers overseas.

With a GeologicAI trailer on site, there is no need to wait for lab results.

Keeping the Supply Lines Open

Service providers in a major hard rock mining district use creative tactics to safely improve performance and productivity

By Steve Fiscor, Editor-in-Chief

Using the latest technology, a Redpath miner operates an LHD from the surface using teleremote controls.

Ontario has a high concentration of diversified hard rock mining operations. Some claim that Greater Sudbury is the hard rock mining capital of the world. Beyond the Sudbury Basin, significant investments are taking place in the Red Lake district and in the polymetallic orebodies that border the north rim of Lake Superior. Many of the mines are or will soon be mining at depth to recover precious and base metals, as well as battery minerals. As such, the province is a hot bed of activity for technology development, which it proudly exports to the world.

The suppliers that serve this part of the world had to deal with the issues related to COVID-19, just like everyone else. They were fortunate the province declared mining essential, which allowed them to continue with business and it gave them the confidence to employ some creative techniques to keep the supply lines open.

The mining sector is thriving in Ontario and mining operations have regained momentum in neighboring provinces. These suppliers are exploring new ways of supporting their customer today and well into the future.

Redpath Adapts to Meet Protocols

Locked down and communicating from his home office, Paul Healy, president of Redpath Canada Ltd., emphasized that the company's No. 1 priority is safety. That includes the safety of its workers and the safety of its customers. "We're doing a lot of work today to identify and eliminate risk throughout our organization," Healy said. "When COVID-19 hit at the end of the first quarter of 2020, it affected us significantly. Quite a few of our fly-in/fly-out projects were placed on care and maintenance, and Quebec shut down all the mines. Projects started to rebound for us in the third and fourth quarters of 2020. We are now back to pre-COVID-19 volumes despite all of the complications related to travel restrictions."

Redpath Canada is busy these days and Healy said they are bidding on a lot of work. "In Ontario, we're starting a project for Battle North in the Red Lake gold district. We're also doing some work for Evolution Mining in that region. We are also starting up a project with Trevali at the Caribou mine in New Brunswick.

Acknowledging that no one really knows what the future holds, Healy said all-in-all, the business environment for mining is positive right now. Between the improved metal prices and the recent ownership changes with mergers and acquisitions, mining companies are making some significant investments in Canada and internationally.

Redpath crews are on-site every day at mines as contractors and they must follow the same health and safety guidelines. Every company, province and country has different policies, Healy explained. "Mongolia, for example, shut down completely. We have expats that have been working there since March that have been unable to leave," Healy said. "The situation in Indonesia is similar, but not as extreme."

Different places also have different rules regarding quarantines. "If we bring people to Vale's Voisey's Bay nickel mine in Labrador from outside the province, they must quarantine for two weeks before they are allowed to visit the mine site," Healy said. "Alternatively, local visitors for some mines only require a quick assessment at the gate."

With Ontario's current lockdown, Redpath's administrative offices in North Bay are currently closed and those people are working remotely. Their shops, however, continue to operate following guidelines from local health officials. "When the gear arrives at the site from our shop facilities, the training and the sign-offs are fairly routine," Healy said. "If it's something special, we will send people to site and commit the necessary resources for the process." Healy explained that, even though they are located only 90 miles east of Sudbury, North Bay lies outside of Vale's travel-restricted zone and a site visit to one of their properties would require proof of a recent negative COVID-19 test result.

Many of the traditional mining companies in this region have merged with others, Vale-Inco, Newmont-Goldcorp, etc., who are not only making investments, but they also have different approaches to business. "Their new capital investment programs are obviously important to Redpath." Healy said. "We have new companies with new management and new expectations, so we have to remain nimble."

"We are improving our services to meet the needs of our clients," Healy said. We continue to evolve as an organization to improve productivity and performance. As a global company, we get exposed to a lot of new ideas and we share that information internally to make us better in all the markets we service."

Healy said Redpath is vitally interested in new technology and innovation. "The two big things for us are systems and training," Healy said. "We're always looking for ways to provide the best information we can in real time to make better decisions from senior management down to our frontline supervisors. That's an area where we keep seeing constant improvement. We're also using technology to roll out training packages that ultimately will help our people operate more safely and efficiently."

Training Technicians for Tomorrow

Based in Collingwood, Ontario, MacLean Engineering is Canada's largest manufacturer of underground mining vehicles. The company employs about 800 people worldwide. The company shut down operations for two weeks at the onset of COVID-19 to establish proper protocols. "That was a wise move. We haven't lost a day since, and we have been very fortunate with a low number of cases," said Stuart Lister, vice president marketing and communications for MacLean Engineering. "We design and build equipment, transport it to the site, and today we have to commission and support it in a travel-restricted world. That's where it gets tricky with training, especially getting all of the technical expertise connected to the site, but because mining was deemed an essential sector in Ontario, we had some leeway." To provide the service its customers expect, MacLean has developed some creative, socially distanced methods for training.

The company took that initiative a step further when it recently announced a partnership with Sudbury's Cambrian College to support skills and technology development for the electric, automated and digitalized mines of today and tomorrow. The MacLean Research and Training Facility in Greater Sudbury will now host the hands-on component of Cambrian's industrial battery-electric vehicle (BEV) maintenance course. Cambrian's curriculum is designed for heavy-duty technicians currently working in the mining sector.

In addition to delivering corporate training courses, Cambrian's Centre for Smart Mining is also the only federally recognized Technology Access Centre specific to mining technology. As such, the Cambrian-MacLean strategic skills and technology partnership will focus both on the training mechanics to support BEV fleets, as well as supporting the development of the next generation of mechatronics workers in the mining industry by providing Cambrian students with the opportunity to work directly with the MacLean Advanced Vehicle Technology (AVT) team based out of the company's Research and Training Facility.

"Practical training for BEV mechanics and applied research opportunities for the next generation of mechatronics professionals to facilitate the adoption of on-vehicle technology — these are concrete examples of MacLean leveraging its test decline in Greater Sudbury to make a difference in the industry," said Stella Holloway, general manager for MacLean's northern Ontario operations. "This is a chance for us to walk the talk when it comes to ramping up our research and training facility to actively support long-term, positive change in mining and I'm thrilled that we're doing this in partnership with Cambrian."

"Successful innovation depends on great collaboration, and I think this partnership with MacLean is a perfect example," said Stephen Gravel, manager of Cambrian's Centre for Smart Mining. "No single educational institution or company can drive change entirely on its own, but rather it's a spirit of cooperation that will help us drive innovation in mining of the 21st century."

The Greater Sudbury branch is MacLean's largest, employing about 100 people. It's located in an area with a great deal of activity, the Sudbury Basin, where majors like Vale and Glencore operate large mines with deep future development projects that will incorporate the use of BEVs.

"The Greater Sudbury branch is our innovation engine and our service and support hub," Holloway said. "The partnership with Cambrian College speaks to what we are doing to further support customers and provide field technicians. We have to train yesterday's techs for today and tomorrow. Cambrian developed a curriculum to train these techs. We assisted with the curriculum design and we're providing the equipment and the environment to train them. That's really something above and beyond." Most of the training is virtual right now, but when COVID-19 passes, Holloway expects to host new groups for training sessions at least once a month.

Noting that Greater Sudbury, with nine mines, two mills, two smelters and a nickel refinery, is the world's most diversified mining cluster, Holloway said she is most excited about the growth potential they are seeing throughout the company. "The design

A MacLean BEV boom truck emerges from the Borden portal in Ontario.

Pre-bagged shotcrete is popular with Ontario's underground miners.

and engineering work for these advanced vehicle packages is happening here," Holloway said. "With the MacLean Research and Training Facility, we will have the technology and the achievements on display."

While most of its equipment sales are diesel-powered units, MacLean has 30 pieces of BEV equipment in operation in Canada and they are expecting a steady transition to BEVs. "We have a good foundation and now it's all about getting the right training in place," Lister said. "We have a contingent of 80 engineers and 25% of them working on advanced vehicle technologies. We are hiring autonomous vehicle programmers. The industry needs the workforce to support this shift from diesel to BEVs. Four years ago, we would not have hired a programmer or a mechatronics specialist. That's how quickly the field has changed."

MacLean currently has 10 vacancies in this area to fill.

Shotcrete Solutions for Rapid Development

Sika operates two shotcrete production plants in Ontario (Toronto and Sudbury), supplying many of the mines in the Sudbury Basin as well as other mining districts in Ontario and throughout eastern Canada. For much of Canada, the company produces a range of specialized, pre-bagged, dry shotcrete products, some of which can be used for wet applications as well.

In March 2019, Sika acquired King Shotcrete Solutions, which built its business on pre-bagged solutions. "They are not only convenient to transport and handle, they also add value from a quality assurance/quality control perspective," said Fabian Erismann, global head mining for Sika. "With each delivery, miners get the exact same high-quality product when they need it and where they need it."

Pre-bagged shotcrete has become quite popular for remote sites in northern Quebec and for the mines in the Arctic territories of Yukon and Nunavut. "They are sought after especially for new mine development," Erismann said. "We use sealift operations to deliver bagged and palletized shotcrete to those operations. The pallets are transported to a Canadian port in Ontario or Québec and shipped to remote mining sites during the ice-free time windows."

Shotcrete consumption is on the rise dramatically throughout the world, Erismann, said, especially with deep mines and caving operations. He estimated that globally 80%-90% of shotcrete is mixed wet in on-site batch plants, then transported underground with trucks or pumped with slick lines. "Transporting or pumping wet shotcrete poses different requirements on quality control as far as how it's batched," he said. "If a mine is batching 250,000 m^3/year, they have to have a good handle on quality as well as costs."

Pre-bagged dry shotcrete is popular in Canada. The product arrives at the mine in big bags and is easily moved underground using truck or shaft haulage. It can be applied wet or dry. For dry applications, the miners fill the shotcrete machines with dry mix and spray it directly with a small amount of water. No additional accelerators are required. They are blended into the mix. For wet applications, miners mix it onsite with agitated trucks and spray it wet.

For the really deep operations in Ontario, Sika has developed shotcrete with rapid early-strength development and fast, high yielding fiber reinforcement, Erismann explained. "These new products absorb

Jennmar automates the production of its Friction-Lok stabilizers in Sudbury.

considerable amounts of energy over short periods to deal with seismic shocks and destressing events," Erismann said.

Sika also produces some specialty products for the Canadian climate, such as cable bolts for permafrost applications. In these polar regions, the top portion of the ground layer of soil remains frozen for years all year round as the region endures extreme subzero temperatures for long periods of times. "Under these conditions, normal cementitious processes will not work," Erismann said. "To grout a cable bolt in these conditions, the grout has to generate sufficient heat to cure. We are the clear market leader with such specialty products."

The company has made considerable investments in material handling operations and logistics for this region. "We see demand for shotcrete increasing in Ontario and around the world," Erismann said. "We are prepared for a considerable expected ramp up in mining activity in eastern Canada. We will have ground support solutions available when and where it's needed to promote rapid development in difficult conditions."

Jennmar Restores Canadian Ties

Jennmar sold its Canadian business to DSI in August 2014. That non-compete has now expired and numerous customers have approached Jennmar to see if they would consider re-entering the market, explained David Hurd, managing director for Jennmar Canada. "We evaluated the situation as far as the requirements to be successful and whether it made sense to re-enter the Canadian market. We quickly determined that it was in our best interests and we should re-enter" Hurd said. "We started with due diligence in early 2020. We also started to look for the right location for servicing the mines and we found the former Marcette Building on La Salle Boulevard in Sudbury and concluded the purchase in September. We have been restoring our presence and building the business. At this point, our primary focus is our ground control products, but we will soon offer the full range of Jennmar's products and capabilities."

Jennmar is taking a blended approach by maintaining a healthy stock of bolts and other ground control supplies. Resin cartridges will be manufactured in Pennsylvania as they always have been, Hurd explained. "Our primary focus is having the product available for the customers when they need them," Hurd said. "If that means the best place to manufacture them is in Canada, that's what we will do. If we need to stock U.S.-made products in Canada, we will do that, too. We're taking the approach of having sufficient stock locally to support the sector and be able to deliver in a short time frame. If the miners need products, we will get it to them as quickly and as cost effectively as possible."

Hurd said Jennmar has seen interest in its ground control products across the board from friction stabilizers to torque tensioned rebar bolts to cable bolts. Noting that some of the mines in region are fairly deep, he said Jennmar is currently working with three clients on developing specialty products and solutions for the changes they are experiencing with their ground control plans. "There has been some influence from Australian hard rock practices and we're looking at ways to clear the round and install ground support as quickly as possible," Hurd said.

Dealing with COVID-19 slowed installation of manufacturing equipment in Sudbury. "Our cable line is now running after significant COVID challenges," Hurd said. "Our friction-set repacking lines also started production recently. We have invested considerable time and effort to automate the manufacturing process. We have implemented state-of-the-art technology to change the way products are manufactured utilizing automobile industry thought processes for the friction stabilizers, torque tensioned rebar bolts and inflatable bolts."

Jennmar has more equipment arriving from the U.S. and they are working every day on a solid logistics plan while delivering products to the mines. "By the end of 2021, we hope to have a team of 25 to 30 people supplying a full range of our products to the mines in Canada, which includes introducing Jennmar's bits, cutting tools and conveyor idlers," Hurd said. For the mines in western Canada, Jennmar is partnering with Mine Supply in Saskatoon, Saskatchewan.

Having spent more than 40 years in mining, Hurd viewed this as a phenomenal opportunity to rebuild what Jennmar once had in Canada. "Beyond filling a void in the market, we are going to build a company that will support the mining industry well beyond my time," he said.

How To Hit Deadlines Delivering Machines

Equipment transporters reveal how to save time and money

By Jesse Morton, Technical Writer

When transporting equipment, time is always of the utmost importance. Recent headlines show how seriously solutions and services suppliers take deadlines for getting a machine from point to point. Whether when moving a drill rig from one work area to another, a fleet of haulers across snowy mountains to port and on to another continent, or an enormous stacker across an intracoastal river, time is money, and these suppliers prove that nowadays there is now little reason to waste either.

Hauler Fleet Goes From Mountains to Port

When JP Tech Services hit its 20th anniversary in November, it was in the middle of the biggest equipment transportation project in the U.S. at the time. The company was moving 10 Cat 785Cs from five coal mines in Appalachia to the Port of Savannah. The trucks were bound for a copper operation in Solwezi, Zambia, owned by an Australian miner.

The company's owner described the project as simply another job, one of a number under way simultaneously that involved millions of dollars in assets and that had personnel, top experts in the field, scattered across several states. Yet, it was not just another job, but rather a fitting cap to two decades of growth.

"This company started 20 years ago with one man with no backing," JP Tech Services President Jonathan Pruitt said. "At one point, we were a coal service group," he said. "We have remade ourselves in the last nine years into a totally different company that still does some work in coal but is now diversified into hard rock mining, transportation and lifting."

Moving 250-metric-ton (mt) haulers through four states would tap expertise from all those sectors. Because the company could complete the entire project without farming out any of the numerous tasks, it easily won the contract, said MB Global, equipment broker for the miner.

"To put the order together for the client, we had to go to multiple owners and pull trucks from five different mine sites in two states," said Chris Burton, executive vice president, MB Global.

In November, JP Tech Services turned 20. The company transported 10 785Cs from five coal mines in Appalachia to the Port of Savannah to be shipped to a copper mine in Zimbabwe. (Photo: JP Tech Services)

"When we started talking with different companies, we found that JP Tech is a one-stop shop," he said. They could dismantle the trucks on-site. They could transport the trucks to a work yard and do the repairs and cleaning. And they could get the trucks to port.

"That is really unusual," Burton said.

"JP Tech is a full-service provider," he said. "Equally important, they meet the time objectives."

Deadlines are nonnegotiable when the client is chartering vessels for oceanic transit. The secret to punctuality is rigid project management discipline, Dennie Leach, transportation manager, JP Tech Services, said.

"That is what makes us strong and gives insight on where exactly we need to be at," Leach said. From the start, every task is built into a comprehensive Gantt chart, he said. "It gives us where we need to be at on every one of the trucks," he said.

The chart itemizes, among other things, tasks big and small, and both near-term and longer-term goals, Pruitt said. "We plan it A to Z, including everything we need," he said. At regular meetings, the chart is referenced to give both the big picture and granular details. "The biggest challenge on any project of this size is being able to see the forest and also see the tree in front of you."

The first trees were inspections. The trucks were to be inspected with Caterpillar's Trade Allowance 2 (TA2) criteria.

"First, we did the TA1 and TA2 inspections, going out and making sure the customer was getting their money's worth," Leach said. "For the TA2, you do oil samples. Then they know if there is any wear issues on their components."

The trucks had been parked, and roughly two days per truck was required to assess hydraulics, oils, batteries and some components, Pruitt said. "These are all mid-20,000-hour (h) to 30,000-h trucks."

After the inspections, the beds and tires are removed and loaded. A 100-ton

JP Tech Services used its own certified escorts to accompany the 10-axle rig hauling a 785C chassis on another gray West Virgina Sunday in late fall. (Photo: JP Tech Services)

Grove crane does the lifting. The chassis goes on a 10-axle rig with a beam trailer. "That is good for 200,000 lb (91 mt) gross," Leach said.

The bed goes on a rig with a 4-axle tractor and a 3-axle lowboy. "Those will be grossed out at about 130,000 lb (59 mt)," Leach said.

The two tire loads are 3 m wide each. "With your last tire load, you put in any extra pieces, catwalks and handrails on that trailer," Leach said.

The first destination is a 10-acre (40,500-m^2) laydown yard and work campus in Mingo, West Virginia. Before mobilizing, Leach and a crew measure the heights of every overhanging tree, line, sign and bridge beam. "Trees grow over the road, so you've got to make sure they don't bust the windshields of the chasses," he said.

"The loads are at 15 ft 7 in. (4.7 m), so we set our high poles at 16 ft 1 in. (4.9 m)," Leach said. "Every wire or every bridge that we come to we log it out. My drivers know every place that they would have an issue with."

Some obstacles will be lifted using poles. For others, "we put runners on the machines so that the wires slide over," he said.

In West Virginia, each super load requires three escorts, and the move must be made in daylight. The state recommends Sunday moves, which Leach said worked best because traffic volume is lower than it is on other days.

"We had several loads that had to have bridge monitors due to the grand weight due to the chasses," he said. "They control the speed and traffic on the bridges while we are crossing to prevent damage to the roadway."

The first loads mobilized in mid-November and encountered rain. The last loads encountered snow.

"The transportation department carried them to our lot in Mingo where we have a wash pad set up to prep the machines, do what is called an Aussie Wash, and control all the runoff of the water so we have no issues with environmental regulators," Pruitt said.

The Aussie Wash cleans the trucks to meet the regulations governing their entry to Australia and South Africa. "You've heard of a white glove test? It is that clean," Leach said.

"No grease, oil leaks, dirt or rocks coming from another country," he said. "It has to be as clean as what would come from the factory."

Each truck spends four days in the first hard wash.

Two-man crews do repairs and maintenance. Assets involved include cranes, manlifts, trucks, tractors and welding trucks. Leach said up to $1.25 million in assets in Mingo was committed to the project.

The trucks are processed simultaneously and on average each requires around a week to be brought entirely up to specifications. "That varies depending on the repairs that have to be done," Leach said.

Some of the needed repairs can be extensive, Pruitt said. "We've had brake packs suddenly start leaking," he said. "Instead of doing planned work, we've had to turn around and take brake packs off, or take final drive assemblies off, or deal with wheel seals."

From Mingo, the trucks go to port, this time primarily by interstate. This part of the project was co-managed by Joe Caudo with National Ironman Plant, an Australian partner of MB Global.

Again the route is fully scouted, with overhanging obstacles identified.

The first superload consisted of three chasses, two beds and the falloff loads. The caravan included 20 escorts and a total of 38 personnel.

"All of our escorts are certified," Pruitt said. "You are in the neighborhood of $3 million of JP Tech's assets traveling down the road."

Those assets are subject to Level 2 inspections by state police at each border, Leach said. "They measure every load," he said. "If anything is off, whether it be just a light out, those loads don't move."

The runs are arranged according to regulations. "Tennessee will let me move two loads on Monday, two loads on Tuesday and one load on Wednesday," Leach said.

In Georgia, different rules apply. "They back them away from each other, a half mile apart," he said.

"They were supposed to run the Georgia runs the same route, but when we

A 79-m-long stacker is offloaded by 66 axles of Self-Propelled Modular Transporters at Neptune Bulk Terminals in Vancouver, Canada. (Photo: Mammoet)

Trailer Power Assist, co-developed by SCHEUERLE and Mammoet is based on the self-propelled K25 modular platform vehicle, drives four of six axle lines, and is situated between a truck and a trailer to provide addition traction force of 400 kilonewtons. (Photo: SCHEUERLE)

got to Atlanta they split us," Leach said. "One goes through Macon. The other goes through Augusta. It adds mileage."

But separating the runs divides the risk, Pruitt said. "Their theory is that if you have a problem it will be with one group or another and maybe you've not tied up one road entirely and there is still another route."

As of this writing, Burton said the project was on schedule and on budget, and could prompt the opportunity to move two additional fleets of 13 and 12 trucks, respectively, for MB Global. "It was an extremely smooth process," he said.

Repeat business is as common as new business, and the company routinely fields multiple simultaneous projects, Pruitt said.

For example, while moving the haulers from Appalachia to port, the company simultaneously relocated a PC5500 Komatsu excavator, four 830 trucks and a Cat 993K wheel loader from an old Arch Coal mine.

"We had a four-week target to completely disassemble, move, re-bearing, install new slewing gear, make some repairs, move the four 830s and the 993K from the Coal Mac property to the Twin Branch property," Pruitt said. The project required 10 maintenance personnel, trucks, two 100-ton cranes, and two 70-ton cranes.

"You are talking about a pretty intense project and we hit our target dead on," he said.

Besides equipment transport projects, the company serves as a maintenance group for mines and other businesses. "We've got resident mechanics at the Haile gold mine in South Carolina, and elsewhere. We do a ton of underground work. We have 10 men on any given day in the underground zinc industry," Pruitt said. "We've got resident mechanics at Waste Management."

Going forward, the company hopes to expand its footprint in the metal/nonmetal mining space. Burton said MB Global is eager to help. "Because we got our origins from the Appalachian region, we love to patronize local organizations when we can," Burton said. "Jonathan's team, and Joe Caudo, have been fantastic."

Team is the key word, Pruitt said. "The only way you can operate at the level this company operates at is with very professional personnel," he said. "It is a team effort. The men do what they do well."

Stacker Crosses Strait of Georgia

In August, Mammoet completed a project that moved a giant stacker-reclaimer in one piece from a factory to its foundation. After three years of detailed planning, the execution was seamless, Mammoet said.

"For projects of this scale, planning is everything since the early stages of the planning process identifies the commercial, technical and operational details necessary to execute the project strategy," said Dave Donnelly, technical advisor, Mammoet.

And the scale can only be described as immense. The stacker and the corresponding tripper car combined for almost 1,000 mt. The stacker was 79 m long, 20 m wide and 32 m high. The tripper car was 54 m long, 10 m wide and 17 m high.

The stacker was manufactured by United Engineers (UE) at Hope Harbor, in British Columbia, Canada. It was destined for the Neptune Bulk Terminals (NBT) in Vancouver. The customer purchased the stacker as part of an $800 million upgrade project intended to help double its metallurgical-coal-export capacity to 20 million mt per year.

Local company Dynamic Heavy Lift decommissioned the old stacker and was tapped for lifting and moving the replacement stacker into place in Vancouver. Mammoet was contracted for the transportation part.

With "years of engineering and operational experience in the art of heavy lift and transport," Mammoet was uniquely qualified for the role, Donnelly said. For example, previously Mammoet helped move a gargantuan Sandvik PD200-2200/60 stacker from the Ridley Island Terminals on Porpoise Harbor to a mine site on the island. That one weighed 1,500 mt and was 140 m long and 30 m high.

"For Mammoet, this project and its operations were a typical heavy lift and transport problem for modularized factory-to-foundation equipment," Donnelly said. "It is a good example of how over-dimension, overweight project items can be efficiently completed away from their installed sites if a project management team embrace a modular approach to its construction strategy."

United Engineers embraced the strategy and built the stacker directly on to steel rails using the exact dimensions specified for loading it on Mammoet's Self-Propelled Modular Transporters (SPMTs).

The trailers come in factory standard units with four axles, with a 120-mt capacity, and six axles, with a 180-mt capacity. SPMTs "can be mechanically, hydraulically and electronically connected, both longitudinally and transversely, for whatever project payload needs to be lifted and transported," Donnelly said. The modular design offers easy mobilization and demobilization, he said.

"The high-capacity SPMT trailer's modular design, including the hydraulic Power Pack Units, allow engineers to combine the SPMTs into whatever configurations are required for lifting and transporting the project item," Donnelly said. "The SPMT's pendulum axles give the trailers their maneuverability and the integral computers provide one-man operation in various steering modes."

On 66 axle lines of SPMTs, the stacker was driven on to a barge aptly named the Dynamic Beast for the trip across the

Strait of Georgia. The Beast is described as a 330- by 120- by 20-ft heavy-lift deck cargo barge with a ballasting system that pumps water to and from tanks in the hull to maintain a level keel.

The ballast system can be activated for either a Roll-On/Roll-Off (RO/RO) or a Lift-On/Lift-Off operation.

The deck capacity is rated at 25 mt per m^2. It is equipped with a Manitowoc M-1200 Ringer Crane at the aft end, which has a maximum lift capacity of 900 mt and that can be removed to make space.

After docking in Vancouver, SPMT teams drove the stacker 260 m to its foundation.

Auxiliary equipment used included 20-m load spreaders and RO/RO ramps, Mammoet reported. The company also constructed a purpose-built frame to provide support during the move. It used "existing heavy-lift ancillary equipment items such as support stands, steel mats and ramps," Donnelly said. "This application of Mammoet's modular equipment coupled with the SPMT's transport configuration hydraulic stability provided a savings for project transport cost and time."

The biggest challenge was harmonizing the timing of loading tasks with those related to the completion of the stacker by UE, and to the timing of tasks at NBT, he said. "These were solved by regular discussions between project managers from Dynamic, Mammoet, UE and NBT."

Donnelly said the project could serve as a template for future ones. "Allowing for project cargo specifics, the same modular approach can be duplicated, especially if blue-water access is available at both factory and foundation sites."

Trailer Assist Solution Wins Award

Trailer Power Assist (TPA) won the 2020 innovation award from the European Association of Heavy Lift and Abnormal Load Hauliers (ESTA). ESTA jurors selected TPA, which was co-developed by Mammoet and SCHEUERLE, from a pool of 38 finalists from 24 companies in 13 countries.

SCHEUERLE said the award speaks to the capabilities of the solution. It also "strongly signals the innovative force of SCHEUERLE and Mammoet," said Volker Seitz, head of global marketing, TII Group.

Manufactured by SCHEURLE to Mammoet's specifications, TPA is an engineered heavy transport solution based on the self-propelled K25 modular platform vehicle. TPA has a robust drive system with a Power Pack Unit that drives four of six axle lines. Situated between a truck and a trailer, it provides a traction force of 400 kilonewtons or the pulling force of two truck tractors.

"Each TPA trailer has a 1,000-hp diesel engine powering an innovative new hydraulic drive system," Seitz said. It offers "twice the pulling force of a conventional prime mover unit."

TPA is designed for international transport and offers a range of benefits.

By replacing tractors, it reduces CO_2 emissions and eliminates the ballast requirements. "Likewise it reduces the time-consuming need for coordination between the drivers that normally occurs in a multi-truck combination in order to synchronize the braking and steering behavior," Seitz said. "Consequently, the TPA also increases the safety of the transport assignment."

Reduced length and weight of transport also improves safety and maneuverability.

"Once the transported goods have been delivered at their destination, the truck can pull the TPA to the next location in freewheel mode at a maximum speed of up to 80 km/h," Seitz said. "Cost effectiveness and efficiency are thus considerably higher than with previous transport solutions."

TPA was designed and tested in 2017 and 2018. It was released in 2019. Shortly thereafter, Mammoet used it to transport a 430-metric-ton (mt) coil. "Without TPA, six towing vehicles would have been required," Seitz said. "With the help of the TPA, two trucks were sufficient due to the additional thrust provided." TPA reduced the time required for the transportation by half.

The award shows SCHEUERLE "is a highly innovative supplier with long-standing experience, and therefore a worldwide leading manufacturer of transport solutions for heavy haulage," Seitz said. "SCHEUERLE develops customized high-efficiency transport solutions, from the practice for the practice."

Trailer for Drills, Dozers Saves Time

Sleipner Finland released the DB-120PLUS equipment transport trailer, which has a maximum payload of 120 mt and is ideal for drills, bulldozers and other tracked equipment. Like the two other units in the series, the trailer is compact, offering speed and agility that translates to substantial time savings and costs savings, Sleipner said.

"It is the size of a David but with the strength of a Goliath," said Conrad Caldwell, sales manager, U.K. and Ireland, Sleipner Finland Oy.

The trailer can be used in routine relocation of equipment. It also allows the miner to be more reactive to emergent realities on the site. Both capabilities can help increase productivity, Sleipner reported.

Becoming more reactive can mean being able to quickly overcome setbacks, Caldwell said.

"With the Sleipner DB system, drills, dozers, diggers and auxiliary equipment can be relocated quickly and safely from the bottom of the pit to the next work area, or to the workshop for service and maintenance during shift change or blast breaks," he said.

The DB120PLUS can carry drills, bulldozers, excavators, wheel loaders, trucks, buckets, pumps, light towers, graders and more. With a hydraulically lowered and

The DB120 has a maximum payload of 120 mt and a maximum towing speed of 15 km/h fully loaded, and can be towed by a 45-mt ADT. (Photo: Sleipner Finland Oy)

The Vehicle Recovery Tool attaches to the towing machine to boost capacity, provide greater stability and balance, and improve safety. (Photo: PHIL)

raised bed, it offers quick rear loading. "One person can handle the whole loading procedure," Sleipner reported.

It offers a max towing speed of 15 km/h fully loaded. Unloaded it can travel at 30 km/h.

A top-tier benefit offered is the opportunity to improve site safety. The bed is wider than the loaded equipment tracks. It poses no risk of overturning. And it has a reversing camera system and an advanced braking system.

"Drag brake surfaces at the tail of the trailer can be lowered to touch the road during downhill transportation and the operator chooses the needed brake assist according to conditions," Sleipner reported. "A secondary wheel brake system is connected to the towing vehicle brake circuit."

Caldwell said big safety gains can also arise from the fact that it can easily join mine traffic while requiring minimal personnel. "Thanks to the compact design and agility, the Sleipner DB-Series fits in with the flow of the haul road traffic, and there is no need for escort teams in the front and back of the lowboy, releasing resources and people."

The wheel span of the unit is 11.8 m. The trailer bed is 8.2 m long and 5.8 m wide. It has a turning radius of 14 m.

The DB120PLUS can be towed by a 45-mt ADT.

The model is the natural evolutionary successor to the original DB120.

Since its release in 2013, the DB120 has been widely deployed and has garnered much positive feedback. One customer with multiple pits on a site spanning roughly 10 km used it to cut maintenance costs enough to justify running four additional dozers, Teijo Höylä, product manager, Sleipner Finland Oy, said.

"In this case, in order to fit the maintenance budget, the mine was planning to cut the dozer fleet from 13 to 9 units," he said. Before it did, it adopted a DB120.

The trailer basically made the fleet mobile enough to dramatically reduce maintenance costs. With the dozers being wheeled around when needed, all maintenance could be done at the workshop. With minimal availability disruption, they could be dropped off for unplanned maintenance.

"After using Sleipner DB120 for only six months, the maintenance cost of the 13-dozer fleet was at below the projected maintenance cost of nine dozers," Höylä said.

There were other savings that proved incalculable. "After all the tracked machines were relocated on wheels, the road repair costs were reduced drastically," Höylä said. "Previously the heavy-tracked equipment was tramming on dust beside the roads, causing damage to the hauling roads."

And using the DB120 proved to be the safest option, he said.

"Safety is not always a calculable or quantifiable factor, but in a comparison between the operational procedures of a conventional lowbed-type trailer and Sleipner DB120, no doubt Sleipner will clearly win," Höylä said. "Low center of gravity allows exceptional stability. Fall risks are minimal. And with rear loading, there is no need for un-hitching or re-hitching the DB120."

Vehicle Recovery Tool Boosts Towing Capacity

Philippi-Hagenbuch announced the Vehicle Recovery Tool (VRT), an intermediary piece of towing equipment that boosts the capacity of a primary tower, such as a lowboy trailer. It is "the safest, most stable way of towing a disabled vehicle within a mine site environment," PHIL said.

"Used independently, the VRT provides a safe, efficient towing solution for trucks of up to 400 tons in capacity," said Josh Swank, vice president, sales and marketing, PHIL.

The VRT attaches to the front bumper of a disabled vehicle, lifting the front tires off the ground. This spreads the weight evenly between the VRT, primary tower, and rear wheels of the machine being towed.

"The VRT's wide base provides greater stability and balance, eliminating the need for a counterweight on the tow vehicle's chassis and ensuring safe towing with no added pressure on the truck or the haul vehicle," Swank said. That reduces "stress on the equipment or the prime mover, decreasing maintenance and, in the long run, increasing longevity of these machines."

It can be put between a towing chassis and a trailer for the same results.

Each VRT is custom-engineered for pairing with the primary towing machine, which can be a haul truck, track-type tractor or wheel loader.

The solution offers speed and peace of mind, PHIL reported. "The VRT allows for quick, efficient recovery of disabled equipment," Swank said. "Operations can move equipment from the field to the shop more quickly."

Repairs done in the shop are typically done faster and better than those done in the field. "These might be small gains in the grand scheme of things, but when it comes to minimizing downtime, every minute counts," Swank said. Those minutes add up for "decreased downtime and better productivity."

Attaching the VRT is similar to attaching a truck body, Swank said. "A hitch arrangement gets pinned on to the truck at the rear pivot mount and then tied down to the hoist cylinder mounts on the truck, or to the hoists themselves," he said. "The VRT utilizes the truck's hoist hydraulic circuit, so there are no additional hydraulics to add or controls to clutter the cab."

The research and development behind the VRT was driven by customer feedback, he said.

"While developing our Ultra-Class Lowboy, our team realized there were definite improvements that could be made to the process for hauling disabled equipment," Swank said. "So, we got to work designing the VRT and applied for its first patent in 2011."

Like all PHIL solutions, the VRT is designed to "integrate with the operation's existing equipment, saving producers money and maximizing productivity," he said. "We take good general purpose haul trucks and make them great for our clients' specific needs."

Mikko Keto Takes Reins at FLSmidth

A leader in mineral processing looks to improve service and provide sustainable solutions for mining companies

By Steve Fiscor, Editor-in-Chief

A great deal of consolidation has taken place with major suppliers serving the mineral processing sector, and more mergers are currently under discussion. Last year, Metso completed its merger with Outotec, and FLSmidth is currently negotiating a purchase of thyssenkrupp's mining segment. As these companies realign, new leadership is emerging across the board and a key C-level appointment was announced during mid-January for FLSmidth. Mikko Keto accepted the position of mining president and will also serve as a member of Group Executive Management at FLSmidth. He replaces Manfred Schaffer, who led the mining segment for six years and announced his plans to retire in 2020.

"This is an exciting time for Mikko Keto to join FLSmidth. Our mining business has been stable with strong order intake, even in the face of travel restrictions and the COVID-19 pandemic," FLSmidth Group CEO Thomas Schulz said. "[He] brings vast experience in developing and executing high-performance business strategies across the mining flowsheet. His many leadership roles in international business give him a deep understanding of how best to serve global customers within a matrixed organizational structure."

"Under [Keto's] leadership, FLSmidth will continue on our path of growing our mining business," Schaffer said. "He will be a strong asset to FLSmidth, our mining organization and to our customers."

Keto began his mining career when he joined Metso in 2010. He started as a vice president of Flow Control Services before moving to president of Automation Services, senior vice president of Performance Service and senior vice president for Spare Parts. He continued to climb the corporate ladder and was eventually named president of Minerals Services and Pumps. Prior to his career with Metso, he also served as head of sales for the Maintenance business unit at KONE Corp. He also held senior management and sales positions with Nokia Networks.

Mikko Keto, mining president for FLSmidth.

With that pedigree, it should come as no surprise that Keto intends to focus his efforts on improved service and sustainable solutions for mining companies. Typically, a new C-level executive for a multinational company would travel to many of the company's locations and meet with colleagues, but this is not currently possible with travel bans and the fears of contracting and spreading COVID-19. So, he is learning the ropes virtually, while locked down at the company's headquarters in Valby, Denmark.

Keto said his primary focus will be to continue maximizing profitable business opportunities across the mining flowsheet, with an emphasis on sustainability, digitalization, service and aftermarket. He will lead FLSmidth's mining organization's focus on delivering solutions and equipment that provide sustainable productivity and meet the changing needs of its mining customers.

"I'm very proud to join FLSmidth at this particular moment," Keto said. "We are well-positioned to seek opportunities for profitable growth and deliver on MissionZero, which aims to enable our mining customers to move toward zero emissions and zero water and energy waste by 2030. It is a great honor to lead the mining organization and I look forward to collaborating with all of our talented employees to provide the very best in sustainable productivity to our global customers."

Lasting COVID-19 Impacts

Keto took time from his schedule to discuss his plans for the future of FLSmidth. "Some of the new communications skills that we have learned from COVID-19 will have a lasting effect on how we conduct business, but you still need to meet face-to-face to brainstorm and to get to know people," Keto said. "It's really remarkable. I feel like I know most of the FLSmidth managers and executives around the world, even though I have been unable to leave the office."

After serving the mining industry for 10 years in various capacities, Keto said he still finds mining to be the most exciting of the industries he has worked with so far. "Its primary position in the supply chain, means that mining is always happening and will continue to do so," Keto said. "When one looks at the projections for tomorrow's world, it's obvious that mining and the raw materials that it provides will always be necessary. Mining is truly a global business, but there is also this feeling of community. It's also a relatively small industry, where sometimes you're a customer and sometimes you're a competitor."

The mining business places a lot of attention on health and safety, Keto acknowledged, and last year the world discovered the importance of public health and safety. "The pandemic is a tragedy and it has caused a lot of pain and suffering," Keto said. "Public health and safety systems around the world are under intense strain. To deal with the pandemic, we have had to learn new skills, and one of the more amazing breakthroughs brought about by COVID is the acceleration of digitalization."

For FLSmidth, more supervisory activities with equipment installations and project commissioning are taking place remotely. "The concept of remote process monitoring, process control and even optimization were well accepted, but now we are executing process changes remotely," Keto said. "Initially, people were confident in remote monitoring, but less comfortable with executing changes remotely. That has changed."

This is happening internally at FLSmidth too, Keto explained. "When we look at supply chains, we now need the online visibility of the status of a spare part or a component coming from a distant location, such as a foundry in Turkey," Keto said. "Expediting is now done online. That high level of transparency is important for FLSmidth's customers and its suppliers as well. We are fortunate to have strong regional teams. The companies that are more centralized are experiencing great difficulties these days."

Future Priorities for FLSmidth

FLSmidth has a large portfolio of equipment and services. Keto said he wants to maintain and build technical leadership throughout the modern mineral processing flowsheet. "Within comminution for example, we recently launched a new large gyratory crusher that completes that product line," Keto said.

FLSmidth's project execution is in very good shape, Keto explained. He plans to build a second, strong pillar focused on service and process optimization. "We need to be the leaders in service," Keto said. "We have good service in most parts of the world, but I want to invest to make service equally as strong as our product portfolio and I also want to invest more in project execution. Ideally, FLSmidth should have a leadership position with helping its customers optimize process performance, which means we need to stay engaged and help sustain and improve that performance continuously."

Digitalization of the plant is super important for future success, Keto explained. "Sensor technology has been a bottleneck for the mining companies," Keto said. "In particular, it impacts the speed at which decisions are made. A prime example would be establishing setpoints to manage the variation of the feed characteristics."

"Today, many countries as well as mining companies have set targets for decarbonization and we want to help them achieve those goals," Keto said. "Performance optimization and improving productivity are high priorities for mining companies, along with sustainability. Sustainability is also important for suppliers."

Explaining that there is no silver bullet, Keto knows the problems mining companies face with water and energy costs, and their social license to operate. "Helping mining companies achieve their environmental goals will drive the introduction of new technologies," Keto said.

Mining companies have achieved a great deal in the last five to 10 years as far as digitalization goes. Keto faults some of the suppliers for moving too slow to adopt digitalization. "The challenge for the miners is the suppliers with the point solutions," Keto said. "You have a piece of equipment with great condition monitoring, but it doesn't interact with other downstream processes. Mining companies today are looking at more wholistic solutions for the entire process and they are frustrated with point solutions."

Keto pointed to FLSmidth's recent acquisition of KnowledgeScape as one of the ways the company will provide improved digital solutions for miners. "They have a wholistic view especially with Optimization and Expert Control software and the significant gains being made in that area," Keto said.

The news that FLSmidth is currently looking to purchase thyssenkrupp's mining segment broke at about the same time the company announced the appointment of Keto. He was unable to discuss ongoing business deals, but said FLSmidth was happy that the negotiations were continuing. "There is some overlap with our product lines, but thyssenkrupp has other products and solutions that would add strength to FLSmidth's portfolio," he said. "Together we would be stronger. The timeline, however, is dictated by the selling party. We have great respect for them and their products and services."

When Keto turns his attention toward the future, he said he really enjoys performance and process optimization projects that increase productivity and provide sustainable solutions. "I have been involved with other heavy industries, such as oil and gas and pulp and paper, and they may be a little more advanced as far as process optimization in some areas and I see similar solutions for the mining sector and that links nicely with FLSmidth's MissionZero program."

MissionZero in Mining

FLSmidth launched MissionZero to offer the mining industry solutions that support a move toward zero water waste, zero emissions and zero energy waste. Dedicated to the development of digital and innovative solutions tied to sustainable productivity, the company said it plans to offer the required technological solutions to move toward zero-emissions mining processes by 2030, with a specific focus on water management.

The company has already developed solutions such as dry-stack tailings that enables mine sites to recover up to 95% of their process water and multiple digital solutions that provide greater processing efficiency. FLSmidth said it is also identifying opportunities to significantly improve productivity and environmental impact across the entire flowsheet, including crushing, flotation, thickener upgrades and filtration, as well as the maximizing potential of pumps and cyclones.

FLSmidth has positioned MissionZero as an invitation to mining companies, third parties and its peers to co-create and ensure adoption of solutions that will transform mining into a more sustainable industry.

More information is available at FLSmidth.com/MissionZero.

In addition to dry-stack tailings, FLSmidth has identified other opportunities to reduce waste and emissions.

Lower Grades Mandate Robust, Efficient Solutions

Suppliers increasingly offer customizable, fit-for-purpose material handling solutions that address project-specific needs

By Jesse Morton, Technical Writer

The trends in the mining industry most relevant to the material handling business are declining grades, limitations on input resources like water and energy, building pressure to reduce fossil fuel consumption, and the increasing need to minimize environmental impact, according to Fluor Corp.

"Declining ore grades, increased processing volume, along with a requirement to drastically reduce water and energy consumption drive a need to scan and screen ore, and separate the waste even before any material enters the process plant," said Claudia Baerwolff, director, mining and metals strategy, Fluor.

"The shift from small, narrow vein underground deposits toward large, low-grade block-cave projects require a much more robust material handling infrastructure," she said.

The push to reduce carbon emissions "increases demand for conveying solutions, not only for long-haul overland conveyors, but also for (in-pit crushing and conveying) solutions," Baerwolff said. "Capital efficient, agile, innovative solutions are explicit demands we receive from clients, oftentimes with a preference for a vertical design and supply package."

Miners are also demanding greater automation and digitalization, said Bracken Spencer, principle engineer, Alpine CME. "Material handling, especially in underground mines, is taking phase shift advancements toward automation, system integration and real-time product tracking, from the face to the mill," he said.

"While the initial installation capital expenditure is higher, the downstream benefits of increased personnel safety, system efficiency, and increased productivity and throughput quickly offset the higher capital cost," Spencer said. "These changes start by asking 'why' as opposed to accepting that the status quo is good enough."

When it isn't good enough, suppliers must "design and supply solutions that address project-specific needs, and deliver fit-for-purpose material handling solutions that include custom configuration, innovative design and at a lower cost than the competition," Baerwolff said.

The standard Rail-Veyor car is 2.4 m long. Recently, the company designs a 1.5-m car for a smaller discharge loop. (Photo: Rail-Veyor)

Many suppliers are increasingly successful at doing exactly that.

Unleashing Mine Design Creativity

Recent news from Rail-Veyor Technologies Global Inc. suggests the company is growing its market share for all the right reasons. The company reported that in 2020 it made headway on projects in Asia and elsewhere, won a sustainable mining solutions competition, and continued to innovate.

Rail-Veyor's flagship solution, the TrulyAutonomous haulage system, is an electric train capable of hairpin turns on a 20% grade. The standard car is 2.4 m long and connects to others with spherical bearings. The train supports a continuous, articulated trough. Sideplates on the train are pushed by multiple drive stations along the route. Typically, at any given time, a train is propelled by multiple drive stations.

The system is custom engineered for each project. It is designed to meet tonnage requirements, and is run by software and without a dedicated operator.

It puts out no emissions, causes little dust and presents no fire risk. That means it solves some major challenges, and thus is increasingly in demand, the company said.

Currently, a TrulyAutonomous system is being installed in a mine in Kazakhstan. "It has been challenging to do this in the middle of a global pandemic, but working with local and regional suppliers and trusted local consultants has allowed the work to continue within the guidelines of the government," Jim Fisk, executive chairman, Rail-Veyor, said. The "project is under way with 99% of the material for installation having been delivered."

Meanwhile, the company is remotely commissioning a project in Venezuela. Elsewhere, the TrulyAutonomous system was recommended as the material haul-

age system of choice by preliminary economic assessments for both Troilus Gold and Rockcliff Metals.

Synchronously, Rail-Veyor won the fourth annual Mining Cleantech Challenge, hosted by the Colorado Cleantech Industries Association, in July 2020. The invitational contest awards solutions that meet current industry needs while introducing innovation to the marketplace.

And Rail-Veyor is definitely long on innovation. "We continue to innovate the most transformational material haulage system in the world," Fisk said.

In 2020, several improvements were trialed, Fisk said. "Our latest iteration of our train car has a rubber lined trough to make the trains lighter," he said. "The flexible nature of the material of the car trough will virtually eliminate material carryback and need for cleaning residual product."

The company recently designed over-under bypasses in areas where room for side-by-side bypasses is limited due to clearance and geology. "We've conducted rigorous successful testing at our John McCall Test Facility in Sudbury, Ontario," Fisk said.

Separately, the company designed a 1.5-m train car to navigate super-tight curves. "This allows for a smaller discharge loop to unload the material," he said.

The TrulyAutonomous system has proven popular with customers, which report savings of as much as 90% over previous traditional truck-haulage systems. "A few of our current customers are looking into second, third, and sometimes fourth systems, either to expand their current system or in other locations," Fisk said.

"Our opex is the most competitive in the industry," he said. "And the capex can be offset by the savings in development and ventilation requirements in underground applications and by reductions in haul road development and maintenance in surface applications."

For example, Agnico Eagle installed a 166-m train at Goldex in 2017. Part of the Deep 1 project, the miner adopted it to move low-grade ore from the lower part of the deposit located at more than a km underground at a cost of less than $40/metric ton (mt).

The train could handle big rocks, so no new crushing solution was required. It cranked out no fumes, so no additional ventilation was needed. Because it could hug the curves of the existing route to the working area, development costs were minimized as compared to conveyors.

Since the commissioning in January 2018, components have been upgraded, real-time detection systems installed, and a dedicated maintenance bay was designed and built, David Paquette, maintenance general supervisor, Goldex, said. "Before, maintenance on the trains was done in the main Rail-Veyor ramp, so we had to shut it down to perform the maintenance work."

At Goldex, Rail-Veyor's "performance has continued to improve, and has not yet reached full maturity," Paquette said. "Since 2018 to date, production has more than doubled and is above design. As for maintenance costs, the figures have been steadily decreasing, and to date they have declined by more than half since its commissioning."

Goldex now has six trains with a total of 408 cars, and hauls around 7,000 mt/day (mt/d). "We meet or beat what we say we will do," Fisk said.

Which garners the praises of customers like Sean Boyd, CEO of Agnico Eagle, said Lisa Youngblood, executive director, communications, Rail-Veyor. "We have heard from our customers that Rail-Veyor, as a company, is the best vendor they have ever worked with," he added.

The system is popular with engineers because it allows them to "unleash their creativity to explore mine design in a way never thought of before," Fisk said. "Our ability to climb greater than 20% gradients and also go around tight curves without the need for additional ventilation or haul road maintenance will completely change the sustainability model for mines."

Automating Stockyard Operations

FLSmidth reported seeing an uptick in demand for digital solutions for optimization, like BulkExpert.

"The trend backs our feeling that one of the big areas of growth will be digitalization," said Franz Rietschel, product line manager, group digital, FLSmidth Mining.

BulkExpert is an automation system designed to optimize stacking and reclaiming operations. It consists of a highly accurate positioning and laser scanning application that creates a model of the site and a machine for intelligent machine control, the company reported.

Positioning hardware and machine modelling provides accurate information

The 14-km overland conveyor for BHP's South Flank operation in the Pilbara incorporates horizontal curves for increased power and efficiency, and lower capex and opex. (Photo: Fluor)

on machine movements. Algorithms and control philosophies add intelligence to the machines.

Benefits include improved productivity, increased equipment uptime and longevity, and reduced energy consumption. The system can be used to, among other things, flatten peak loads, speed ship loading and cut CO_2 emmisions, Rietschel said.

"The offering for yard machine automation has a wide range of solutions," he said. "Different options are available, starting from automation to operate the machine fully automated controlled by a PLC, or more advanced with an autonomous solution."

Recently, it was purchased by a miner to fully automate the stockyard operation of two large iron ore shipping export terminals in Brazil. The customer previously deployed BulkExpert to a port stockyard in Southeast Asia.

At the Brazilian terminals, the solution is being used to increase reclaim throughput and equipment efficiency, the company reported. Remote operation, anti-collision and collision-avoidance systems will reduce stoppages. Quality management will track material movements, and material blending control will reduce quality deviations.

Expected benefits include higher throughput and improved performance, the company reported. Extended machine life and reduced maintenance will result from lower stress on the machinery.

Construction of the parallel coal handing facility at Glencore's open-cast Rolleston mine. WSP designs the plant on time and within budget. (Photo: WSP)

Separately, FLSmidth designed and supplied two large stockyard machines for a miner in Australia. The supplier reported it is currently building a bucketwheel reclaimer and a traveling stacker with a luffable and a slewable discharge boom.

The reclaimer will feature state-of-the-art stockyard machine technology meant to improve the accessibility and maintainability of the components, FLSmidth said.

"A further refined bucket design reduces carryover of material and minimizes micro-spillage because of reduced gaps between the bucket teeth," said Branco Lalik, director, mining systems, FLSmidth Mining. "Additionally, a special optimized sealing system between bucketwheel and ring chute was developed and implemented."

FerroCer impact wear liners for the buckets could double the bucket exchange frequency and reduce maintenance costs, he said.

"On top of that, the rotable bucketwheel head can be exchanged as one complete unit including the steel structure, bucket-wheel drive and ring chute, which increases the uptime of the whole machine in operation," Lalik said. "The automation and control package, with radar-based stockpile scanners, provides increased efficiency, a higher level of safety, and it also helps our client to monitor his inventory."

Rising metals prices bode well for the company's material handling solutions business. "There is increased activity on the projects side, and we expect this to have a positive impact, even considering the pandemic situation," Lalik said.

For example, the supplier has won two orders for H2 2021 for stockyard equipment for a mine and a port in Brazil. Supplying a drum reclaimer and a bucket wheel reclaimer extends "our large installed base of mobile balanced machines in South America," Lalik said. "It confirms that we are well-positioned in this segment."

South Flank's Horizontal Curves

Like the Nazca lines or the canals of Babylon, the overland conveyors for BHP's $3.6 billion South Flank project must be viewed from the air to be fully appreciated. The sprawling 14-km, 90° curved conveyor is a "state-of-the-art implementation of complex conveyor design" in one of the most forbidding environments on the planet, Fluor Corp. said.

Engineered by Fluor and partner AC-Tek, and executed by an integrated BHP and Fluor team, the design is of the most advanced complexity, said James Markey, project manager, Fluor.

"Horizontal curve design in high-capacity overland conveyors is unique, and this combination of length, capacity, vertical terrain and horizontal curves was not previously attempted," he said. The design process involved, among other things, dynamic modelling of the elastic behavior of the conveyor under numerous load cases, horizontal and vertical curve analysis, terrain modeling and optimization, and component configuration and optimization.

Conveyor geometry and material selection was carefully considered to reduce power draw along the conveyor, Fluor reported. This resulted in a design using belting with low indentation losses and lightweight composite material idlers. Lighter rollers reduced installation and operating costs.

The conveyor was designed to add value in multiple ways, said Neale Watson, executive director, engineering, Fluor.

"Incorporating horizontal curves in high-capacity overland conveyors is a unique specialty in the industry, and can effectively replace two or more conveyors and associated transfer points," he said. Benefits include increased power efficiency, reduced component wear, and lower capex and opex. "Conveying solutions have a high impact on an operation's carbon footprint, which is why we look at material handling as a core pillar of our mining and metals business."

Nearing completion, the South Flank project will replace production from the prolific Yandi mine.

Beyond a total of 25 km of overland conveyors, the centerpiece of the project is an 80-million-mt/year crushing and screening plant, stockyard and rail-loading facilities.

Because of the remote location, "the project is using modular construction techniques to speed up the build and reduce exposure hours on site," Markey said. "The modules, with some weighing up to 350 mt, are the biggest ever delivered into the Pilbara."

Ultimately, upon completion of the project, Fluor will have managed more than 2,300 individual modules, 300,000 fabrication drawings, 36,000 mt of fabricated steel, and a staggering 2.5 million individual assemblies.

"Fluor offers industry-leading capabilities in modularization and prefabrication with the highest standards of budget and schedule control, and maximized site safety," Watson said.

Construction at South Flank began in in mid-2018. First production is expected this year.

"South Flank will form part of the largest iron ore processing facility ever built in Western Australia, and one of the largest in the world," Markey said.

Modelling Designs to Up Production

WSP reported that, beyond working closely with the customer, disciplined design management and powerful digital tools were the keys to the massive success of designing a duplicate coal handling facility for Glencore's open-cast Rolleston mine.

The engineering firm was contracted by Glencore to design the parallel plant, determined to be the most viable means of increasing coal production at Rolleston.

The original plant, commissioned in 2005, had a dump hopper, three-stage sizing system, and a linear traveling and luffing stacker. Upgrades to the crushing and stacking circuit over the years enabled the plant to process up to roughly 4,000 mt/hour (h) of two types of coal. The reclaim system moved about 4,500 mt/h to the train loadout.

Initially, Glencore considered debottlenecking it, but there wasn't the space for the needed equipment, WSP said. "To overcome these constraints, the existing coal handling facility would require major changes, necessitating major production interruptions," said Bintan Malar, marketing lead, WSP.

Instead, theoretically a duplicate plant working a parallel product stream could "increase throughput capacity, operational flexibility and production continuity," he said. It would have a higher direct capital cost, but without a significant interruption to production.

The challenges WSP bested were many. It had to develop detailed designs, position the new facilities on an existing site, design capacity upgrades to the train-loading conveyor, and design the foundations and retaining wall for the facility, which was located on top of a 14-m-high unconsolidated pad.

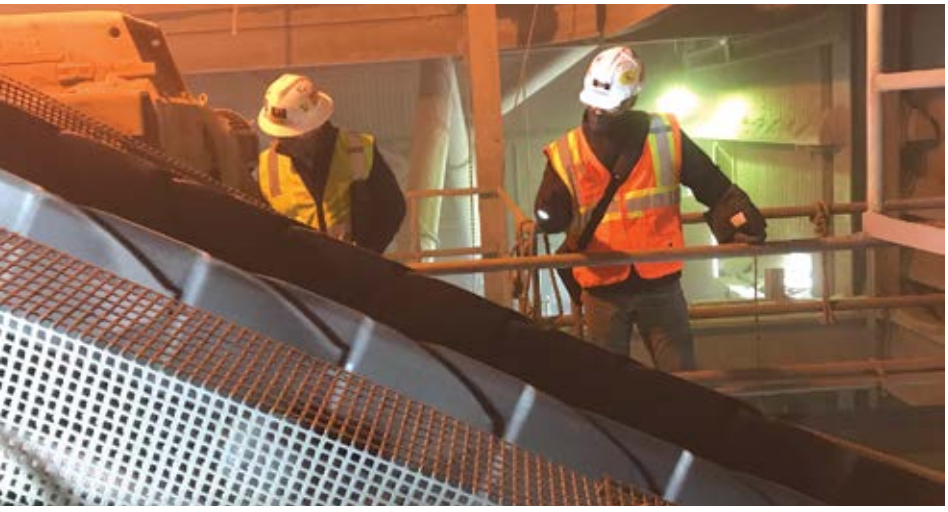
"In ensuring the upgrade was future ready, we had to make allowance for the new coal handing facility to feed to, and receive product from, a future dry destoning plant," Malar said. That meant, among other things, that a belt plough station had to be later fitted on the stacking conveyor, he said. "Likewise, calculation and spatial allowance was made to receive weighed, destoned product coal."

The project, of course, involved multiple contractors, and had a tight timeframe and budget.

Complicating things, the designs would have to be made with limited data on the major equipment. "WSP managed this risk by detailing the design interfaces in the datasheets and by rigorous checks of the vendor drawings and 3D models, when available," Malar said.

The engineering firm used what it described as a multidiscipline 3D model when generating drawings. "That improved the confidence of delivering a quality product in such a compressed timeframe," he said.

"The project was complex and involved numerous detailed interfaces,"



The ProService chain and lifecycle support package includes system optimization, installation support, inspections, wear analysis, performance tracking and personnel training. (Photo: U.S. Tsubaki)

Malar said. "WSP's designers could review these interfaces in a virtual model environment before putting pen to paper. The use of 12D, Prosteel and Inventor enabled WSP to utilize a wider range of 3D and 2D design resources."

The collaborative 3D model incorporated data on earthworks, equipment, the process, the structures and various services. "It facilitated clash detection and elimination," Malar said. "It enabled visualization for Glencore's team."

It also helped with safety and operational reviews, and with troubleshooting potential issues with construction. "It allowed us to show detailed models to be checked and compared with original design models," he said.

The modelling ultimately was used beyond the design phase. "WSP provided the civil design 3D model as one of the deliverables for use in the construction of the project," Malar said.

WSP completed the project on time and within budget. "The new Rolleston parallel coal handling facility is a clever solution to the business imperative of rapidly increasing throughput at an existing mine site," Malar said. "Glencore and WSP worked as a team to overcome the challenges of a fast-tracked schedule, low capital costs and minimal interruptions to production."

Such collaborative work "is what leads to successful outcomes," he said. "Upgrading the Rolleston coal handling facility is a great example that demonstrates the benefits of working closely together so that clients can determine the right solutions that fit their needs, now and into the future."

Introducing Maintenance 4.0

ABB Ability Asset Vista Condition Monitoring helps Vale's S11D mine avoid downtime and reduce maintenance costs, ABB said. "The solution payback time was achieved in only a few months," said Eduardo Botelho, product manager, global material handling service, ABB.

S11D is described as one of the largest open-pit mining operations on the planet, with an annual output exceeding 100 million mt. There, "Asset Vista covers the open-pit mine and processing plant, with more than 10,000 assets under monitoring," Botelho said.

"Asset Vista helps the maintenance teams' opex, targeting bottlenecks that could be electrical, mechanical or in automation," he said. "It integrates monitoring with customer maintenance strategies, but also adds value to the capex investment, making use of the large amount of data available in the existing system."

The system is an integrated portfolio of maintenance capabilities, sensors, connectivity, data aggregation, visualization and analytics to support decision making. "Customers benefit from access to big data and the ability to compile it efficiently using dashboards to sustain and improve maintenance performance," Botelho said.

Information from different condition monitoring systems, such as vibration analysis, can be integrated into a single platform. That platform can talk to enterprise asset management and computerized maintenance management systems. It "breaks down traditional barriers to information, and can be accessed through PCs, notebooks, tablets and mobile phones," Botelho said.

"It can be applied to virtually all critical asset types in a mining plant, removing traditional information silos and creating a single focal point," he said. "It is ABB's top solution in asset management applications and has modular, compatible and expandable features."

The system can help a miner transform maintenance operations from being driven by abstract deadlines to being driven by condition-based monitoring, he said.

Bridging the Chain Knowledge Gap

U.S. Tsubaki reported the ProService chain and lifecycle support package increases the reliability and lowers the operating costs of Tsubaki solutions.

"It is composed of a unique and comprehensive portfolio of technical and field support resources that have proven to foster reliable and predictable chain and sprocket performance," said Mike Darragh, senior product manager, conveyor chains, U.S. Tsubaki Power Transmission. "Tsubaki will build the ideal chain for an end-user's project, optimize it as their needs change, and proactively assist in its performance throughout its entire lifecycle."

The core services include system optimization, installation support, inspections, wear analysis, performance tracking and personnel training. Benefits include improved reliability, lower cost of ownership and predictable performance, the company reported.

"Tsubaki ProService provides end-users the proactive resources necessary to ensure they get the maximum value and performance out of their chain and sprocket systems," Kris Ferguson, field engineering manager, conveyor chains, U.S. Tsubaki Power Transmission, said. "This is often referred to as the Tsubaki difference."

The offering arose as data from the field showed that general knowledge of mechanical chain systems was on the decline throughout the industry. "Over the last decade, Tsubaki diligently surveyed its customer base and studied the root causes of customer-reported issues and complaints," Darragh said. "In virtually all cases, poor installation or maintenance practices had led to the demise of the supplied product."

Tsubaki solutions typically have a higher upfront cost but a lower overall total cost of ownership due to superior quality. "Yet in order to achieve this, the product must be properly specified, installed, and actively maintained," Ferguson said.

"In order to safeguard the true value of Tsubaki, a technical field service team or professional service offering was needed," he said. "It had to be a lifecycle-engagement program, an embedded partnership."

Since launching, the program has been "very popular" and "has delivered substantial success," Darragh said.

"Feeder breakers, bucket elevators and stacker reclaimers are the typical production-critical applications that our engineers are involved with on a day-to-day basis," he said. "Challenging applications within synthetic gypsum, coal, gold, copper, molybdenum, pet coke and fly ash are the very installations that Tsubaki ProService was built for."

With the customizable program, service cycles are rendered reliable, predictable and trackable. Such pays dividends, Ferguson said.

"In many cases, service lives have gone from a year or less to greater than five years," he said. "Not only does lifecycle duration increase, but overall throughput and productivity also typically elevate."

Also, with the program, U.S. Tsubaki evolved, Darragh said. It proved to be "the catalyst that has taken Tsubaki from a traditional reactive product supplier to a proactive and comprehensive lifecycle solution provider," he said. "Tsubaki's commitment to a customer goes far beyond the product itself."

Effectively Removing Carryback

Martin Engineering reported the CleanScrape Secondary Cleaner (CS2) was designed for longer life, low maintenance and safer servicing. "The system represents a revolutionary concept that delivers superior cleaning and up to four times the service life of conventional designs, with half the maintenance," said Dave Mueller, conveyor product manager, Martin Engineering. "The combination has been shown to remove as much as 99% of the carryback in most belt-cleaning applications."

CS2 can be used with any primary cleaner, but was engineered to be used with the company's original CleanScrape Primary Cleaner. "When used together, they form a rugged, low-maintenance system that effectively removes carryback, helping to prevent fugitive material and the associated cleanup," Mueller said.

The solution is ideal for challenging applications, including those defined by space limitations. It "is particularly effective in conditions where continuous production is a high priority or cleaner service is difficult," Mueller said.

It typically requires only one re-tensioning, ever, and "the extremely low maintenance requirements and outstanding cleaning ability help reduce the cost of ownership," he said.

CS2 is made of stainless steel. The carbide blade tips have a small corner radius to protect against belt damage. Each is on spring-loaded arms. "The load springs allow independent blade rotation back and forth, as well as up and down," Mueller said.

"This range of motion provides equal load pressure across each blade, bypassing obstructions and conforming to ever-changing belt undulations," he said. "The unique design holds the blade in an effective

CleanScrape Secondary Cleaner is meant for challenging applications, including those defined by space limitations. With stainless steel construction and carbide blade tips, it typically has to be re-tensioned only once. (Photo: Martin Engineering)

cleaning position but allows the blades to retreat for reversing belts or rollback."

The negative rake angle reduces wear on the belt cover. "With the negative rake angle, CS2 delivers outstanding performance, while mitigating the potential for belt damage," Mueller said.

The solution is designed to shed removed material, which falls back into the cargo flow. "This 'free flow' design, with an absolute minimum of exposed surface area, delivers optimum cleaning results while allowing material to pass through the arms," he said.

It requires minimal space, and can be installed inside or outside discharge chutes.

The solution is also available in a Safe-to-Service configuration. It can be serviced by simply sliding it out on a track. "Because the cartridge extends outside the conveyor path, maintenance or blade replacement can be performed without confined space entry, helping to minimize the hazards to staff," Mueller said.

CS2 furthers the company's mission to make bulk material handling cleaner, safer and more productive, he said.

"The company operates under the assumption that safety should be designed-in whenever a new or improved product is being considered," Mueller said. "Every component that the company supplies is engineered with this in mind."

Improving Particle Size Distribution

Hexagon's mining division reported a customer in Peru using HxGN Split-ConveyorCam and other HxGN Split solutions improved particle size distribution (PSD), mill energy consumption and mill throughput.

"The open-pit mines saw a $7.5 million per month revenue increase thanks to the use of HxGN Split fragmentation analysis technology," said Brian Norton, director, business operations, HxGN Split, Hexagon Mining.

Split-ConveyorCam is a "monitoring system employing image processing technology for particle size, shape and color for any conveyor belt or feeder location," Hexagon reported. It gives "an automatic online measurement of the PSD," Norton said. Such "immediate feedback" can be used to manage and improve crushing, screening and milling.

PSD can be used to "ensure the operation is crushing and sizing to the desired specifications," Norton said.

"Split-ConveyorCam provides information for control of crusher settings and information on the integrity of screen decks," he said. "An operator can manually adjust crusher settings based on crusher product readings, and can know when a screen deck is malfunctioning and passing out of spec rocks."

PSD can help in identifying needed crusher maintenance, and can be used in technical calculations for improving the energy consumption of a comminution circuit, Norton said.

The image-processing and rock-sizing algorithms used by the technology were first developed by the University of Arizona in the mid-1990s. "Split Engineering was founded in 1997 with the objective to commercialize the software and systems for the worldwide mining industry," Norton said. "Hexagon acquired Split Engineering in 2019."

Hexagon adds value by installing HxGN Split solutions such that the customer can fully utilize and benefit from them. "We provide experienced engineers who come to your site to promptly design and commission a system, and will train your personnel how to use and maintain the system," he said.

Hexagon can also integrate a HxGN Split system into broader mine-management solutions, "which is in line with the greater Hexagon vision for an autonomous future," Norton said.

"PSD information from blasting is a great metric," he said. "But even greater value for the customer is easily, automatically connecting this information to the mine plan and design for further evaluation with the goal of continuous process improvement."

Currently, there are more than 550 systems installed for roughly 140 mining customers around the world.

Capturing Data on Idlers

Continental reported its autonomous conveyor idler and roller inspection service for open conveyors can help a miner improve maintenance planning and reduce downtime. The service uses aerial drones and sensors to inspect and detect failures, with results available online.

The drones are equipped with infrared and RGB cameras. The data are uploaded and then analyzed by software, with the results presented on a web app.

Drone flights can be done automatically or manually, the supplier said. "The data are uploaded while the drone batteries are being charged in the drone base station," said Clemens Panzer, project lead, conveying solutions, Continental.

"The data analysis algorithm automatically generates the results and identifies failing idlers," he said. "After charging and data upload are completed, the drone is ready for the next take-off."

The service allows miners to make better maintenance plans that target greater uptime.

Roughly 10% of unplanned shutdowns of conveyors stem from idler issues, the company reported. That has driven many miners to launch maintenance teams dedicated to idlers and rollers. Those teams often lack the technology to make data-driven decisions, Panzer said.

Historically, "maintenance planning has been based on inconsistent data, and puts the miner in a reactive position," he said. That means damage is often discovered too late. "Maintenance and repair work as well as cost-intensive downtimes are unavoidable."

Contrarily, Continental's conveyor inspection service allows the miner to be proactive. It enables a maintenance department to shift personnel away from inspection tasks and to the maintenance process. "Inspection quality will be increased thanks to higher inspection frequencies and more reliable data," Panzer said.

Typically one drone is able to inspect all of the conveyors at an operation.

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Maintenance Technology Advances Help Mines Predict, Plan, Prepare

Embedded sensor arrays, constant connectivity and rapid data analysis tools help maintenance organizations examine a machine's past, understand its present status and look into the future to avoid unplanned downtime

By Russell A. Carter, Contributing Editor

Like many other essential links in the mining chain, the nature of maintenance is changing. Industry-wide, there's a transition under way, at least philosophically, from conducting maintenance as a primarily reactive, localized nuts-and-bolts, boots-on-the-ground function focused on responding to wear-and-tear damage or sudden equipment failures, to one in which worker and machine connectivity, leverage of IoT capabilities and data analysis are becoming as important as a mechanic having the right wrench at the right time.

Although the industry has steadily expanded its maintenance perspective from time-based methods to more proactive, preventive and predictive strategies, its drive to implement better maintenance planning and performance strategies was kicked into a higher gear in 2020 by the urgent need to deal with severely constrained staffing/scheduling options, global travel restrictions and parts availability concerns related to the COVID-19 pandemic.

The economic pain companies may have endured during this period to inject novel solutions into maintenance planning and performance seems to be a price they're prepared to pay into the future. A recent report by GlobalData forecasts that interest in improving productivity and reducing downtime will lead to further investment by mining companies in predictive maintenance for both mobile and plant equipment in the next two years. A mine-site survey reveals that while more than three-fourths of surveyed mines have already made at least minor investments in predictive maintenance, 48% of those surveyed expect to either invest in the technology for the first time or invest further in the coming two years.

The report, *Global Mine-Site Technology Adoption Survey 2020*, noted that across the regions studied, predictive maintenance adoption was highest overall in Australasia, and this region is expected to see the highest levels of investment over the next two years, followed by the Americas. Regardless of where and to what extent companies will invest in maintenance, it seems likely that the structure and strategy of tomorrow's successful mine maintenance programs will be strongly influenced by several factors, including:

- Improvements in asset design, such as new products, features or capabilities introduced by equipment OEMs, service providers and other industry vendors.
- Advances in technical and practical support offerings, from maintenance planning and analysis software to "smarter" diagnostic equipment and tools.
- Organizational objectives that reflect the evolving role of the maintenance workforce in an increasingly digital world.

Here's a look at a few recent examples of each.

In addition to incorporating design changes aimed at reducing maintenance costs and improving efficiency, OEMs like Hitachi are refining machine-health predictive analysis capabilities that warn fleet operators in advance of potential equipment problems.

1 Rig, 2 Roles

Komatsu's recently introduced ZB21 underground bolting rig and ZJ21 jumbo drill rig illustrate how OEM design philosophy can concurrently simplify both operational functionality and machine maintenance. Both rigs are based on a common platform: the ZB21 bolter's inner boom can be swapped out for a drilling feed system, effectively converting it to a jumbo, and vice versa with the ZJ21; its inner boom can be changed out for bolting.

Komatsu pointed out that the common platform approach goes beyond just the attachment: the controls are similar as well. A hydraulic pilot control system with universal bolting and drilling controls simplifies user training and adoption across both models. Platform universality also provides advantages with job site efficiency, leveraging common parts, service and maintenance. Komatsu said it also re-engineered the feed system to enhance maintainability and productivity, with new lightweight polyurethane components add-

ed for flexibility. Timing ropes are identical lengths with common part numbers and come with a standard quick-attach feature to make changing the ropes easier in an underground setting.

The polyurethane hose drum is bearingless and the graphite-impregnated drum is self-lubricating. Guide strips have been designed with maintenance in mind: they are common from left to right and thicker than those on competing models, but use a slightly softer material to reduce cracking. A single technician with hand tools can change them out, according to the company. Diesel versions of both the ZB21 bolter and the ZJ21 jumbo are available now, while a battery option will be available sometime in 2021.

And in another design breakthrough, Komatsu also plans to introduce two new jumbo boom designs — one with only six hoses that will be commercially available in spring 2021, and a completely hoseless design that handles all fluid and communication transfer within the boom cylinder. The company said its ZJ32Bi jumbo with hose-free booms, which will be introduced at an unspecified later date, eliminates the need to account for hoses in its automation algorithms, and also eliminates wear between the inner and outer boom tubes.

Komatsu's new ZJ21 jumbo drill rig and ZB21 bolting rig feature a boom design that permits swapping of a drill feed system for a bolting setup and vice versa. The machines are based on a common platform that optimizes operator familiarity, maintenance efficiency and parts inventory requirements.

Cat Gears Up

As a maintenance-related benefit for high-volume surface mine operators, Caterpillar incorporated numerous improvements in component design and serviceability features into the latest version of its 90-ton to 120-ton-payload 7495/7495HF electric rope shovels. Among the major changes to the 2021 models are a new propel gear case that is claimed to offer nearly double the life of previous units in extreme operating conditions. The company said precise adjustments to gearing geometry and advancements in tooth hardening have enhanced gear case durability and productivity, resulting in lower total cost of ownership. An ecology drain simplifies oil draining and enables kidney-loop flushing, which reduces abrasion-causing contaminants and oil change frequency.

According to Cat, reconfiguration of the shovels' crawler carriage now allows drive shaft and tumbler replacement from the outboard side without removing the propel transmission. With this design, thrust loads are evenly distributed on large, tapered roller bearings rather than bronze thrust plates, increasing durability to align with 25,000-hour planned rebuilds, even in harsh environments.

Improvements to the swing mechanism include an upgraded third rail that makes access easier for inspection and retightening and adds support to the thrust rail during operation. New swing girder bushings and girder-to-chassis shim designs offer improved access, reducing service time.

The 7495 and 7495 HF shovels include as standard equipment Cat's Product Link Elite, which transmits critical machine operating data such as utilization, location and condition via cellular or site internet connection. And to further assist maintenance planning and efficiency, Cat now provides a full bill of materials for each model as an aid for streamlining the parts ordering process and improving parts availability.

Avoiding the Unexpected

In both surface and underground operations, an unexpected failure of a production machine can have mine-wide consequences: a track drill that breaks down in the pit and can't be moved might delay an important production blast, for example. Underground, getting repair parts to a broken scoop in a distant drift can take precious time, but having that rig fail while tramming in a main passage can clog operations on an entire production level, elevating the problem to a new order of magnitude. Both of those possibilities are strong incentives for mine management to know what condition a machine is in, either in real time or on a rapidly updated basis, and what's likely to fail first. Vendors such as Sandvik, Epiroc and Hitachi, among others, offer programs that can provide solutions to the problem in various ways.

Sandvik, for example, collaborated with IBM to incorporate IBM's Watson AI platform into its OptiMine Analytics information management solution, which leverages IoT and AI capabilities to enable real-time decision making, equipment failure forecasting and the ability to predict and simulate various options.

As explained by Sandvik, OptiMine Analytics, through visualization of Overall Equipment Effectiveness (OEE) — a measure, basically, of how much a machine is working effectively within a given time frame — intuitively pinpoints bottlenecks and areas for fleet improvement in terms of mechanical availability, utilization and the quality of its use by operators. From a maintenance standpoint, OptiMine Analytics can inform users about what it expects will occur regarding breakdown of key components throughout an equipment fleet, allowing a mine to efficiently schedule maintenance and optimize mechanical availability.

Meanwhile, Epiroc's RigScan audit service leverages various technologies to make the equipment audit process faster, less intrusive and more comprehensive, according to the company. Experienced technicians using thermal cameras can find early signs of wear or part stress invisible to the human eye, and unseen internal leaks.

The RigScan audit process is completely digital and conducted on a tablet, allowing the service to incorporate many functions into a single tool that stores images, videos, parts catalogs and equipment manuals. The audit process is tracked internally by the tablet and all data are recorded and fed back into a central server to ensure that nothing is overlooked.

Last year, Hitachi Construction Machinery Co. and its subsidiary, Wenco International Mining Systems, announced ConSite Mine to assist in identifying and resolving equipment problems by remotely monitoring surface mining machinery and applying IoT and AI-based analysis of equipment operational data. Detailed information from predictive alerts is provided on a web-based ConSite Mine dashboard.

In the ConSite Mine system, Wenco provides the IoT digital platform and software technology by which data are collected and displayed on a dashboard customized for each customer, while HCM leverages its expertise on applied analysis technology for structural parts of excavators and haul trucks.

ConSite Mine is an extension of the data-reporting system HCM originally developed for its construction machinery customers. HCM said it currently is piloting the mining-related technology in Australia, Zambia and Indonesia and will use customer feedback from the field sites to refine the system before its commercial release.

Hitachi said ConSite Mine, when released to the market, will offer:

- **Load Index,** an AI technology designed to monitor and predict the possibility of cracks in excavator booms and arms. ConSite Mine collects data from sensors on EX–7 series 190- to 800-ton excavators and analyzes cumulative loads of the boom and arm by utilizing AI and applied analysis technologies.
- **Pending failure of hydraulic pumps.** ConSite Mine will be able to detect signs that presage failure of hydraulic pumps on EX-7 series excavators and send alerts. HCM said applicable components will be added in the near future.
- **ConSite Oil,** an oil condition-monitoring service initially offered in the construction-machinery version and suitable for application to mining-class equipment. Sensors will monitor an excavator's hydraulic and lubrication systems, providing data that will enable evaluation of the fluids and associated components.

RCT's vehicle-mounted Smart Service Monitor alerts operators and maintenance personnel to an upcoming need for service, based on user-selectable parameters.

Getting Smarter

RCT, an Australia-based provider of mine automation and control solutions, introduced the Smart Service Monitor to expand the range of its Muirhead equipment-protection products.

The new expands upon the role of the original Service Monitor — a countdown timer used to indicate when a vehicle is due for service. That device has two stages of warning. The first stage, an amber LED, indicated that the service is due. The second stage, a red flashing LED, indicated that the service is 10% overdue. Both stages also activate an output that can operate a visual and audible alarm. The Smart Service Monitor has four warning stages.

According to RCT, the new monitor expands the capability of the basic device, which only gave an estimate on when a machine needs service, and delivers a more complete information system with data collected from multiple inputs. The new device "allows the monitoring of up to eight measurable components," RCT Mining and Resources Product Manager Mick Tanner said. "Information is power and having accurate information delivered in an easy and concise manner allows management to ensure machines and their individual components are serviced correctly, therefore significantly increasing machine availability and extending the lifespan of equipment."

RCT noted that, for example, the monitor could intelligently log engine run hours. By monitoring the RPM, the device can monitor time in idle and time in a work state off the same input. The counter can count up or down depending on what is required.

The monitor's expanded logging capabilities can help customers ensure that machine servicing is carried out when required to ensure optimal performance. According to the company, monitoring a specific machine component via the Smart Service Monitor only requires a frequency input, PWM input or a simple digital or analog voltage. The device is configured through an internal programming tool, using a WiFi-connected smart device, PC, laptop or cellphone. The connection is password-protected to prevent unauthorized changes or resetting of the device.

RCT also introduced a system designed to monitor operational and service data from an enterprise's light-vehicle fleet, an asset that generates significant maintenance demands but sometimes gets overlooked as companies focus on opex associated with their large production machines. The EarthTrack Light Vehicle Machine Monitoring delivers machine and operator data from multiple light vehicles across a site.

"It empowers management with the information needed to improve light vehicle operations to lower maintenance costs from damage, reduce unplanned maintenance and deliver an overall safer operation by encouraging better driving habits," said RCT's global operations manager, Dave Holman.

"We've had reports from some clients that they are seeing about $10K a month in damage due to vehicle abuse and driving conditions and that is on top of the programmed maintenance costs. So, the EarthTrack Light Vehicle Machine Monitoring aims at eliminating these costs," he said.

The solution is scalable and consists of automated reporting, operator login, pre- and post-start checklists, engine, speed and impact monitoring. The end-user receives an automated summary report on events and violations, early warnings on engine conditions to ensure preventative maintenance can be carried out. Reports can be delivered daily, weekly or monthly depending on preference.

The system, according to the company, can monitor as many vehicles as required with website access hierarchy. Companies can monitor an entire company fleet based on regions or sites if deployed at multiple locations.

The Human Factor

Futuristic scenarios envision machines diagnosing and repairing themselves, but successful mine maintenance organizations will

always need a human presence, including a workforce organized and trained to accommodate rapid technological advances.

For example, the role of maintenance managers could change significantly as companies eventually transition to AI-supported prescriptive maintenance methods in which the AI platform would not only monitor and recommend an overhaul for a pump based on temperature and vibration readings, but would also initiate a work order to authorize the repair and then oversee the workflow.

Maintenance teams might comprise a variety of specialists ranging from on-the-spot repair technicians — the "first responders" — to 3D printing specialists trained in industrial design and rapid parts production. As mine equipment design trends move increasingly toward modular design concepts, a core of highly skilled maintenance technicians might be supported by a growing number of generalist workers qualified to perform "plug and play" repairs and tasks of a general nature.

In the current environment, the pandemic-induced inability to allow maintenance teams and specialists to travel freely to mine sites as needed has increased focus on the use of mixed-reality technologies that allow off-site engineering and maintenance teams to observe and instruct on-site crews during equipment installations, repairs and inspections. Travel restrictions prompted BHP, for example, to initiate a program in mid-2020 it calls Remote In, Remote Out (RiRo) for maintenance support at its Western Australia Iron Ore operations.

The core of the program involves an expedited collaboration with Microsoft to outfit mine maintenance workers with the HoloLens 2 — a head-mounted computer with a see-through display running Microsoft's Dynamics 365 Remote Assist service, which allows off-site supervisory personnel or consultants to immediately see what on-site workers can see, send needed documentation, videos and schematics on the fly, and use digital ink and arrows to annotate real things in the physical world in order to help complete tasks and inspections on remote sites.

In a similar vein, last November, Hexagon's PPM division announced it was continuing to advance development of interoperability between its Xalt Connected Worker solution and RealWear's HMT family of wearable, hands-free devices.

Hexagon's Xalt | Mobility is a cloud-based enterprise software platform designed to allow users to quickly build robust mobile workflows to solve daily challenges. Its technology connects with a customer's existing enterprise applications, systems and sensors providing front-line workers with necessary data from a single app. Through this approach, said Hexagon, maintenance teams can have real-time access to current work orders, maintenance history, associated engineering documentation, manufacturers' schematics, permits, safety documentation and best practices. Data integrity, smoother operations and dramatically reduced administration costs are ensured with low initial overhead, according to the company.

RealWear's voice-enabled headset solutions allow workers to remotely perform live inspections via two-way video as supervisors watch on a laptop.

This approach to maintenance-related digital workflows is designed to optimize a technician's "time on tool," according to Hexagon, and improve important metrics such as Mean Time to Repair (MTTR), First Time Fix Rates (FTFR) and overall reliability.

Informed Gear Oil Selection Can Help Reduce Mining Equipment TCO

By Gabriela Fedor, Thomas Schimmel and Frank-Olaf Mähling

Gearboxes used in mine equipment of all types must deliver reliable production, often in extreme environmental conditions. Selecting the right gearbox oil for the application is essential for ensuring optimal performance.

Equipment maintenance is a potentially high cost factor in a mining operation, especially when it comes to unexpected machine shutdowns. Many operations are trying to avoid case-by-case solutions in favor of a more cohesive strategy for maintenance planning. Selecting high performance gear oils is an example of how an integrated approach can benefit mining operations globally, taking into account total cost of ownership (TCO) as well as the cultural shift toward collaboration and improved performance through comparative data analysis.

Lubricants on average account for less than 5% of overall maintenance costs. However, lubrication issues may contribute to as much as 75% of all equipment failures. Improving lubrication practices can cut maintenance and repair costs by up to 30%, according to a recent study commissioned by Shell Lubricants. Obviously, a failure to incorporate lubricants into TCO assessments means miners are leaving money on the table. Shell Lubricants, for example, documented customer savings of $55 million from 2011 to 2016 by working closely with mine operators to develop an integrated maintenance and lubrication strategy as part of an overall TCO approach. The Shell study underscored how collaboration with suppliers can lead to cost savings and an improved integrated strategy.

Yet, many companies fail to recognize the critical role of lubricant selection and application in reducing their TCO for various types of equipment. Mining is a major consumer of industrial gear oils globally, so there is good reason for the industry to pay attention to the positive impact high-performance gear oils can have on equipment life and their importance to minimize potential disruptions during production.

Selecting the proper oil for a specific application, however, is not always a simple process leading to one correct answer. The solution usually involves trade-offs — but buying inferior or improper gear oil may actually increase costs rather than save money. First, let's take a look at what gear oils are meant to accomplish and what types of oils are currently available on the market, taking into account new developments and options for achieving the optimum cost-benefit solution.

Performance Requirements of Gear Oils

Basic functions of gear oils in mining applications include reducing wear and friction, dissipating heat, inhibiting rust and corrosion, flushing contaminants, and reducing noise, vibration and shock. Gear oils must protect a gear set from pitting, spalling, scuffing, scoring and any other condition that can lead to premature failure of gear teeth or bearings. Other important properties include satisfactory viscosity at operating temperatures, oxidation resistance, high thermal stability, pressure resistance, foam suppression, compatibility with various alloys in some cases and an ability to demulsify so that it is easier to remove water from the gear box.

Gear oils can be mineral-based or synthetic, with mineral-based gear oils currently accounting for about 90% of the market. Within the mineral oil-based gear oil category, there are variations in performance and price depending on the formulation. Oils used in conditions that are considered demanding in terms of temperature, load and speed are usually formulated using additive chemistry. Mineral-based industrial gear lubricants have trade-offs related to high operating temperatures in certain applications, including heavy-duty applications within the mining industry.

Synthetic gear oils are mainly based on polyalphaolefins (PAOs), polyglycols or ester oils. Despite their superior performance, their usage has been mostly confined to specific gear systems such as wind turbines or other equipment with difficult maintenance accessibility and/or high temperatures. However, they do represent a highly attractive market with an annual growth rate of 5%, with the strongest growth projected for the European market.

Synthetic oils with high viscosity index numbers exhibit reduced friction and churning losses at colder temperatures resulting in improved mechanical efficiency. Increased film thickness at

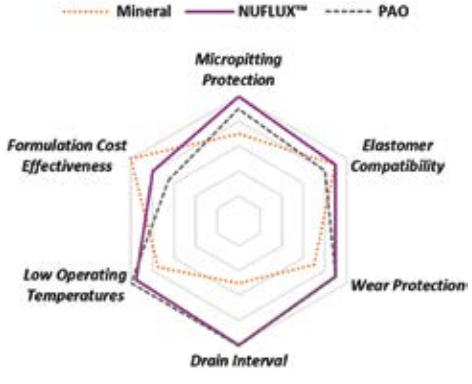
warmer temperatures results in improved overall equipment protection.

Protection at a Reasonable Price

Evonik Industries, a specialty chemical company, does not supply gear oils or lubricants directly to end users but works with all major formulators. The company believes that awareness by mine operators and OEMs of new oil formulations is an important step in enabling customers to make more informed decisions when dealing with their lubricant suppliers. Evonik's additives specialists have developed a high-viscosity synthetic base stock — a durable fluid foundation for specialty additives, which allows formulators to work with a number of low-viscosity base stocks. Evonik's NUFLUX formulation has been developed in combination with highly refined Group III base oils, providing a cost-effective solution without compromising the superior performance offered by synthetic fluids.

NUFLUX formulations equal or outperform established synthetic gear oils with respect to efficiency, durability and wear protection, at lower total production costs. They are approved by leading gearbox OEMs and meet various international and national standards including DIN 51517-3, ANSI/AGMA 9005-F16, ISO 12925-1 (CKD), AIST 224 (previously US Steel 224) and IEC 61400-4. NUFLUX was tested according to the most stringent specifications in the industry. It is highly suitable for price-sensitive, high-tier applications where other synthetics are too expensive and for applications where mineral-based oils cannot achieve the desired performance.

The core of NUFLUX technology is VISCOBASE 5-220, a high-viscosity synthetic base fluid with high-shear stability and viscosity index. When combined with low-viscosity mineral or synthetic base stocks, it provides a highly durable fluid foundation for specialty additives and flexibility to work with different chemistries. VISCOBASE 5-220 offers favorable polarity that can eliminate the need for different compatibilizers even in fully synthetic formulations with PAOs.



Performance rating of ISO VG 320 gear oils based on mineral, Polyalphaolefin and NUFLUX technology.

Trials conducted on this test rig at a coal mine in Germany provided results indicating that NUFLUX gear oil formulations can provide protection equal to more expensive fully synthetic gear oils, at a reasonable cost.

A direct comparison of performance of NUFLUX with conventional mineral gear oil and PAO-based gear oil is shown in the accompanying figure. Elastomer compatibility and micro-pitting performance are setting new benchmarks for the industry.

A controlled field trial at RAG's coal mine in Bottrop, Germany, provided an indication of the performance advantages of NUFLUX formulations. A test rig was built with two three-stage bevel-spur commercial gearboxes typically used on conveyor systems in mining applications, a 400-kW motor and a brake. One gearbox served as a slave and was filled with mineral oil and the other gearbox was filled with the lubricants being tested, which were changed after three test runs. The load was applied in three different stages: 0% (to monitor churning losses), 30% and 50% (limitations in load stage given by motor capacity). The entire rig was enclosed during testing to minimize the effects of changes in ambient temperature while generating the data set.

The tested fluids were divided into VG 320 and VG 220 series: mineral and PAO-based (both commercial products readily available on the market), NUFLUX VG 320 and VG 220 (VISCOBASE 5-220 and Grp III oil), and a fully synthetic NUFLUX SYN formulation with VISCOBASE 5-220 and PAO base stock. Four temperature sensors were installed and monitored on the gearbox, two of them of major importance: oil sump temperature and water-cooled input shaft-bearing temperature.

With respect to oil sump temperatures, the difference between mineral and synthetic fluids was approximately 10°C, which has a major impact on oil drain intervals and is considered significant for equipment performance and protection. Furthermore, in viscosity grade 320, it was confirmed that both NUFLUX formulations performed at the same level as common PAO formulations.

The impact on input-bearing temperatures was equally significant. Mineral fluids had a tendency to reach 10°C-13°C higher bearing temperatures than synthetic fluids and NUFLUX formulations. All three NUFLUX formulations outperformed mineral reference fluids by 9°C-13°C and showed equal performance when compared to the reference PAO-based fluid.

Lower gear oil operating temperatures contribute to a slower oxidation rate, approximately by a factor of two. From the overall system durability perspective, cooler gearbox operation contributes substantially to increased protection of gears, bearings and elastomers, and directly translates into prolonged oil drain intervals, lower downtime and maintenance costs.

Gearbox efficiency also responds to minimal changes in viscosity over the wide range of operating temperatures. NUFLUX formulations with a viscosity index above 160 ensures sufficient equipment protection, while contributing to the overall mechanical efficiency of the whole system.

NUFLUX is a new formulation technology that achieves a high performance level of fully synthetic industrial gear oils while allowing for reduced formulation costs.

Gabriela Fedor, Thomas Schimmel and Frank-Olaf Mähling are with Evonik Resource Efficiency GmbH. For more information, visit www.evonik.com.

Load Volume Scanner Gains More Acceptance

Underground mining truck passing under a Loadscan LVS system in New Zealand.

Loadscan CEO Carey West believes that 2020 marked a turning point in the market, where load volume scanning technology achieved mainstream acceptance as an accurate load measurement system.

So much so that Loadscan closed 2020 with a record order book. They noted a marked increase in global inquiries across all target industries, with mining and civil construction leading the way. A commonly stated requirement was to cost-effectively increase productivity and maximize operating profits. With the tightening economic conditions, mines have been forced to re-evaluate every aspect of their business, ensuring that production assets are optimized.

Results of numerous load audits conducted by Loadscan, as well as feedback from current customers, suggest that trucks are often underloaded by between 5% to 15%. Loadscan's original patented Load Volume Scanner (LVS) helps mines to optimize loading by maximizing every load, thereby increasing trucking factors and improving profits.

Sandvik Acquiring DSI Underground

Sandvik Group is acquiring DSI Underground from Triton Investments. The ground support solution supplier will join Sandvik's Mining and Rock Solutions business area.

With the acquisition, Sandvik will gain DSI Underground's 22 production facilities, and will grow its range of offerings.

DSI Underground said the company will fit "very well" with Sandvik. "With our knowledge of ground support technologies, we can add a valuable and complementary offering to Sandvik Mining and Rock Solutions," DSI Underground CEO Michael Reich said. "At the same time, we will be able to expand our global reach and combine our offering with Sandvik products and services for the benefit of our customers."

DSI Underground has 1,700 employees in more than 70 countries. It offers anchor systems, injection resins, pumpable injection chemicals and forepoling systems.

Hexagon Installs CAS at Ghana Mine

More than 220 mine vehicles were equipped with Hexagon Mining's MineProtect Collision Avoidance System (CAS) at Gold Fields' Tarkwa mine in Ghana's western region, the supplier reported.

MineProtect's Operator Alertness System, Personal Alert and Tracking Radar were installed with minimal delays, despite pandemic lockdowns. Local partners and technology, such as remote body cameras, helped the installation and training stay on schedule, Hexagon reported.

Willingness to embrace change was key to the successful installation, Hexagon reported. "The resourcefulness displayed by everyone involved was impressive," said Andrew Crose, vice president, autonomous, Hexagon's Mining division. "It ensured that we completed the project with minimal delays."

LKAB Buys More Epiroc Machines, Services

LKAB ordered Scooptram ST14 Battery and Minetruck MT42 Battery machines, and Batteries as a Service for the Konsuln test mine. The order stems from the Sustainable Underground Mining collaborative project. Both companies participate in the project, and it gives the miner early access to battery machines.

"The alliance allows us to test several applications in a controlled fashion providing high confidence regarding the design of future CO_2-free mining," said Thomas Kammerby, senior project leader.

The order will be delivered in 2021.

Epiroc plans to offer its entire range of equipment as battery-electric versions by 2025.

LKAB orders Epiroc's MT42 Battery truck for Konsuln test mine. (Image: Epiroc)

DeZURIK to Acquire Red Valve

DeZURIK announced plans to acquire Red Valve from Hillenbrand Inc.

DeZURIK reported the move furthers a strategic initiative. "Red Valve's brand reputation and diverse product line complement the broad DeZURIK lineup and provide new opportunities to solve customer's most complex challenges," Bryan Burns, president and CEO, DeZURIK, said.

Red Valve makes elastomers, pinch valves, check valves and engineered mix-

ing systems. DeZURIK makes valves, and acquired APCO and Willamette in 2011, and HILTON Valve Inc. in 2012.

Yohohama Off-Highway Tires America Launches

Yokohama Rubber Co. Ltd. changed the name of subsidiary Alliance Tire Americas to Yohohama Off-Highway Tires America Inc. (YOHTA). The move is part of an effort to consolidate the off-the-road tire business brands that Yokohama Rubber acquired from Alliance Tire Group four years ago.

The development involves a new corporate identity and logo for the renamed brand, as well as a new website, yokohama-oht.com, and new apps.

The new company combines Alliance Tire Americas' four U.S. warehouses with two Yokohama distribution facilities in Ohio and Georgia, USA. YOHTA is based at the Alliance Tire Americas headquarters in Massachusetts, USA.

Horton Opens Carolina Facility

Horton Inc. announced its new 112,000-ft^2 facility in Oconee County, South Carolina, is fully operational.

The plant will add 125 jobs to the area. It will produce fans for equipment, and includes an e-coat line, a powder coat booth for custom component coloration, an injection molding machine, and several robotic solutions.

The company said the new facility was a major investment in a mission to remain the world leader in thermal management. "Our company was founded on the principles of innovation, customer service and family values," Horton Vice Chair Terry Gilberstadt said. "We chose Oconee County because we see those same values in our new employees, neighbors and friends here."

Whitmore, Shell Form JV

Whitmore Manufacturing and Pennzoil-Quaker State Co. formed a joint venture named Shell & Whitmore Reliability Solutions to market, distribute and sell lubricants, greases, coolants, reliability products and related services.

Whitmore is a subsidiary of CSW Industrials. Pennzoil-Quaker State is a subsidiary of Shell Oil Co. Each owns a 50% stake in the joint venture, which will offer expertise, equipment, services and an integrated product portfolio.

The production assets will be co-located at Whitmore's Rockwall, Texas, facility.

A desire to satisfy customers drove the creation of the joint venture, Shell reported. "The resilient B2B sectors are key pillars for the future of Shell Lubricants, where we see a lot of opportunity for growth to support the market," Machteld de Haan, president, Shell Lubricants Americas, said.

Ritchie Bros Acquires Rouse Services

Ritchie Bros. completed the acquisition of Rouse Services, a provider of data intelligence and performance benchmarking solutions. The two seek to enhance the data analytics and service offerings available, Ritchie Bros. reported.

Beyond data and analytics, Rouse Services offers equipment sales support and fleet appraisals. Both services will continue under Ritchie Bros. and Rouse will remain in Los Angeles, California.

CEFA Sends LNG to Oz Mines

Global infrastructure fund I Squared Capital acquired Perth-based Clean Energy Fuels Australia (CEFA) and is backing it to develop an Energy Transition Platform for reducing the carbon footprint of mining operations in Australia. The platform could invest up to $500 million on assets providing low-carbon and renewable solutions, CEFA reported.

The Energy Transition Platform will offer an integrated solution to remote mining customers that will include end-to-end logistics for liquefied natural gas (LNG) solutions for replacing diesel with LNG, re-deployable solar solutions and green hydrogen solutions.

Silver Lake Resources' Deflector gold mine is the first customer adopting LNG infrastructure and solutions, CEFA reported. "In addition, CEFA has secured a site in Port Hedland, which will serve as CEFA's second LNG Hub in the Pilbara region," Romano Bernhard, managing director, CEFA, said. "CEFA aims to build modular and flexible LNG liquefaction plants with cumulative capacity of up to 200,000 metric tons per year."

Motion Opens New Shop

Motion Industries Inc. announced it will operate under the brand name Motion with the logo "Mi." The rebranding coincides with the company's 75th anniversary.

Motion Industries Inc. rebrands as Motion with the logo 'Mi.' (Photo: Motion)

Separately, Motion held a groundbreaking ceremony at the site of its planned shop facility in Irondale, Alabama.

When completed, the $11.2 million 104,000-ft^2 building will house Motion's area fluid power shop, hose and rubber shop, and engineering department. Capabilities will include fluid power component repair and fabrication, power unit fabrication, machining, hose kitting and assembly, and engineering design.

The new facility will help the company grow, Motion reported. "The main reason for the investment is to strengthen our position and provide the best customer service possible," President Randy Breux said.

MTU Plant Celebrates 10 Years

Rolls-Royce reported its MTU Aiken manufacturing facility is celebrating its 10-year anniversary.

The 395,000-ft^2 campus, which produces off-highway MTU-brand diesel engines, opened in fall 2010 after the company decided to move manufacturing from Detroit to Graniteville, Aiken County, South Carolina. The facility began initially assembling MTU Series 2000 and Series 4000 diesel engines. Later it brought on machining operations, allowing it to machine its own components on-site.

The decade was defined by a spirit of innovation, leadership at the plant said. "We have continually challenged ourselves to take on the next program or develop the next competency, all with a focus on developing our people and our community along the way," said Joerg Klisch, director of operations at the plant.

Asset Management Plan Cuts Maintenance Costs at Tronox Mine

Working closely with the customer, a Weir Minerals team designs a plan to keep crucial production assets such as this mineral-sands dredge in top shape, reduce overall maintenance costs and improve productivity.

Weir Minerals has successfully implemented a total asset management plan at the Tronox mineral sands mine in Cooljarloo, Western Australia. Under this arrangement, Weir is tasked with managing 20 assets, including slurry pumps at the plant, two floating dredges and a floating concentrator, which processes more than 3,000 metric tons per hour of heavy mineral concentrate.

"The Weir Minerals team worked closely with Tronox to determine what their goals and vision for their mine were. The team then developed a tailored Total Asset Management plan, which aimed to look after the customer's assets, improve their wear life and keep the mine running," said Daniel Fleckhammer, Weir Minerals director.

Weir Minerals said the asset management plan has helped Tronox reduce maintenance costs by 10%, unplanned maintenance by 30% and also enabled the company to transition from a six-month to an eight-month shutdown cycle, which will save the mine more than $1 million on maintenance costs each year. This increased reliability is potentially worth more than $1 million annually in additional productivity, according to Weir.

Dave Netherway, maintenance manager, Cooljarloo, said, "Under the Total Asset Management Plan we have with Weir Minerals, we pay on cents per ton based on the throughput through the plant. Weir has skin in the game with the way we operate."

An on-site Weir Minerals team is poised to perform crucial maintenance and gain vital insights into the customer's issues. Weir said a clear set of KPIs, developed in conjunction with Tronox, makes it possible to improve both savings and asset reliability.

New Flotation Cell Offers Improved Recovery and Lower Opex

Maximizing the sustainable recovery of minerals has become a critical success factor at a time when the efficient recovery from less rich ores, aging or secondary deposits is one of the mining industry's key challenges. TAKRAF Group, known for its Delkor brand of liquid/solid separation and beneficiation equipment, recently introduced new-generation BQR flotation cells with the proprietary MAXGen mechanism, claimed to provide best-in-class performance.

TAKRAF said the MAXGen mechanism — a product of extensive bench scale tests, 3D prototyping, pilot scale studies and plant scale trials — offers superior recoveries with higher mineral grade, along with faster flotation kinetics by generating favorable bubble size distribution and energy-efficient hydrodynamics. A unique rotor/stator configuration enables the rotor to operate at a lower tip speed, providing reduced power consumption and wear.

According to the company, the MAXGen flotation cell also offers additional features that address practical concerns related to installation, maintenance and operation of flotation circuits, particularly in existing concentrators. For example, its "bypass-ready tank design" allows for installation and upgrading with cell bypass systems at any stage, without compromising the original layout and without modification to the tank shell. This flexibility makes adjustments faster and cheaper, enabling operators to continually optimize flotation bank setup over time.

The new flotation cell incorporates deeper launders with higher slope to help evacuate froth quickly. Cells can also be customized with various optional external, internal and radial launders to suit specific froth transport parameters based on the application.

TAKRAF says its MAXGen flotation technology was developed by careful selection of a trade-off between the agitation levels and the bubble distribution to facilitate flotation of fine and coarse particles equally, efficiently keeping solids in suspension which, in turn, maximizes the probability of bubble-particle interaction.

Digital Ore Sorting Gives Deeper Insight Into Process Efficiency

Tomra, a provider of advanced collection and sorting systems, now offers the benefits of Insight digital sorting to the mining industry. The company said the Black chrome mine, an asset of the Sail Group in South Africa, is currently using the technology, supported by a local Tomra service team.

Tomra described Insight as a subscription-based service that turns sorting machines into connected devices that generate valuable process data. The data are gathered in near real-time, stored securely in the cloud, and can be accessed from anywhere and across plants via a web portal available for desktop and mobile devices. For the Black chrome mine the platform is, in an early trial-stage period, being managed by Tomra's service manager, Dean Labuschagne.

"The ability to remotely monitor all sorting activities, using a single interface, is particularly interesting for our customers in the mining industry," Labuschagne said. "With big distances between headquarters and mining site, this is exactly what companies such as Black need to build a better collaboration between management and operations."

"Mineral processors can now move from making decisions based on experience and local observations to decisions based on experience and hard facts," he continued. "This means Tomra Insight can help reduce waste rock and downstream processing costs, enabling processors to earn more dollars per ton.

"With TOMRA Insight, you have the ability to know exactly what your sorter is doing at any given time. Is it running? Is it running with or without feed? Are we feeding under- or oversized material? Do we need to intervene? The digital sorting dashboard captures and visualizes a wide variety of valuable performance metrics."

According to Tomra, even in this early stage, data-driven optimization projects such as the one at Black show the mining operations' cost-efficiency can be significantly improved. Downtime is reduced by monitoring machine health and performance in near real-time, identifying gaps in production and analyzing potential root causes. Maintenance management is made easier by moving to predictive and condition-based maintenance, and by preventing unscheduled machine shutdowns. Throughput is maximized by evaluating material grade variations and optimizing sorting equipment accordingly. And sorting to target quality is enhanced by having accurate material composition data, which enables decisions to be based on more detailed information.

Tomra Mining said it is working closely with customers to further development of TOMRA Insight and plans to add more features and functionalities, which customers will automatically receive as part of their service level agreement.

Labuschagne concluded, "I am convinced that digital sorting metrics generated with Tomra Insight will rapidly grow into a strategic management tool with benefits from mining site to boardroom. A well-documented view of the sorting data will become an indicator for the mine's overall performance. And, a better insight into the volume and grade of both the deposit and the yield will become a determining factor for a more adequate mine management."

Upgrades to Shovels Increase Efficiency

Caterpillar reported more than a dozen significant standard feature upgrades to the 7495 Electric Rope Shovels that combine to increase operating efficiency by up to 10%. Component enhancements, increased frame durability and improved serviceability help reduce the cost per ton of material moved by as much as 15%, the company reported.

The list of upgrades include several new parts and technologies.

A new propel gear case offers double the longevity. Adjustments to gearing geometry and advancements in tooth hardening enhance gear case durability and productivity. The result is lower total cost of ownership by as much as $8 per hour, Cat reported.

Updates to the AC electric-drive system deliver greater reliability, improved maintenance access, enhanced safety, and expanded high-altitude and temperature capabilities.

Reconfiguration of the crawler carriage allows drive shaft and tumbler replacement from the outboard side without removing the propel transmission.

HydraCrowd, a new adaptive control system, comes standard and offers up to 25% cost savings on the ACS valve.

An array of technologies can help improve operator performance. Operator Assist comes standard and simplifies operation. Product Link Elite comes standard and transmits critical machine operating data such as utilization, location and condition via cellular or site internet connection. It can be linked with MineStar Fleet. Also available is MineStar Terrain for guidance and MineStar Health for analytics on machine health and operating data.

These upgrades and many more speak to the company's commitment to meeting customer needs, Cat reported. "Many of these improvements are compatible with shovels in the field, so customers can realize these gains through upgrades to their existing fleets as well as new machine purchases," said Dan Wyatt, product value stream manager, electric rope shovels, Caterpillar.

www.cat.com

Loaders Deliver High Productivity

Sandvik Mining and Rock Solutions introduced the Sandvik DD212, a compact and intelligent single-boom electrohydraulic drill for tunneling and mining development in narrow vein drifts. The drill is an upgrade of the Sandvik DD210, and will deliver a high level of productivity and a low cost of ownership, Sandvik reported.

The DD212 delivers up to 20% reduction in boom positioning time per face, and 15% improvement in drill penetration rate. Its 3% improved pullout ratio can result in up to a 10-cm-greater advance per face over similar equipment, Sandvik reported. During testing, the solution reached 93% mechanical availability, accumulating 300 hours percussion within 2.5 months of operation.

The drill features the THC562 drilling control system, with torque control and reaming hole selection; and a new intelligent boom with electronic hole positioning, Sandvik reported. The 1-m boom extension and two narrow-vein rotation actuators offer large face drill coverage, from 6 m^2 to 25 m^2. The DD212 has an extended TF feed for a 12-ft rod. The RDX5 rock drill provides fast drilling cycle time and low operating costs, Sandvik reported.

For multipurpose operations in 2.5 by 2.5 to 3.5 by 3.5-m drifts, the DD212 delivers accurate face drilling, cross cutting and bolting.

www.rocktechnology.sandvik

Connectors for Electronic Dets

E*STAR Connectors have an all-weather resistant seal, anti-slip contours, a flip-top hinge, and are easy to handle while wearing gloves, Austin Powder reported.

Duplex bus line wire eliminates the need to split wires when making a connection, which is instead made by placing the duplex wire into the connector, in any polarity, and snapping the lid shut. The connectors offer double-connect capability and allow eight points of contact on the detonator leg wires and eight contact points on the bus lines.

www.austinpowder.com

Starter, Alternators for Harsh Mines

Leece-Neville reported the award-winning PowerPro Extreme 10 starter and IdlePro Extreme alternators are field tested in some of the harshest mines around the world. The units deliver industry-leading starting power and output, and can be installed by one person, the company reported.

The PowerPro Extreme 10 starter offers 10.5-kW starting power, weighs 16.3 kg, can operate at temps between 125°C and -40°C, is suitable for both wet and dry clutch applications, features a rotatable flange and radial bell housing seal, and works on a range of OEM engines.

The IdlePro Extreme alternators offer up to 275 amps, weigh 17.7 kg, can operate at temps between 125°C and -40°C, and features isolated ground technology, dual-cable terminals positioned laterally and axially, and a heavy-duty housing design.

The company said the solutions deliver cost savings and dependable, long-lasting power.

www.prestolite.com

Drill hole Deviation Measurement

Carlson Software announced the Boretrak2 borehole deviation measurement system is simple to use and can measure boreholes in any inclination. With Carslon Scan software, it can check the accuracy of drilled holes and their deviation from design.

It can be used in audits, to record and visualize drilling data, and to proactively address risks and challenges, Carlson reported. Benefits include optimized blasting, in-field report generation, and support for data-led decision making.

The system can be used by one person. It is designed for use in extreme environments, and is resistant to water and magnetic interference.

Boretrak 2 can be used in both surface and underground operations.

www.carlsonsw.com

Tests Prove Button Bit Performance

Robit reported field tests demonstrated the Rbit button bits, "manufactured with recyclable 100% Green Steel," offer superior drilling performance. The tests proved the bits offer better flushing and longer grinding intervals, the company reported.

The Flat Face model has an optimized button layout for maximized rock contact and energy transmission. It and the Drop Center model have an enhanced flushing design for a faster rate of penetration. Redesigned wider retrac grooves allow more space, delivering a better flow for the cuttings.

www.robitgroup.com

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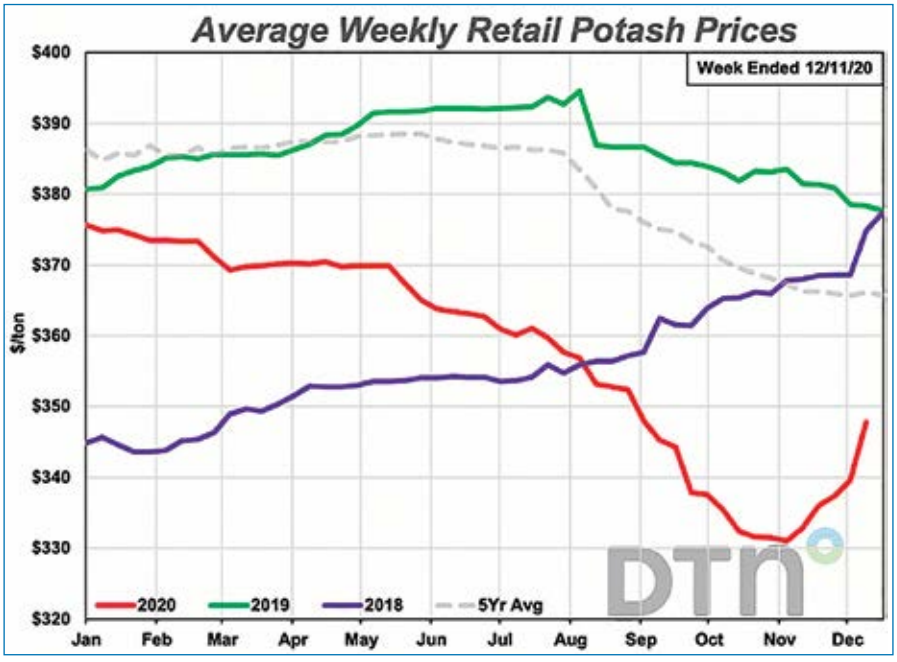
Potash Prices Move Higher

Prices for potash, which is used as a fertilizer, plummeted with the COVID-19 disruption in 2020. The market is now tightening and spot prices are increasing from recent three-year lows. While they have a long way to go before achieving the highs experienced in 2019, potash prices are heading in the right direction for miners.

For the third week of January, DTN reported at average retail price for potash of $379/ton, which was up $14/ton from the same period in December. DTN tracks market data for North American farmers. That would be equivalent to $418 per metric ton (mt).

During early February, Intrepid Potash announced it was increasing its potash prices by $50/ton at all locations for all new orders, saying that the potash prices were now $140/ton above the 2020 summer-fill value. "Intrepid continues to benefit from great early season demand for fertilizers as increasing commodity prices, tightening inventory levels and strong farm economics are quickly leading to the best spring season in years," Intrepid Executive Chairman, President and CEO Bob Jornayvaz said.

The market leaders, Nutrien and Mosaic, were planning fourth-quarter announcements for mid-February and not commenting on the market. Nurtien and its agent Canpotex, however, were complaining about the Belarusian Potash Co.'s (BPC) recent potash sales to China and India.



BPC signed a potash supply agreement with China at a contract price of $247/mt CFR ($224/ton), saying it would be a $27/mt increase from its previously reported China contracts. A month earlier, BPC signed an agreement to supply Indian Potash Ltd. 800,000 mt at a price of $247/mt CFR. BPC exports the potash mined by JSC Belaruskali and controls up to 20% of the global supply.

Canpotex said these prices were significantly below current market levels for potash in key offshore markets and a complete disconnect from the strong fundamentals currently being seen for major agricultural commodities in numerous growing regions throughout the world. Record potash shipments were made in 2020, and Canpotex anticipates further export market demand growth in 2021.

E&MJ PRICES INDEX

(February 1, 2021)

Precious Metals ($/oz)		Base Metals ($/mt)		Minor Metals ($/mt)		Exchange Rates (U.S.$ Equivalent)	
Gold	$1,861.20	Aluminum	$1,985.50	Molybdenum	$24,860	Euro (€)	1.206
Silver	$28.55	Copper	$7,827.00	Cobalt	$41,240	U.K. (£)	1.367
Platinum	$1,127.00	Lead	$2,024.50			Canada ($)	0.778
Palladium	$2,272.00	Nickel	$17,807.00	Iron Ore ($/dmt)		Australia ($)	0.763
Rhodium	$20,300.00	Tin	$24,325.00	Fe CFR China	$168.13	South Africa (Rand)	0.066
Ruthenium	$320.00	Zinc	$2,548.50			China (¥)	0.155

Gold and silver prices provided by KITCO Bullion dealers (www.kitco.com). Platinum group metals prices provided by Johnson Matthey (www.platinum.matthey.com). Non-ferrous base and minor metal prices provided by London Metal Exchange (www.lme.co.uk). Iron ore prices provided by Platts Iron Ore Index. Currency exchange rates were provided by www.xe.com.

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*Comparison of Cummins engine configuration against EXI200-6.