Let's get technical

Whether talking about exploiting big data or making the most of machine automation, smart technology solutions seem to be on the lips of many exploration and mining professionals right now. *GDI* spoke to mining software companies about their latest solutions

Exploration and mining companies are continuously looking for improved solutions that will bring added precision and efficiency to their operations across the mining life cycle.

Tough times in the mining industry are forcing all players to keep costs down, and as a consequence more companies are turning to new technologies to help them achieve this. Improved technology solutions can provide miners with reliable data in real-time, helping them make informed business decisions faster and more confidently.

"The downturn in the industry has affected mineral exploration. Not only that, but mining projects are becoming more complex and more expensive to develop. They're based on country rules, environmental rules and financing. It's this combination of factors that has elevated the role of software in mineral exploration," says Glenn Wylde, Hexagon Mining's chief innovation officer for planning.

"Forward-thinking companies know that it's now more important than ever to reap the benefits software can provide, while also understanding the science behind this technology so that results can be audited."

"Forward-thinking companies know that it's now more important than ever to reap the benefits software can provide"

Reflex TN14 Gyrocompass installed on a rig

Maptek's customers are also experiencing challenges in finding, permitting and funding future mining development.

"Once the 'easy' ore is extracted, deeper and less accessible deposits are investigated. The costs to prove these resources, and develop economically viable operations, have increased drastically. Lower commodity prices, and uncertainty in what the future holds, have created a difficult operating environment," confirms Peter Johnson, Maptek's general manager for Australasia.

Accordingly, to better understand, anticipate and react to economic fluctuations, miners need improved technology solutions, which help them streamline collection, analysis, modelling and reporting of business-critical data.

Reflex's global product manager for data solutions, Michelle Carey, has also noticed that the main trend now is to use "technology to distil the enormous amounts of data currently generated through software solutions and automation to provide relevant information at a manageable scale".

NEW, IMPROVED TECHNOLOGY

With increased demand for smart technology, including software, automation and sensor technologies, miners have many products to choose from, with updated and new solutions cropping up regularly. Key mining software companies that offer solutions for drilling processes include Reflex (part of Imdex), Carlson Software, Maptek, Micromine, Promine, Geovia, Modular Mining Systems and Hexagon Mining (which combines the technologies of ►

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Carlson's DrillGrade system: navigation to the hole and drilling to a target respectively

► MineSight, Devex Mining, Leica Geosystems Mining and SAFEmine), to name a few. Here, some of these companies introduce their main products and newest solutions.

CARLSON SOFTWARE

Carlson Software offers mining-design software, with a new blast-hole-design solution currently in development. Its machine-control division markets high-precision navigation and 3-D drilling-machine guidance systems. Carlson can support mixed fleets of platform/vertical drills as well as articulating/crawler drills, encompassing mining, quarry and construction drill-and-blast applications.

According to Randy Noland, director of Machine Control at Carlson Software, the DrillGrade 3-D positioning system affords greater accuracy by utilising 3-D modelling over physical stakeout at grid intervals, and drastically improves efficiency, quality and documentation. The high-accuracy navigation and positioning can all but eliminate the need for surveyors.

Drill patterns can be predesigned and loaded via a thumb drive, SIM GSM radio or other wireless methods. There is a complete record of all work performed, including a DRL file with as-built information. Previously drilled holes are also clearly marked in the software. DrillGrade supports DXF, DWG, IREDES and CSV file formats.

Carlson also has a partnership with Atlas Copco, providing a factory-integrated solution primarily for its SmartROC and FlexiROC drills.

The Fleet Manager Office Suite from Carlson provides production analysis, 3-D viewer (near real-time and historical playback) as well as a web-based Visual Reporter offering a configurable dashboard, timeline and auto-generation of reports per schedule with email individual or group delivery.

HEXAGON MINING

At less than a year old, Hexagon Mining has yet to release its own debut products. However, it will soon be ready to launch HxM Blast, a new drill-and-blast management utility, which, according to Hexagon, will "revolutionise" the design and execution of drill-and-blast plans from within MineSight 3D. With one interface, users will be able to design drill patterns, apply

Incident resolution with Maptek BlastLogic

In a scenario where production crews ran into significant hard digging in the pit, a truck operator was injured when loading oversized material. There was minor damage to the digger as well.

When an incident occurs at a mine, it is urgent to find out what happened and why. Survey locations must be cross-referenced with drill designs, timing and videos. Then files are searched for shot reports and explosives-loading sheets. It can take several days to pull together all the information to understand the full picture.

Maptek BlastLogic connects and centrally stores all operational drill-and-blast data. This can be instantly recalled for analysis, streamlining incident resolution and fostering continual improvement. Once the problem area has been identified, BlastLogic steps through the complete blasting history. The drill design can be viewed against the as-drilled data. Water depth in holes, downhole delays and associated timing, and post-blast effects can all be ascertained. Explosives used and misfires can be checked. Video footage can also offer important information.

BlastLogic allows all of this blast information to be found, reviewed and reported in one hour. More importantly, having interrogated the information and determined the cause of the incident, a solution can be implemented and tracked.

Under-drilled or backfilled holes are a common cause of hard digging incidents. The drilling history may show a correlation between bad holes and an operator or drill rig. Follow-up, such as daily visual feedback from BlastLogic, can inform operators how close they are to target.

BlastLogic makes it easy for operations to improve backfilling and explosives-loading performance. If current accuracy is 80%, a new goal of 85% can be tracked accordingly. KPIs can be customised to record observed blast performance, or indicate whether hole savers were used to prevent excessive fallback. Checks at critical stages can track adherence to the blast plan and ensure that certain criteria are met.

The aim is to prevent future incidents. BlastLogic analytical tools allow ready comparison of parameters across multiple blasts. Performance summaries by hole or blast help with pre-design research or regular reviews. For example, all holes from the previous year can be loaded, the powder factor trend for the lower bench can be displayed, and misfires highlighted.

Queries about products used in the shot and who was in charge are instantly answered. Filtering data for best dig rates or lowest vibration allows the focus to shift to improvement. New tie-up designs can be tracked against post-blast metrics such as digability or fragmentation.

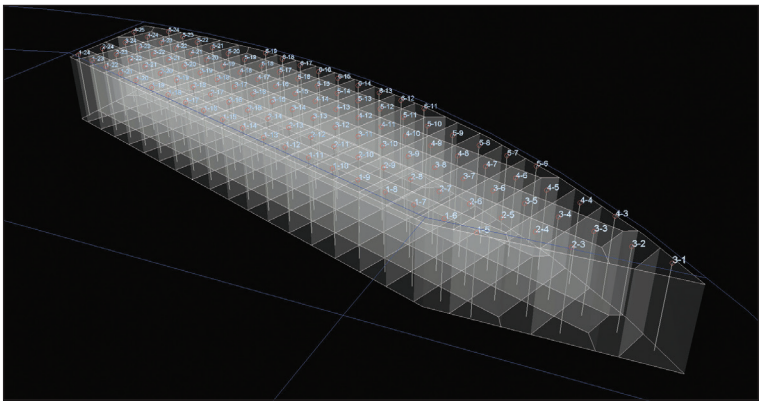
blasting parameters to holes and do the tie-in of a shot.

Getting the blast right will benefit other mining processes, and HxM Blast promises to give users more control over the design, management and reporting of drilling patterns.

The new utility features an interface that mirrors the look and feel of the MineSight suite's newest products. It will design and manage drill-and-blast patterns interactively on screen while storing all of the design (and actual) information in a SQL database.

"A bad blast can undo all of the good work done by geologists and engineers to develop a robust block model and mine plan. So it is crucial that the blast design and execution minimises error and interprets the effects when things do not go to plan.

"Several factors affect the quality of a blast. The geology and geotechnical characteristics of the rock are unchangeable, but the blast-pattern parameters, such as hole spacing, depth, diameter and amount/type of explosive used can be modified. The ability to change these parameters dynamically in response to as-drilled information is critical to achieving good fragmentation," explains Wylde.

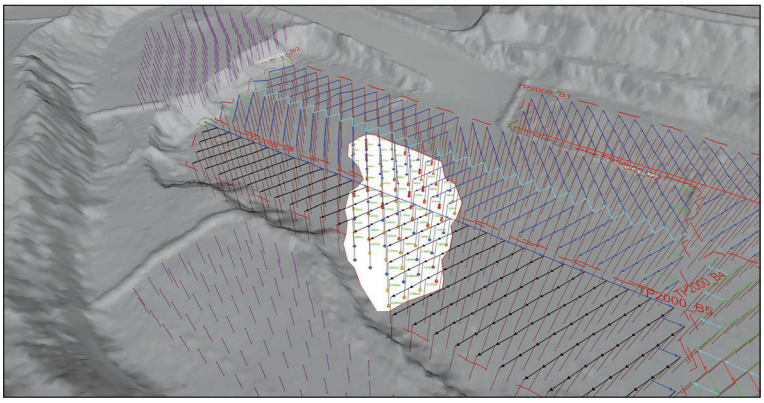


Viewing volume of influence solids and polygons will be among the display features in Hexagon's new HxM Blast

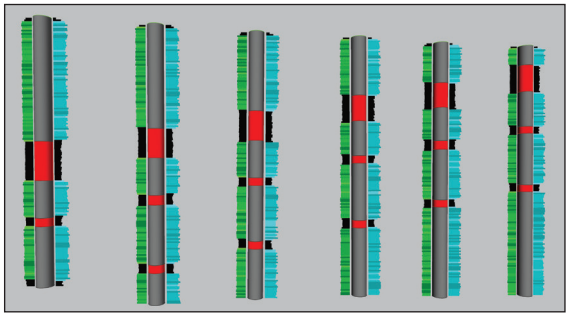
HxM Blast will work with existing pattern polygons already created in the MineSight suite, or new ones can be digitised on the fly within the program. It includes editing functions and templates for the design and naming of patterns. An HxM Blast database stores data, making it easy for the software to 'talk' to the MineSight suite's drillhole management and scheduling products.

HxM Blast links directly to Hexagon's Gantt scheduler, MineSight Atlas, so mine planners can update their schedules based on actual drilled metres to get more accurate activity durations.

"A bad blast can undo all of the good work done by geologists and engineers"



BlastLogic presents a clear picture of factors affecting blast performance, allowing fast resolution of post-blast incidents



New MWD tools in Maptek Eureka allow automatic strata recognition; the left green trace shows weight on bit and the right blue trace shows torque

Additionally, it allows users to compare designed drillholes with actual drillholes, giving decision-makers the information necessary to adjust blasting plans accordingly.

Importantly, says Hexagon Mining, the utility will empower engineers to design production shots and pre-split patterns simultaneously using substrings. This will replace the time-consuming process of manipulating string and polygon.

According to the company, it will remove the uncertainty of calculating the volume of a blast. With the visualisation options showing the area and volume of influence, it is simpler to predict the result before the blasted earth is removed.

Future releases of HxM Blast will include blast simulation, analysis and optimisation to reduce the workload of drill-and-blast engineers.

Hexagon Mining's second debut product, HxM Athena, will import, validate, analyse and store data from multiple input sources to a single data repository. It will then present the data in dashboard views that are easy to use and understand. The sources of data can be extremely varied, such as fleet-management systems (FMS), drill rigs, on-board fragment-analysis cameras and general mine-planning systems. Dashboards for safety and slope stability will be added in future versions.

Analysing and merging this data can answer questions such as: "Why are my shovels not meeting their production targets?" There could be several answers to this question, but one answer could be that the rock is not being fragmented efficiently, making it harder to dig.

It is critical for managers to be able to understand what is going on in their operation across multiple areas of the mining value chain. Being able to track poor shovel performance back to a sub-optimal blasting process, for example, can give managers the confidence to change projects, improve practices and track the results. This can be priceless information but it is easy to attach a value to this as well.

"Some companies are embracing data capture via technology such as laser scanners or HPGPS tracking, but without the means to actually make good use of the data. HxM Athena is different because it offers both business intelligence and business analytics," says Wylde.

MAPTEK

Maptek technology solutions cover the entire mining execution chain from exploration through design and production, to rehabilitation. Specific Maptek

Productivity and cost improvement with Reflex technology

Reflex recently provided a productivity and cost improvement enabler for exploration-drilling rigs for one of Australia's largest coal producers.

The company required timely access to reliable, accurate data relating to all drilling activity to enable better business management, forecasting and productivity.

The drilling companies contracted to the business also benefited from Reflex's technology as they were able to gain immediate access to information on current drilling activity, which assisted in the efficient management of their operations and the timely payment of invoices.

Reflex's solutions included in-field data collection through mobile forms, and customised Schedule of Rates and Production Planning modules, all accessible on-site by means of mobile, hand-held devices, with approvals and relevant information available in near real-time, off-site.

The solution provided the ability to report on a range of activities, provide shift activity approvals, and track current expenditure and activity against that forecast and budgeted for, all in real time.

"It was easy to access and view all the drilling information we needed to run our business," remarks a drilling contractor working on the project.

For the resource company, access to real, accurate data enabled efficient reporting and reconciliation of all activity across its drilling projects. This ensured that costs remained within

products that aim to boost productivity around mining and drilling processes include Vulcan 3-D mine-planning and modelling software, I-Site laser imaging and survey systems, Eureka exploration software and the BlastLogic quality-management system for drill-and-blast data.

Maptek Eureka provides an interactive 3-D environment for visual interpretation of exploration data including drilling, geophysical surveys, maps, imagery and GIS. Recent development in the solution allows downhole geophysics and telemetry data to be fully exploited to build accurate strata models. Coal is readily identifiable using gamma and density drilling logs.

Geological modelling tools in Eureka create roof and floor surfaces for each seam, which can be used to give an accurate reference for charge placement, with potential for improving drill-and-blast performance.

Geophysical logging of drill holes is resource-intensive. In a blast pattern, if only every fifth hole is logged, interpretation for modelling seams is limited.

Exploiting measurement while drilling (MWD) data captured by drill-rig automation systems leads to better modelling. Vast amounts of telemetry data such as pull-down pressure, air pressure, drill-bit rate and torque are available. MWD logs record the changes in these variables as the hole is drilled. This information can be visualised in Eureka, analysed and converted to strata models.

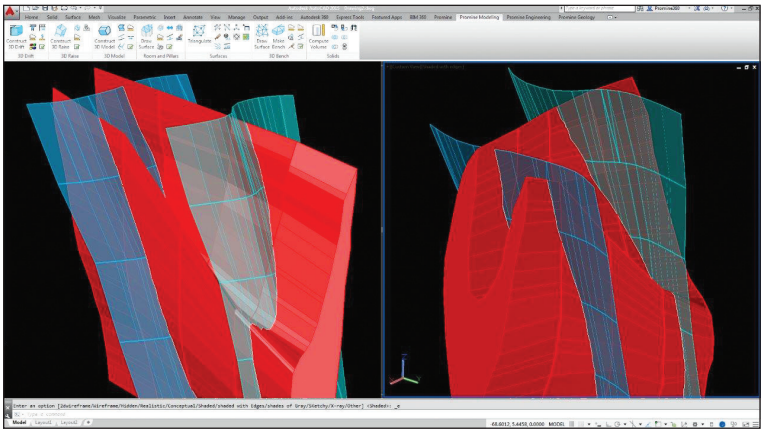
Importing geophysical (LAS) data relating to drill holes and assigning downhole intervals based on the change in properties of differing material types automates what has been a time-consuming process.

Building a coal surface using the MWD data captured from every hole drilled in a blast pattern gives a clearer account of the resource. For through-seam blasting, the MWD method allows accurate charge placement and loading for every single hole, leading to less coal damage and greater recovery. Removing the ►

forecast and that project progress remained on track.

"Improving efficiencies in the acquisition of data, the inclusion of this data in our reports and visibility across our business are our priorities," says the manager of exploration planning and reporting for the resource company.

"Being committed to this project and working closely with the Reflex team has resulted in significant operational efficiencies that are already adding value to our business."



Promine's 3D Modeling tool can be used for generating 3-D models of geological features or stopes by connecting projected contour lines

need for geophysical logging takes people away from the pit, improving safety for the blast crews. Data is available earlier with MWD than LAS, resulting in a faster turnaround for modelling.

PROMINE

From early exploration to resource estimation and mine design, Promine provides end-to-end solutions for geologists and mining engineers. Its geology solution allows users to visualise 3-D geological information, perform quick resource estimation and integrate geological data across multiple platforms.

When it comes to drilling modules, Promine provides underground and open-pit drilling solutions for exploration, analysis and operations.

For geologists, its Hole Planning module allows users to do cost estimation, hole previews in a plan or section, lock targets and configure expected deviations, calculate azimuths and dips, issue drill plans, annotate holes and create drilling reports. The Diamond Drill Holes module in turn allows users to visualise data from any database with read/write capabilities and customisable annotation options, and build sample sets to be used in block-modelling computation.

For engineers, Promine offers an open-pit blasting module comprising intuitive and dynamic tools that allow simple loading of drills, explosives and easy generation of customised reports. With its underground Drill and Blast solution, users can design drilling and blasting scenarios, issue plans, create profiles of the drills used on-site, perform energy analysis and delay generation to optimise drill-and-blast procedures.

REFLEX

Reflex's solutions have application across the mining life cycle from targeting and exploration drilling through development to mining.

Where drilling contractors need to remotely manage drilling teams, information on rig activity on-site as well as pre-start and safety checks can be managed and monitored from any location, in real time. Reflex says it has new technology, not as yet released, that will dramatically change the way drilling is currently managed.

The company's technology enables drillers to provide validated data to their clients, in near real-time and with confidence.

The Reflex EZ-GYRO is a north-seeking gyroscopic survey instrument that has been developed for accurate surveys in all (including magnetically disturbed) environments. The "smarts" of the instrument are contained within the unit, the use of which is simple enough for effective operation without the need for any advanced training, Reflex confirms. This allows efficient use on-site by the drilling team

"The technology enables drillers to provide validated data to their clients, in near real-time and with confidence"

Modular Mining's customer milestone with Vale

Modular Mining Systems, a provider of real-time mine-management solutions, recently announced that iron-ore provider Vale has selected Modular technologies for its Pico open-pit mine site in Brazil.

This agreement marks the signing of Modular's 250th customer mine, as well as more than 20 years of partnership with Vale.

In a meeting held on March 6 at the Pico Mine, Davi Freire, general manager, Modular Brazil, and Michael Lewis, vice-president for product innovation, Modular, presented Vale's Alano Reis Teixeira, mine operations manager, with a plaque commemorating the milestones.

"Pico Mine has plans to optimise its operations and we expect that Modular's mine management systems will help us achieve our goals quickly," said Teixeira.

Modular's partnership with Vale began in 1993, when the Carajás mine became Modular's first customer in Brazil. Since the initial installation, Modular has continued to deliver mine-management solutions to a growing Brazilian market.

Over the years, Vale has implemented Modular's technologies at 14 of its mine sites worldwide. "The fact that Vale continues to trust and rely on us speaks volumes about the value that Modular products bring to their organisation," says Lewis.

On commissioning, Modular's Dispatch Fleet Management system will optimise haulage operations on Pico's extensive fleet of trucks, shovels, drills, loaders, dozers and auxiliary equipment units. Additionally, Modular's MasterLink Enterprise solution will provide the operation's wireless network infrastructure.

without the need for a service provider.

"Imagine the savings in time and cost where there is no requirement for a service provider. The drilling team can both continue to survey without relying on the availability of a service provider with the risk of extended 'standby' time, and be confident that the geographical direction of the drill hole is accurate and reliable," says Kelvin Brown, global product manager for drilling at Reflex.

The EZ-GYRO can switch from single to multi-shot without the need to retrieve the instrument. Through Reflex Connect, survey data is transmitted directly from the instrument to Reflex Hub for real-time assessment. Innovative adaptations on the instrument are pending imminent release.

The Reflex TN14 Gyrocompass, in turn, promises to provide accurate and repeatable underground and surface rig alignment, in minutes. According to Reflex, without the roll and pitch limitations experienced by some rig-alignment systems, azimuth integrity remains high at all angled and near-vertical drilling applications.

Connectivity with Reflex Hub allows drill-hole co-ordinates to be entered directly into the hand-held unit on-site or pre-loaded from any location and sent directly to the rig. Drill-hole alignment data is then transferred back into Reflex Hub for drill program management. The Reflex TN14 Gyrocompass reduces the risk of error, which can save time and costs for the drilling contractor.

Reflex is currently working with a number of customers to ensure that its solutions are relevant and intuitive and offer significant gains for the user.

FUTURE MINE

The next step in mining software development will lay further emphasis on technology and the real value it adds to mining operations.

"Mining software's greatest contribution will be to help companies deal with an ever-increasing flow of data. Big data is a bit of a buzz-phrase, but the digital mine of the future is closer than people might realise," explains Hexagon's Wylde. To that end, Hexagon Mining is also introducing its HxM Athena, which is a business-intelligence/business-analytics tool, aiming to help companies transform their data into knowledge.

"Our goal is to understand the big problems, but provide practical, achievable and scalable solutions in the short term," says Wylde.

Maptek also stresses innovation through integration as a key to improving operational productivity. Delivering efficient business and systems solutions helps operations to optimise their resources.

"Data from automated collection devices such as drill rigs and scanning systems can be more tightly integrated with measurement and resource data. This will help to build a near real-time feedback loop where processes are ultimately self-correcting and self-reliant. If processes are always running on the latest data available, and this data is being fed back into the processes, continuous improvement is ensured," says Johnson.

The Reflex EZ-GYRO

"Big data is a bit of a buzz-phrase, but the digital mine of the future is closer than people might realise"