MAPTEK™

Forge

March 2019 Newsletter

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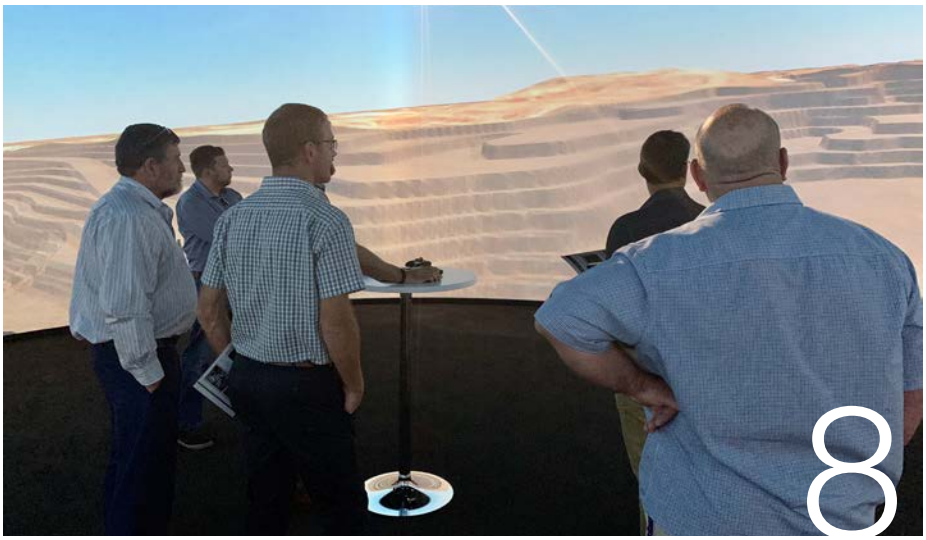
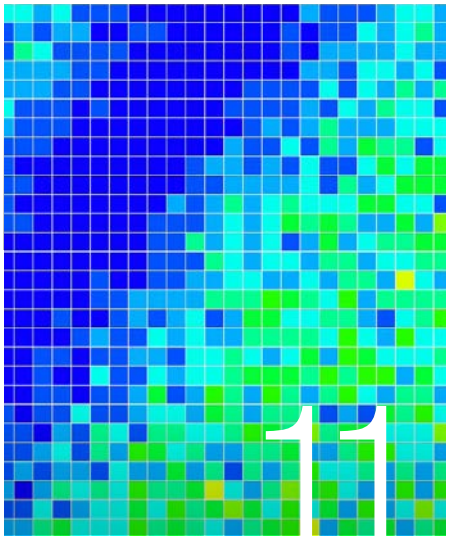
Welcome to the first issue of our Forge newsletter for 2019





Maptek Sentry monitoring system at Letšeng Diamond Mine, Lesotho. Open pit and underground mines use Sentry to sustain safe operating environments. Fast setup and operation minimises time in active mining areas, capturing accurate data for strategic risk management.

I'm excited to see a common theme of collaboration driving innovation in the feature articles. It is inspiring when we can work with our customers to provide new solutions to 'old' problems.

The value of the human element in driving technological change should not be underestimated. Spending time with customers to analyse particular challenges in the context of their operational parameters has led to dramatic reshaping of the capability and reach of Maptek systems.

We constantly question if there is a better way! Working with experts in specialised technology areas is fast extending our solutions for mining customers. Shared insights are leading to new possibilities.

Aside from the direct benefits to individual customers, advances in technology flow on to improving global mining practices, which means we are all playing a part in future proofing this important industry.

Maptek looks forward to ongoing collaboration with customers and technology partners as we forge a successful path into 2019.

We hope you enjoy this issue and welcome feedback at forge@maptek.com

Peter Johnson
Managing Director

Benchmarking drill and blast

Maptek™ BlastLogic™ enables improved design compliance monitoring and downstream productivity optimisation across Anglo American's open pit operations.

Anglo American's Technical team launched an improvement project in 2017 to provide a foundation for developing sound drill and blast designs which could be effectively executed and easily reconciled.

Maptek™ BlastLogic™ was selected to enable the quantification of compliance to design metrics and provide confidence in sustainably achieving desired blast outputs.

Six operations were scheduled for initial implementation, with mines in Chile, Brazil, and South Africa across a range of products including copper, diamonds, iron ore and platinum group metals.

Technical solution

The technical system included:

- Advanced drilling design
- Blast design and reconciliation
- Benchmark reporting capability

Roll-out of the technical solution has enabled efficiency gains through standardisation and alignment of various processes.

For example, one operation required normalising to a common scale of four different coordinate systems used by three different drill navigation systems and general mine planning software. Although systems had previously been in place to manage the disparate data, the alignment process gave engineers additional time for other tasks and reduced errors associated with data management.

Integration with existing applications such as electronic initiation systems has reduced the need for information to pass through different systems and further decreased transformation or re-formatting requirements.

Due to the wide geographical distribution of operations, the technical system is hosted in centralised data centres on each continent and the validated data is consolidated through a global reporting platform.

This has led to improved integration between different business unit technical teams, facilitating the benchmarking of data and aligning operations on key compliance to design metrics.

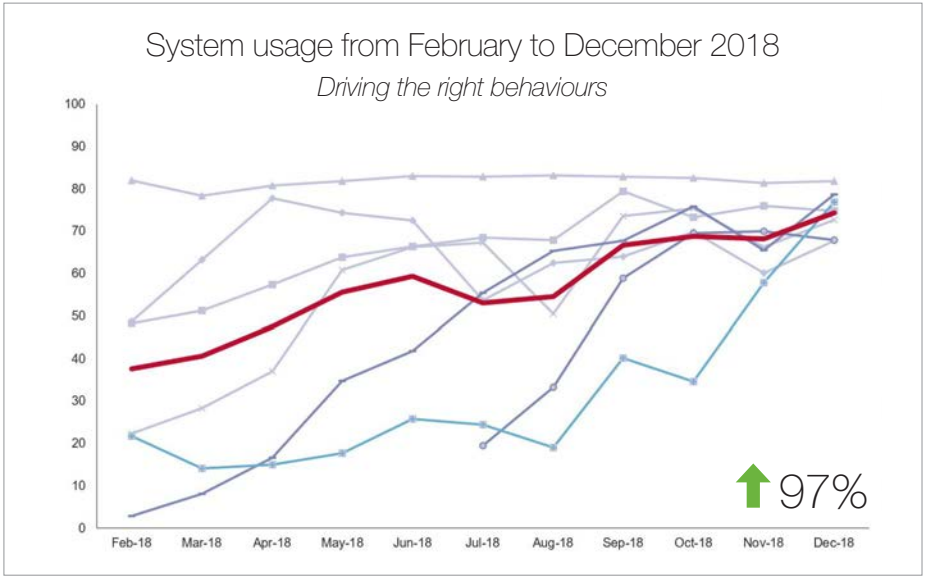
> Importantly, it has resulted in a reduction of inconsistencies and discrepancies in metrics reported between operations, as the calculations and data are derived from a single standardised source of truth.

Common access to centrally stored and managed data allowed different functional teams to meaningfully collaborate, start delivering sustainable operational value and identify additional improvement opportunities.

In particular, the coordination shone a light on the importance of tracking and analysis of drill and blast metrics in a consistent manner across the global business. Inefficiencies are now clearly identified at critical stages of the process, and site personnel are empowered and enabled by management to devise strategies for improvement.

Study results

Results from five performance metrics were tracked over a six-month study period from February to August 2018, incorporating 142,000 hole records.



Positive trends in performance metrics were observed over the period after implementation in the first six mines. Although no baseline analysis from before implementation was readily available, the results show collective improvement.

The BlastLogic solution has enabled improvement in supervision of planning and operational processes. Average overall system usage increased by 54% as personnel focused on role specific value-adding tasks interlinked within the drill and blast process and critical to desired outcomes. This enabled the start of more integrated work practices and a breakdown in functional siloed behaviour.

Specifically, the data validation process overseen by the engineers provided the necessary quality assurance to support downstream operational routines.

Performance metrics

Hole collar compliance
Hole collar compliance improved by 8%, with all six operations reducing variability and converging to the highest collective values. One factor was the alignment of data from disparate drill navigation systems.

Hole depth compliance
Despite significant variance between operations, a 20% increase in compliance to hole depth was realised. Systemic sources contributing to deviations in targeted hole depths were recognised and addressed.

Hole charge
Charge compliance varied significantly across operations, and generating a sustainable uptrend remained a challenge over the period. Several behavioural and operational factors are understood to impede the desired improvements.

Hole stemming compliance
Stemming compliance realised a 125% improvement following a renewed focus on the metric in May 2018. Unfavourable work practices and lack of consistent setting and measurement of design tolerances were identified as issues.

Hole exceptions
The hole exception metric saw a 21% decrease until June 2018, before the trend started to reverse. Hole exceptions are defined as holes which fall within one of the following categories:

- Holes drilled but not designed
- Abandoned holes
- Holes designed but not drilled
- Holes charged but not drilled

The aim is to minimise or eliminate exceptions through improved design, information management and work practices.

Analysis of the data revealed that the high values were mainly attributed to ‘designed-not-drilled’ and ‘charged-not-drilled’ conditions. This is representative of many contractor rigs lacking drill navigation systems and survey not measuring the collar locations. The reporting highlighted a gap in quality control and has resulted in better integration of inter-functional processes.

Conclusion

BlastLogic is now relied on as an operational mining tool to track, quickly understand and act upon all factors impacting critical stages of the drill and blast process.

Evidence-based information was central to achieving successful implementation, with the immediate feedback loops delivering improved awareness of the key performance indicators. Personnel have thrived in working with state-of-the-art technology and participating in the drive for group wide improvement.

> A 23% improvement across 142,000 hole records was realised in relation to overall compliance to designs over the six-month period.

Quantification of five fundamental design parameters highlighted significant variability in relation to executing designs effectively. Further focus on these metrics will allow for improved accounting of blast performance, and better definition of practical tolerances to which they should be executed.

Stabilisation of variability within the measured data will allow operations to safely capture additional value through their blasting practices, enabling opportunities such as pattern expansion, steeper pit slopes, grade engineering and improved mine to mill practices.

Successful roll-out at the six original sites has supported extension of the BlastLogic technical solution to other Anglo American operations, and strengthened the prospect of sustainably achieving desired outcomes through improved compliance to design.

Thanks to
Alan Tordoir, Lead Drill & Blast
Anglo American

Periodic monitoring with Sentry

Maptek™ Sentry Patrol watched over workers during the successful remediation of a rockfall at Kanmantoo Copper Mine, allowing operations to quickly resume.

01 December 2018 rockfall on the west wall of the Kanmantoo pit
02 Hillgrove Resources staff deploy Sentry in the base of the pit to monitor the west wall
03 Scans at three-minute intervals allowed remediation work to continue on the west wall without compromising safety

Kanmantoo Copper Mine is located in the Adelaide Hills of South Australia. In December 2018 about 6000 t of rock slid from a height of 24 m on a rock structure, following a failure on a series of closely spaced J4 joints that dipped steeply out of the west wall of the pit.

The three-week remediation work included construction of an access ramp, removal of overhang by scaling and blasting, scaling back the scarp and removal of ramp and rockfall debris.

During this work Maptek™ Sentry Patrol was set up on a tripod in the base of the pit to monitor wall movements. This allowed the best line of sight for the laser scanner compared to crest locations, to detect potential rock movements.

Patrol is one of four configurations of Sentry, which combines a Maptek laser scanner with sophisticated software to monitor, analyse and report on surface movements.

Periodic monitoring with the Patrol system mounted on a tripod, wall or bollard allows large scenes to be quickly captured, helping to determine zones to watch more closely. Continuous monitoring can then be used where conditions pose the greatest risk, providing real-time accurate data to guide safety management programs.

> Sentry can be rapidly deployed to monitor events and protect staff during situations such as the rockfall remediation.

Whenever remediation work was carried out at Kanmantoo the scanner was operated by personnel trained to read the scan data and react appropriately.

Hillgrove Resources, the mine operator, said this approach had proven to be very successful. No wall movements were observed above the remediation works other than the scaling effects and minor mesh movements.

Following the success of the remediation work monitoring, Hillgrove Resources decided to staff the Sentry Patrol system with trained pit technicians to monitor on a three-minute scan basis whenever personnel are working on the west wall. A wi-fi system allows geotechnical staff to remotely access the system to assist in interpretation 24 hours a day.

This setup will continue throughout the final 36 m of excavation of the 350 m deep, steep-walled pit.

Geotechnical analysis

The versatile Maptek XR3 laser scanner used for Sentry Patrol can also be deployed for day-to-day survey tasks such as topographic survey, stockpile volumes, end-of-month measurements and mine modelling.

Scan data collected at Kanmantoo was brought into Maptek™ PointStudio™ for geotechnical analysis of the rockfall.

In the central portion of the failure the basal plane passed just under the shear pins. Following an initial 20 mm of displacement, the failure eventually ripped through the rock mass to the south, where the shear pins penetrated the J4 joints and restricted further movement. The northern end of the failure comprised a long steep joint, from which the failure pulled away.

Survey of the basal surface and the original southern and northern release surfaces provided a slip volume calculation of 6321 t. A total of 11,985 t was removed during the remediation.

The J4 joints mapped on the remediated surface have an average dip of 54° compared to an average dip of 60° from mapping the complete western wall. The close spacing and planar nature of the joints combined to create the stepped-down basal sliding surface.

Sentry development

Hillgrove Resources has been using Maptek laser scanners and Sentry for integrated survey and monitoring tasks for more than five years.

The company was instrumental in progressing R&D into laser-based monitoring, and feedback from geotechnical staff has been invaluable for the development of Sentry.

In 2014, Sentry was able to predict a failure below a ramp in time to evacuate the pit floor, ensuring safety of personnel and equipment.

Bruce Hutchison, Principal Geotechnical Engineer, highlighted the importance of safety at Kanmantoo Mine. 'Hillgrove Resources has been able to mine safely from a steep-sided open pit thanks to a stringent geotechnical program,' he concluded.

Thanks to
Bruce Hutchison
Principal Geotechnical Engineer
Hillgrove Resources

Continuous monitoring in cold climates

An exciting addition to the Maptek™ technology portfolio answers the need for continuous, reliable surface monitoring in extreme environments.

The Maptek Sentry cold climate system can operate continuously in temperatures from -20°C to +50°C, and for a limited operational time below -20°C.

The generator, hydraulics and electrical systems have been adapted to maintain energy efficient, cost-effective operation. The redesigned battery pack and housing is insulated to keep the unit at a stable operating temperature.

To operate at the lower temperatures, Sentry requires a cold climate XR3 laser scanner, which has also been redesigned. A removable neoprene scanner jacket provides extra protection against wind chill.

Sentry is a mobile remote monitoring system that uses laser scanning to continuously measure ground movement with extremely fine spatial resolution and accuracy. Housed in a self-contained unit with autonomous power and communications capabilities, Sentry relies on sophisticated software to monitor, analyse and report in real time.

The 3D point cloud data collected while monitoring can be used for geotechnical analysis and other applications. The laser scanner can also be redeployed from monitoring for routine survey tasks.

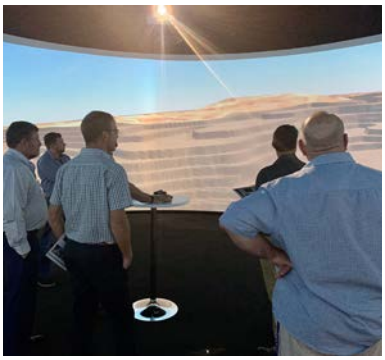
Sentry is available in four configurations to suit mobile, fixed, open pit and underground monitoring applications.

Why use Sentry

- Safe, remote monitoring of pit walls, floors, tailings dams and mine access ramps
- Cost-effective monitoring and survey solution for managing operational safety
- One-person operation to set up and start monitoring in minutes
- Set alarm thresholds and notification protocols to meet your site safety programs
- Local technical support from mine survey and geotechnical experts

Data visualisation revolution in mining

South African mining companies are poised to take advantage of new technology to enhance mine planning, improve safety and reduce costs.



In December 2018, personnel from LlamaZOO Interactive and Maptek™ South Africa demonstrated the potential of data visualisation, in the form of augmented and virtual reality (AR/VR) for mining companies.

Charles Lavigne, CEO of LlamaZOO was impressed by a business culture in South Africa that embraces innovation.

'Mining companies in Canada, Australia and now South Africa are already using data visualisation and VR to speed up the mine planning process and reduce costs. One of our customers used LlamaZOO MineLife to create a digital twin, or 1:1 virtual replica, of a planned mine site. They started the project two years early and saved millions of dollars,' said Lavigne.

The digital twin included drillholes, facilities and equipment, roads, forests and wildlife populations. The entire scene could be explored from a 10,000-foot view down to ground level using a VR headset.

VR and other data visualisation technologies meant that fewer people had to be transported to the remote mine site, saving thousands of dollars, and making the planning and training process much safer.

> Combining Maptek scanning technology, LlamaZOO data visualisation capabilities and cloud networking means anyone can use the technology from anywhere in the world to make faster, better, safer decisions.

Nick Venter, General Manager Maptek South Africa, explained, 'A digital twin allows different planning scenarios to be simulated, and the impact of each can be clearly visualised. For example, for a major coal customer, we transferred mine schedules generated in Maptek Evolution into VR.'

'We then navigated through the different phases of extraction. This is a very effective means of communicating complex information. Miners are keen to discover ways that a digital twin could deliver real value to operations.'

Real-time visualisation

Resource companies seek to make their operations more agile to drive cost savings. Data from various sources, such as haul truck telemetry, SCADA-connected devices in mine site installations, and individual workers in the pit, can be combined to create a real-time live digital twin that is presented via data visualisation to operations staff.

Fleet management is a strong case for real-time visualisation. By feeding live fleet data from Maptek partner MinLog into MineLife, any manager anywhere can monitor machine health and driver behaviour.

'By remotely monitoring wear and tear on haul truck tyres, one of our Canadian customers saves nearly a million dollars a year at one operation,' noted Lavigne.

Haul truck telemetry allows checking of meta performance data, such as driver name, speed or oil pressure. This information could be used to highlight whether particular drivers need more training. It could also allow sites to measure the efficiency of haul routes and where repairs are needed.

Survey data along the haul route could call attention to potential hazards and whether the routes have been built according to specification.

Modelling drill and blast

Data visualisation such as AR/VR brings the abundance of data in a complex mining ecosystem to life, helping identify where business performance can be improved.

Drill and blast is one of the biggest cost centres for an operation. It has a major impact downstream; for example, sub-optimal fragmentation can have a negative effect on processing, and incorrect slope angles can affect slope stability, which leads to higher risk.

Users of Maptek™ BlastLogic™ can already test, measure and optimise the entire process. AR/VR data visualisation takes it a step further by making it very easy to digest and communicate information.

OCC 3D (LlamaZOO's operational command and control solution), allows mine operators to visualise the drilling process in real time. Information from BlastLogic can be imported into MineLife and the blasting process can be simulated to identify possible constraints, inefficiencies and bottlenecks.

Testing scenarios

VR is a powerful mine planning tool. A large iron ore operation in the Cape takes different market prices of iron ore and determines the economic feasibility of extraction based on exploration data.

The mine site is always changing, and mining companies need efficient ways to monitor and update data. Maptek™ Vulcan™ visualises the data and Maptek Sentry can analyse slope condition.

> Making data universally accessible in visualisation platforms means that insights gained are more actionable.

For example, a company with underground operations wants to build a digital twin of their mine to identify potential hazards and tunnels in which machines may become obstructed.

Greenfield projects

Funding and permitting greenfield or expansion projects requires buy-in and sign-off from multiple stakeholders. Engagement takes significant time and energy and can introduce risk and uncertainty into the mine planning process.

Customers see the immersive nature of data visualisation as a particularly effective means of presenting information. A digital twin makes it easier for investors and other stakeholders to understand the value and potential impact of a mining project.

Mining companies must work with governments, regulators and local communities to earn the social licence to operate a mine over its life. It is costly and potentially risky to fly stakeholders to remote locations where mines are planned.

If a government or host community does not understand how the impact of a mine can be controlled, or how future remediation and restoration will occur, it may take years to get off the ground. There is no need to travel to the physical mine location. A digital twin allows stakeholders to get a clear sense of near-term and future plans.

Personnel training

Innovative South African mining companies have begun thinking about the potential for employee training. For example, training haul truck drivers is expensive, and not without risk. Shifting training from the mine site to a digital twin visualised in a classroom setting minimises costs and risks.

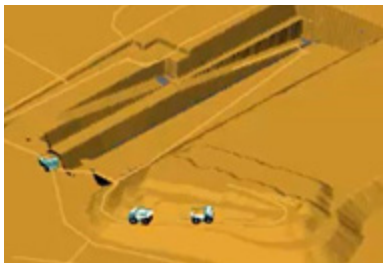
Venter concluded, 'This can already be done. Trainees can learn the job and familiarise themselves with the mine, without actually being there! We can upload accurate lidar data, captured by Maptek laser scanners for example, to create a true representation of the mining environment.'

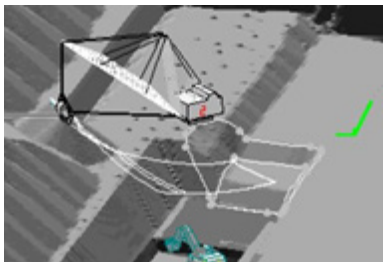
Data visualisation will revolutionise the mining industry by improving communication, speeding up mine planning, reducing costs and protecting the key assets of an operation.

Thanks to
Charles Lavigne, CEO
LlamaZOO Interactive

Reclamation bond optimisation

Optimising reclamation bond designs through 3D simulation increases the overall efficiency of mining and has a measurable cost-benefit.





A reclamation bond ensures that companies extracting resources will restore and clean up the site during and after the project. This is becoming increasingly important, and is a large capital expense for operations.

Simulation software such as 3d-Dig from Maptek™ partner Earth Technology can solve challenges around meeting the requirements of the reclamation bond guidelines, giving more accurate results than conventional 2D CAD methods.

Traditional design methods based on 2D contours can guarantee final slopes, but the process is time intensive and the designs can also be difficult to balance.

Using uniform grades for all slopes ensures that compliance is met and makes reconciliation easier. While this generic approach is a quick way of creating a bond surface, it hides subtle details for optimisation.

Difficulties arise when trying to balance the design. Maintaining the cut/fill balance through the volume and reserves calculations is challenging, and extra time is then spent justifying the balance. It is also often necessary to take an extra cut to achieve the balance.

Standardised reclamation bond methods can be used by first picking practical equipment and excavation techniques, and then analysing the cost benefits of certain techniques.

Benefits of simulation

Using 3d-Dig simulation software streamlines the process and provides a more realistic design that can be effectively mined.

The simulation clearly shows how material is transported to design or depletion. Balance checks are made simply, as excess fill remains in the material log.

The visual environment decreases the learning curve for users, and improves communication. Simulation videos are easily created to share with management, shareholders and regulators.

In the case study, a generic pit design was used, with an 11° slope over an area of 1 million sq. metres (~250 acres). A swell factor of 1.1 was used for volumes. Different approaches – 2D CAD, reshaping and simulation – were compared following standard guidelines.

Simulation resulted in 19% less material moved and a 50% total saving.

The simulation method produces better results, as well as being easier to use. It replicates real world conditions, pushes can be localised to shorter lengths and each zone can build into others.

Conclusion

Mining impacts the environment, and companies have a responsibility to ensure that the land and water are safe for future generations of people, plants and animals. A reclamation bond is a safeguard to ensure that remediation of the mined area is carried out to a high standard.

It makes sense for a mining company to optimise reclamation designs so that the work is cost-effective. Simulation software provides a 3D solution to a 3D problem.

	2D CAD	Reshaping	Dozer simulation
Total cut	92,500 LCM	95,600 LCM	75,700 LCM
Average distance	149 m	89.5 m	90 m
Cost	$91,000	$56,700	$45,000
Time	70 minutes	5 minutes	15 mins, including reshaping

New paradigm for domain modelling

Deep learning provides the ability to generate domain boundaries direct from drillhole sample data into a block model.

A model should portray the best understanding of geological observations and facts. However, it must be remembered that the interpretation of these facts into a full 3D representation does not mean that a unique result is generated.

Several possible interpretations can be and should be generated to test hypotheses. Geological uncertainty can be just as important, and in some cases more important, than grade uncertainty when building resource models and reports.

Many years ago Maptek™ introduced the ability to build geological uncertainty into implicit models, whereby a nested set of 3D solids is produced from the same set of raw data.

Simulation of categorical variables can also generate domain models with uncertainty. Resource geologists can take this uncertainty into the resource block model and use it to generate a range of estimates, not just a single tonnes-grade number for the mine planner to optimise during mine design and feasibility.

Computer-based geological modelling has traditionally replicated hand drawn methods. For example, sectional interpretations are joined into 3D solids, or surface contours are generated to build 2D boundary surfaces. The resultant surfaces and solids build the geological boundaries, which are then used to constrain domains in resource block models.

Depending on the complexity, building 2D and 3D models can be laborious and occupy a significant percentage of time, maybe up to 50%, in the preparation of resource models.

A 2D or 3D model will only represent one possible interpretation of the in situ geology.

Explicit and implicit techniques can be used individually or in combination for model construction, ensuring that boundaries between domains are honoured and that the overall results are geologically feasible.

Maptek's new deep learning engine provides the ability to generate domain boundaries direct from drillhole sample data into a block model, without the need for time-consuming manual digitisation or slow and cumbersome mathematical functions.

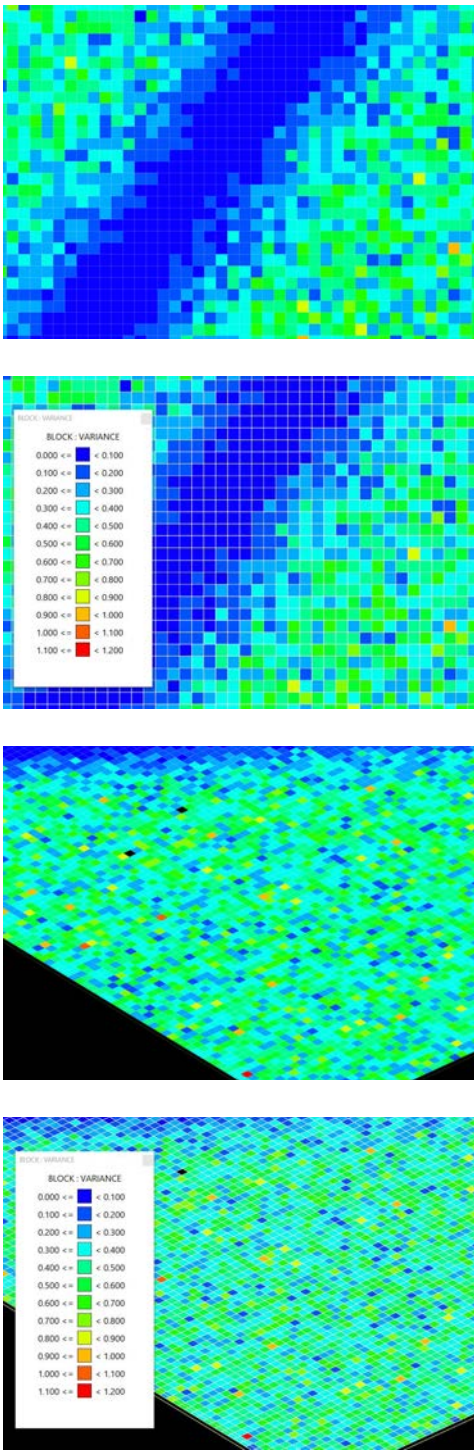
The deep learning function rapidly works through the data and correlates geological database coding straight into the block model, and then uses resulting domain codes to constrain grade estimation.

The deep learning domain determination is fast, often taking a few minutes to assess and generate the results from thousands of drillholes.

Sub-blocking within the resultant block model and measures of uncertainty are also incorporated into the deep learning modelling process, providing levels of confidence in the final result.

Deep learning for geological domain generation directly into a block model is the breakthrough that resource geologists have been seeking for rapid assessment of resource models.

Contact Maptek for a demonstration with your data.



Different views of the in-development deep learning solution for geological domain modelling showing variation in uncertainty within a block model – strong correlation indicated in blue

Innovative ore control system

A new ore control system has been implemented at an open pit gold mine in Peru, combining Maptek™ Vulcan™ with other processes to streamline analysis.

The Yanacocha Mine is located in Cajamarca, Peru, within the largest gold mining complex in South America. Doré metal is produced as a final product at the open pit mine.

Yanacocha has been using Maptek™ Vulcan™ since 2010. A new ore control system has recently been implemented with the support of Maptek South America.

Ore control is among the many mining processes carried out, with the objective of correctly categorising materials by means of classification polygons. Each class of material must be sent to the appropriate destination that generates the greatest economic benefit for the operation.

> It is important to correctly classify material to positively impact the mining business.

Poor classification of material causes huge issues, such as unnecessary mineral dilution, inadequate recovery arising from erroneous transport to processing, reworking effort, lower productivity and also significant economic loss.

It is also important to consider the practicality of control polygons, to ensure that the material can be extracted by the mining equipment. Complex polygon shapes decrease the productivity of the operation.

Implementation

The new ore control system at Yanacocha has demonstrated a high level of efficiency, great flexibility to handle changing scenarios, speed of results and ease of use.

These features all contribute to freeing up the valuable time of mining professionals, and increase the productivity of the ore control process.

The ore control system comprises eight independent modules covering all process stages. Some of the functionality can be used for other applications in the mine, increasing its value to the operation.

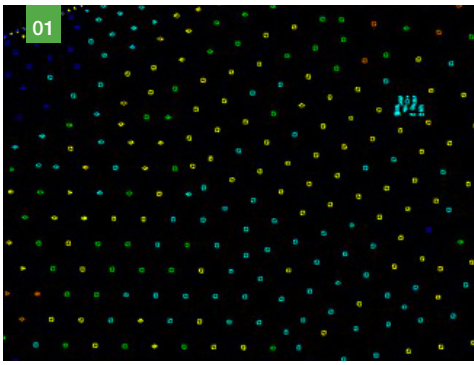
At the same time, the stages combine to form a comprehensive, integrated and adaptable process for any mine.

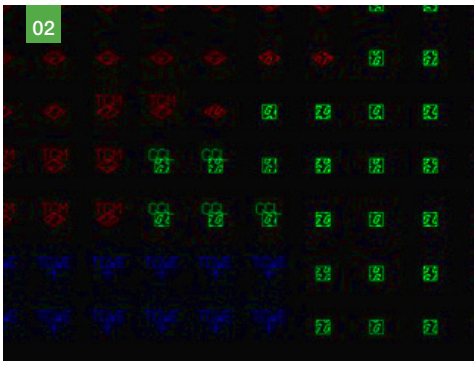
Benefits of the new system for the Yanacocha Mine include:

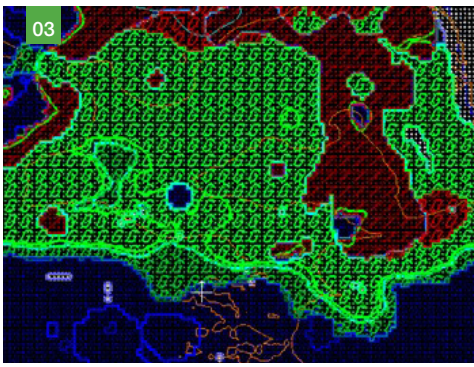
- Rapid classification of destinations, based on product benefit functions
- Productivity increase arising from easy setup and quick results
- Solid environmental compliance, allowing polluting materials to be separated out, thereby reducing their effect on the environment
- Facilitation of the creation of polygons with both space and form operational restrictions
- Great flexibility to accommodate changes that the operation faces
- Provision of a fully auditable and transparent ore control process

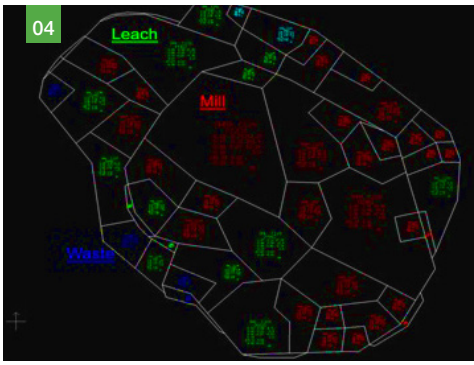
In summary, the new system is robust, and can be implemented and adapted for any type of mining. The result is that professionals can spend more time analysing and solving problems than running the computations.

Thanks to
Minera Yanacocha SRL









01 Blastholes and assays
02 Block model estimation and computation
03 Ore and waste classification and contours
04 Mine polygons

Connecting operations and planning

MineSuite streamlines information management and contextualises data from various sources to close the loop between operations and planning.

Maptek™ has enjoyed a long-term involvement with MinLog, providing customers with integrated planning and production systems.

MinLog's MineSuite provides for manual data capture and automated data acquisition for both production and maintenance, adhering to MinLog's one-version-of-the-truth philosophy.

Mining companies can reap value from keeping their software up to date. MinLog values client partnerships and works closely with operations to understand and respond to their needs.

The latest MineSuite release allows the acquisition of quality analysis results and particle size distribution to complement volume data already provided. Plant managers and metallurgists thereby obtain an enhanced view of plant production.

A new technology platform reduces the server resource demand when MineSuite acquires and processes data from other sources, and contextualises the data. A simplified end-of-shift philosophy reduces data validation effort by operators and supervisors. Data is immediately available for decision making.

MineSuite has met industry expectations since the early 2000s, and confidence in the product has led to requests to include data from other process-level sources.

Recently a client discovered unexpectedly high levels of a certain analyte in their production. This has serious business implications, hence the need to obtain analyte results from various data sources in the operation and report on the weighted average production at each of the available measurement points. The latest MineSuite functionality to acquire, process and contextualise data provided the ideal solution.

MineSuite has since become the primary source for operational data, including production volumes, product qualities and performance. The MineSuite train loadout and dispatch module has extended management information requirements to include product beds and train turnaround times.

Requiring better data management capability, a manganese ore client requested MineSuite integration with the control system to receive and share data needed for control decision of stacking and reclaiming equipment. MinLog developed the additional functionality and the enhanced MineSuite solution was promptly deployed.

MinLog has also developed system capability to handle the upstream and downstream effect of unexpected downtime in a series–process–flow operation. This led clients to upgrade MineSuite to better understand the influence of individual equipment on overall performance. Users can measure the effect of these interruptions on the equipment, production stream, module and plant as an entity.

For example, a feed conveyor in a large beneficiation plant is on breakdown with a belt tear, so the equipment is unavailable. The plant module availability could be 50%, and the overall plant availability could be 20%.

> The new MineSuite technology platform allows for advanced data acquisition, data processing and data contextualising from various sources.

MinLog's expanding product development team is working on a total mine operations management solution for a first-tier underground mine in Australia. The solution includes horizontal integration and consolidation as well as task control, activity management, fleet management and stockpile management.

Staying abreast of the latest technology provides advantages in data security, compatibility, efficiency and technical support, and helps attract and retain the best staff.

Eldrid Koortzeen, MinLog Customer Support Manager believes that staying up-to-date with software releases allows users to reap the benefits of new features and enhancements, which in turn increases business productivity and efficiency.

MinLog will upgrade existing MineSuite users to the new technology platform over the next 18 months.

University partnership

A partnership between Maptek™ and the University of Sonora in Mexico has exposed students and lecturers to the latest mine planning software tools available in the industry.

Teachers and students in the University of Sonora mining engineering degree course were given an update in the use and application of Maptek™ Vulcan™ version 11, thanks to an agreement of participation between the university and industry.

The course was conducted in the engineering design laboratory over a full week in December 2018.

The training was supported by Professor Brenda M. Quijada, who is in charge of the computer lab, as well as Maptek personnel – Alberto Ramírez, Regional Manager of Maptek Mexico and the Caribbean, Edén Rivera, Business Development Manager, and Oscar Carrillo Luna, Vulcan Technical Services Engineer.

'Being able to rely on Vulcan software is important for the university; currently there are four software groups with five hours a week each. Topics reviewed included starting a project, plotting, underground tools and geological interpretation,' commented Professor Quijada.

'Some of our students are doing community service in the engineering design laboratory. They serve the student community and also learn more about the software.

'We have had several degree projects applying the software tools; once the students learn to manipulate it, interest is generated in being able to develop projects, which in turn serves to expand their knowledge,' she added.

> We are very happy with this partnership; we have benefited greatly from the contribution that Maptek has made to the university.
> - Professor Quijada

Exploring undercover

Keen future geoscientists from across Australia had much to explore during this annual summer school.

The third annual National Exploration Undercover School (NExUS) took place over three weeks in November–December 2018. It was attended by 32 eager geoscience students and early career mining and exploration professionals.

NExUS is a prestigious Australian summer school for next generation exploration geologists. It is funded by the Minerals Council of Australia (MCA) and Minerals Tertiary Education Council (MTEC), co-ordinated by the University of Adelaide and supported by geoscience industry, government and academia.

The 2018 cohort represented every Australian State and Territory, selected from 11 different universities, together with geoscientists from five exploration and mining companies, Geoscience Australia and the NSW Geological Survey. Participants included geology and geology/engineering undergraduates, honours and masters students, and recent graduates.

> Attendees were encouraged to think critically about the challenges facing mineral explorers today, as well as the technology and practices required to overcome these.

The 3D orebody modelling component exposed students to the latest Maptek™ Vulcan™ geological modelling tools.

This session was presented by Dr Gavin Springbett (G&S Resources) and covered: geological databases, data appraisal and validation, orebody boundary definition (implicit and explicit), surface and block modelling, model visualisation and validation, and resource-reserve estimation.

The practical session provided a valuable understanding of the modelling process, the stages involved and tools available.

The NExUS Alumni (2016-2018) now numbers in excess of 100 students, with all participants remaining in the Australian geoscience sector and about 70% involved directly in mineral exploration.

Feedback from participants has been very positive. They called out a much greater appreciation of the career opportunities within mineral exploration, the comprehensive nature of the program for professional development and the benefits of networking as key course outcomes.

Maptek Calendar

2019

March 4-22
XVII Citation de Geoestadística 2019
Maptek, Viña del Mar, Chile

April 2-4
Discoveries
Hermosillo, Mexico – Booth 141

April 9-11
ACG International Conference on Mining Geomechanical Risk
Perth, WA, Australia – Booth 1

May 6-8
Canadian Institute of Mining
Montreal, ON, Canada – Booth 1800

May 21-23
Austmine 2019
Brisbane, Qld, Australia – Booth 91

May 27-30
Exponor 2019
Antofagasta, Chile – Booth 430

June 6-7
Elko Mining Expo
Elko, Nevada, USA

June 18
Copper to the World
Adelaide, SA, Australia

October 24-26
XXXIII Convención Internacional de Minería
Acapulco, Mexico – Booth 428

November 25-26
International Mining Geology
Perth, WA, Australia

2020

May 12-14
International Symposium on Slope Stability in Open Pit Mining and Civil Engineering
Perth, WA, Australia

September 28-30
MINExpo International
Las Vegas, Nevada, USA

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