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Maptek customers, staff, family and friends viewed the total solar eclipse in North America on August 21





Photography credits: Anne Gauer, group shot taken at Golden, CO; Christina Johnson, Castle Gardens Petroglyph Area, WY; Cesar Carrasco, Grand Island, NE; Amanda Deutsch, Glendo, WY; Dede Butler, Golden, CO



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MAPTEK FORGE / SEPTEMBER 2017



Maptek specialises in developing powerful, smart 3D solutions to help miners better understand and take control of their information to enable safe, efficient and productive operations.

Maptek possesses a unique combination of mining domain knowledge, technical expertise and engineering resources, providing the ideal foundation for holistic mining solutions development.

We aim to integrate data connections within the mine environment to build more robust systems which span larger parts of the execution chain. This aligns with an Internet of Things approach to communicate real-time information.

Maptek products are an integral part of our technology roadmap, but not the whole story. The roadmap also defines the direction of the development and we invite you to share the journey with us.

Peter Johnson Managing Director





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Intuitive I-Site geotechnical solution provides for advanced data analysis and risk assessment underground

Measure, audit and improve drill and blast

A large South American copper mine has seen close to 60% increases in efficiency in key processes since adopting Maptek™ BlastLogic.™

Maptek[™] BlastLogic[™] removes the divergence from drill and blast plans, leading to efficiency gains of more than 60% in key processes. Importantly it helps identify areas where money is wasted.

Drill and blast processes are typically one of the most expensive, but hardest to measure and audit activities for mine operations. Drilling route allocation, operational loss through rough estimations of drilling length, load design, reporting and control are frequent challenges for drill and blast teams.

Maptek developed BlastLogic to solve these challenges, creating a software solution linking blast designs directly with geological and geotechnical data, mine plans and field measurements to enhance blast precision. A significant feature is the ability to track drill and blast information, identify trends and learn from the data.

Recently, a large South American copper mine has reduced costs by streamlining blast design, overcoming the inherent complexities that changes in the technical mine landscape add to drill and blast processes.

Dramatic improvement

A Maptek team helped implement the system over a 12-week period. The site has improved operations by more than US\$100,000 per month in nominal over-drilling. Site safety was improved where it was dangerous to bring the rig back to re-drill.



BlastLogic provided control from hole to hole. Drillhole measurements were shared online with details of shifts, personnel, metres drilled and hole positions.

In the second month, data capture was implemented via the BlastLogic tablet. Better field data capture of drillhole quality assessment, integration with ground equipment, comments and explosive reports improved data quality control and strengthened connectivity to management.

Accurate online reporting, and availability of data as forms, reports, images and videos, enabled more informed operational decision making. Local site knowledge is now supported by auditable data.

Precision and quality

Precision and quality of drilling was improved through detection of failed holes and holes outside tolerance. Reconciliation of planned hole design against actual holes allowed more informed revision of designs and identification of trends. More user-friendly reporting improved communication. BlastLogic development philosophy revolves around the Maptek customer-centric focus. Iterative feature rollout in close contact with various key customers has resulted in a powerful and efficient solution.

BlastLogic helps optimise total cost as it enables consideration of mine and plant costs together.

Implementation of BlastLogic led to identification of several areas of improvement, including a critical need to address the automatic depth gauge measurement on the drills. Wireless connectivity in the pit allowed capture of near-live data from drill rig systems to feed into the BlastLogic database.

Action has been taken to improve activities by operators who may have drilled random sequences based on their own judgement. BlastLogic was instrumental in decreasing loss by enabling drilling to happen at the right time, to see whether design plans were followed, and to identify how well the blast design was followed so that designs can be improved.

BlastLogic also enables more efficient feedback of field knowledge to designers in the office, and activity tracking allows for automatic communication to be sent to suppliers to streamline ordering of materials.



New Grade Control Optimiser

A new approach to classifying material for mining eliminates the manual generation of polygons, taking the guesswork out of grade control while maximising economic value.



Maptek[™] Vulcan[™] Grade Control Optimiser generates optimised and practical mineable polygons in a repeatable, auditable process.

Grade control is vitally important at open pit mines. Decisions are made daily about where to send the newly mined material, and in this fast-paced operating environment sub-optimal decisions have an immediate, irreversible impact on the mine's bottom line.

Open pit mines must balance the correct decision based on the geological model and analytical data, with the practical solution which accounts for the mining method.

Current practice involves drawing polygons by hand, with only a cursory focus on maximising value, and does not provide the ability to conduct robust sensitivity studies. This process is not repeatable as different engineers can classify material differently according to their experience.

A new tool in Vulcan, the Grade Control Optimiser, tackles the problem in a different way. Instead of a single result digitised by an engineer, Grade Control Optimiser generates thousands of solutions and evaluates them to achieve an optimised result. Depletion from ore loss and dilution is minimised, while satisfying mining parameters.

User-defined constraints

Grade Control Optimiser uses a variety of optimisation techniques from exact to meta-heuristic, to achieve a meaningful result, faster and more accurately than could be done by hand. The process is also repeatable and auditable. Optimisation can be guided by economic value, or by cut-offs to minimise misclassification.

Mineable polygons are then automatically generated to delineate the different regions. These polygons are controlled to limit vertices and sharp angles, creating proper operational polygons that can be staked in the field and mined when required.

Any changes to the polygons are reflected quickly in reporting of tonnage, grade and value. Generating grade control polygons automatically leads to more time for in-depth analysis. An open pit mine may have a range of equipment available, some larger and less selective, and other smaller equipment that is able to more carefully extract different ore types.

The value of the more selective equipment must be quantified in order to make an informed decision. Grade Control Optimiser may be used to generate different polygons for each choice, and the true impacts of ore loss and dilution may be measured.

This innovation provides mines with tools to optimise their daily activities and avoid expensive mistakes.

Grade Control Optimiser was developed over the last year in partnership with Newmont and Barrick, and is being evaluated at several other sites.

Grade Control Optimiser was released alongside Vulcan 10.1.2 and is available for purchase now.

Geotechnical analysis for safer mining

Maptek™ I-Site™ technology helps improve safety by reducing time spent underground and enhancing identification of risk.



Nothing is more important in underground mining than safety. Fast, accurate survey techniques allow surveyors and geotechnical engineers to efficiently capture data in the hazardous underground environment.

Maptek[™] I-Site[™] laser scanners are designed for underground survey applications. The 125° vertical angular scanning range allows overhead data capture. A carbon-fibre boom mount extends the scanner safely into voids for stope survey.

Accurate mapping

A single point cloud from a standard three-minute scan encompasses 1.5 million points. With extremely fine point accuracy, all of the detail required for accurate geotechnical mapping is collected.

Point cloud data is modelled in I-Site Studio software with intuitive geotechnical mapping tools for applying data to critical applications such as rock bolt identification and joint studies. The information is ideal for use in rock mass classification systems such as GSI (Geological Strength Index), RMR (Rock Mass Rating) and Q-System (rock tunnelling quality).

High resolution laser scans collect even more detailed data for geological mapping and volume calculations.

Streamlined I-Site Studio workflows guide users to select, crop and clear relevant scan data instantly. Filtering points by minimum separation is an effective step for creating a complex 3D surface that retains a high level of detail.

Discontinuities

Geotechnical discontinuities can be automatically extracted for easy stereonet generation. Stereonets provide for clear identification of sets of discontinuities that present a potential risk.

Joint numbers can be calculated to apply to Q-System and RMR, and users can view whether joints are favourable or unfavourable in relation to the direction of underground drives and reconcile these against the mine design. Selecting discontinuities on a stereonet highlights them for viewing in the 3D window for easier identification. Simple drag-drop of data into the discontinuity spacing panel allows users to calculate joint spacing. Maximum, minimum, mean and standard deviation can be reported for GSI and RMR application.

The joint spacing tool displays the 3D measurement lines for application in GSI and RMR. Discontinuity spacing data can be exported as multiple file types for mine design and planning.

Users can calculate wedge volumes by mapping the extents of intersecting discontinuities which pose potential wedge failure risk.

Modelling discontinuity solids allows geotechnical engineers to calculate the weight and likelihood of a block's gravitational fallout by analysing its planes in a stereonet.



Rock bolt analysis

Rock bolts can be digitised directly on the laser scans. Users can view the orientation and penetration of bolts into hanging walls by generating and translating lines. Comparison to discontinuities helps visualise rock bolt effectiveness in 3D.

Scan data can be used to reconcile rock bolt distribution and extrapolation against rock tunnelling standards, and check joint spacing conformance.

A unique waviness tool allows users to easily calculate the level of undulation for RMR. The discontinuity projection tool helps visualise how a discontinuity can potentially affect other areas of the mine, providing guidance for predicting ground conditions.

Deformation

Identifying and monitoring areas subject to high stress is critical for preventative safety measures. Users can analyse spalling rate over time by comparing scans; colouring by distance can reveal effects of significant stresses as bulging or movement.

Laser scan data is also very effective for monitoring the progress of stopes and the impact of drill and blast activity. Potential dilution or structural changes can be easily identified.

Deformation in key working areas, such as around crushers or workshops, can be monitored using the Maptek Sentry system. Alerts and thresholds can be set to allow decisions to be made around remedial action.

Laser scan data and intuitive software provide an unbeatable solution for assessing geotechnical risk to support safe operational decisions underground.



Applications & benefits

- Automatically extract discontinuities from laser scans
- Measure discontinuity spacing, calculate waviness, create discontinuity solids
- Reconcile rock bolt distribution
- Create 3D linked stereonets and rose diagrams
- Perform interactive kinematic analysis
- Measure block dimensions and calculate volumes
- Identify and map tension cracks, scarps and fissures
- > Monitor deformation in key areas

To learn more about our geotechnical solutions contact your local Maptek office or email solutions@maptek.com

































































Roadmap guides development journey

The Maptek[™] Technology Roadmap outlines our 5-year vision and reflects our strong commitment to design and develop solutions that add value to mining operations.

Maptek[™] Chief Technology Officer Simon Ratcliffe says the Technology Roadmap is a crucial communications document which helps ensure the company's vision aligns with that of its customers.

Understanding the strategic direction allows customers to have confidence in working with Maptek to meet their own goals.

'We want to get customers enthused and inspired about our direction and say, 'Absolutely, this is where we want to head as well. Maptek's going to be a great partner to help us get there,' Ratcliffe comments.

'We design software that is very advanced and for people with specialist knowledge. We don't shy away from going into those technical nooks and crannies to get a specialised job done.'

A robust core technology framework allows individual customer needs to be addressed.

'Core technology common to all Maptek products enables an environment where customers can create integrated technical

I-Site Studio I-Site Scanners Sentry PerfectDig BlastLogic Evolution Epoch

operating models across a range of systems and data sources – in a way that reflects the reality of their mine.'

Fundamental areas include data sharing and management, workflow modelling and business process management.

The roadmap guides the integration of all our desktop applications into the Maptek Workbench to provide a platform for these processes. The Workbench, introduced in 2016, also improves licence management and flexibility.

'The inputs to various pieces of software will no longer be constrained to that software – you'll be able to open multiple pieces of software and have the data flow from one to the next,' Ratcliffe says.

Enterprise connectivity

'Another project involves creating a new spatial platform. This will allow the kind of data that we deal with in our software, such as large block models, triangulated data structures, grids and big laser scans, to be efficiently stored and communicated between machines. 'Once you put those two concepts together you can start getting data from different disciplines, or different machines, onto the one machine and into a range of software.'

This enterprise connectivity allows multiple users to share data for multiple functions across multiple applications, which enhances collaboration, efficiency and accuracy.

Geospatial, geological and 3D surface data, and planning, scheduling and production data will seamlessly unite the technical workflows of Maptek applications.

Mapping the technical mining process to mine data models and application workflows results in significantly more robust, efficient systems.

The Workbench offers a Workflow Manager which provides enhanced transformation of the data through a series of automated steps. This also establishes best practice for repeatable results.

'These results can be handed off to other people and other groups on a mine site. So you're building an ecosystem to gather data, marshall to a single point, analyse, decide, add value and then apply it in operations,' says Ratcliffe.

'If you put all those parts together you start getting some very powerful capabilities, giving greater confidence in understanding and resolving variations to plan. Businesses can focus their attention on continual improvement.'

The roadmap defines the direction of our technology and we invite you to share that journey with us.

MineSuite controls information flow

MinLog information management systems enable operations to collect, analyse and report information to drive improvement.

Managers who are frustrated by their inability to control processes, systems and information flows within their operation face additional challenges when there is a large on-site plant or mobile fleet to manage.

Ten years ago, Beeshoek Iron Ore Mine Plant Management implemented MineSuite to tackle these issues. Their journey illustrates the benefits of using an integrated information solution to track, monitor and report on products, equipment, processes and personnel. It is described here in the context of MinLog's #ONE statements and development philosophy.

#ONE View across processes and systems

The difficulty of using siloed spreadsheets of information as a corporate asset led to Beeshoek Plant Management adopting MineSuite. The aim was to address the shortcomings of traditional technical systems which catered only for specific needs in the mining value chain.

MineSuite was first deployed to provide for manual data entry in the Washing & Screening area. With encouragement from plant management, control room operators embraced the new data capture environment.

#ONE Version of the truth

As confidence in data integrity grew, Beeshoek identified legacy spreadsheets to be replaced by MineSuite reports. Information gathered in silos results in duplication and replication. Independent validation of data within the silos creates multiple, opposing versions of the same information. The source, context and granularity of the original data are often lost.

Contextualisation of data from the point of origin in a lossless environment creates a single point of reference across processes and disciplines, with unique opportunities for:

- > Enterprise wide optimisation and business improvements
- Closing the loop between planning and operations
- Integration between survey, planning and production to reconcile planned vs. actual
- Standardisation of KPIs and KPAs across disciplines, e.g. maintenance and production

#ONE Product on operational level

With continuous improvement in mind, Beeshoek identified additional data measurement points. A revised MineSuite configuration reduced the need for manual data entry, further increasing information integrity.

MineSuite allows data from third party sources to be validated and consolidated into a single, scalable and configurable process model. With the context understood, complex analysis and optimisation can be conducted in real time across the process.

#ONE Solution across the mining executional value chain

Building on confidence in plant production and productivity, including time accounting values from MineSuite, the next logical focus for Beeshoek was on ore and product qualities.

MinLog, laboratory and StarLims representatives collaborated to develop an interface to provide laboratory results for volumes produced per time period.

With production volumes and qualities now available, Beeshoek can compare lab and geophysical survey results. Geophysical values are important for setting jigs during plant operation and it made sense to compare these with lab results to obtain a view of plant performance holistically.

MineSuite combines multiple systems and modules to deliver a unique solution tailored to an operation's needs.

#ONE Focus on strategic partnership

The 10-year journey with Beeshoek Plant Management is testimony to MinLog's investment in strategic partnerships. The 50% Maptek shareholding in MinLog creates a strong, viable partnership for addressing the fast-growing need for information gathering, analysis and optimisation across the mining value chain.

#ONE International footprint

MinLog offices in Newcastle, Australia and Pretoria, South Africa are supported by Maptek resources globally. This unique combination of skills and mining industry expertise guarantees #ONE effective team, covering product development, project management, training and delivery.

For information on MineSuite systems, please email one@minlog.co.za

Closing the design – scheduling loop

Maptek[™] provides integrated solutions that directly target the complexities of mining in the underground environment.

Integrating design, evaluation and scheduling tasks shortens the planning cycle and ensures mining is guided by current information.

Maptek[™] Vulcan[™] closes the loop from design to scheduling, helping operations to improve safety, performance and productivity.

The underground mine planning process combines a series of clearly defined steps, starting with the resource model and moving through access design, life-ofmine scheduling and into cash flow analysis.

The Vulcan Block Model containing the mineral resource forms the backbone of the planning process.

Analysis of cut-off grade and mining methods leads to the design of mineable shapes which will become the underground production area.

Vulcan Stope Optimiser uses algorithms refined over 10 years to automatically maximise the value of recovered ore within the given orebody geometry and design constraints.

The latest features provide greater flexibility and control over final stope shapes for mine planning and scheduling. Users can quickly generate individual stope designs – saving days or even weeks of manual work. Once a stope is defined, the next question is how to best access the production areas.

Vulcan Level Designer creates hundreds of crosscuts in seconds. Design strings and costing information are provided for each development scenario, allowing engineers to determine an optimal plan for stope access.

Decline Optimiser integrates with Level Designer to generate multiple underground development scenarios for consideration in mine planning.

With completion of stope design and mine access plans, the focus turns to life-of-mine scheduling to run cash flow analysis and determine the net present value (NPV).

Vulcan Gantt Scheduler (VGS) handles resource and activitybased scheduling.

Users can create, sequence and allocate resources, animate scenarios and report activities efficiently and transparently within a single application. VGS is totally integrated with Vulcan, meaning it directly reads Vulcan block models. Multiple files can be imported and exported for scheduling shorter range plans from life-of-mine.

Mine planning teams can quickly create long term schedules that optimise NPV while adhering to operational resource constraints with Schedule Optimisation Tool.

Visualising schedules helps identify potential issues early so they can be efficiently addressed.

Powerful processing that exploits available computing power allows users to run multiple alternatives in a very short period of time.

The Maptek solution demonstrates how users can close the loop between underground mine design and scheduling within the one software package and add value, without compromising safety or practicality.



Geostatistics courses

Valuing relationships with universities allows Maptek to help train the next generation of mining professionals.



Citation courses

Maptek is proud of our ongoing partnership with Dr Clayton Deutsch, Professor and Director of the School of Mining and Petroleum Engineering, Department of Civil and Environmental Engineering at the University of Alberta. Maptek Citation Programs in Applied Geostatistics have been taught for more than 18 years, and include the option to receive a university accreditation awarded by the Faculty of Extension at the University of Alberta.

The 2017 Citation Program in Applied Geostatistics recently concluded in our Golden, Colorado office, was extremely well-received. Participants could see immediate benefit, thanks to the emphasis on applications for mining. This fourweek course involves theoretical and practical aspects of the use of modern geostatistical tools.

This year, the Citation Program was taught by Dr Deutsch alongside Dr Jeff Boisvert, Assistant Professor in the School of Mining and Petroleum Engineering at the University of Alberta, and co-Director of the Centre for Computational Geostatistics.

The Citation Program is highly regarded in South America, being run annually since 1999 in Chile. Marcelo Arancibia, General Manager Maptek South America, is a strong advocate of the geostatistics program and also runs various specialty master classes for students at universities throughout the country.

Masters program

In 2018, Maptek South America will present a new specialised training program, Masters in Geostatistical Modelling of Mineral Deposits. The program is oriented towards geologists and mining engineers with experience in geostatistics, and consists of 10 modules taught over two years, by Dr Clayton Deutsch, Dr John Manchuk and Dr Ryan Barnett.

Short courses

In August, Maptek held three, one-day geostatistics courses in our Perth, Australia office in the lead up to the 2017 International Association for Mathematical Geosciences conference.

Specialist instruction on Locally Varying Anistropy, Implementation Aspects of Simulation, and Recoverable Reserves and Localisation, was provided to an engaged mix of Maptek customers, employees and other geostatisticians keen to learn practical skills to enhance grade modelling accuracy, simulation studies and reserving in their projects. This was a valuable opportunity to learn in an intensive format from Dr Deutsch before he participated in IAMG as the 2017 Distinguished Lecturer.

For 2018 geostatistics course dates and registration inquiries visit www.maptek.com/cl or www.maptek.com/mx.

Maptek Calendar

Learn about Maptek solutions at these global events.

2017

October 4-6 XIII Feria Minera - Expometálica Medellín, Colombia - Booth 175

October 11-13 First International Congress on Underground Mining Technology Sudbury, Ontario, Canada

October 17-19 XVIII Maptek Users Conference 2017 Viña del Mar, Chile

October 25-28 XXXII Conferencia Internacional de Mineria Guadalajara, Mexico - Booth 679

November 14-15 New Gen Gold Perth, Western Australia

2018

February 19-March 2 | April 16-27 Citation in Applied Geostatistics Mexico City, Mexico

February 25-28 SME Annual Expo & Conference Minneapolis, Minnesota, USA

March 5-30 Citation in Applied Geostatistics Lima, Peru

April 23-27 Expomin 2018 Santiago, Chile - USA Pavilion Booth 811-2



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Triangulation Solutions Online Training

free trial ends 17 November

Customers are invited to try our new Online Training. Take the free sample course and quickly learn the basics of Vulcan triangulations.

Register via Maptek Users Area



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