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Newsletter December 2016

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Vulcan 10 modelling Drill & blast challenges Strategic planning Transportable monitoring Information integration Really useful Eureka Evolution development New technology leaders University partnerships

Activities in Asia



India

Maptek joined Indian resellers Aimil Ltd at the International Mining & Machinery Exhibition in Kolkata in November to promote the latest hardware and software solutions. Embracing technology to tap the potential of the Indian mining industry was high on the agenda at the biennial summit and international exhibition.







Indonesia

Maptek distributor PT Asaba organised the 3rd Indonesian 3D Laser Scanner gathering in Balikpapan to demonstrate Maptek Sentry and I-Site laser survey systems to 50 attendees. A workshop allowed attendees to apply the latest I-Site Studio 6.1 software to process and model laser scan data.

Strong talks from government and universities highlighted the importance of slope stability monitoring in mining. The Maptek demonstration showed how Sentry could monitor and predict surface movements by measuring changes in displacement, velocity and inverse velocity. Sentry has been proved as a reliable, accurate and cost-effective tool for risk management.





Maptek is an innovative software and technology company. Our highest priority is to devise and develop the best applications for the mining industry.

We are working to better align our organisation with our core values. We recently announced a new leadership structure that will allow us to implement untapped ideas to bring more groundbreaking technology to market.

Engagement with key customers and industry leaders has provided positive feedback on our roadmap and the endorsement to continue the direction initiated by the Maptek Workbench. The outcome will be transformational for the industry and for Maptek.

With signs of the mining market in recovery, companies are looking to take advantage of opportunities. The Internet of Things approach where connected data, devices, services and users all work together can deliver efficiency, accuracy and agility. Our customers recognise the huge potential to exploit this technology.

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







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Eureka is a really useful tool for dynamic interaction with exploration or mine site datasets to better understand project geology.

Streamlined solutions for Buenaventura

Buenaventura uses Maptek™ Vulcan™ to streamline a range of modelling and mine planning applications across their operations in Peru.



The latest Vulcan tools help Buenaventura to model and visualise the underground orebody for assessing mining potential and plans.

Buenaventura is Peru's largest publicly trading precious metals company and a major holder of mining rights in Peru. The company is engaged in the exploration, mining, processing and development of gold, silver and other metals via wholly owned mines, as well as joint exploration projects.

Buenaventura deploys some 30 Vulcan licences across exploration, survey, geology and engineering departments for geological modelling, underground mine design and stope optimisation.

Buenaventura commenced operations at Orcopampa in 1960. The Chipmo mine is located in the Chilcaymarca and Orcopampa districts in Arequipa, 3800 metres above sea level. Exploration of the Nazareno vein began in 1998 and the mine-deepening project commenced in 2004. The Chipmo silver and gold deposit contains high, intermediate and low sulphidation. Structural control associated with mineralisation is found in 2 fault systems, N210/85 and N60/80.

Mineralisation is emplaced in volcanic rocks of the Sarpane Complex. Hydrothermal alteration is associated with the mineralisation.

Maptek[™] Vulcan[™] was used to set up and validate the analytical database. Channel samples representing 84% of the population were analysed with an average sample width of 0.59m. Drillhole samples represented 16% of the population, with an average sample length of 0.36m.

Histograms were produced in Vulcan, showing an average vein width of 1.8m for Prometida and 2.14m for Nazareno. Compositing width is 1.5m, with a 3mx1.5mx3m block size.

Buenaventura applies Vulcan variography tools to improve understanding of geological data. The new interface introduced in Vulcan 10 streamlines the workflow when performing variography studies. Users can easily create and test multiple alternatives and compare these models side by side. Downhole and principal vein values can be plotted, visualised and analysed.

Resource estimate

The resulting resource estimate allows a better understanding of the mining potential and greater confidence for planning how to mine the ore.

The block model information allows users to ascertain the magnitude of error and quantify the quality of the estimate. This helps in calculation of minimum distances in diamond drilling and channel sampling.

The Vulcan block model has allowed Buenaventura to standardise procedures. These are easily auditable and are recognised by regulatory codes for defining resources and reserves, such as JORC and NI 43-101.

Thanks to Octavia Vargas Machuca Bueno Modelling Geologist Buenaventura

Estimation and modelling approach

Uniform Conditioning is an increasingly popular technique in the Maptek[™] Vulcan[™] resource modelling toolbox.

In resource modelling, when data is sparse and widely spaced with respect to the selective mining unit (SMU), there is a constant tension between creating a resource model that produces accurate, well informed local estimates and a model that is good for predicting global resources and producing reliable grade-tonnage values.

Commonly the big picture is sacrificed for improved local estimates.

Uniform Conditioning is an estimation technique that has gained popularity in recent years.

Uniform Conditioning was originally developed to address the inability of traditional estimation methods, such as kriging, to produce reliable grade profiles that describe the global distribution of a deposit. However, in order to produce valid results large panels were required, and there was no indication of where the actual SMU grades were within those panels.

Recent developments within Maptek[™] Vulcan[™] grade estimation have addressed some of the earlier shortcomings of Uniform Conditioning. Alternatives to localise and rank the SMUs in a panel now make the grade assignment process straightforward and flexible.

Uniform Conditioning models allow users to validate the amount of recoverable reserves, providing an invaluable tool either at the prospecting stage or during production. When using a cutoff grade to evaluate resources and if the data is sparse, this method will mitigate the risk of overestimating or underestimating the grade and amount of ore.

Estimation method

Uniform Conditioning is available as another estimation method in Vulcan, alongside inverse distance, and simple, ordinary and indicator kriging. The process of setting up a uniform conditioning estimation is virtually the same as setting up a kriging plan. The user simply specifies the panel definitions and a localisation strategy.

Vulcan allows both regular and irregular panel definitions. For example, a panel could be defined using a set of 3D solids or by a block model variable. Simple regular panels are also allowed.

This provides great flexibility and helps in accommodating the panel shapes to the orebody and domain shape that is under study.

The corrected panel scale distributions can be assigned to the SMU scale blocks using one of four different localisation strategies. The user can then choose and adapt a method that best fits a particular mineralisation.

Uniform Conditioning in Vulcan has all the advantages and power of Vulcan grade estimation, including multi-threaded execution, batch mode and options to output additional variables that are part of the estimation process.

The latest Uniform Conditioning is available to GeoStatModeller users with the Vulcan 10.0.2 updates.



Grade estimation using ordinary kriging compared with models using different localisation strategies below







BlastLogic is the logical choice

The world's leading mining companies have one thing in common – they have all invested in Maptek[™] BlastLogic[™] for drill and blast.

Maptek[™] Development Manager Blast Accuracy Solutions, Mark Roberts says mining's most advanced drill and blast system is being used at sites in Australia, North America and South America for a range of commodities including coal, iron ore, copper, zinc, gold and diamonds.

Detailed evaluation of capability, and due diligence of supplier track record in implementing and supporting blast design and management solutions has led the world's tier one mining companies to invest in Maptek BlastLogic[™].

BlastLogic is the only solution that delivers a mechanism to address drill and blast and operational improvement challenges in a sustainable way. Regardless of the geology, commodity type, engineering expertise, technology footprint, drill and blast processes, and business drivers, companies know that BlastLogic meets their individual challenges.

Many different operations are taking advantage of BlastLogic to address common needs.

A large gold mine in Western Australia and a metalliferous coal mine in Queensland are examples of sites which require vibration control to manage risk. As part of the drill and blast process they rely on BlastLogic to control safety of adjacent underground operations. Having a tool to check and model vibration based on blast designs is very important. BlastLogic has the most advanced charge rules for calculating maximum instantaneous charge for every hole relevant to many monitoring points.

A large new iron ore mine and another large gold mine in Western Australia currently use BlastLogic to optimise fragmentation, dig rates and crusher throughput. Being able to correlate rock type, ore grade, drill penetration rates and blast design allows more informed valuein-use decisions to be made.

This capability enables mines to integrate single process improvements into a holistic mine-to-mill blasting approach.

BlastLogic is also being used by some mines to reduce cost on drill and blast while mitigating degradation in fragmentation.

Only BlastLogic, through its modelling and analysis tools, is able to show engineers how their blast objectives are impacted by the design, and then allows them to check compliance to design in real time as the plan is executed in the field.

BlastLogic is also used in conjunction with other Maptek products to further optimise mine safety and productivity. A group of large copper mines is focusing blast designs on wall control as part of their strategy to create steeper, reliable walls so that more ore can be recovered. Steeper walls bring an increased safety risk which is related to the structural integrity.

Maptek PerfectDig[™] and Maptek I-Site[™] laser scanning are used to monitor the design of the walls during excavation, and Maptek Sentry is used to monitor movement and look for trends and any risks.

Drill and blast is the key to the entire operational flow. Engineers design drillhole placement. Through BlastLogic's direct interface to supported drill navigation systems they can validate as-drilled data for conformance to design. Plans can then be adapted accordingly.

Another unique discriminator of BlastLogic is its flexible, scalable deployment options. It can be accessed as a managed service on the Cloud, minimising IT overheads for customers and providing secure access to authorised users. Alternatively BlastLogic can be used on-premise in a customer's data centre.

Both options support central access by multiple mines and users to access their drill and blast information. This provides economies of scale for our customers, and enables benchmarking across operations.



Strategic planning increases production

The Súria mine in Spain has taken advantage of custom Maptek™ Vulcan™ upgrades for modelling complex geology.

ICL Iberia Súria & Sallent, headquartered in Súria, Barcelona, is dedicated to the extraction, processing and marketing of potassium and sodium salts. With a workforce of 1200 people, it is part of the multinational Israel Chemicals Limited (ICL), a world leader in the production of fertilisers and chemicals.

ICL Iberia Súria & Sallent is currently implementing the 'Phoenix' strategic plan to increase production at the Súria Mineww. The project will extend and modernise the current facilities.

The desired production increases have brought new challenges. The Súria mine deposit is made up of complex, highly folded geology and planning engineers require an





accurate geological model to be able to hit production targets. To help model the deposit, ICL chose Maptek[™] Vulcan[™] geology and mine planning software.

A large number of lines were created to guide the wireframing. Intermediate section interpretation was required between the main sections, due to the highly folded nature of the deposit. This was very time consuming.

Maptek deployed a team of experts to analyse the specific requirements for generating the geological model. Several custom Vulcan enhancements were developed to facilitate and speed up the geological workflow. Geologists can now create intermediate sections on the fly while generating the wireframes. It now takes one-third of the time to generate the geological interpretation.

This time saving is significant as the deposit covers several square kilometres, with three seams to be modelled.

The new functionality created by Maptek increases the value of Vulcan as a uniquely powerful software solution for all companies modelling deposits with highly complex geology.

The next step is to implement Vulcan mine design and underground planning tools to help further advance progress of the Phoenix plan at ICL Iberia Súria.

Thanks to ICL Iberia Súria & Sallent













































MAPTEK Sentry

Advanced solution for change detection

















Transportable monitoring solution

Maptek™ offers a transportable solution with Sentry surface monitoring software, a trailer-based mount and remote power and communications systems.

The innovative unit provides flexible options for reliable monitoring of mining faces, benches, tailings dams, road cuttings, tunnel entrances and other civil applications. Remote access is enabled via Sentry software.

Solution operation

Drive the Maptek trailer to your monitoring site. Follow the simple instructions to lock the trailer and set up the system. In most cases you can start monitoring within 15 minutes. Sentry can be run remotely or in situ.

The trailer contains all of the power, networking and communications infrastructure to run the system.

Drive into position, level and lock the trailer, set up the laser scanner and start monitoring! The hydraulic laser scanner mount in the trailer offers a stable alternative to mounting on a fixed bollard and is suitable for short to long term monitoring with Sentry. Remote power and communications support includes solar with backup generator power, 3G/4G and wifi links.

An industrial grade network switch incorporated into the trailer design affords high temperature resilience, wide voltage input tolerance and ethernet shielded discharge (ESD) ports, providing comprehensive remote management features.

Port-based power monitoring (passive PoE at all ports) and temperature monitoring are included. The hardware is ideal for radio communication and relay links, featuring greater packet buffer memory compared to most other industrial switches.

System package

- > Sentry Premium software suite
- Custom-built trailer with 2 pack polyurethane protection
- Dual axle, 2 tonne GTM, galvanised electro-plated steel, light truck tyres, steel rims, hydraulic/mechanical brakes
- Hydraulic stable laser scanner mount
- Remote power system, 24V 80 amp generator
- > 4 x 6V 390 amp AGM batteries
- > 2 x 260W solar panels
- Remote power management console with switch gear, PoE switch, ethernet 4G/3G communication module, charge control system and computer
- > Weather station and communication antennae



Information integration

MinLog has adopted innovative technology and architecture to model, measure and interact with processes across the mining value chain.

Several years ago MinLog embarked on a new development roadmap aimed at reinforcing MineSuite as the only solution capable of integrating information from various business processes across a variety of disciplines into a single source of consolidated, verified and approved operational information spanning the mining value chain.

The result of this journey is the MineSuite InfoManager, with the MineSuite Application Server at its core.

A major challenge is the different control and process-level systems that generate source information, each built on an individual technical platform best suited to its function. Source data is often hard to consolidate due to factors such as naming conventions, data structures, data media and timing.

MinLog has adopted innovative technology and architecture to address this shortcoming, resulting in an ability to model, measure and interact with processes across the mining value chain. The new architecture caters for integration and consolidation, providing the ideal platform for optimisation across the mining value chain. The global mining industry is rapidly catching up with other industries with respect to operational information demands. MineSuite is ideally suited to provide solutions.

'The MinLog–Maptek partnership has recognised the changing industry trend. We have identified several potential joint projects to exploit the unique benefits in combining our offerings', said Karel Gilliland, Managing Director MinLog.

'We are not only thought leaders in the industry, we have the operational, technological and industry knowledge to implement those ideas.'

One example is a quality tracking system in coal mines. MineSuite's ability to model, measure and track material flows through various processes from pit to port combines with Maptek capabilities in depicting multi-dimensional stockpiles and their attributes for accurate product reclamation and transportation. Another joint exercise involves integrating MineSuite Production Management Module with Maptek[™] Evolution Epoch. This will close the loop between short term planning and mine-to-plan execution, with real time monitoring in a Gantt view. Mines benefit by attaining greater control over the plan execution through continuous feedback regarding progress and critical exceptions.

MinLog believes that InfoManager will provide a stable platform for operation-wide information requirements, including standard reporting, interactive dashboards, control charts and data analysis.

Consumers of information emanating from InfoManager, including reports, ERP and planning systems, will no longer be exposed to the effects of failed interfaces due to changes in mine technical systems.

At the same time, the process modelling capabilities of MineSuite will ensure consistent, accurate information in a dynamic mining environment.

Contact one@minlog.com for more information



Eureka – compact product, hugely useful

Maptek[™] Eureka[™] is much more than an exploration package, with advanced modelling, lithology, seismic and geotechnical tools that add value to geological investigation.

Maptek[™] Eureka[™] is a really useful exploration package, ideal for working with all available GIS, spatial, historical, imagery, geophysical and geological data in the one place.

Eureka also provides specialised modelling and analysis tools for the interpretation of complex surfaces generated by disparate and often discontinuous data, and exposes useful information for mining and geological interpretation.

Eureka is useful in exploration and geological investigation where multiple data sources are present and trends, correlations or anomalies may indicate orebody targets. A powerful visualisation environment allows viewing of very large datasets on a regional scale.

Results generated in Eureka are useful for various downstream processes, streamlining exploration projects through to orebody modelling and mine design. Eureka Lithology Targeter is an easy to learn and use time saver for drill and blast engineers. A built-in workflow allows them to drag and drop the latest holes, drill rig telemetry and LAS files onto the screen. Eureka will 'pick' the coal seams and model the top of coal contact in minutes, ready for planning the next blast.

Eureka Implicit Modeller provides an effortless approach for creating and editing orebody models ready for first pass volume calculations. Geologists can drop their ISIS or CSV drillhole database, CAD control and triangulation envelopes onto the screen and quickly make an implicit orebody model using interactive orientation ellipses to visually guide the output.

For geotechnical engineers wanting a package that seamlessly communicates with Maptek[™] I-Site[™] Studio and Vulcan[™], Eureka Geotech is an extremely useful bridge. Providing comprehensive surface interrogation, stereonet population and failure analysis features, it also displays fully annotated boreholes and existing Vulcan models. Mining professionals may want an easy to use tool to quickly view, edit and fix complex or extremely large triangulation files from a range of input formats, or need access to the latest dynamic CAD tools. Eureka Core (available as a free trial until 30 June 2017) is a way of keeping Vulcan and I-Site Studio licences free for other users while still generating required outcomes.

Eureka is the ultimate solution for the exploration geologist who wants to integrate multiple formats of data from disparate coordinate systems, including seismic profiles, GIS data, aeromagnetics, topography or any formatted ASCII file into a common interface.

Eureka has been designed from the ground up to handle tens of millions of datapoints in dynamic 3D with level of detail capability. Any or all of the data types mentioned above can be integrated.

Good things really do come in small packages and with the upcoming integration into the Maptek Workbench, Eureka will become even more useful!

Evolution development

Maptek™ Evolution continues to add value to operations through dynamic and flexible scheduling functionality.

Since the initial application of the Lerchs-Grossmann algorithm for computing ultimate pit limits, research has continued on solving challenging problems in open pit mining, particularly mine production scheduling.

Determining the sequence in which blocks should be removed from a pit over the lifespan of a mine while maximising net present value of the mining operation is critical.

Maptek[™] Evolution is an agile, dynamic solution for targeting complex, real world challenges. It delivers systematic production schedules along with a practical development plan. Evolution is intelligent enough to concurrently consider multiple objectives, so there is no need to aggregate data.

Evolution architecture and optimisation engines are being applied to the in-development Evolution Epoch short term scheduling solution. Due for release in early 2017, Epoch will apply haulage and blending optimisation technology for scheduling of stratigraphic and metalliferous mines.

Evolution can easily handle the flexibility required by modern projects, the scale of which is beyond spreadsheet and linear approaches.

Evolution benefits include:

- Increase in value by higher grade early in the schedule
- > Advanced constraint modelling
- > Blend optimisation constraints
- > Interoperability with Vulcan
- > Integrated haulage and waste landform scheduling
- > Easy setup and quick runtime
- > Reliable, repeatable outcomes



Also due for release in 2017 is Evolution Phase. It answers the universal need for integrated and automated tools to manipulate optimal shells developed in pit optimisation. Users can adjust, split and combine shells and write new stage codes back to the model. These new stages can then be tested to improve NPV while achieving practical mining shapes.

Phase design is critical to the success of schedules. Engineers commonly face complex pit optimisation runs from which it is difficult to get a practical high value schedule.

Simplification involving detailed phase design work takes time. It is relatively easy to generate the ultimate pit shell and corresponding ultimate pit, but what happens between that and the endpoint is a function of shell selection, experience and intuition.

Phase incorporates the design process into the Evolution workflow in a seamless and auditable way. It allows engineers to take outcomes from a pit optimisation run and use them to make valued phase designs based on accumulating and manipulating blocks in 3D. The result is quick provision of inputs to a scheduler which can pre-qualify whether designs will work from a scheduling perspective, i.e. ore tonnages reached, no peaks in waste stripping and value being maximised.

The engineer can now rapidly iterate between Phase and Evolution Strategy to ensure the schedule works, before moving onto the actual design stages.

The powerful combination of Evolution Phase and Strategy has proved to add significant value to a project. In some cases, more than 20% has been added by applying these two techniques.

While value is an important factor, early cash flow is paramount to mine developers, bankers and shareholders. The ability to defer expensive stripping without compromising the integrity of the overall operation is critical.

Being able to efficiently examine numerous scenarios from the outset ensures future development is based on informed decisions.

Key positions drive innovation

Two new leaders promoted from within Maptek™ Core Technologies and I-Site™ software development teams will oversee delivery of the Technology Roadmap.

The Technology Roadmap is a summary of the major development and research projects which Maptek[™] is undertaking in all product areas. Our solutions target orebody knowledge, mine planning and design, mining execution, measurement, reconciliation and technical disciplines within a mining operation.

Appointed recently as Chief Technology Officer (CTO), Simon Ratcliffe will manage technology strategy and how this can improve the value of mine planning and operational information. He will be supported by an expert R&D team focusing on data management and solution integration.

This team will collaborate with individual Maptek product groups to implement the functionality defined as critical to ongoing customer productivity.



Simon Ratcliffe, Chief Technology Officer (left) and Jimmy Howlum, Head of Development Mine Planning

'My new remit allows me to grow an innovation culture across the whole business, while also driving productivity and efficiency through better pooling of code and resources,' said Ratcliffe.

'Our aim is to identify opportunities faster and accelerate delivery of high quality, ground-breaking solutions to our customers.'

'We plan to maintain technical depth by developing world class code in-house where this creates strategic advantage.'

'Release of the Maptek Workbench in 2016 launched a mission that will ultimately provide a single, comprehensive platform for all spatial modelling, design and analysis tasks,' added Ratcliffe.

'Rather than concern about too much change, Maptek's bigger challenge is how to bring enough progressive change within our company and our industry.'

The Workbench will combine multidiscipline workflows and product capabilities (from Maptek and third parties) to work on a single data model shared throughout the value chain, bucking the trend of individual products being applied to individual processes. This data model can be connected forward across event horizons to execution stages and upwards toward enterprise and resource planning.

Users can set up and run scripts, edit spreadsheets, auto-populate fields and export reports in the same environment as their design and modelling functions, tightening integration. Custom workflows across different applications will deliver another boost in productivity and facilitate hand off between groups.

Eureka will be hosted on the Maptek Workbench early in 2017, followed by I-Site[™] Studio, BlastLogic[™] and Evolution. Ultimately users will choose from a toolbox representing best practice in survey, design, modelling, scheduling, drill and blast, monitoring, geotechnical analysis and reporting.

Considered review of existing functionality will ensure that the rationalisation positively impacts our customers.

A top priority for the new CTO was leadership of software development for exploration, geological modelling and mine planning.

Former leader of I-Site software development, Jimmy Howlum is the new Head of Development Mine Planning. He looks forward to steering Vulcan and Eureka development from a broad crossproduct view.

Howlum sees the Workbench as the linchpin for data sharing and enhancing user experience. Solutions which span traditional products and respect business process flow will radically benefit modern mining teams.

The new leaders will visit Maptek software groups in Viña del Mar, Denver and Sydney before concentrating on the implementation of critical roadmap items such as Vulcan 10.1 and Eureka 4, both due at the end of the first quarter in 2017.

University partnerships

Students gain an edge with the Maptek™ Senior Design Group



Maptek[™] values the rising generation of mining professionals and wants students to have the best tools available as they transition to industry positions. That is why Maptek has launched a new university outreach targeted at higher year students completing capstone and senior design courses.

This new initiative comprises a LinkedIn group with shared resources, including documents guiding project workflows, instructional videos, and training opportunities.

Students from different colleges and universities in Canada, the US and Peru have joined this LinkedIn group to take advantage of help provided directly by Maptek. The online community can collaborate, share ideas, access resources, and ask questions related to their projects.

A part of this initiative was a live webinar hosted in October, which introduced topics in Vulcan for completing a pre-feasibility mine design:

- > Importing data
- > Compositing drillhole data
- > Building a block model framework
- > Inverse distance grade estimation
- > Open pit and underground mine design

The fast-paced instruction was well received and allowed students and their professors to ask questions informed by their academic experience.

Maptek is committed to ensuring that the mining industry benefits from graduates with the appropriate skills in the latest technology which enables them to be immediately useful employees.

Maptek Calendar 2017

February 19-22 SME Annual Conference and Expo Denver, Colorado – Booth 1409

April 25-27 Mining World Russia Moscow, Russia

May 22-24 AUSTMINE 2017 Perth, Western Australia – Booth 16

July 24-26 Iron Ore 2017 Perth, Western Australia

September 2-7

IAMG International Association for Mathematical Geosciences Perth, Western Australia

September 20-22

Tenth International Geology Congress Hobart, Tasmania



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