



December 2019 Newsletter

Forge



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Welcome to our final edition of Forge newsletter for 2019



What a year it has been!

I started the year as Product and Business Manager for our Evolution scheduling solution and end it as the new Maptek CEO.

During 20 years with Maptek, my varied roles in the South American and Asia-Pacific regions have provided wide perspectives on how our customers operate and how different solutions can be transferred.

Technology is a critical differentiator for our industry. Heading into 2020, automation and digitalisation rank highly as enablers to increase safety, reduce costs and improve productivity.

Our solutions meet everyday challenges as well as help future-proof your business. This is the value that Maptek has delivered for nearly 40 years and remains our guiding principle.

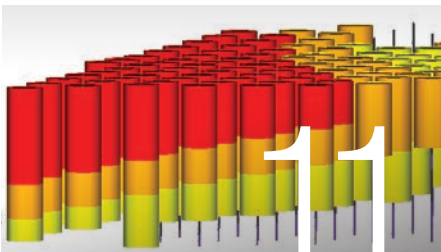
I am enthusiastic about the capabilities of Maptek people, and the potential for applying our accumulated knowledge to offer better products and services.

In the near term, I very much look forward to meeting more customers across the globe to ensure we can support you into 2020 and the future.

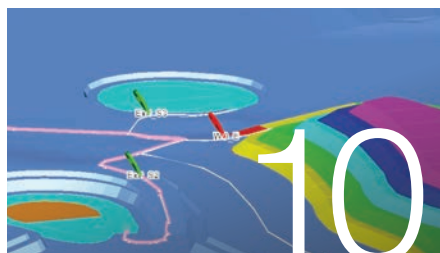
We hope you enjoy this issue and welcome your feedback.

Eduardo Coloma
CEO

Contact us: forge@maptek.com



Sentry is ideal solution for continuous stability monitoring



Scheduling solution uncovers value

Maptek™ Evolution scheduling solution has uncovered more than \$10 million in extra value for a Barrick Gold Corporation project in western Africa.

Massawa Gold Project is a large greenfields exploration project located about 700 kilometres southeast of Dakar, the capital of Senegal. In 2018, Barrick commissioned Maptek™ to produce a detailed strategic schedule and equipment study for Massawa.

Barrick had already completed a considerable amount of mine planning and now wanted to find out if Maptek™ Evolution could help increase Net Present Value (NPV) and optimise equipment utilisation.

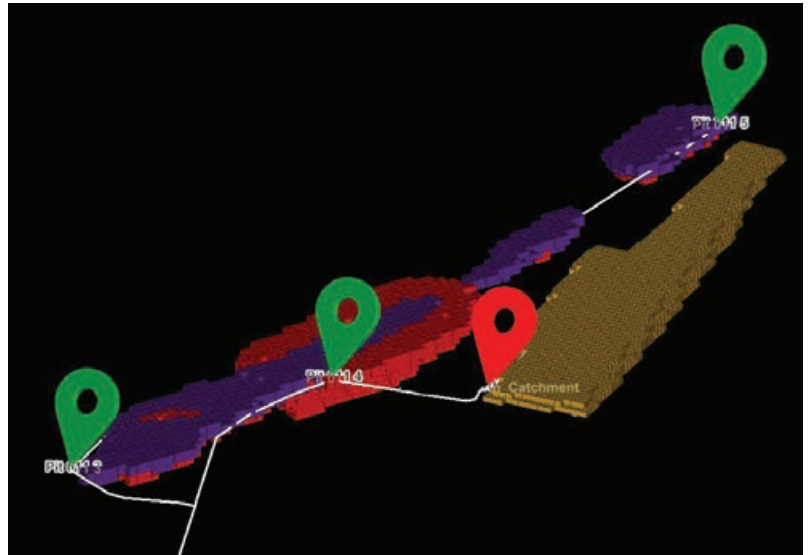
Any form of scheduling is a complex task, requiring considerable data preparation, heavy computational power and long processing times. The Massawa project was all the more complex due to its size and number of components. A total of 13 mine phases, 4 pits, 2 processing plants, 6 stockpiles and 9 waste dumps required scheduling.

Barrick wanted to maximise NPV and optimise haulage and equipment allocation, meet plant production targets and create a consistent waste mining profile.

Increasing NPV

Evolution allowed NPV to be increased by deferring waste and minimising equipment investment.

The first step involved exporting all of Barrick's data and previous designs into Maptek™ Vulcan™ mine planning software to design the pits and stages. This included block models, topography, waste dumps, current stockpiles and surfaces, tonnes and grade/blending targets, haulage routes, speed limits and equipment requirements.



Simple data transfer between Vulcan and Evolution allows integration between mine design and scheduling.

Evolution uses industry-leading genetic algorithms, delivers systematic production schedules along with a practical development plan and is intelligent enough to consider multiple objectives.

Many schedulers focus on optimising material movement, whereas Evolution optimises both haulage and trucking hours simultaneously rather than in two separate steps. This results in time and cost savings, is far more practical and delivers a more achievable, realistic schedule.

The new Evolution production schedule for the entire site improved NPV by 2%, or \$10.5m, compared with the previous schedule.

Evolution optimised ore and waste movements in the four open pits and estimated the minimum size of the haulage and equipment fleet required to deliver the proposed schedule. As a result, Maptek proposed purchasing the minimum number of trucks during the early stages of mining.

A key feature of the new schedule was that waste mining was shifted towards the end of the life of mine which improved NPV, reducing costs by \$54.27m.

Waste was reduced by 16.7 Mt for the loss of only 53 Kt of ore across all pits.

Other highlights included redesign of staging to reduce stripping ratios early on in production, haulage hours being postponed to late in the strategic schedule, and providing a continuous supply of ore to the crusher.

Bringing forward value

The new schedule allows Barrick to reduce costs and improve NPV early in the life of mine, meaning it will be able to pay back its investment more quickly. Barrick now has a practical schedule that maximises the use of its truck and equipment fleet.

The project was able to deliver NPV, stockpiling, haulage optimisation, material movement and plant feed targets in a single run.

A unique solution

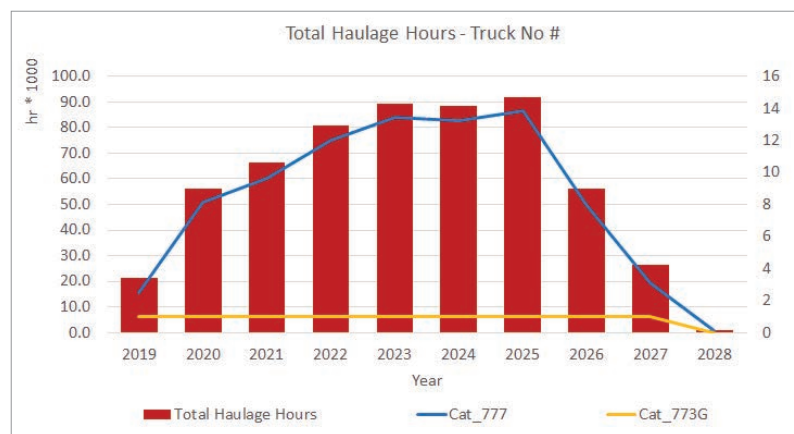
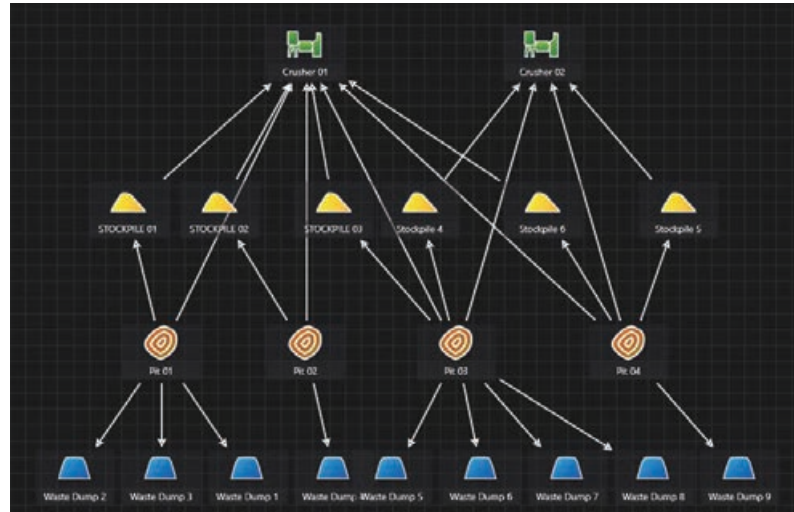
Evolution's highly evolved algorithms, cloud processing and ability to handle multi-objective optimisation transform the scheduling process.

Evolution allows mine planners to undertake scheduling tasks which would take countless hours or be impossible with other methods. The speed of delivering results means users can run and compare multiple scenarios with different parameters.

Evolution also enables haulage to be optimised on a block-by-block basis, rather than bench-by-bench, which helps improve NPV and reduce haulage costs compared to other scheduling approaches.

Users can create practical schedules to meet production, with full control of bench turnover by period, minimum mining width and mining setback. Projects can be scheduled by available stages or phases and broken down into weeks, months, quarters and years.

Thanks to Barrick



Stockpile topographic survey

Maptek™ laser scanning technology is being used for calculating stockpile volumes at a gold mine in Mexico.



The Torex Gold property lies 180 kilometres southwest of Mexico City, in Guerrero state. The El Limón Guajes (ELG) Mining Complex comprises the El Limón, Guajes and El Limón Sur open pits, and the Los Guajes El Limón underground mine, processing plant and infrastructure. Media Luna is a development project.

Enclosed stockpile survey at the ELG complex was one of the most important tasks. The main challenges were environmental conditions, poor lighting, excessive dust, temperature and humidity.

Surveyors needed to be able to efficiently gather accurate information and deliver high quality results in a timely manner. The goal was to know the volume of material and the shape of the stockpile.

Torex surveyors have been working for several years with the Maptek™ 8820 laser scanning system for data acquisition, together with Maptek™ PointStudio™ software.

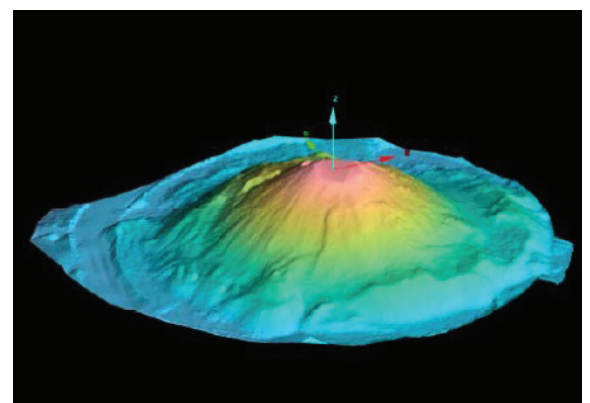
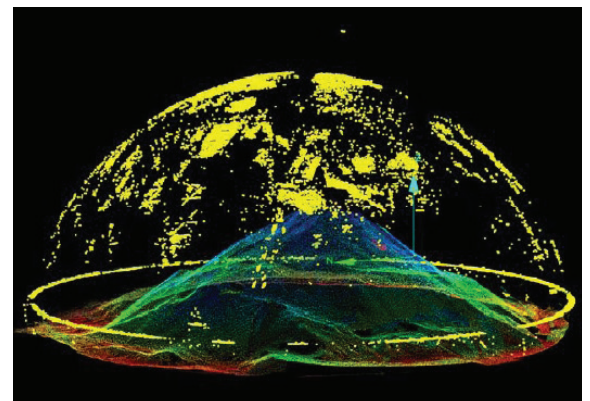
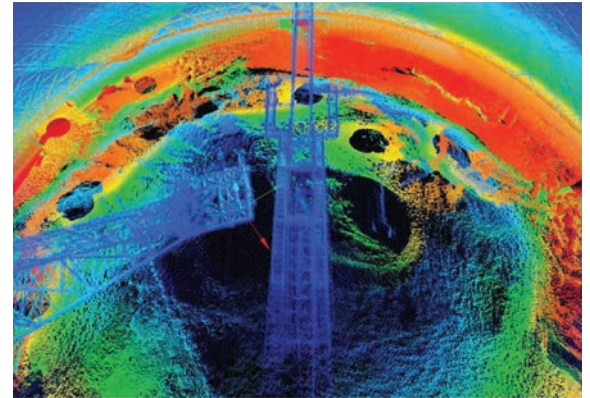
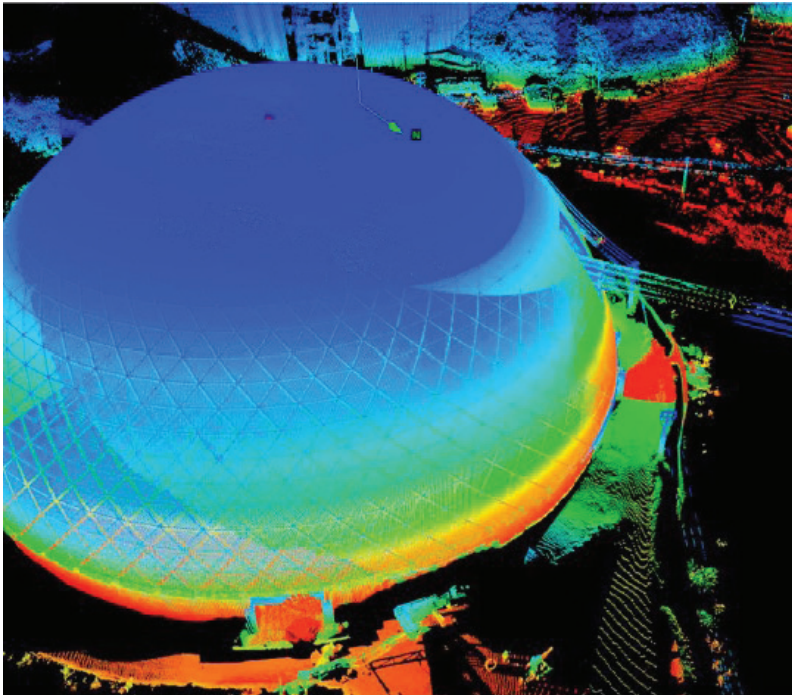
Surveying is done without control points within the enclosed stockpile structure. Local coordinates and global coordinates obtained with GNSS receiving antenna are used as well as orientation with the physical infrastructure.

Stockpile surveys can be carried out quickly, due to the speed of the laser scanning equipment, simplicity of use and inbuilt workflows.

Surveys with global coordinates are oriented in the post-processing stage. Multiple scans must be performed to gather sufficient information. Global registration provides quick and reliable information to guide surveys. The result is used as the basis for the orientation of the rest of the scans.

The Automated Initial Positioning tool in PointStudio allows scans to be moved in seconds from their initial local coordinate position to global coordinates. This allows automatic orientation of the scans with local coordinates.

After initial positioning, surveyors perform a global orientation to ensure that all elements are fully adjusted. Scans with the best fit in relation to the main scans are defined as the stockpile base. For best results, scans are divided into sectors with the closest possible correspondence between elements.



The main survey objective is to calculate the total volume of material contained under the dome. Unnecessary elements can be filtered out using a range of options.

Automatic identification of a terrain (topographic) surface and quick removal of all non-surface elements (structures) is fast and efficient. This complex work is completed in seconds and provides a visually attractive report for head office.

Data that cannot be filtered automatically is manually removed. The final stockpile surface is created from the coordinated and filtered information.

The highly detailed surface generated in PointStudio is an accurate representation of the stockpile shape. The volume of the contained material is then calculated.

Benefits of the Maptek solution are:

- > Fast and accurate survey
- > Information with a high level of detail, adjusted to reality
- > Simultaneous use for other survey activities
- > Multi-disciplinary survey system
- > Adaptable to any environment
- > Automated processes
- > Powerful, simple software tools
- > User-friendly workflow

*Thanks to
Jonathan Barajas
Short-term Planning Engineer
Torex Gold Minera Media Luna*

One-model solution for coal products

CIMIC Group's global mining services provider, Thiess strives to design and deliver solutions that unlock potential and create pathways to greater performance.



Thiess geologists overcame software limitations by developing improved run of mine (ROM) modelling methods that incorporate multiple coal products into one model.

Working across Thiess' various mining projects, geologists Alistair Buchanan and Helgi Stedman applied new tools in Maptek™ Vulcan™ to develop the ROM modelling functionality.

For a typical deposit, not all coal seams are compatible for seam aggregation, despite being close enough to form a working section.

Vulcan 12 offers new flexibility to build working sections that simultaneously align separable parting rules and aggregation compatibility. Before Vulcan 12, ROM modelling functionality was limited to one aggregation rule, which provided less flexibility.

A seam which is not to be aggregated with an overlying seam is known as a geological 'hard boundary'. Vulcan allows a geologist to select the hard boundaries and control the working sections forming a given work area.

Having flexible hard boundaries is only part of the one-model solution for complicated product requirements that prescribe multiple loss and dilution parameters.

Site geologists were challenged to find a modelling method to evaluate all potential ROM working sections that align with specified ROM product requirements.

In previous Vulcan versions, multiple product specifications were written into separate ROM models, each limited by one set of loss and dilution parameters.

The difficulty in creating one model containing multiple parameters is that once adjusted, in situ seams take on a new thickness which can no longer be referred to as in situ. This is a structural adjustment limitation inherent in the software.

'When applying loss and dilution to in situ thickness, seam structure adjusts to a position equal to the net change. Depending on the amount of loss and gain, the net change is thicker or thinner than in situ thickness,' says Stedman, Thiess Principal Mining Geologist.

'Once in situ structure is adjusted, you're not able to revisit original thickness and adjust with different parameters to create a different product.'

'When a product specification prescribes different loss and dilution parameters as well as various flitch thicknesses over diverse products, there is nothing in the ROM modeller to cater for this,' he says.

The team found the ROM model to be the ideal approach as it is easily built from the resource model without loss of geological fidelity, allowing for the creation and storage of many variables required for the final output.

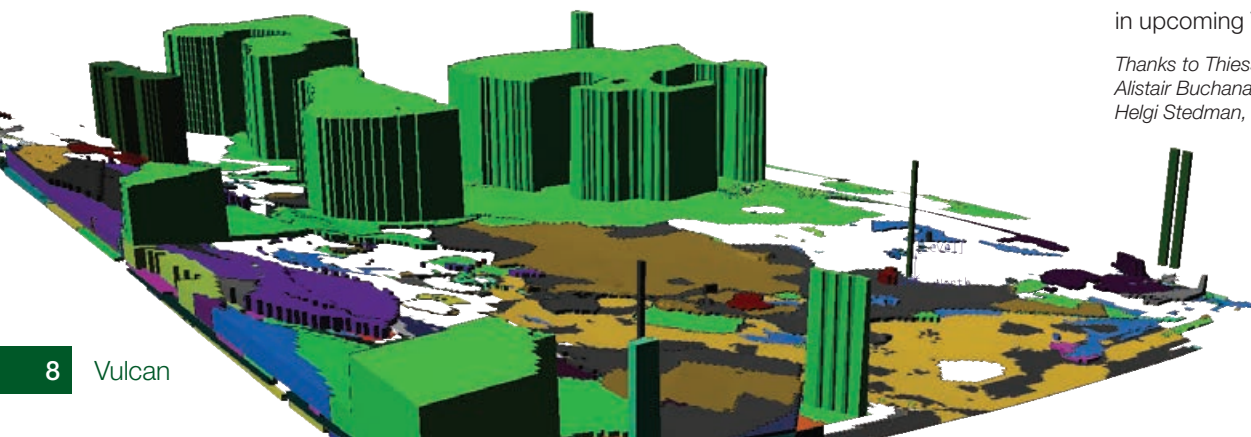
To work around the structural adjustment limitation and create a single model, a 'step-down' method was employed where loss and gain are applied as a multi-step process.

This method allows restricted structural adjustments to be applied within the software and then multiple products to be modelled into one principal model. Numerous scripts that run sequentially are streamlined using the Maptek Workflow Editor.

Maptek worked with Thiess in rolling the one-model workflow into a single click. The solution was achieved by combining tools in Vulcan 12 using an alternative approach to loss and dilution.

Maptek has used Thiess feedback to enhance ROM HARP modelling in upcoming Vulcan releases.

*Thanks to Thiess
Alistair Buchanan, Senior Geologist
Helgi Stedman, Principal Mining Geologist*



Stability monitoring for peace of mind

Continuous monitoring using Maptek™ Sentry provided effective risk management during equipment maintenance at an Australian mineral sand operation.



Tronox has purchased Maptek™ Sentry after a rental trial to monitor a floating concentrator while a dredge pond was drained for maintenance work.

The Ginkgo and Snapper mines are located about 85 kilometres north of Mildura in southwest New South Wales. The mineral sand deposits are relict beaches from an inland sea that existed 7 million years ago.

Both mines use conventional tractor scoops for topsoil handling, truck and shovel operation for overburden, and wet dredge mining and floating concentrator plants to recover and separate the heavy minerals in the ore deposit.

The heavy mineral concentrate obtained by the wet-dredging process is pumped ashore to the mineral concentrate stockpiles and separated into three streams containing primarily ilmenite, ilmenite and leucoxene, and rutile and zircon.

Ginkgo operators wanted to be sure the concentrator was not shifting on the soft bed when the dredge pond was drained for maintenance work, so they would be able to alert staff to clear the area if any movement occurred.

In February 2019 Sentry was set up on the bank of the pond to monitor the concentrator while the maintenance was undertaken.

Sentry captures laser scan data continuously to compare new scans to earlier scans and detect any movement.

Intuitive Sentry software displays movement as both graphs and heatmaps, making data easy to understand and analyse. Alarms can be set if movement thresholds are breached.

Multiple zones of interest can be monitored simultaneously, meaning that pontoons, side walls and roofs of the plant on the dredger could all be analysed.

Sentry can focus on areas as small as a couple of square metres. Separate notification thresholds can be set for each area, allowing users to filter out the necessary movement of the maintenance workers and equipment.

The site used Sentry with a Maptek LR3 laser scanner to detect potential movement down to as little as a few millimetres.

Tronox Superintendent Surveying Pieter Bekker says that Sentry was a highly successful application and provided peace of mind to the operation during the docking, refurbishment and re-floating of the concentrator plant.

'It proved invaluable as an early warning system to ensure the safety of all personnel accessing the area.'

When the concentrator was being refloated Sentry was able to determine its flotation point, showing the minimum water level to keep afloat.

Tronox will now apply Sentry to monitor the slopes of the Ginkgo pit and the dredge pond.

'We are also looking at new applications for automated monitoring of the progress of overburden removal where capturing the survey data is time critical, for example rapid advance of overburden removal and backfill,' says Bekker.

The mine uses a Maptek XR3 laser scanner and vehicle mount for day to day survey tasks on site. The LR3 will be able to assist with this work when it is not being used for Sentry.

Bekker says 24/7 remote access to Sentry from multiple devices combined with its alarm system was important to the operation.

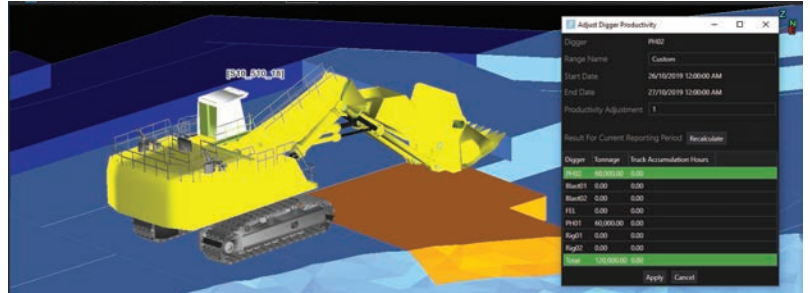
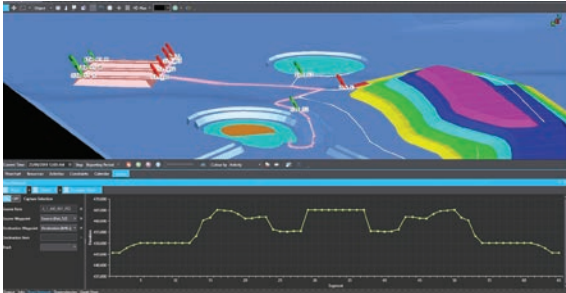
'Continuous monitoring was key to us and this is very hard to achieve with conventional survey methods,' he says.

'We now have a second scanner to use for general surveying and the added benefit of stability monitoring capability.'

*Thanks to Tronox
Pieter Bekker, Superintendent Surveying*

Detailed scheduling for short term plans

Maptek™ Evolution Epoch uses proven value-enhancing technology to produce practical short term schedules that are aligned with life of mine objectives.



Maptek™ Evolution Epoch allows planning engineers to produce practical short term schedules that maximise resource use and are aligned with long term mine objectives.

Short term planners face daily challenges. Time-consuming manipulation of data from different sources to create a single scheduling scenario is just one. Limited reporting capability or a convoluted reporting process to bring together different data formats also causes inefficiencies.

With Epoch, engineers can manage multiple mining activities, tasks and equipment and efficiently produce detailed short term schedules. A flexible interface allows users to define mining sequences, and also to manually adjust destinations. Data preparation and processing time decreases from days to hours.

The robust Evolution engine handles complex real world scheduling. Engineers can run what-if scenarios to ensure equipment and plant are maximised while minimising haulage and fuel costs and cycle times.

Automated dependency creation is built in to Epoch. Operations can balance stripping ratios, ensure the mining sequence is practical and account for necessary constraints.

Epoch targets practical schedules of up to 18 months without losing sight of mine life objectives. Users can define calendar events as short as minutes and communicate weekly plans to stakeholders.

Analysing multiple sequences to guide the execution level is achieved via a live dashboard.

Reports and charts are displayed together and planners can step forward in time to evaluate the impact of the current sequence.

Data integration between Evolution and Maptek™ Vulcan™ allows engineers to load information and instantly see changes in the schedule, improving the connection with mine planning.

- > Integrated framework for mine planning and scheduling
- > Comprehensive platform for scheduling across different planning horizons
- > Live dashboard enables graphical analysis of schedules
- > Rapidly iterate scenarios that consider multiple objectives
- > Animate sequences to evaluate impact of current sequence



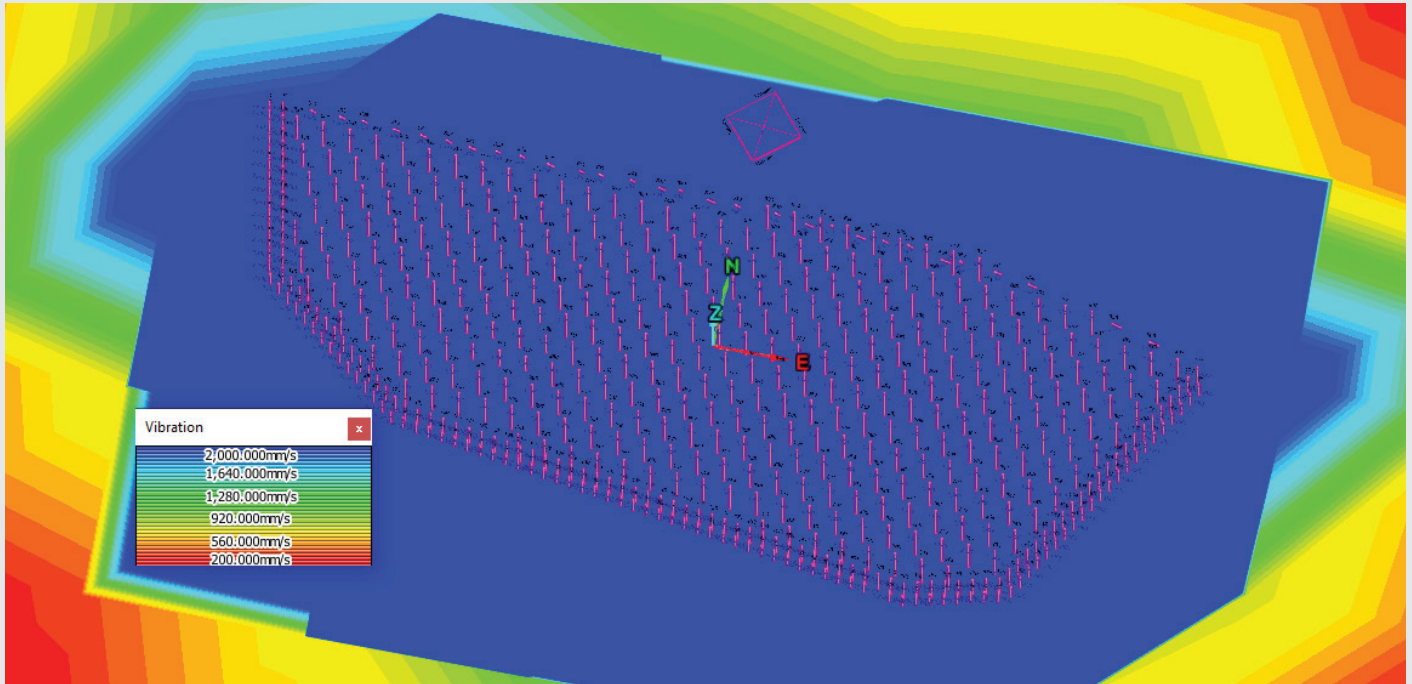
With most schedulers, it is difficult to iterate digging plans and truck requirements. Moreover, there is a high risk of overlapping or competing outcomes when different users solve individual parts of the same scheduling scenario.

With Epoch, integrated haulage and waste dump functionality is delivered through simultaneous route selection, which in turn allows engineers to evaluate the impact on haulage hours.

Epoch architecture matches other Evolution applications – Strategy and Origin – which together provide a single platform for scheduling activities across all strategic to tactical planning horizons.

Electronic tie-up

Maptek™ BlastLogic™ gives operations greater blast precision, choice of explosives initiation system suppliers and mine planning software integration.



Tie-up is an important part of drill and blast workflows and electronic tie-up is becoming the method of choice. Electronic tie-up provides finer timing control and reduced misfire potential, increasing safety for field crews, reducing costs and minimising excessive vibration and noise.

Maptek™ BlastLogic™ helps mining companies prepare tie-up plans that adhere to regulations and make use of actual data to deliver designs in a seamless workflow.

BlastLogic provides timing and 3D animation for complex scenarios such as multi-horizon timing and hybrid tie-ups, and uses the as-drilled information gathered through integration with leading drill navigation systems.

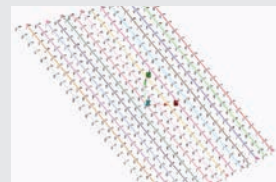
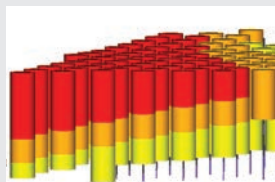
The actual loading data captured in the field using BlastLogic tablets is used in modelling calculations so engineers can make adjustments based on deviation from designs.

Vibration models use propagation rates and wavefront reinforcement to predict vibrations at critical locations. Holes leading to increased vibrations can be adjusted either manually or using the automated algorithm to minimise vibration and overpressure.

The latest version allows live data sharing where design changes in Maptek™ Vulcan™ are instantly reflected in BlastLogic. Drill and blast engineers can see the live impact of their drill design on the total cost, charge, tie-up, vibration and fragmentation modelling.

Integrating BlastLogic with a range of leading initiation system providers has given users freedom from getting 'locked in' to a single supplier.

Integration simplifies the iterative design process and removes time-consuming manual import/export between different packages. BlastLogic acts as a single source of truth for feedback, improvements and investigations around drill and blast.



Optimising the future

Maptek™ supports future mining professionals across the globe through educational lectures, training programs and other donations to universities.



Director of Wits Mining Institute, Professor Fred Cawood with Nick Venter, Ayanda Njotini and Vuma Nokwe



Lecture at University of British Columbia

Laser scanner donation

Mining engineering students at Wits University will benefit from modern survey technology in a range of mining disciplines, following the donation of equipment by Maptek™ Africa.

At a handover to the Wits Mining Institute (WMI), Maptek's Nick Venter said the Maptek 8800 laser scanner will give students valuable insight into how this technology can assist in survey, geology, geotechnical and mining applications in both open pit and underground environments.

'Our technology combines long range laser scanning hardware with processing and modelling software for the mining industry,' said Venter.

The data collected by the scanner can be applied for stope and drive survey, drive mapping, rock bolt identification, geotechnical analysis, stockpile volumes, mine modelling and identifying tailings dam deformation. The detailed data can be analysed with 3D modelling and analysis software.

WMI director Professor Fred Cawood emphasised that real-time visualisation of underground environments for risk management is very important for safe mining.

'The ability to scan complex scenes and then add risk management content to the point cloud, allows for a 'realness' that other forms of augmented reality are not capable of,' said Professor Cawood. 'The Maptek scanner will be put to very valuable use by WMI.'

WMI hosts the Sibanye-Stillwater Digital Mining Laboratory (DigiMine), the Centre for Sustainability in Mining and Industry and the Centre for Mechanised Mining Systems.

Head of the Wits School of Mining Engineering, Professor Cuthbert Musingwini highlighted the value of raising technological awareness and competence among students.

'The School of Mining Engineering deeply appreciates the Maptek laser scanner donation. It will be beneficial for both teaching and research in geospatial techniques,' said Professor Musingwini.

Venter noted that Maptek has maintained a long relationship with Wits, recognising the importance of strong partnerships between academia, the mining sector and technology suppliers.

Guest lecture

Maptek™ Mining Engineer, Ann McCall presented at the University of British Columbia (UBC) in October. The two-hour guest lecture covered pit and stope optimisation, and demonstrated tools to begin building mine designs based on optimised results.

McCall encouraged the 4th year mining students to explore the latest technologies so they have the best chance of success in their careers.

The Mining and Mineral Processing Department at UBC has a rigorous curriculum. Maptek™ Vulcan™ is used to help students understand mining principles and gain hands-on experience in mine design.

In their capstone projects, students must identify and define an issue to be solved, develop an action plan, complete and evaluate the work, including environmental, economic and risk assessments.

The advanced training allows them to explore complex ideas and develop creative solutions to mining industry challenges.

Maptek has worked closely with UBC for several years, providing in-person training, mentorship, lectures, licences of Vulcan, Evolution and Aegis, and online training to professors and students.



Maptek Master Class at National University of San Marcos attracted 30 mining engineering students

Master class

In October, Dina Cárdenas from the Maptek™ Peru post-sales team conducted a Master Class at the National University of San Marcos as part of the university partnership.

Thirty 4th and 5th year mining engineering students participated in the course, which focused on the use of Maptek™ Vulcan™ for open pit optimisation and design, as well as the latest theoretical concepts applied to mining.

The main benefit for students is access to the latest technological methods for open pit and underground mine planning. This knowledge prepares them to develop professionally and improve the future of mining.

As well as determining the highest economic value of a mine, the tools help students optimise resource utilisation and focus on more responsible and sustainable mining.

Students learned to work as a team over the duration of the class. They were able to experience the same high-level training that is developed for miners and see how customised classes help achieve optimal knowledge of the topics discussed.

University alliance

Maptek™ maintains an Academic Alliance with over 21 universities in South America, providing more than 700 free educational Maptek™ Vulcan™ licences for use by mining, geology, surveying and engineering students. The key objective is to prepare future professionals in the best possible way.

As part of the alliance, Maptek prepared a training program to update university teachers with knowledge of Vulcan so that they can transfer it to students and maximise use of the software.

Senior Vice President of Maptek South America, Marcelo Arancibia, introduced the program to the academic authorities of each university in a meeting during the XIX Users Conference in Viña del Mar, Chile in August.

The program comprises a Basic and Advanced Course for two teachers from each university. The Basic Course was held in November at the Maptek office in Viña del Mar, while the Advanced Course is scheduled for December.

Maptek appreciates the trust that the universities have placed in us to prepare their students and we will work together so that they get the maximum benefit from our alliance.



Training program participants in Maptek Chile

New global CEO for Maptek

Eduardo Coloma is the new global CEO to lead Maptek™ at an exciting time for mining.



Eduardo Coloma has worked in South America and Australia for more than 20 years, with expertise in sales, technical and managerial roles.

Commenting on the appointment, Peter Johnson, Director of Maptek™, says, 'This appointment will allow for further global growth and I am confident that Eduardo is the perfect CEO to succeed me. I remain as director and will work closely with Eduardo and our shareholders to continue to set strategy and business structure as well as fulfil corporate oversight.'

Coloma, a Mining Engineer, is well-known to the industry and has hands-on understanding of the needs of mining operations. He is keen to see Maptek take the development and implementation of innovative technology to the next level.

'My experience across different countries and cultures has cultivated strong relationships within Maptek as well as with our customers,' states Coloma.

'A clear vision of the role technology plays in mining will ensure we offer solutions that help mines work in the easiest, safest and most effective way. Close alignment with customers is our hallmark.'

'Maptek consistently advocates for technologies to visualise, analyse, model and optimise every component of the mining process.'

'Today, mining is all about how to transform data into information to support the decision making process in a timely manner.'

Coloma holds a Civil, Industrial and Mining Engineering degree from the University of Antofagasta, Chile and also completed an Executive MBA at Adolfo Ibáñez University in 2008.

'Enrolling in the MBA proved to be one of the best decisions of my professional life,' Coloma adds. 'It was a unique experience and has proved integral to my career pathway.'

Johnson agrees, 'Eduardo has demonstrated that he has the skills and drive to strengthen and grow Maptek.'

Coloma is enthusiastic about the capabilities of Maptek people, and the potential for applying the accumulated knowledge to make even better products.

New GM for Maptek Africa

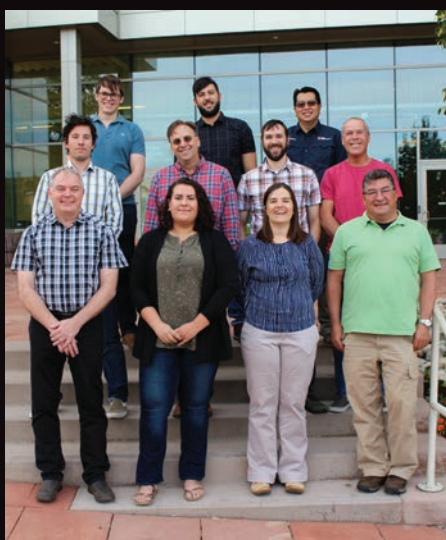
Gideon Slabbert has been appointed to the role of General Manager of Maptek™ Africa.

A Mining Engineer, Slabbert joined Maptek in 2017 as Product Manager for BlastLogic™. He quickly demonstrated strong leadership, and an understanding of customer requirements and challenges in the region.

Slabbert replaces Nick Venter who will join Maptek's North American operations as Director of Sales and Technical Sales Support.

'Gideon has been a self driven individual and capable manager,' says Venter. 'He has a strong, experienced team and I believe he is the right person to lead Maptek Africa into further growth.'





Around the globe



Maptek Calendar

2020

January 20-23

AME Roundup
Vancouver, British Columbia, Canada

January 26-29

ISEE
Denver, Colorado, USA

February 23-26

SME
Phoenix, Arizona, USA

March 1-4

PDAC
Toronto, Ontario, Canada

March 2-20

XVIII Citación de Geoestadística
Maptek, Viña del Mar, Chile

April 20-24

Expomin
Santiago, Chile

April 21-24

XIII Conferencia Internacional de Minería
Chihuahua, Mexico – Booth 078

April 28-30

Discoveries 2020
Guadalajara, Jalisco, Mexico – Booth 61

May 3-5

CIM
Vancouver, British Columbia, Canada

May 12-14

Slope Stability 2020
Perth, WA, Australia

June 4-5

Elko Mining Expo
Elko, Nevada, USA

June 10-12

RIM
Zacatecas, Mexico – Booth 304

August

Magister en Modelamiento
Geoestadístico de Depósitos Minerales
Viña del Mar, Chile

September 8-10

Bowen Basin Geology Group
Symposium
Mackay, Qld, Australia



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