Forge

MAPTEK™

December 2021 Newsletter

In this issue

Welcome to our Forge newsletter December 2021

Maptek is delighted to bring you this issue of Forge, which is brimming with success stories from our customers around the mining world.

The case studies reflect the many ways we partner with operations and are a fitting culmination to our 40th anniversary celebrations.

In China, modelling and planning at the complex Shandong Gold operation has been streamlined by live links between 3D design and scheduling, which allows budget and actual throughput to be compared on a per stope basis.

Maptek has helped gold miner Coeur Mining in the USA solve their scheduling dilemma, modelling and tracking the stacking and offloading of material onto leach pads using the same footprint.

A copper mine in Mexico benefitted from the combined expertise of specialist consultants for accurate survey and geotechnical analysis.

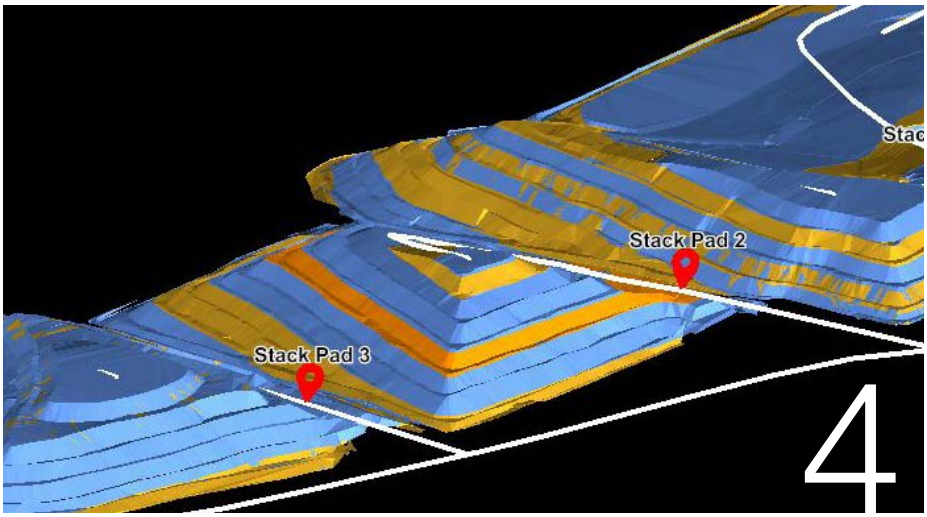
A focus on our Australian-based laser scanner production spotlights how mining processes and the technologies that enable them have progressed in 20 years. Our expansion into hardware was triggered by a drive to deliver the best 3D laser survey measurement system for providing decision support.

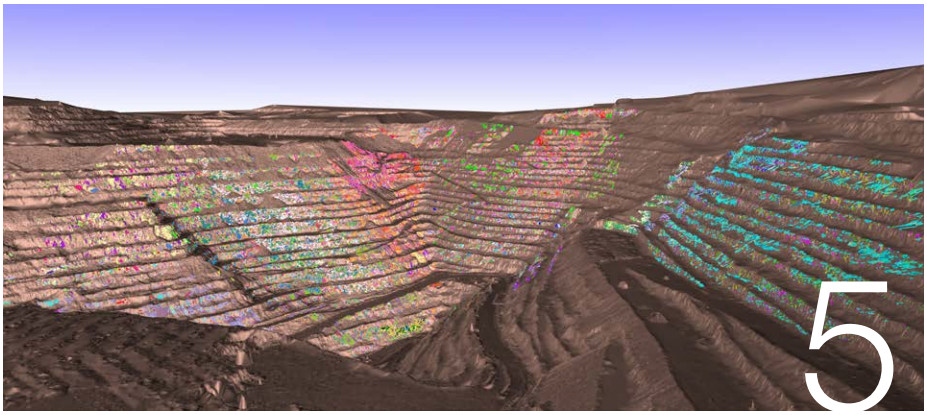
A new workflow for geothermal blast hole logging and another that significantly reduces runtime for open pit survey updates are examples of how Maptek helps operations find solutions that promote value and efficiency.

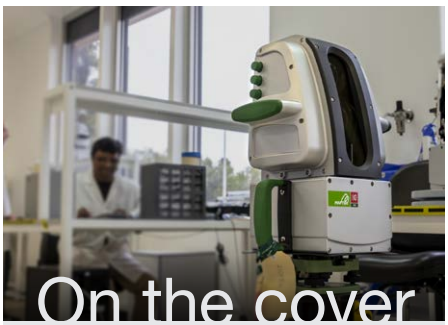
Finally, we announce the winner of the geology challenge and explore several university partnership projects that support future mining professionals.

We hope you enjoy this issue and look forward to sharing more stories with you in 2022.

Eduardo Coloma
CEO







On the cover

Maptek laser scanners are produced under ISO 9001 quality management certification for reliable operation

Contact us: forge@maptek.com

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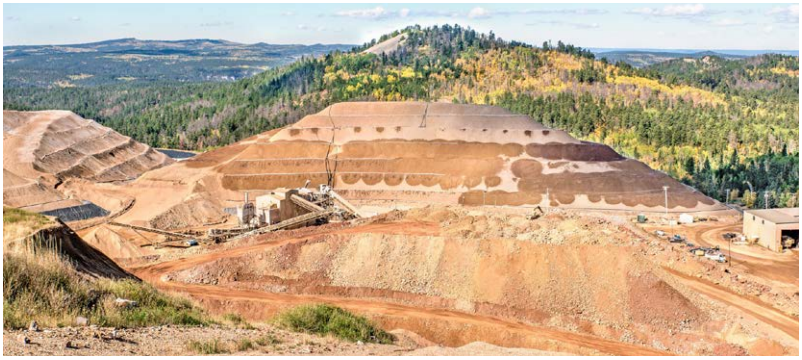
Evolution of gold extraction scheduling

Outside of the box thinking has helped provide a solution to an open pit heap leach operation scheduling challenge involving the reuse of leaching pads on a set footprint.



Coeur Mining operates the Wharf open pit gold mine in South Dakota, USA. Leaching is used to extract gold from the low grade deposit. In early 2021, Coeur implemented Maptek™ Vulcan™ and Evolution™ software for geology, mine planning and scheduling applications.

Scheduling of the open pit mining is relatively straightforward, with several material types and two fleets of both trucks and diggers to be considered.

The operation must properly track the planned tons sent to leach pads, which is critical for ensuring the proper amount of time is allocated for lifts to leach.

A unique aspect is planning the pad offload, since, unlike most leach operations that must leave and reclaim material in place, Wharf mine is permitted to reuse its leach pad footprint.

> There are five pads within the approved footprint that use live leaching, and the reuse method requires the sequencing of material movement to include both stacking and unloading.

This component was not included in the initial Maptek software rollout due to its complexity, remaining a 'wishlist' item to scope once the main applications were covered.

After the primary implementation, Maptek Mining Engineer Amanda Wahrer spent a week considering the pad stacking and offloading challenge and produced a solution using existing functionality in Evolution Origin Solids.

'I was able to use the current features in Evolution in an outside of the box way,' Wahrer said.

The proposed solution uses existing tailings tracking to model the pad stacking portion of the process and models pad offload as a separate 'pit' model. The overlapping entities (pad stack and pad offload) are then sequenced via constraints and dependencies.

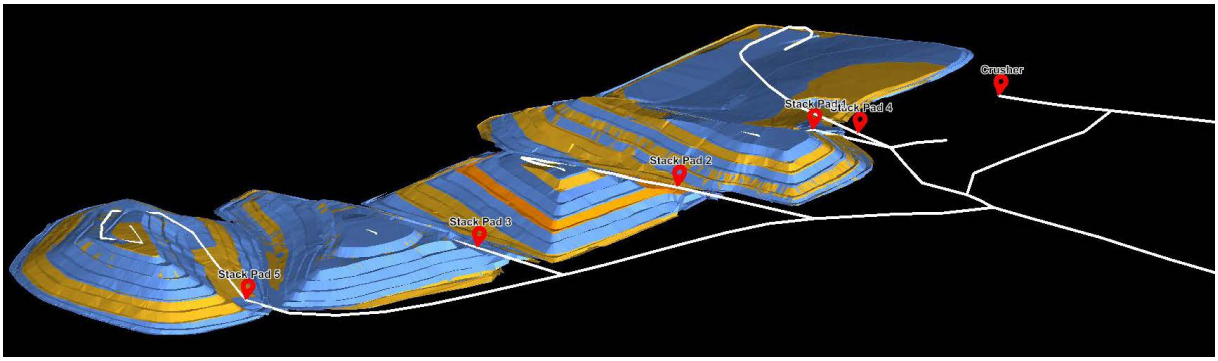
Prior to this solution, the client had to use separate planning tools to document all material movement. A majority of the scheduling was done in complex Excel spreadsheets and required many iterations.

Wahrer commented that the client appreciated having a solution contained entirely in a single Origin Solids setup – no other scheduling package they had investigated produced a usable method.

'The offloading meant Wharf mine wanted to move things twice, and they kept running into a software limitation that the scheduling tools were only able to say whether it was in the pit or the mill,' she said.

Wahrer enjoyed dedicating the time to collaborating and trying out different applications of the Evolution tools and was excited by the outcomes.

Thanks to
Garth Evers
Technical Services Supervisor
Coeur Mining



Data collection and analysis synergy

A copper mine in Mexico benefits from the combined expertise of specialist consultants for laser scanning and geotechnical analysis.

Buenavista del Cobre is an open pit copper mine in Sonora, Mexico. The mine began operation in 1860 and is considered one of the biggest copper porphyry deposits in the world. In 1991, Buenavista del Cobre was acquired by Grupo México, the world's third largest copper producer.

SRK Consulting and Maptek™ worked together to meet the need for high-density scans that would quickly and accurately extract geological structures and faults for performing geotechnical analyses.

'The data collection and information processing service is of a high standard, reliable and efficient. Maptek not only provides us with the requested work, but also actively participates with our team to solve problems,' commented Fredy Henriquez of SRK Consulting.

The speed and range of the Maptek XR3 laser scanners made it possible to obtain the necessary point cloud data. Using Maptek PointStudio™ software, extraction of structures and geotechnical analysis were carried out in minutes – this had seemed impossible in a single conventional process.

Buenavista de Cobre is one of the largest copper mines in the world, covering an area of 2.5km x 2.3km, with a depth greater than 500m. More than 800,000 tons of ore is moved daily, the equivalent of 40,000 dump truck trips.

The XR3 scanner captured 28 standard low resolution 360° scans with coordinates and 49 high-density scans, collecting a total of 390,292,902 points for geotechnical data processing.

PointStudio was used to process the data. Georeferencing of the low resolution scans was carried out with the Global tool, and the Copy Scan Registration tool was used for the high-density scans.

The georeferencing tools are very intuitive and easy to manipulate, needing only a basic configuration to operate. The pit was divided into several geotechnical zones, taking the azimuth of the slopes as a criterion. Predominant families of structures were extracted in each zone, with more than 85,000 discontinuities.

Discontinuities were extracted using Query, Smart Query and Extract tools. The fully automatic tool is the most intuitive, configuring minimum parameters to extract families of discontinuities with hundreds of structures. Finally, based on the families of discontinuities, Create Stereonet and Spacing tools were used to statistically ensure that the mapped structures are consistent.

The results were of excellent quality, and importantly, were acquired safely, as operators could avoid approaching slopes and the risk of encountering equipment or falling rock.

Another highlight is solving the challenge to visualise and extract structures on higher benches that are not accessible.

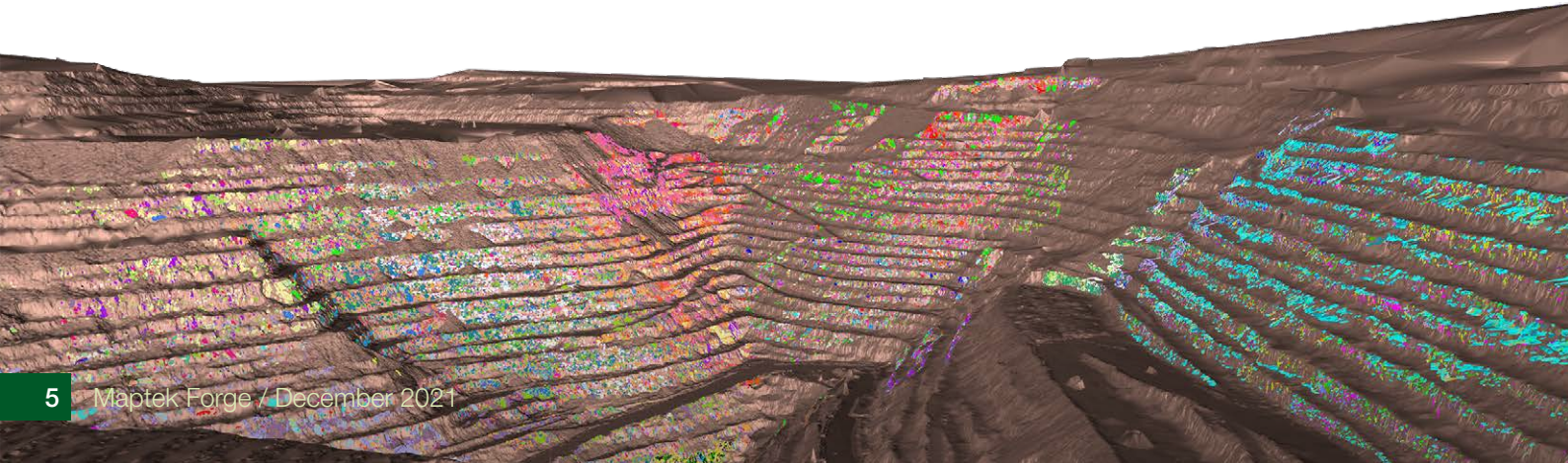
The work undertaken in the field and in the office was critical for the geotechnical analyses carried out jointly with SRK. It will be necessary to continue updating the information on the structures and families of discontinuities to maintain optimal slope stability information.

> One improvement that SRK can rely on is a 5% increase in slope angles, meaning significant savings in production costs and underwriting plans for one of the largest mines in Mexico.

SRK recognises the valuable contribution of Maptek to their business. The professionalism of the Maptek team and the efficiency of delivering results leads to the reduction of project times and costs. Applying the information allows SRK to deliver reliable and optimised designs to clients, reducing the risk profile of projects.

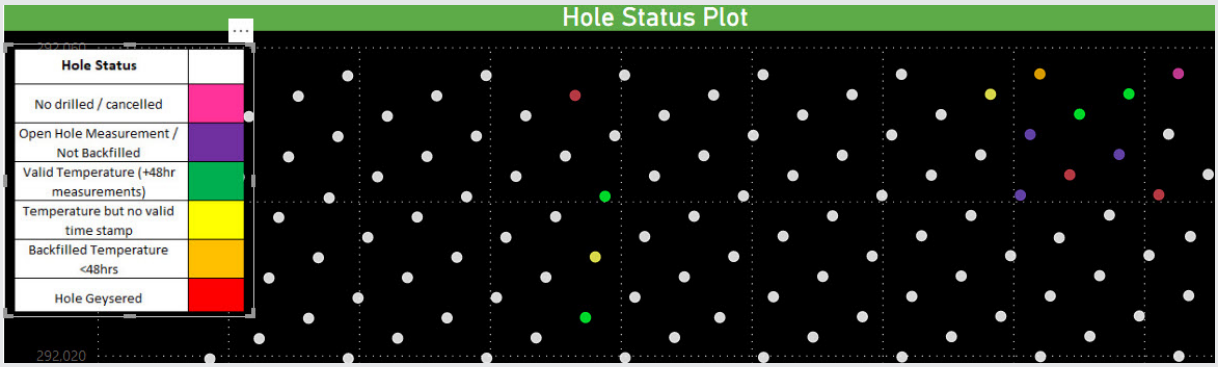
SRK and Maptek Mexico will continue to collaborate on projects in Central America.

Thanks to
Fredy Henriquez
Principal Consultant
SRK Consulting US



Customised workflow solutions

Customised Maptek™ workflows are helping operations embrace data-driven decision making, improving mine planning and safety.



Maptek™ BlastLogic™ has been used successfully at operations around the world for drill and blast management. Many sites are taking the next step and exploring how other aspects of data collection and analysis can be improved.

Maptek Specialist Mining Engineer Rahul Suhane emphasises that the Maptek philosophy is to understand an operation's problem and work with the site team to find a solution.

For example, Suhane has been working with the geothermal team at a gold mine that is located on a geothermally active extinct volcanic crater. The volcanic caldera retains remnant heat, and high rock temperatures present a unique challenge for teams to operate safely and efficiently.

The aim was to create a tailored workflow for geothermal temperature logging and data analysis, to feed into the innovative engineering works underway to meet the challenge.

The solution involves customising the BlastLogic tablet interface to enable digital capture of time-stamped temperature readings in the field.

A quick glance at the digital dashboard shows users which holes are yet to be monitored within the required 48-hour period. This makes it possible for the crew to efficiently focus on the task at hand rather than check through reams of paperwork.

GPS approximation assists the process and information on whether holes have been geysered, backfilled or not yet drilled can be entered on the spot.

The information is fed into Microsoft Power BI and dashboards with colour legends clearly display the status.

> The digital process eliminates potentially confusing paper sheets which can be difficult to manage and update easily especially when working in an active geothermal area with steam rising from the pit floor.

'The flexibility of the underlying BlastLogic architecture made it possible to implement this new workflow – it's very satisfying to see it in action,' said Suhane.

Suhane, who is based in Perth, Western Australia highlighted the strong guidance and feedback from the mine at all stages, while connected remotely from the Maptek office.

A key benefit of the digital approach is the ability to display spatial relationships clearly and in context. The relative positions of non-consecutive blast holes can be spotted instantly on the tablet or dashboard.

'Paper plans are not dynamic. The more digital you go the better you can adapt,' Suhane concluded. The digital method now allows the mine to recalibrate mine plans and operations based on the best information.

Shandong Gold leads the way

Sanshandao Gold Mine uses Maptek™ Vulcan™ to streamline modelling and mine planning at the complex underground operation in Shandong Province.

A subsidiary of Shandong Gold Group, Sanshandao Gold Mine is one of the five largest gold mines in China, producing 3.7Mt of ore per year. The underground mine employs cut and fill, drift and fill, and room and pillar mining methods, depending on the orebody thickness and geometry.

Since May 2019, technical services and production teams at the mine have been using Maptek™ Vulcan™ modelling and mine planning software.

About 60 geologists, surveyors and mining engineers use Vulcan to analyse, explain and interpret the complexities of the orebody, and create production models for mine planning.

The previous approach used a 2D method for all geological mapping, review, interpretation and drafting as well as mine planning tasks.

Due to the complexities of the orebody, understanding the geology can be very time-consuming.

Because of the controlled mining methods applied, with relatively smaller stopes, production scheduling work is more difficult, especially with respect to medium term and long term planning.

To simplify the task, mine planners had used assumptions based on past experience, which had sometimes led to compromises.

One of the outcomes of the customer–developer relationship between Shandong Gold and Maptek has been the refinement of CAD tools to facilitate a more automated, integrated design approach.

With tailored software for 3D modelling, Sanshandao mine is now using Vulcan for survey, geology, geostatistics, mine design and scheduling.

The live link between the 3D mine design and the scheduling spreadsheet allows interactive changes to the mine plan to be assessed quickly.

> It is important for the operation to be able to compare the budget and actual throughputs on a stope by stope basis.

Survey data of as-built stopes is compared against original designs, providing reports of over/underbreak and dilution to feed into improving the next stope design.

There were some initial challenges transferring the tasks into a new environment. However, once staff became familiar with the workflow, they soon recognised the benefits of the 3D visualisation tools. Mine planning had never been connected to scheduling before so this is a significant improvement.

The whole team is now sharing a common platform for mutual benefit. The easy-to-use software has provided time savings, streamlining and automation of processes, and improved communication across the entire operation.

Pioneering Inc., the Maptek mine planning reseller in China has provided software training and technical support, with a 24-hour, 7-day a week hotline and instant online response to solve any issues.

Geologists and engineers are excited that they can use a single platform in the world's leading mining software to solve their problems. Using Vulcan has streamlined routine modelling and mine planning tasks so that more time can be spent on decision making and management.

Thanks to
Ping Wang
Engineer in Charge
Sanshandao Gold Mine

Manufacturing high end survey systems

Maptek™ has been manufacturing terrestrial laser scanners for almost 20 years. Read how we entered the hardware market and the outcome for survey technology.

As we mark our 40-year anniversary in 2021, Maptek™ also celebrates another important milestone – 20 years since venturing into 3D laser imaging technology.

Mid year we released our latest XR3 and SR3 models, shortly before delivering our 400th R3 scanner. As Australia's only manufacturer of high end terrestrial laser scanning systems for mining we hold firm to our aim of creating the world's best.

Co-located across two buildings 5km southeast of the Adelaide CBD in South Australia, the Research & Development and Production teams have grown to nearly 30 people.

Electronics Engineer Mark Pfitzner has been with Maptek since 2001 when work on the scanners began.

'We responded to a gap in the market – there was no terrestrial survey system available with the performance, accessories and robustness to deal with the harsh nature of mining,' Pfitzner said.

The Maptek team embarked on a program of R&D and after four years had built a laser scanner that, combined with our point cloud processing and modelling software, would provide surveyors with a safe, accurate, reliable measurement system.

'The results convinced us we were ready to start manufacturing. The scanner technology was too complex to outsource effectively, so having our manufacturing and R&D teams on the same site really assisted in getting the project off the ground,' continued Pfitzner, the R&D Team Leader.

Precision matters

Producing high-end technical instrumentation, with ranges of up to 2400m, accuracy of +/- 4-5mm and the robustness required for the mining environment, presents unique challenges.

'Maptek indoor and outdoor testing ranges are independently verified by third-party surveyors using calibrated equipment to ensure the accuracy of data capture,' said Quality & Production Engineering Manager Quentin Lewis.

The production building features long corridors – one measuring 80m – for rangefinder calibration.

Warranty servicing follows more than 190 steps to ensure operation at the highest standard. Range checks and calibration are key components, and during servicing, software and mechanical upgrades developed during the life of the scanner are applied as appropriate.

Maptek employs fully qualified specialists and follows rigorous quality assurance and quality control processes.

'Dedication to technical review and improvement led to standardisation of our processes and systems to ensure we consistently produce a quality product that allows customers to survey and monitor their operations 24/7,' Lewis said.

> Achieving ISO 9001 Quality Management System certification in 2013 demonstrates our commitment to quality.

Maptek is currently expanding the scope of certification to include all Australian operations.

Dedicated workforce

Skilled technicians, specialised engineers, and procurement and logistics professionals fill the Production and R&D teams. All staff adhere to laser safety practices and regulated standards. Routine training ensures skills for optical handling, soldering and electrostatic discharge remain current.

Scanner cables are built and tested, electronics technicians inspect and test all of the PCBs (printed circuit boards) and technicians collimate and align lasers to the required specifications.

The production group works with various modules and assemblies, including optical alignment, bearing assemblies, electronics, cable looms and connectors throughout the manufacturing process.

Maptek added the Sentry DMS transportable trailer for laser-based surface monitoring software in 2017, requiring an expanded workforce and skillset to handle onboard generators, solar power systems and an industrial electrical cabinet.

> In-house 3D printing is used to quickly create prototypes, jigs and fixtures, and future R&D will aim to include more 3D printed components into product development.

The transition from concept and design to actual production covers many processes and disciplines. Testing and pre-production trials transition to production runs in manufacturing, requiring extensive team crossover.

Mechanical, electronic, computer systems, software and optical engineers in the R&D team work closely with Production to fine tune the scanner systems.

Ongoing improvement

‘Our laser scanners have been in the field since 2005, which means a range of systems and accessories continue to require support and warranty checks,’ said Lewis.

Ongoing R&D leads to replacement models with the latest technologies that deliver higher specifications.

Customer feedback plays a key role in determining enhancements and introducing new features.

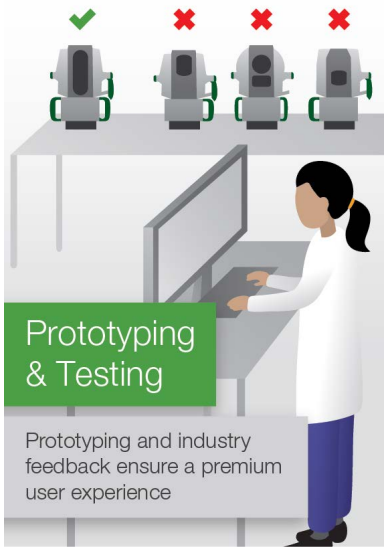
‘Our technical staff are attuned to what's happening on site and provide input for improving the user experience,’ Pfitzner said.

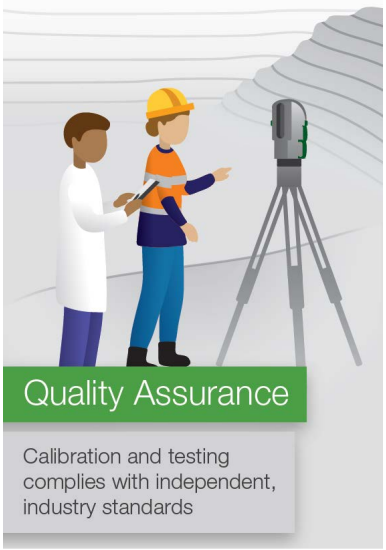
Input from production staff around system operation and ease of assembly and disassembly for servicing is also important for making survey hardware that is field-robust and easily maintained.

‘I like knowing that Maptek products are improving safety and efficiency for our users,’ Lewis concluded.

Satisfaction comes from seeing how 3D spatial mapping has enhanced measurement and analysis of mine topography and infrastructure.

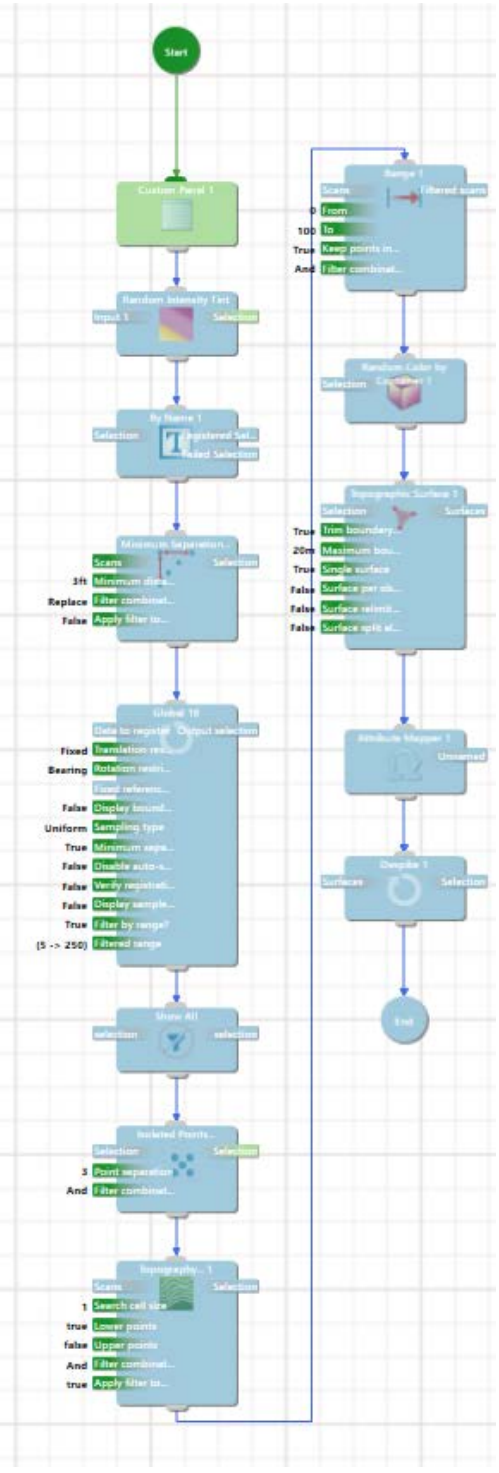
The entire manufacturing group takes pride in delivering a quality product, sharing the simple goal of continual improvement and better outcomes for customers.





Mine measurement workflows

Maptek™ workflows can automate and streamline processes for underground and open pit mines, increasing efficiency and making it easy for new users to step into a task.



The complexity of mine planning operations can be broken down into sets of repetitive tasks. Building those steps into logical workflows can optimise the processes and increase productivity for underground and open pit mines.

At one site, an automated open pit workflow reduced an 8 hour process down to about 30 minutes, with minimal user input after starting the workflow.

Maptek™ Mine Measurement Engineer Nick Ingwers explained that the main objective was to streamline an existing process, which involved switching between Maptek PointStudio™, AutoCAD, and Maptek Vulcan™.

Detailed standard operating procedures had been written to streamline and complete the task, but this process was cumbersome and required knowledge of several different software programs.

Streamlining the process reduced the back and forth between programs and increased efficiency, taking roughly 1/16th of the time.

Updating as-built maps and site data typically involves around 50 scans, which can be difficult to register simultaneously. Registering the scans separately is arduous. The workflow speeds up the process and efficiently handles large volumes of data.

Reducing the time taken to update as-built maps allowed for faster turnaround of deliverables to the operations team, who previously waited a day for updates.

> Using this workflow weekly to update as-built maps means the site effectively gains an entire day of productivity.

The Workflow Editor accesses all Maptek software tools, and each workflow resembles a flowchart. Progress is easy to follow as the workflow runs, and once built, it runs with the press of a button.

The user imports raw scans, corresponding survey data, overall mine topographic surface, and as-built toes and crests.

The workflow registers and filters the scan data, creates a surface from the new scans and combines that with the existing topography.

Existing toes and crests are then cropped to the boundary of the new area. The user digitises the new toes and crests, and clicks OK. The workflow combines new and existing toes and crests, maintaining data integrity.

Ingwers begins with a scoping call to understand customer needs and project direction before starting work on the shared data. Regular progress calls ensure that everyone knows the capabilities of the Workflow Editor.

Site training is important, and is structured to walk through each step. Users learn how to complete the process manually, ensuring that they understand what the automated process entails.

Explanatory messages appear throughout. Users can easily follow along and run the workflow with limited knowledge about PointStudio software or the process, learning as they go.

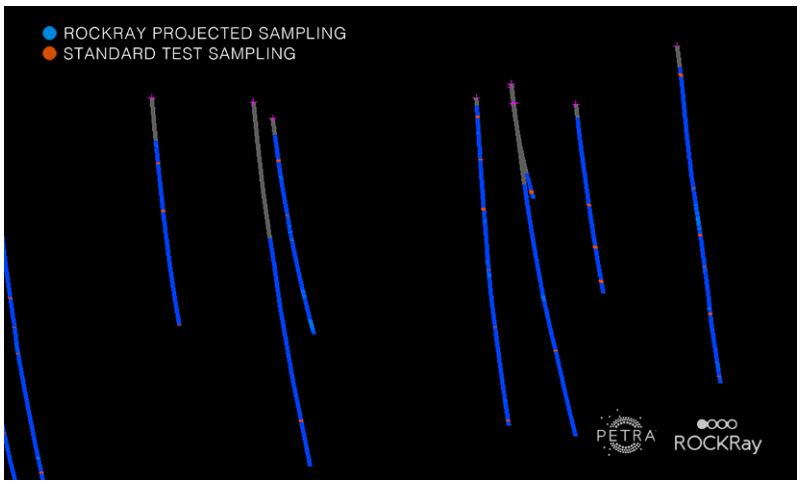
The training and workflow dialogues provide insight into how workflows are built, allowing users to adjust and potentially build new workflows. Tasks can also be completed by different people, if the usual drafters and surveyors are unavailable.

'This particular customer wanted to completely remove the need for AutoCAD in the task. When I showed them the workflow and how little user input is required, they were immediately impressed that they can do everything in one program,' said Ingwers.

Ingwers will continue to help the site add to the workflow and train users. Ongoing contact, including when PointStudio updates are installed, will ensure that the workflow is still serving the desired purpose.

Workflows improve efficiency and productivity, allowing users to spend more time on meaningful analysis, rather than repetitive tasks.

PETRA's ROCKRay implementation success at an underground mine in South Australia



The problem

In 2019, an underground project study team in South Australia was looking for new ways to improve rock strength estimates because standard lithological domaining techniques produced typically high standard deviations of 20-50%.

As per standard industry practice, rock testing costs limited the granularity and variability captured in the block model to the scale of 16 lithological domains.

Mining and geotechnical engineers involved in the study required reliable estimates of rock properties for mine design, ground support design, numerical modelling and fragmentation modelling.

Each of these studies required reliable estimates of the mechanical rock properties including:

- Rock strength e.g. Uniaxial compressive strength (UCS)
- Modulus of elasticity e.g. Young's modulus (E)
- Density

The solution

ROCKRay by PETRA Data Science was the chosen solution as it was capable of filling in laboratory rock testing results along untested lengths of core and enabled the team to estimate rock testing results at the block model scale. Using optimised data fusion and machine learning it promised to:

- reduce the need for extensive drill core sampling and time consuming laboratory tests
- turn hundreds of drill core test results into thousands of predictions along uncharacterised lengths of drill core
- allow engineers to simply upload drill core data and receive packaged predictions in less than eight hours

The results

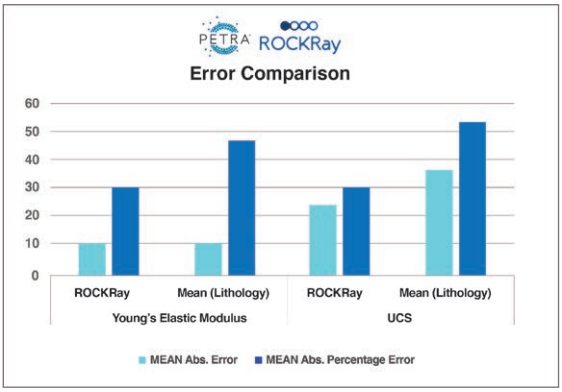
The ROCKRay implementation project was complete within six weeks and enabled the project study team to build high granularity 3D block models by providing them with a 190 fold increase in the amount of core length with rock strength estimates available for engineering design and 3D orebody modelling.

Before implementing the machine learning software, the site had approximately 30 metres of rock sample laboratory test results for 16 lithological domains from 28 holes.

After using ROCKRay the team had access to 5690 metres available for 3D block modelling.

This meant the study team had block model scale estimates of rock strength that were significantly more accurate than the lithological mean, as seen in the error comparison chart below.

Contact PETRA
www.petradatascience.com/contact/



Geology tools solve engineering project

Earlier this year, Maptek™ set a challenge to geologists to apply new software tools to a geology related application of their choice, with an emphasis on innovation.

Machine learning is new, exciting technology and one that is proving successful in generating rapid models using large quantities of data. One of the biggest benefits of Maptek™ DomainMCF is that it leaves more time for geological analysis and evaluation.

The Maptek Geology Challenge offered participants a chance to experience the benefits first hand by providing access to software tools for applying to a geology related project, with an emphasis on innovation.

Richard Jackson, Senior Technical Lead, Maptek and organiser of the global challenge said he was thrilled with the effort from all participants.

‘The winning entries were strong examples of well-defined problems that were difficult to solve with traditional methods, highlighting the benefit of using machine learning to act on multiple data types to create a geological model,’ Jackson said.

Winner of the challenge, which had to be completed over one week, was Henry Dillon, a Senior Geologist with global consultants, Golder, a member of WSP.

Dillon, who works in Christchurch, New Zealand applied Maptek Vulcan™, Vulcan GeologyCore, Vulcan Data Analyser and DomainMCF to model complex shallow surface geology beneath a proposed engineering structure.

‘I had been wanting to try DomainMCF for some time, since I first started seeing it used and being talked about,' Dillon said.

‘Our key problem was how to use all the data in the boreholes to model all the geologies and still get

the low and high density sands in the right places throughout those drillholes,’ he continued.

Dillon's answer was to assign and use numeric values, and combine the data with soil behaviour types and shear wave velocities to control the geological model.

DomainMCF handled complicated interfingering of sandy and silty materials and modelled sand–gravel interactions, generating the complex lithological interactions expected from braided river systems.

> Speed is a known benefit of DomainMCF and proved to be the case for the Christchurch study.

‘We were able to construct a reasonable lithological model from drillhole and cone penetrometer test data for an area of known geological complexity. We sent 193,000 data points to DomainMCF and received our model after 13 minutes and 6 seconds!’ Dillon said.

As well as the innovative approach to geotechnical assessment of performance and design for the foundation of a future structure, Dillon provided invaluable feedback for improving the integrated modelling solution for all users.

‘DomainMCF has targeted the mining industry, but many other industries find traditional modelling processes to be equally time consuming – we can spread the benefit,’ Dillon commented.

Second place in the competition was awarded to a team from Anglo American led by Reece Stewart, for their innovative approach to overburden definition modelling, with third place going to Matt Green, Evolution Mining, who compared implicit modelling to DomainMCF for interpreting complicated geological structures.

‘Submissions displayed a range of novel techniques and applications that will contribute to innovation in our industry,’ Jackson concluded.

Maptek anticipates running another challenge in 2022 and looks forward to ongoing industry collaboration to simplify modelling processes and inspire geologists to find additional applications for the machine learning technology.

Students solving real world problems

Maptek™ has sponsored several research projects at the University of Adelaide, mentoring students as they apply their learning to industry problems.

Maptek™ mentors and software engineering students from the University of Adelaide, South Australia have worked together to fight computer hackers in one of four research projects.

A group with Harkaranveer Singh, Manraj Singh Dua, Tze Chung Tai and Mitchell Martinez set about implementing cyber security concepts to obfuscate neural networks and infer results using graphics processing unit resources.

'The goal was to prevent hackers or malicious users from discovering the inner workings of the neural network and stealing intellectual property,' Harkaranveer Singh said.

Singh, who will start an internship with Maptek this month, says that the agile development approach and sessions with mentors open to novel solutions gave his team great insight into industry practices.

The other projects covered Fake Geological Models, 3D Complex Geometry Calculations and Block Model Compression.

Anthony Seager, Scott Ahern and Thomas Papaemmanouil worked on Fake Geological Models, aiming to create a program that could randomly generate realistic looking block models given a user's input.

'As a software engineering student I knew little about geology, let alone block models and the structure of ore deposits,' Seager said.

Seager, who has also scored a Maptek internship, learnt the use of Maptek Evolution mine scheduling software and Python scripting.

Maptek Global Development Strategy Manager Will Reid says the projects are a win-win.

'Students get access to an industry project and industry professionals, and Maptek gains solutions to problems we haven't had a chance to look at yet,' he says.

'These students will enter the workforce and contribute to technical advancements being made here and around the world,' concluded Reid.

Maptek actively supports universities across the globe by providing educational software licences, hardware donations and technical guidance.

www.maptek.com/university

University of Adelaide software engineering students Tze Chung Tai, Harkaranveer Singh, Manraj Singh Dua, Scott Ahern, Thomas Papaemmanouil and Anthony Seager undertook research projects with Maptek mentors

Final year mine design prize

Maptek™ awards an annual prize to final year mining engineering students at the University of Adelaide in South Australia.

The 2021 Maptek Mine Design Prize winners are looking forward to greater job opportunities and the chance to emulate the success of previous winners.

This year's annual prize, contested by groups of final year University of Adelaide Mining Engineering students, was won by Cheng Li, Claudio Wiehe Jr and Yixuan Xiang.

Given a resource block model for a copper-gold project, groups had to convert this to a mining reserve for extraction by both open cut and underground mining methods.

Maptek Senior Technical Sales Specialist Steve Sullivan, who provided Vulcan training and assessed the entries, said the winning team presented the most comprehensive study and managed the important transition from open cut to underground method best.

Claudio Wiehe said communication and understanding were the key to the team's success. As future workmates they will keep helping each other to succeed.

'The recognition by Maptek was worth the effort,' he said.

Cheng Li (Ethan), has started work at Maptek full time with the Evolution mine scheduling team after working on a part time basis whilst studying this year.

'I enjoyed learning Vulcan and this project definitely reinforced my interest to pursue a career in mining engineering,' he said.

Yixuan Xiang is following in her father's footsteps – he graduated as a mining engineer in China and worked as a civil engineer. She was glad of the chance to study mining engineering in Australia.

'As a graduate mining engineer, this prize definitely gives me confidence – it proves that hard work will pay you back in the end,' she said.

Maptek has supported the University of Adelaide since 2010 when the mining engineering undergraduate course commenced.

'The commitment was highlighted when this year's winners saw names of past winners who now have senior positions in industry. In a couple of cases, the current winners had applied for graduate positions to past winners. A nice connection,' Sullivan said.

Sullivan noted a decrease in enrolments in mining engineering across all Australian institutions. This year there were 13 in the local course, whereas a few years ago class sizes were 40-50+.

The upside for current students is that they all step straight into jobs, and often have multiple choices.

He said there was a need for more students to graduate as mining engineers to help the industry grow and maintain the standard of living to which we have all become accustomed.

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Maptek Senior Technical Sales Specialist Steve Sullivan presented University of Adelaide mining engineering students Cheng Li, Yixuan Xiang and Claudio Wiehe Jr with the 2021 Maptek Mine Design Prize


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