MAPTEK™

40 Years

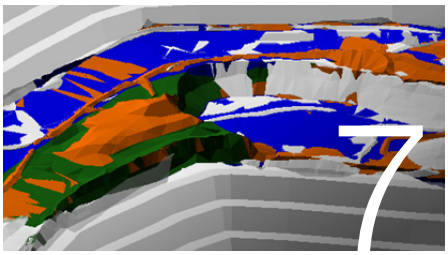
Forge

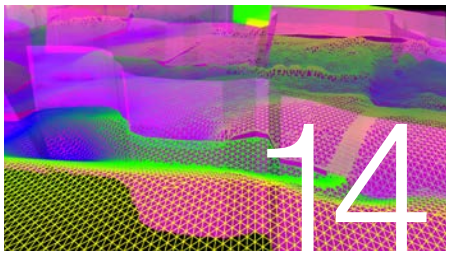
March 2021 Newsletter

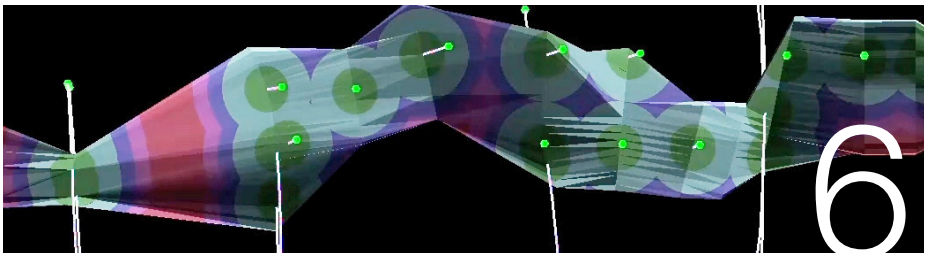
In this issue

Contents

Welcome to our Forge newsletter March 2021







Western Sydney International Airport bulk earthworks project is benefiting from Maptek mine measurement technologies

Contact us: forge@maptek.com

This year marks four decades in business for Maptek.

We've been here through boom and bust. We've experimented with different approaches and applications. We've pushed the boundaries to continually find a better way of doing things.

We've grown from a single office offering database and plotting services to a global technology business with 350 staff serving more than 20,000 users across 90 countries.

In the 1980s our automated 2D plotting revolutionised the work of geologists and engineers. We are still developing tools to make mining workflows easier and more robust.

Today, through harnessing data connectivity, cloud computing power and optimisation algorithms, we are revolutionising the automation space.

We owe our achievements to a mining community motivated by excellence, innovation and improvement.

In this issue we highlight solutions that leverage collaboration with customers and technology partners to meet design conformance, track material and predict performance, and automate mine compliance.

Please visit our website to learn more about our 40-year activities and how you can participate.

Eduardo Coloma
CEO

Survey keeps airport project on track

Maptek™ mine measurement technology helps ensure bulk earthworks meet design for the Western Sydney International Airport.

Maptek™ survey technology has increased data acquisition capability and quality, and decreased the data processing time for the joint venture earthworks partners.

In April 2014 the Australian Government designated Badgerys Creek in Western Sydney as the site for the city's new airport and geotechnical investigations began in 2015.

The government later committed $5.3 billion in equity to build Western Sydney International Airport, and the CPB Contractors and ACCIONA Joint Venture was awarded the contract to undertake the earthworks.

At 800 hectares, the project is one of Australia's largest ever earthworks infrastructure projects outside of the mining sector, and will excavate and place a total of 25 million cubic metres of earth.

The site currently runs 73 heavy dump trucks (42 rigids and 31 articulated) and has had up to 76 scrapers running at any one time.

> Maptek equipment is built to handle the rugged mining environment, so applying it to a large scale civil project was a natural fit.

In 2019 the site began using a Maptek LR3 laser scanner to track material movement using a stop-go data collection method.

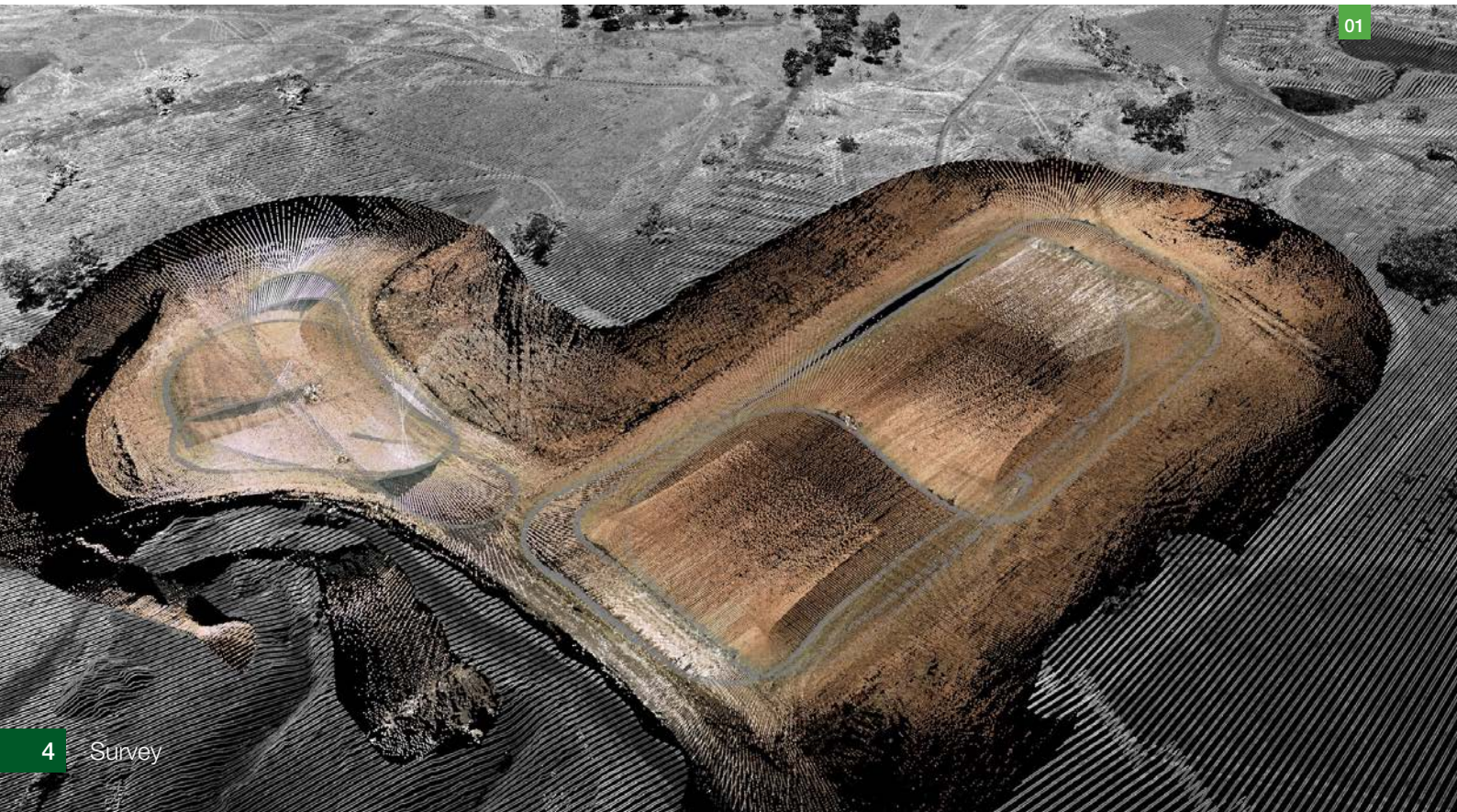
As the cut and fill project progressed, with 300mm of fill being laid every day and the need for precise measurement to ensure the right material, thickness and compaction was achieved, speed of data capture and processing became a key issue.

Given the lack of elevation change in the terrain and therefore elevated positions to scan from, it was challenging to capture and process the data quickly, prompting a fresh conversation with Maptek and a trial of Maptek Drive.

Maptek Drive allows the continuous acquisition of laser scan data with a Maptek laser scanner mounted on a moving vehicle and removes the need for any scan registration.

Since March 2020 the site has been running two Maptek Drive systems with LR3 scanners, along with Maptek PointStudio™ point cloud processing and analysis software, and using them daily.

The mobile scanner has proven itself on site, with continual daily use over 12 months in rough terrain, with no breakdowns.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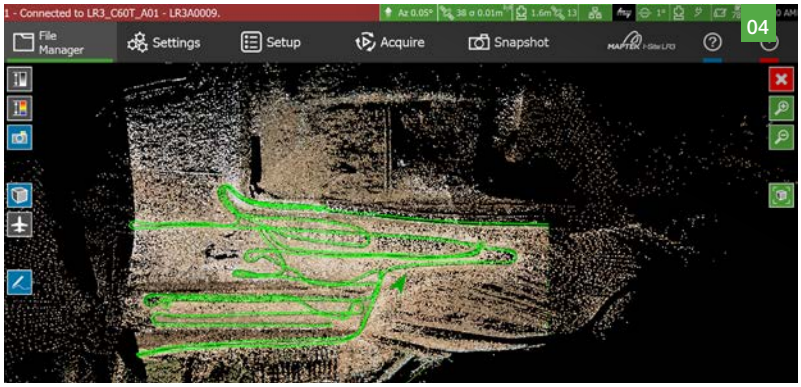
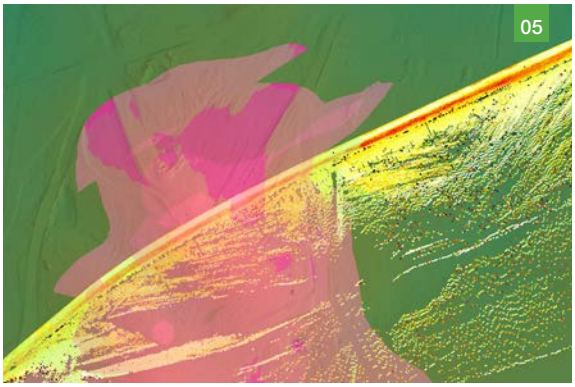




All equipment accuracy checks continually exceed site expectations and meet site tolerances.

Large inaccessible areas can be quickly captured and processed, giving the team greater confidence in the results as all surfaces are captured.

> Turnaround time for data capture and processing has been drastically reduced.

The previous method saw multiple static scans captured, processed and stitched together. Now a single drive captures a massive amount of data which is processed within minutes of getting into the office.

Custom workflows have been set up to convert the raw scan data to a smoothed surface and extracted via a polygon. Using workflows allows automation of repetitive processes, improving the time taken to process data, and allowing new users to quickly grasp the software.

The CPB Contractors and ACCIONA Joint Venture recognises the value of embracing new technology.

The laser scanner produces accurate repeatable data. Importantly, the safe working distance keeps the survey team away from heavy machinery and does not slow production.

The site has found Maptek easy to work with, and always interested in providing innovative solutions to meet the end goal.

01 Maptek Drive makes fast work of updating existing data with mobile scan data around the vast, 800-hectare site

02 Aerial photo showing the extent of the bulk earthworks project

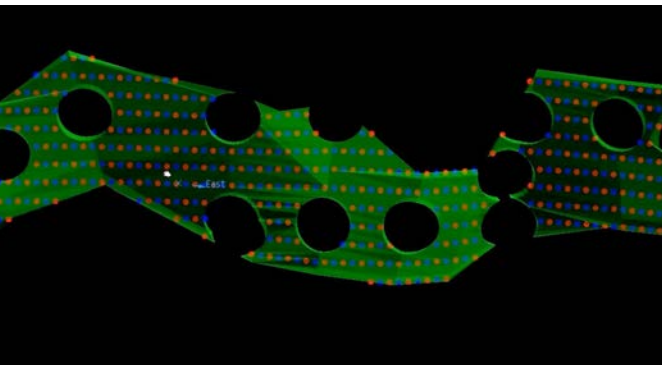
03 Continuous data acquisition from the vehicle-mounted Maptek LR3 laser scanner improves safety

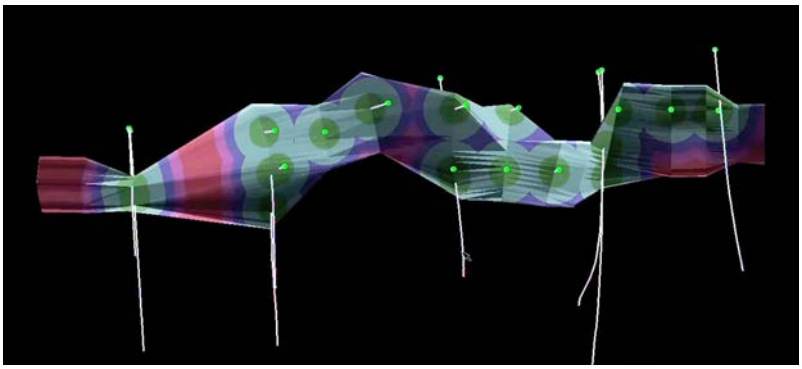
04 Survey teams can review scan coverage on the in-cab 3D interface before leaving the area

05 Overlay of geological boundaries (pink solids) and scan data (lower section) on the topographic surface

Enhanced drillhole planning

The first stage of a transformational development for drillhole planning complements the drillhole optimiser and is now available to Maptek™ customers.





Integration between new Drillhole Planning tools and the Vulcan Drillhole Optimiser provides geologists with a streamlined end-to-end drill planning process.

Production geologists, who spend a large part of their working hours designing and managing drilling operations, will be able to automate repetitive tasks, greatly reducing the time required to generate long term conceptual drilling and day-to-day production designs.

In Vulcan 2020.2 we introduced new drillhole planning tools under the Geology menu for GeoModeller or GeostatModeller licence users.

The Drillhole Planning sub-menu features new options to evaluate drill density and create drill targets.

The Evaluate Drill Density option illustrates the current density of selected drillholes within a triangulation, based on user-defined distance ranges, giving a clear overview of where to focus drillhole planning.

Create Drill Targets quickly and easily creates drilling target points within a triangulation based on user-defined grid spacings.

The scope of this new tool is much wider than simply creating drilling targets. For example, it is perfect for making mid surfaces from solids that can be used when creating anisotropy models and creating grids of collar points across a topographic surface.

> The latest drillhole planning tools pave the way for the development of a wider suite of capabilities.

Users will be able to define desired drillhole orientations, extend holes a set distance beyond the footwall of a triangulation, create wedge drillholes, apply deviation based on rates automatically calculated from previous drilling, automatically adjust collar locations to account for drill rig setup constraints and calculate estimated drilling costs.

Drillholes will be able to be exported into CAD layers, CSV files and directly into Isis drillhole databases.

Ongoing development will see a highly sought after feature for creating drillhole hazard cones to help in potential breakthrough interactions.

Reports will highlight the hazard objects, how far down the drillhole interactions are expected and how close to the drillhole the interaction occurs.

Combining these drill density and targeting tools with the Vulcan Drillhole Optimiser makes Vulcan the complete package for drillhole planning.

Drillhole Optimiser is ideal for identifying areas that will benefit best from targeted drilling to uplift the resource when defining a life-of-mine conceptual drilling budget.

That Drillhole Optimiser output can then be brought into the Evaluate Drill Density option to assess the geological confidence and support justification for proposed budgets.

Drillhole Planning tools due later in 2021 will further enhance the interoperability with Drillhole Optimiser, with output being used in Edit Drillholes to extend holes, rename them and apply deviation.

Feedback from customers has provided impetus for this transformational development that goes beyond expectations.

Measuring plan conformance

Maptek™ has tailored an automated approach to measuring mine compliance that allows engineers more time to analyse results and make timely decisions.

The Maptek™ mine compliance concept measures how closely a mine budget is being adhered to. Lack of plan conformance can be critical to business success.

Budget deviations can be costly, with unplanned work being 1.5 to 5 times more expensive than planned work. Mill blend non-compliance results in recovery issues and the need to account for unplanned blending. Value is lost when an optimised plan is not able to be followed through.

Non-compliance is a risk that mines must attempt to prevent, control and mitigate. When mining deviates from plan, timely intervention is crucial. Information must be available where and when it can make a difference.

> An automated solution enables timely analysis and fast response to correct deviations and improve adherence to the mine plan.

The Maptek approach includes automated solid generation, database storage of historical results and comprehensive compliance reporting.

Inputs include: the mine plan (planned surface at the beginning and end of period OR planned solids); the actual surface (at the beginning and end of period); and the stage limits (polygons).

The mine plans (movements and grades per stage/period) can be imported into an SQL database from Maptek Evolution, or in a standardised .csv format. Factors such as budget, forecast, short term planning and stripping can be included and there is no limitation on the number of plans that can be stored.

The output intersection solids are created directly from the surfaces and/or planned solids. The user must validate those intersections, cropping or removing solids according to criteria based on their expertise.

The solution sees a surface intersection performed every time a period is analysed. A period can be years, months, weeks or any unit defined by the user.

The validated solids showing mined and not-mined volumes as well as reserves calculated from the block model, are stored in the SQL database.

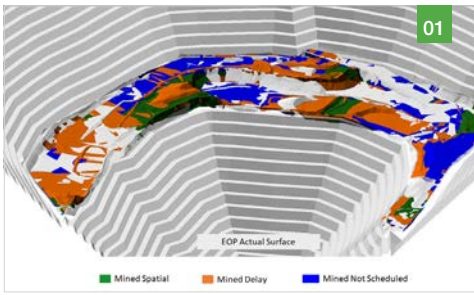
The stored data is associated with one of the plans already loaded in the database, including volume, tonnage and grade. The data can be used on a web application or PowerBI dashboard.

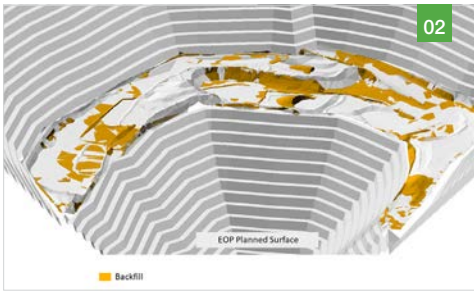
Compliance reports are output from the SQL database for any period analysed, and with respect to any desired category.

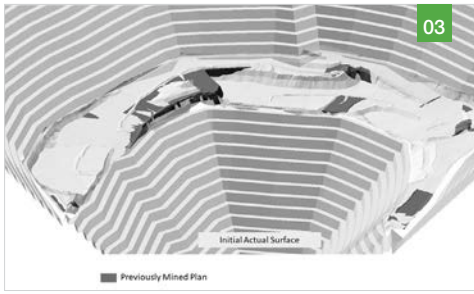
This can include: monthly volumes, spatial and volumetric compliance; year to date plans with month by month movements, ore/waste product breakdown, and monthly deviation from plan with regard to volumes and grades.

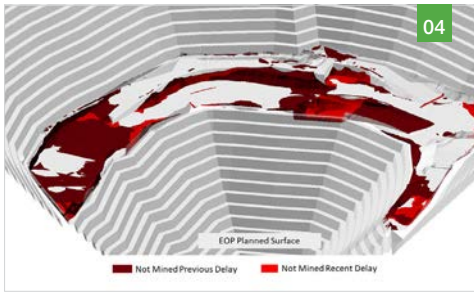
This automated approach provides planning engineers with a robust tool for plan conformance analysis on a monthly, weekly or daily basis. Engineers can now spend more of their time analysing results and making timely decisions to prevent further deviations.

Maptek can tailor this solution to your operational requirements.









01 End-of-plan actual surface showing the mined area (green), delayed mining (orange) and unscheduled mining (blue)

02 End-of-plan planned surface showing backfill (yellow)

03 Initial actual surface showing the previously mined plan (dark grey)

04 End-of-plan planned surface showing not mined previous delay (dark red) and not mined recent delay (red)

Maptek 40-year celebration

The Maptek philosophy is to keep customer needs first and foremost – aiming for your success is the motivation behind four decades of innovation.

1981–1990
Finding our feet

Great ideas are only a starting point. Our first customers told us what they really wanted, and kept our feet on the ground. Interactive graphical editing of drillholes coupled with fast surface and block modelling found good traction on large projects with tight timeframes. Desktop 3D software gave mining professionals control over their projects, following familiar workflows.

1991–2000
Riding the waves

The mining industry has always been subject to market whims. Having ridden out the 1987 crash we surfed the ups and downs of the 1990s, changing position with our hardware platforms, finding new applications for our software and testing out new markets. We expanded into new geographical locations to serve our multinational customers. We even survived the Y2K Millennium bug!

2001–2010
Building confidence

Having proved ourselves in the geological modelling and engineering design software arena, we pivoted into revolutionary survey hardware. Our 3D laser scanning systems with inbuilt panoramic camera and advanced software set a benchmark for portability and soon travelled to all corners of the globe. Customers validated the benefits of a cross-product integrated mining solution.

2011–2020
Looking outwards

Customer operations were promoting standardisation. We streamlined our licensing and introduced automated workflows. We saw gaps in mining processes and stepped in to fill them. We collaborated with industry leaders and partnered with like-minded providers. We nurtured future professionals around the world through university training and internship programs.

2021
Driving the future

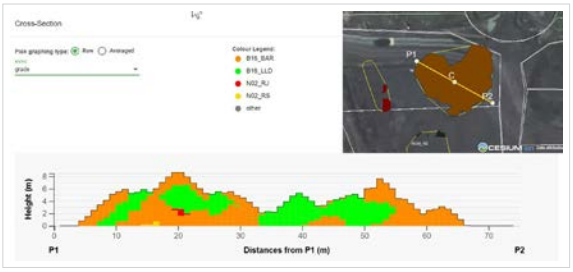
The challenges of 2020 gave fresh impetus to developing and adopting new ways of working. Data connectivity, cloud computing and optimisation algorithms are key to unlocking the power of automation. Our technology roadmap targets solutions that benefit industry, increase operational productivity and enhance user experience. Input from our customers has driven us since the start of our journey.

Closing the loop

Continuous improvement does not mean abandoning the past. A customer recently wanted to look at some of their data from 40 years ago. Without any fuss, it was loaded into a current version of our Vulcan software and was immediately ready for use. Our DNA talks of our past and charts our future. Thank you to all our customers and employees who are links in that continuing (mine value) chain.

Improve with real-time material tracking

Consistently delivering a correct blend, and keeping track of inventory and quality at all stages of production are universal challenges at mine sites.



Mine value chains are complex and fast moving, making it difficult to accurately track and manage ore.

Each site has different imperatives for blending. Planning becomes more complex depending on the consistency of the lithology and the intended use of the product. Delivering an overly rich or diluted product unfit for purpose wastes time and money.

Disconnects within data and systems that track inventory have typically resulted in a loss of value through a lack of compliance to plan. These gaps cause delays and operational inefficiencies, and present a risk in contract penalties and under-valuing products.

Maptek™ MaterialMRT tracks the value of resource, planning and production data along the mining value chain. This integrated enterprise system allows all stakeholders to better understand the factors that impact operational performance in near real time, and in greater detail than previously possible.

Mining operations benefit from quality and quantity control of material flows from in-situ resource to run-of-mine stockpiles and feed into the plant. This is enabled through a cloud-ready centralised server, with a web-based user interface and a database optimised for storing arbitrary time series geospatial data.

MaterialMRT provides a 3D display, configurable dashboards and data warehouse for custom reporting.

Maptek Group Product Strategy Manager, Mark Roberts says that MaterialMRT is applicable to a wide range of operations.

'Everyone can benefit from reduced costs, increased revenue and reduced risks of delivery off spec,' says Roberts.

MaterialMRT connects the resource model, mine plan, fleet management, on-belt analysers, survey, laboratory and plant time usage data. It presents a validated, accurate and up-to-date view of mined material as it moves through the value chain.

> MaterialMRT provides the big picture on operational performance.

'The value chain starts with the in situ resource, where we've already made assumptions about the value. Then we blow it up, dig it up, haul it and direct feed it into a plant or put it on a stockpile. By continually tracking the movement and flow of material from in the ground to the plant feed we can now reconcile back to the resource model and mine plan from each stage of the value chain and address issues in the next planning cycle,' explains Roberts.

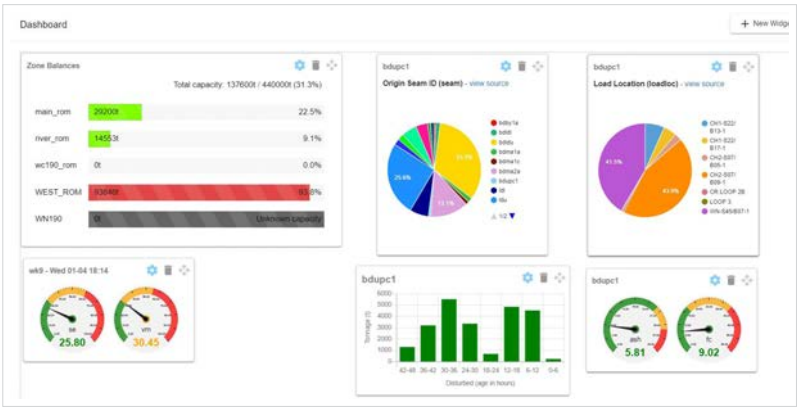
Access to accurate, validated data is vital to avoid ambiguity, uncertainty and risk. Better decisions can then be made per shift and in shift.

Material MRT delivers the current state of material flows and stockpiles through close integration with all critical data sources and systems. This provides a decision support mechanism for most accurately meeting the plant feed plan and product objectives.

'This support is important for business success. Robust, repeatable and user-independent systems are consistent with a data-driven approach,' says Roberts.

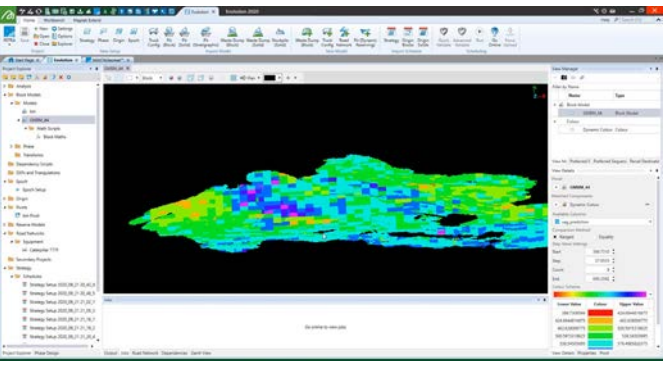
The outcome is more accurate integrated planning of plant feed so miners can maximise long-to-short term performance in product delivery and plant throughput, thereby maximising value in their resource recovery.

All stakeholders across the mine value chain can now have clear, easily understood information about the objectives, plans and performance of the operation.



Leveraging integrated solutions

Mining professionals today have less time available and need to be more productive with that time. The collaboration between Maptek™ and PETRA adds value to their work.



Work at mines is becoming increasingly complex, involving ever more sophisticated systems and techniques aimed at improving capability and potential. However, working in disconnected systems, constantly transferring files or data and switching between various environments can distract engineers from doing the actual work of engineers, and productivity can suffer.

Maptek™ and PETRA have collaborated to offer solutions which leverage our unique strengths. New product integrations enable seamless, efficient and easy use of a number of value-adding techniques.

PETRA MAXTA solutions can now be operated from the Maptek Workbench, and also within Maptek Vulcan™ and Evolution planning and design applications. MAXTA provides mine value chain optimisation by predicting and simulating downstream process performance as a function of geology, geometallurgy and mine design decisions.

Performance of downstream activities such as load and haul, crusher and mill, and minerals processing and recovery can be accurately predicted based on orebody knowledge and planning decisions.

Orebody knowledge available at the point where mining decisions are made allows planning not only for tonnes and grade, but also for overall performance optimised throughout the mine value chain.

This solution integration has allowed fast, easy access to MAXTA results within the Vulcan and Evolution planning environments. Engineers can update and apply MAXTA predictions without switching applications.

> Results are incorporated within the block model for immediate use in the working environment – no need to save or copy files, or change windows – it is fast and easy.

Each block of ore represented in the block model can contain parameters created using MAXTA digital twin technology, describing the expected performance of that ore in downstream processes.

Combining these environments allows the valuable data generated by MAXTA to be used quickly, easily and efficiently by engineers. Users of Maptek and PETRA products can now access a truly integrated planning, prediction and optimisation environment that is supported, reliable and sustainable.

The PETRA FRAGx solution is now available as a standalone Maptek Workbench application or via integration with Maptek PointStudio™. FRAGx allows fast, reliable fragmentation assessment using machine learning on point cloud data from any source.

It is not always feasible to supply the high quality 3D point clouds required by many other fragmentation analysis techniques, and FragX is especially suited to noisy or poor quality data.

Customers want to use an increasing range of sensors to create 3D data, and there are inevitable trade-offs between practicality, speed, safety and data quality. FRAGx allows more measurement options to be considered, meaning greater flexibility and lower cost.

FRAGx allows users to report on a customised range of size bins within the fragmentation range and determine the proportions of material in each bin. Processing is very fast and can be automated for continuous or repetitive data feeds such as drawpoints, where identifying outsized fragments can be critical to production and safety.

FRAGx can become part of a workflow-enabled automated process to identify potential problems related to fragmentation.

PETRA and Maptek are also collaborating to enable MAXTA to integrate with Maptek resource tracking solutions – connecting more data from within the mine value chain and using that data to help improve understanding and performance of the entire mining process.

Harnessing deposit complexity

Machine learning techniques use all data sources for geological modelling, enhancing the understanding of complex deposits and improving decision making.

During development of Maptek™ DomainMCF, a review was undertaken of resource reports lodged to statutory bodies. This found geological models with over-smoothed lithology boundaries, many of which do not represent how geology appears in the field, pit or underground development drive.

The underlying data is often too complex or messy to be incorporated into the resource model and is thus a simplification of reality, to the detriment of the mining operation and its shareholders.

These approximations can be improved with new modelling techniques such as machine learning. However, with poor data or improper use of machine learning techniques, the conclusions can be just as misleading as with current techniques.

Complexity in deposit modelling is accentuated by at least six factors: data diversity, structural controls, chemistry, data volumes, process workflows and external constraints.

Data diversity

Models are built to represent the underlying geology for use in resource estimation, reporting, geotechnical studies, geometallurgical work and mine planning.

Relevant data can be sourced from a range of technologies such as geological logging, geochemistry, geophysics, geotechnical, hyperspectral, pXRF, photography and lidar.

Each source has different data formats and provides differing levels of accuracy and relevance.

As well as merging data from different backgrounds, an environment for analysis, interpretation and modelling must be able to process the complex array of disparate data.

Structural controls

Many mineralised systems have been formed by controlling structures while others have been modified since emplacement by post-mineralised events such as folding, faulting and/or shearing, sometimes of multiple generations.

> Understanding the structural framework is important in deposit modelling.

The sequence or hierarchy of complex events such as post-deposit faulting or cross cutting dyke emplacement will impact geotechnical competency and mine planning studies.

Chemistry

Mineral deposits are natural enrichments of elements or compounds of economic interest. Deposits can be simple in geometry but complex in mineralogy and chemical composition.

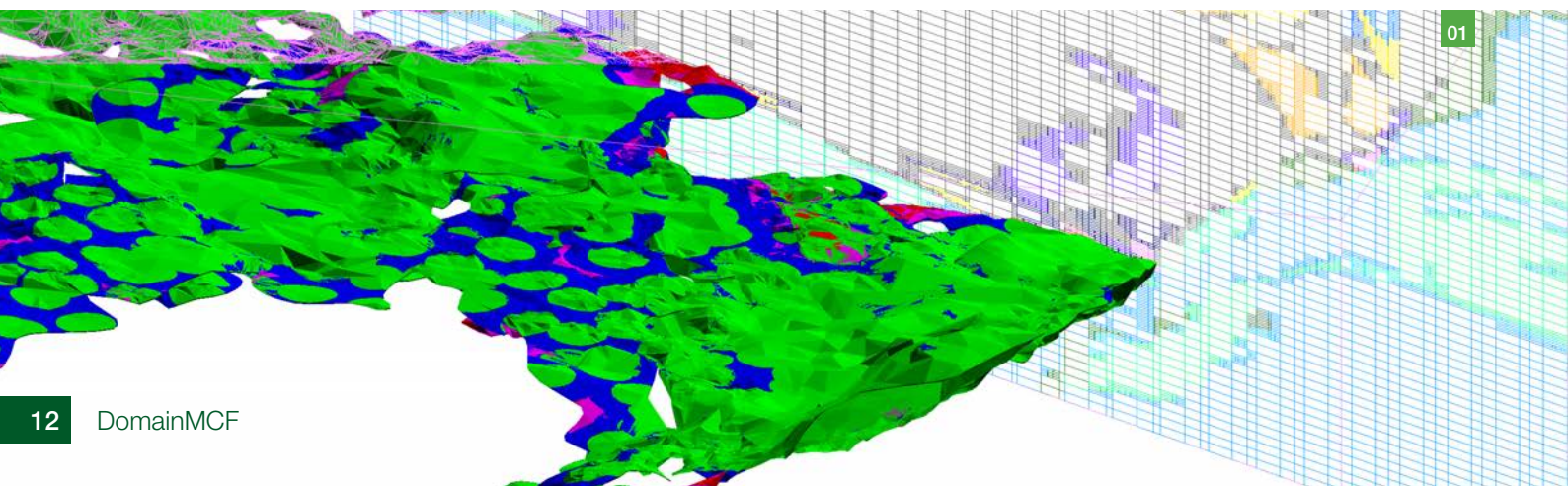
This complexity can exist in the economically important minerals where they are locked in refractory mineral species. And when deleterious elements are intimately entwined within the mineralisation their distribution also needs to be understood.

Data volumes

The increased availability and variety of sensors collecting data for geological modelling has led to a significantly greater volume of data.

A decade ago, input data sizes may have been measured in megabytes or gigabytes; the current generation of core imagery from hyperspectral sensors can generate terabytes in minutes.

Managing the validation, integration and usefulness of this data is a significant challenge for operations and adds to the complexity matrix.



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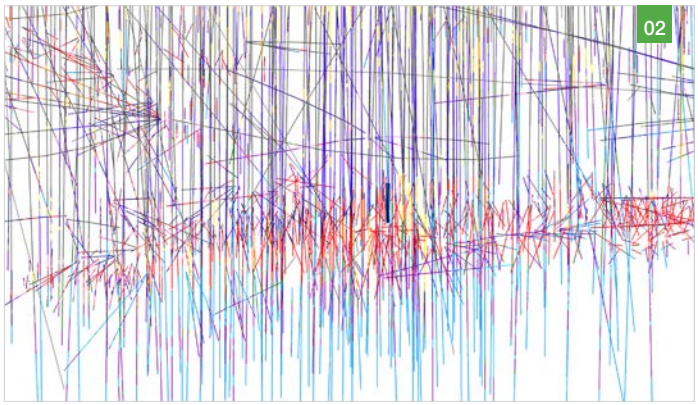
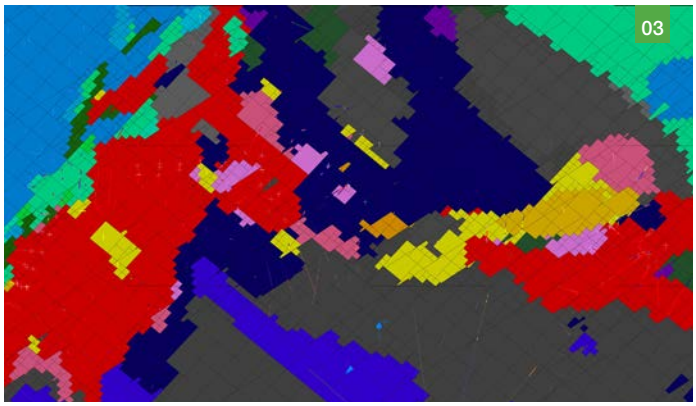
01 DomainMCF uses the full richness of geological information to provide better understanding of complex deposits

02 Data is often too complex or messy to all be incorporated into a resource model, with risk of over-simplification or smoothing

03 A geological model benefits from including surrounding country rock and regional structural controls as well as ore and seam interpretations





Process workflows

Many customers use a lot of different software to manage and process their geological data.

Having complex software interactions adds an overhead for IT application management and data flow, requiring validation that the process is not broken by software upgrades.

There is also increased potential for data transfer errors. Learning multiple new software interfaces each with their own method of operating can be confusing, so it requires more effort to induct new personnel into a team.

External constraints

In addition to technical constraints, external complexities can impact the production of geological models.

Continuity of geological staff is a principal concern for many operations.

Multigenerational mines require stewardship through the hiring/firing cycles that follow the highs and lows of commodity prices.

Shorter-lived or remote operations using fly-in fly-out staff, can experience an inconsistent and distracted workforce.

It is important to maintain geological data integrity, regardless of who is collecting and recording it.

Case history

In a recent project for a deposit adjacent to an existing mine in a complex structural setting, more than 50 lithology codes had been reduced to six composite codes for modelling.

This reduction of complexity, including ignoring any zones that had been logged as faults or shears, resulted in an overly simplified model.

> Presenting the full richness of the data to DomainMCF resulted in a model with a complicated mixture of faults and shears that dislocated lithologies.

Use of all the geological information in the resultant resource model brought new light to understanding the deposit, providing a basis for more informed mine planning decisions.

Machine learning rarely offers a single ‘right’ outcome, rather a range of possible outcomes from the data provided.

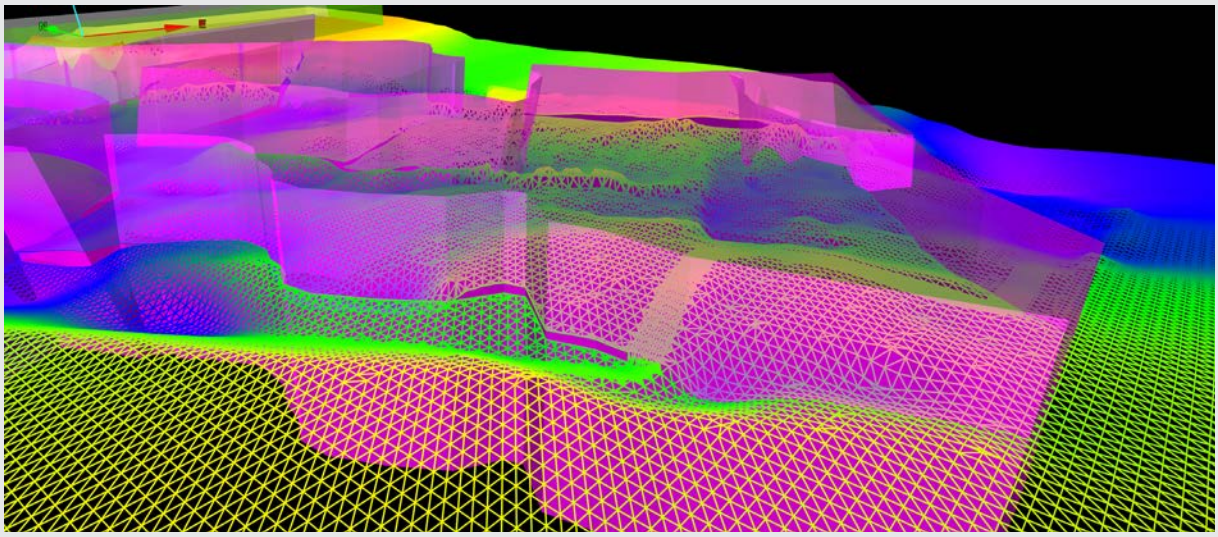
Does it provide meaningful information in an easily accessible way? Absolutely, and rapidly.

Use all the data, use DomainMCF.

Model merging – best of both worlds

Vulcan 2021 introduces two new applications to address a common request for combining multiple models into a single multi-resolution surface.

Vulcan



Geologists who deal with surface models want to be able to vary the resolution of the models to reflect the input data and combine multiple models into a single multi-resolution surface. Vulcan 2021 introduces two new applications to address this need.

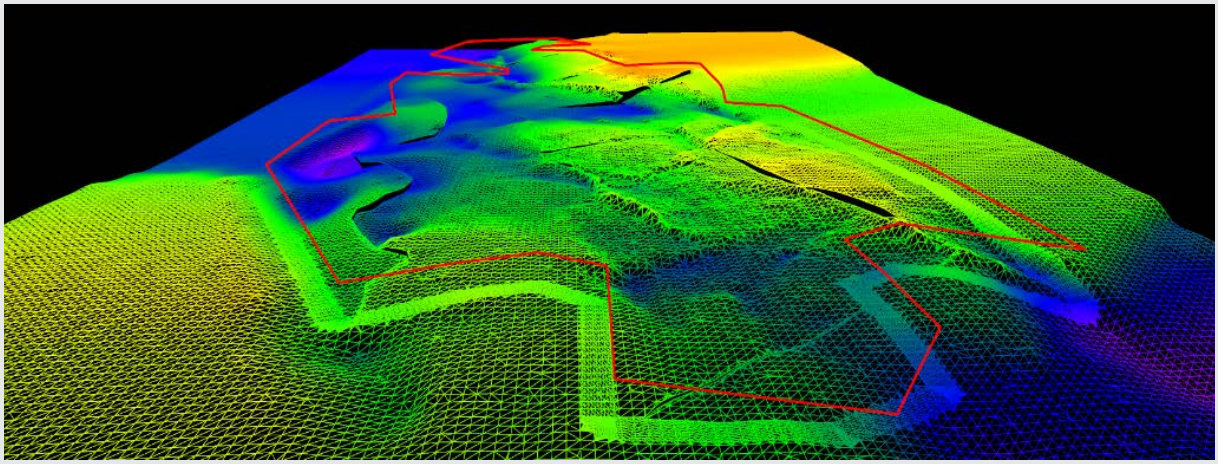
Merge Surface Models accepts two individual grids or triangulations as input, with the option to provide a polygon representing the merge zone or simply use the natural extent of the surfaces. Two entire directories of surfaces can be supplied as input and the option will merge the two versions of the same models in a batched process.

To ensure there is no dramatic step between one model and the next, a merging width is defined, and the option will intelligently morph from one surface to the next.

Stratigraphic geologists who employ Block Faulting will appreciate the second application of this technology – within the Grid Calc faulting options.

Creation of block fault solids can sometimes require faults to be drawn out beyond their known geological extent to allow closure of the solid triangulations used. This can create artefacts within the resultant surface models, showing faults that do not actually exist.

Geologists can now specify a polygonal extent to faulting. The resultant surfaces will be a merge between the block faulted surface and an unfaulted version of the same surface, removing artefacts and resulting in a final surface representing the best of both worlds.



University partnerships

Online training platforms have continued to provide access to workshops and courses for customers and students in all geographic locations.

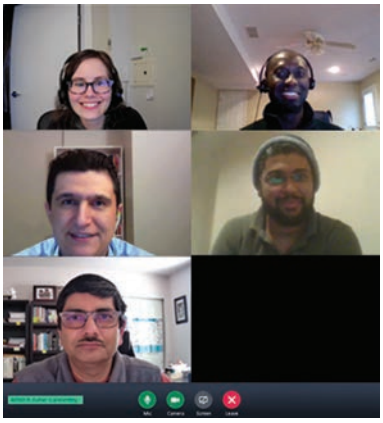
Train the trainer

In January Maptek hosted the 7th annual Train the Trainer Workshop, which was held 100% remote.

Professors from all across North America participated in blended learning where they took online training in the Fall semester and then participated in live instructor led training.

Course topics included geological modelling, exploration data analysis, block modelling, underground and open pit design, pit and stope optimisation, and scheduling.

The Maptek team is excited to see teacher assistants, researchers and professors implement these new skills in their work.



Engineering online

University of New South Wales 3rd and 4th year Mining Engineering students have begun online Vulcan training. This new format allows them to continue to benefit from four decades of Maptek industry experience.

Technical Services Mining Engineer Mike Winfield, one of the Maptek team members who has regularly delivered in-person lectures and training at UNSW, says they have adapted teaching methods because of the global pandemic.

An understanding of software used in the mining industry provides a positive foundation for future career outcomes.

‘The COVID safe system prevents access for us to universities at the moment, so our online training courses provide the opportunity for students to upskill,’ Winfield says.

‘We’re presenting a distilled version of courses available to industry, tailored to suit their studies.'

‘At the start of their careers, the next generation can benefit from their predecessors. There's a solid history of people using Maptek software for 40 years.'

‘We're training students to not just replace them, but to launch from the work of the past. We want to empower and encourage them to come up with new and creative ideas.'

Students will study elements of industry courses which focus on resource modelling, such as Getting started with Design Data and Getting started with Drillholes and Databases.

Winfield says an understanding of software used in the mining industry provides a positive foundation for future career outcomes.

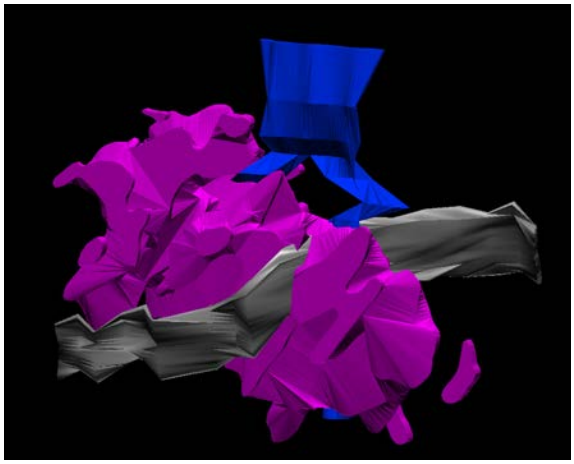
‘For the mining industry, it’s not ‘out with the old, in with the new’, it’s seeing how we can take this industry so much further.’

UNSW School of Minerals and Energy Resources Engineering Professor Serkan Saydam says the online format gives students access to training whenever they want.

‘It gives them huge flexibility,’ he says. ‘In the current environment many of the students are working full-time. So it is quite suitable for them.’

Professor Saydam says there is still great value in face to face training and looks forward to continuing to work with Maptek.

‘The students highly appreciate the guest lectures or projects from industry to gather the practical information.’



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