![MAPTEK logo]

Forge

In this issue

Global activities

Fast-track to success

There is a good reason why Maptek is the popular choice for miners - our easy-to-use products appeal to new customers and strong relationships ensure that we continue to meet the needs of the mining industry.

There's no doubt that day-to-day tasks are changing for operations. Our tools help mining professionals work as efficiently and effectively as possible. We extend productivity levels by collaborating around solutions.

We optimise operations by elevating skills and promoting cultural change in a sustainable way across processes and technologies. *Understanding the constraints as well as the possibilities engendered by technology makes us the ideal fit for your mining business.*

Tapping into our expertise and proven solutions fast-tracks your projects on the path to success. We seek practical, sustainable outcomes and match techniques to applications.

We thrive on making technology accessible, enabling customers to use their skills and freeing them from time-intensive dead-end tasks to work smarter and more productively.
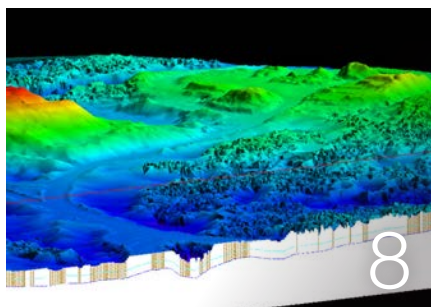
We hope you enjoying reading the stories around these themes in this issue and welcome feedback at forge@maptek.com

Peter Johnson
Managing Director

Forge

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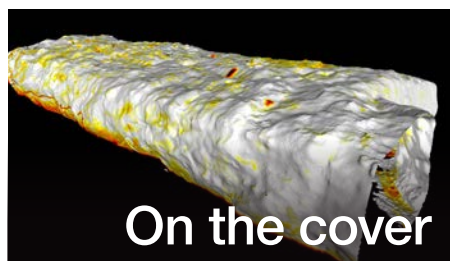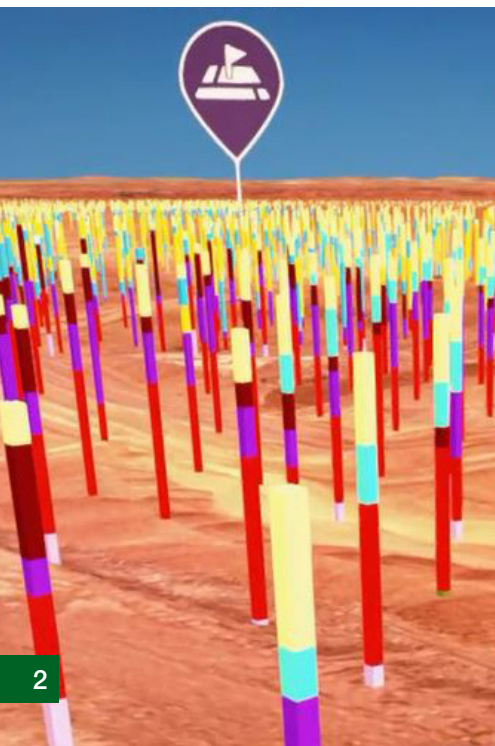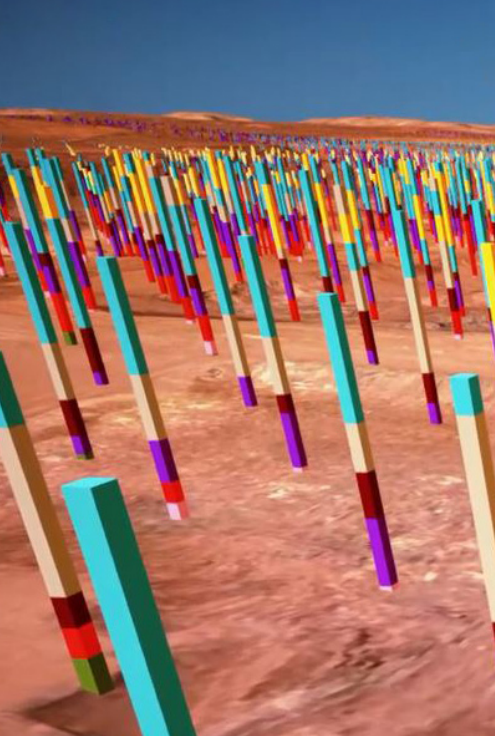
Maptek Roy Hill smart mining partnership

Maptek™ and Australian iron ore producer Roy Hill are collaborating to leverage deep learning, artificial intelligence (AI) and immersive technologies to accelerate orebody knowledge and inform upstream planning.

The world is facing rapid changes brought about by technology, globalisation and social values. Our personal and work lives are being increasingly disrupted, and the rate of change is accelerating.

Society is already adopting automation, with plans for driverless trucks and cars. The mining industry is no exception, and the geoscience disciplines have been actively trialling and applying evolving technologies for many years to improve the understanding and application of orebody knowledge.

Machine learning has been of interest to Roy Hill Superintendent Modelling, James Batchelor, for almost a decade and he is excited by the current co-investment project with Maptek.

"I'm a strong believer of being in the right place at the right time. Technology projects were somewhat stymied by the GFC, but many companies are now taking a different perspective to innovation and technology.

While orebody knowledge and machine learning are in strong alignment, Roy Hill has taken this further with a deep learning approach to anything that can be classified and labelled. Orebody knowledge is a key component of the Roy Hill Smart Mine program, which aims to create *tomorrow's mine, today.*

By 'smart' we mean applying our intelligence to critical thinking, creativity, and reasoning, and then combining this intelligence with social skills such as influencing, coaching and empathy to create and shape our future work. The outcomes will enable us to improve safety, increase productivity and deliver predictable performance for a sustainable operation.

Collaborative, agile approach.
In June 2017 Roy Hill Technical Services held an Orebody Knowledge Workshop attended by key stakeholders, vendors and Executive Leadership. The aim was to acknowledge the great work completed by Roy Hill and its partners to date, and tap into the wealth of expertise and experience to formulate an Orebody Knowledge Roadmap.

Orebody Modelling has many touch points across the business from Ore Definition through to Technical Marketing, and formed a core component of Roy Hill's Digital Twin concept. As a long-term supplier of Vulcan software to Roy Hill, Maptek was invited to present and help generate new ideas to form a vision for the future of Orebody Modelling.

Ultimately, this led to the scoping of a co-investment project aimed at exploring and building innovative modelling tools and technologies. With help from the Technology, Commercial and Legal teams at Roy Hill this two-phase project went live at the end of 2017. Phase 1 encompassed improvement projects, with phase 2 focusing on R&D and innovation projects.

Roy Hill and Maptek met weekly to track progress and costs, to ensure a standard approach. At the technical and thinking levels, however, the team was highly collaborative and agile. Capturing the best ideas, approaches and insights ensured that the end product enhanced the way business units work better, add real value, and provide a strong foundation for future innovation, standing the test of time.

Engagement with Maptek and the level of support and enthusiasm for the project has been second to none. Like all innovative collaborations, discussions are energetic, fluid and always insightful.

Challenging the way we think and communicate.

The project introduces new technologies, and replaces or improves on previous approaches. The following areas are the five key enablers to success:

> Python programming with highly functional and efficient libraries to facilitate modelling AI among other developments.

> Workflow tools allow the wrapping up of scripts developed over time into a larger automated process.

> Powerful probabilistic resource estimation in the form of Multi-Gaussian Kriging.

> Immersive visualisation capabilities via collaborative development with companies such as LlamaZOO.

> Advanced enterprise level data management and democratisation.

The human brain is a phenomenal machine for dealing with large amounts of data. At the same time humans struggle with correlating massive datasets and have become dependent on computers to do the calculations.

Machine learning algorithms have effectively replaced human thinking capability while also expanding on it, as they don't suffer from the same constraints that we experience.

These new technologies and approaches have the ability to empower by freeing us from manual, mechanistic and repetitive tasks. AI will do the leg work, while humans spend time developing new knowledge and insights in an environment where there is time to think, develop and collaborate as geoscientists.

Democratised technology and recognising inherent bias.

Deep learning is a democratised technology – anyone can use it. A high level of excitement permeates across continuous improvement projects through R&D and beyond to the eventual positive impacts on people, culture and philosophy.

Innovation and modelling go hand in hand. Ten years of using Vulcan has raised a keen interest in using programming to rapidly manipulate datasets and replace boring, repetitive

tasks. Being able to weave imaginings and learnings into a range of technological solutions, and tailor those into something of value both to Maptek and Roy Hill has been very exciting.

The project has presented some profound challenges. The innovation journey involves recognising and managing cognitive bias and dissonance. The team faced a paradigm shift around what modelling is, how it should be done, and what needed to be achieved to ensure we are well positioned for tomorrow.

The machine can come up with an answer, it can come up with many answers, but it can't make meaning out of them. It will be a long time before computers have the same level of cognitive functionality as the human brain.

The main outcome we've achieved is the development of data relationships. When trying to make a prediction from very little information, we can now actually generate something close to an answer, as well as the level of uncertainty. Previously, guesswork or drawing spurious correlations inspired no confidence whatsoever.

Learning to experiment and fail.

The implementation of Machine Learning in various areas of the modelling process has ranged from Geological Classification and Risk Quantification to the prediction of previously unpredictable phenomena. New tools to experiment with allow us to fail fast.

Machine Learning can generate more reliable results than conventional methods with less effort, less data (even though it prefers more) and with a measure of uncertainty. Long gone are the days of defaulting to regressions, rules based logic and conventional interpolators to populate variables.

The initial results from the Deep Learning for Estimation project look fantastic. At a statistical level the data compares well with conventional approaches. One of the big challenges will be changing the way we think about modelling and estimation. Natural bias borne from our experiences tends to drive an expectation of a certain outcome.

Maptek and Roy Hill

Roy Hill Iron Ore is a world-class integrated iron ore mining, rail and port operation in the Pilbara region of Western Australia.

The partnership between Maptek and Roy Hill began in 2011. Roy Hill uses Vulcan for geological and mine modelling as well as grade control. A Maptek I-Site 8820 long range laser scanner handles survey applications.

Introducing AI means that the team needed to 'rethink' so as to get the best value from the technology, unhindered by any cognitive bias. The biggest barriers to innovation are fear of failure and having too much experience. With so much experience, there is the risk of becoming convinced that all the answers are available. When different evidence is presented, it may be dismissed out of hand.

To avoid this, the team started implementing a 'work-flowed' approach, introducing new and advanced techniques and eliminating old processes.

Output from the virtual reality work completed to date by Maptek in collaboration with LlamaZOO is amazing. The team is not aware of any other virtual reality (VR) package that builds the various components of a mining and exploration project into a high-performance solution so seamlessly and holistically.

A key aspect of VR is that it helps with how the team does something *and* how it is communicated. The visual medium is the best possible way to tap into communicating, making a huge difference to the viewer. Achieving both in the one project is the best possible outcome.

Driving cultural change.

From the outset, key business drivers were improved efficiency and effectiveness, for example reducing the time taken to generate an answer, estimate or insight, and positive cultural change.

"Roy Hill's core cultural values are Lead, Care, Think and Perform. The project with Maptek will contribute to value in each by:

> Increasing the frequency of deep insights and generating better information and knowledge, thus enhancing the ability to make effective decisions, inspire our people and be effective leaders.

> Helping identify, quantify and mitigate risks, thus reducing the likelihood of damage to people, plant and reputation.

> Freeing people from manual, mechanistic and repetitive tasks and processes, opening up a knowledge and insight enriched space in which to think, develop and collaborate.

> Ultimately, improving the way staff lead, care and think will have positive outcomes in the way employees perform.

There is still much work to do. Measuring success and value will begin once there is a stable platform and baseline to work from.

Achieving our vision for the future.
Maptek acknowledges the significance of the project in terms of applying a targeted effort in orebody modelling. The possibilities are endless, and in many cases life changing!

Once the outcomes of the Maptek co-investment project are made available to the wider mining community it is likely to spark much debate and new thinking. Ultimately these technologies have the potential to change the *what, how and why* of mining in quite profound ways.

Several modelling projects are in the pipeline as well as closing out this phase of the Maptek project. The new approach is becoming mainstream for Roy Hill through engagement with other software vendors who apply AI and various data analytics teams.

Together we've achieved some phenomenal outcomes on a very small budget. Working with a technology partner who understands our business has made it faster and a lot more effective. The engagement, collaborative effort and learnings have contributed to a wholly positive experience.

Maptek's drive to build tools around this as a core function on their roadmap sets them apart.

Of course, there are still many unanswered questions. The maxim 'if you're going to fail, fail fast' applies. Don't wear too much resource or financial pain.

Roy Hill has already used AI via the new Vulcan Python interface to facilitate the generation of at least six streams of information to make better decisions. There will be an inevitable cost benefit as well as a reduction in the time it takes to get to an acceptable outcome.

The team has had a very clear vision from the beginning, and taking an agile approach to achieving this vision has been a vital component of success. One key learning for future reference on collaborations such as this is to incorporate a training and development component to the program.

Maptek collaboration with Roy Hill on this project has seen all participants gain a greater appreciation for each other's creativity. What this collaboration has achieved is a tribute to the passion, skills and singular focus on outcomes by all members of the team.

Maptek's agility and ability to pivot as the project has evolved highlights its real strength – the team's ability to think in a different way, instead of just looking to change a single process or system."

Thanks to
James Batchelor
Superintendent Modelling
Roy Hill Iron Ore

Geology
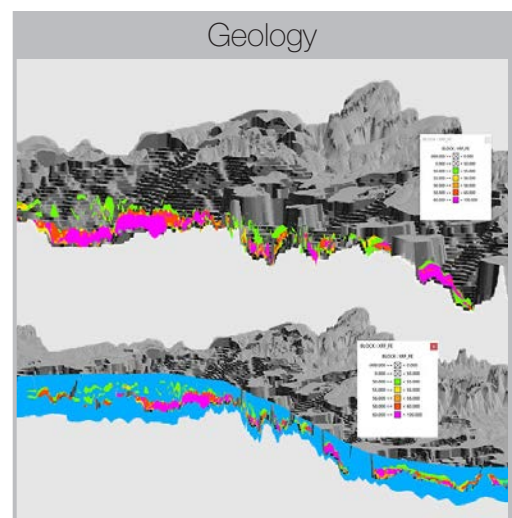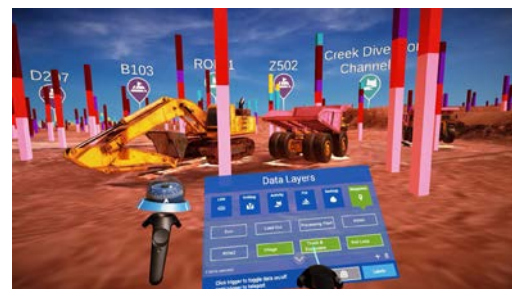
Digital twinning & the complexity of reality

Rapid development of the digital twin approach offers mining operations the promise of optimising processes and automating decision making – if they are brave enough.

Digital twinning is based on the idea that a digital information construct of a physical system can be created as a separate entity. The digital information is a 'twin' of the information embedded within the physical system itself, and is linked to it throughout the entire lifecycle of the system.

The basic concept of the Digital Twin model has remained fairly stable from its inception in 2002 when it was introduced by the University of Michigan's then new Product Lifecycle Management Centre.

The premise driving the model is that each system consists of two subsystems – the physical system that has always existed and a new virtual system that contains all of the information about the physical system. This means that there is a mirroring or twinning of systems between what exists in reality to what exists in virtual space and vice versa. In most cases the virtual system will contain many sub-virtual systems.

Transforming data. Digital twin systems are about the traditional transformation of Big Data into information, knowledge and mining wisdom. The reality in today's competitive mining world is that an operations team must consider global factors even at the local level.

The digital twin must work under such pressures and must exploit this dynamic, big data environment. Data collected by itself, unanalysed, is essentially an expensive and fruitless exercise, even if the twin is a small entity with few parameters. Data MUST be transformed into meaning and insight.

An important difference between the digital twin concept and the traditional simulation concept is that the digital twin is always at work and always active. In contrast, the older style simulators are fed old data or generated disturbance data, with the results observed and a conclusion created. The digital twin workflow is dynamic and fundamentally different.

The operator typically sees data filtered through the digital twin, which could be performing many functions that may not need operator intervention or clarification. The digital twin interacts with big data or AI tools, which help shape the digital twin, and could be optimising (and disturbing) digital twin behaviour. Operators have the option to bypass the digital twin analysis and access direct data, access big data analytics information or access AI information.

Intuition plays a big part in operator decision making. While this can be supplanted by deep learning techniques, there is still a chasm between autonomy and intuition especially in the face of complexity.

One of the concerns in digital twin proposals is that of interoperability. In future worlds, systems, equipment, modelling, analytical, and automation processes do not live in isolation. The cyberphysical systems (machines and equipment) communicate with each other and with the mining staff around them (operators, planners, managers), so interoperability must be assured and seamless.

A digital twin adds value to an operation. It needs to operate in a 'plug and play' environment. To say that this is a revolutionary concept, is an understatement. The digital twin promises to optimise processes, effect quick decision making, and potentially so much more.

In the future, we could see a short cycle, where an autonomous decision-making process leads to changes in the digital twin in a strategic sense with wide implications, as well as a real-time effect within a mining operation. While it is early days, a rapid development in this technology suggests possibilities that we cannot even imagine.

The complexity of reality. The digital twin is a reflection of a perceived reality, in physical characteristics as well as in planning and management. However, collecting data is not enough. Various levels of analytics, visual representations, machine learning and AI techniques now enable us to see and reflect on reality in novel and potentially powerful ways.

How capable are we to handle these new frontiers? In creating a digital twin, do we proceed with traditional, lengthy, purely functional analysis of the whole operational environment, or do we embark on a more epistemological approach? The latter is harder, but importantly, promises a better understanding of the complex reality of a mining operation.

Recent history shows that we are, en masse, incapable of thinking beyond simple cause and effect systems analysis. Such linear thinking is well entrenched in society, politics and management philosophies.

Where does this leave digital twin philosophy? The obvious answer is to vaguely suggest that the digital twin concept is an evolving field. Mining companies must take baby steps toward a vision of future mining, knowing that they need to expand their understanding of complex reality, non-linear systems, advanced decision theory concepts and the power of deep learning and Bayesian technologies. Success is there for the adventurous, collaborative open-minded pioneers.

Talk to Maptek about how we can partner with you to exploit new and evolving technologies.
Contact chris.green@maptek.com.au

Capture of post-disaster conditions

Fast and accurate capture of post-disaster data is key to resilient rebuilding. A new facility at the University of Washington has taken the lead to ensure baseline geospatial data can be collected, processed and analysed immediately after natural hazard events.

In the aftermath of an earthquake, hurricane or other disaster, the details of precisely how the built and natural environments reacted to the forces unleashed upon them lie fresh in the devastation. Clues to why a home collapsed under high winds may be found in its rubble, and an explanation of how a slope turned into a landslide as the earth shook may be spread across a four-lane highway.

This vital information is rarely captured before it has been altered or removed. Emergency managers tasked with recovery efforts are trained to move quickly to restore basic services and get the local economy back on its feet. Roads are cleared, damaged bridges are repaired and crumpled buildings are razed. Ironically, the data that could be most valuable in rebuilding the community is lost in the rush.

'That data is perishable; if there isn't someone to swoop in and capture the information, it is gone forever,' said Joe Wartman, H.R. Berg Professor of Civil and Environmental Engineering at the University of Washington (UW). 'When one of these events occurs, it is a full-scale living laboratory of consequences and effects of wind speed, ground shaking and destruction.'

UW has taken the lead to ensure baseline geospatial data can be collected, processed and analysed immediately after natural hazard events to inform recovery and guide rebuilding. With US$4.1 million in National Science Foundation funding and cooperation from Oregon State University, Virginia Tech and University of Florida, UW has established the Natural Hazards Reconnaissance Facility (RAPID Facility) on its Seattle campus.

'Data collected by the RAPID Facility will directly support the development and validation of simulation for natural disasters,' said Wartman, the facility's director.

> 'These models can help communities anticipate what will occur in a disaster and take action to mitigate risk.'

RAPID has spent much of the past year acquiring a variety of geospatial technologies and training personnel in their application under difficult conditions. The facility has pinpointed LiDAR technology in the form of long-distance laser scanners, along with 3D data analysis capabilities, as among the most important solutions that will be deployed.

Speed, accuracy, safety

The RAPID Facility's purview is to study natural disasters related to earthquakes, tsunamis, hurricanes, tornadoes, and floods. While their causes are distinctly different, the results are usually the same – they inflict often massive change on the built and natural environments. Winds, tidal surges, flood waters and ground tremors can knock a building off its foundation and dramatically transform the surrounding landscape in the process.

'Laser scanners are unique in their capacity to capture the details of changes in three dimensions and with centimetre-level accuracy,' explained Jake Dafni, PhD, PE and RAPID Site Operations Manager.

Because of the challenging conditions in which RAPID teams will conduct surveys, mapping and data collection, the facility is rigorous in its choice of technologies. Hardware must be rugged, and software packages need to be easy to learn, given that response teams are composed of researchers from diverse technical backgrounds.

RAPID ultimately selected Maptek™ as its supplier of long-range laser scanners and spatial analysis software. Maptek™ XR3 and LR3 models were designed primarily for use at open pit mine sites. Ruggedised and equipped with integrated optics and GPS, the laser scanners are lightweight, dustproof and can be used in rain, snow and extreme temperatures.

The primary driver was the ability to capture highly accurate scans from a long distance. The Maptek XR3 has a 2.4 km range while the LR3 operates at 1.2 km. The laser scanners capture enormous volumes of data in their fields of view, allowing the RAPID teams to collect data quickly while located a safe distance from a still unstable disaster site.

'There are damage scenes that we can't otherwise get close to for physical reasons,' said Dafni, noting that speed and safety are paramount to their missions. Additionally, RAPID operating procedures call for not interfering with ongoing site rescue efforts.

'During a pre-RAPID exercise, we deployed to the site of a large earthquake in New Zealand and we were interested in studying some large landslides across a valley. We couldn't get across a river to scan onsite, and there was a lot of emergency helicopter activity preventing our use of drones,' said Wartman.

This incident led RAPID to add long-range scanners to its equipment acquisition list, which includes digital cameras, total stations, mobile LiDAR, seismic sensors, water level gauges and aerial and marine drones.

Informing better building

Laser scanners are crucial to the RAPID Facility's core mission because they capture in three dimensions the details of how the natural environment and built infrastructure interacted during the disaster. In a tsunami or earthquake, for example, it might be a wave of sediment or falling rocks that wipes out a bridge, and not the shaking ground. Such information is critical in determining how to engineer structures to withstand future events.

'We're supporting the geologists who want to know why a landslide occurred, but we also focus on the engineering community, which is responsible for the built infrastructure,' said Wartman.

Central to the analysis is 3D point cloud processing. UW's Civil and Environmental Engineering Department has a long-standing relationship with Maptek as a user of its I-Site™ Studio geotechnical analysis software.

The easy-to-learn software differs from most LiDAR processing packages in that it performs registration of the laser scans, processing of the point cloud and then numerous complex geotechnical analyses.

For RAPID purposes, its most important modelling function is the ability to digitally compare and contrast two point clouds acquired in the same area at different dates to detect changes, specifically movement of the ground, rock faces and even building structures.

With change detection in mind, RAPID has agreements with international organisations that maintain large archives of historical LiDAR data and remotely sensed raster imagery. These files will serve as before-disaster data in the change modelling.

Analysing pre- and post-event point clouds with I-Site Studio software can detect subtle differences in infrastructure and landscape that help explain what happened during the disaster.

'This information will be used to develop models to predict locations of landslides in future events, for example, so communities may take action to mitigate landslides that will impact critical infrastructure,' said Wartman.

RAPID and Maptek are working together to find ways to further the RAPID Facility's mission. They are now engaged in using Maptek software to create an immersive environment called The Cave on the UW campus where researchers will step into a 3D disaster scene, generated from LiDAR data and colour photos, to interact with the data from an in-person perspective.

Thanks to
Joe Wartman
H.R. Berg Professor of Civil and
Environmental Engineering
University of Washington

Modelling phosphate deposits

Maptek™ software and hardware solutions are helping the Republic of Nauru Phosphate Corporation to measure and model phosphate deposits on the Pacific Island.

Maptek™ solutions are helping the Republic of Nauru Phosphate Corporation (RONPHOS) to model, map and measure phosphate deposits on the Pacific Island nation of Nauru, situated about 3000 km northeast of Australia.

Phosphate, the naturally occurring form of phosphorus, is exported primarily for use in agriculture. Overwhelming demand for the high quality Nauru rock is driven by the growth in food production and development, particularly in Australia and South-East Asia.

Phosphate mining was central to the economy of the 21 km² island until the depletion of its primary mines in the 1980s.

RONPHOS was established in 2005 to maintain and operate the phosphate industry on Nauru in a safe, efficient and profitable manner as mining and exports resumed.

The first pass of mining selectively extracted phosphate, leaving behind dolomite pinnacles as waste. RONPHOS now faces the challenge of accessing these remaining deposits, which cannot be mined using traditional methods.

Modelling

Maptek™ Vulcan™ software was used to model the remnant dolomite pinnacles from aerial lidar data of the as-mined topography.

Modelling showed the existence of additional phosphate below the current mined surface, occurring as remnant dolomite pinnacles, some as tall as 12 m.

Due to the spacing of the aerial data there is uncertainty as to the exact location of the pillars. So 3D laser scanning was used to provide precise positioning information on the dolomite pinnacles in an area targeted for testing the new mining methodology.

By extrapolating the dolomite pinnacles to depth, an estimate of remnant phosphate was made using Vulcan block modelling.

The new phase of mine operations involves a program of backfilling and then complex drill and blast to remove the exposed tops of the pinnacles to the level of the remaining phosphate. This will allow secondary mining of the phosphate.

Laser scanning

During a week-long trial, a Maptek LR3 laser scanner fixed to a 45-metre crane boom was used to undertake accurate topographical mapping.

The 3D laser scanner provides greater penetration of vegetation and more accurate, detailed data than aerial lidar and photogrammetry.

The fast, lightweight LR3 has a range of up to 1200 m, is accurate to 4 mm, and can be wirelessly controlled through a tablet for remote scanning. The laser scanner can also be used for tasks such as stockpile reconciliation and engineering surveys.

Data collected by the laser scanner is processed using Maptek™ I-Site™ Studio software. Scans taken on a tripod can be easily integrated with RTK GPS for georeferencing and used as a reference for the uncoordinated crane scans to be registered into mine grid coordinates.

Mining trial

After backfilling, knowing the exact position and size of the pinnacles allowed RONPHOS to determine where to drill and to what depth. The trial provided enough information for RONPHOS to mine the secondary deposits for three months.

Mining Manager Paul Haynes said the trial had been hugely successful and led to the purchase of a Maptek laser scanner, accessories and software.

'Phosphate recovery from this trial pit was in line with the recoveries estimated by our Vulcan block model,' Haynes said. 'Being able to quickly and accurately map the pinnacle fields underpins our whole methodology.'

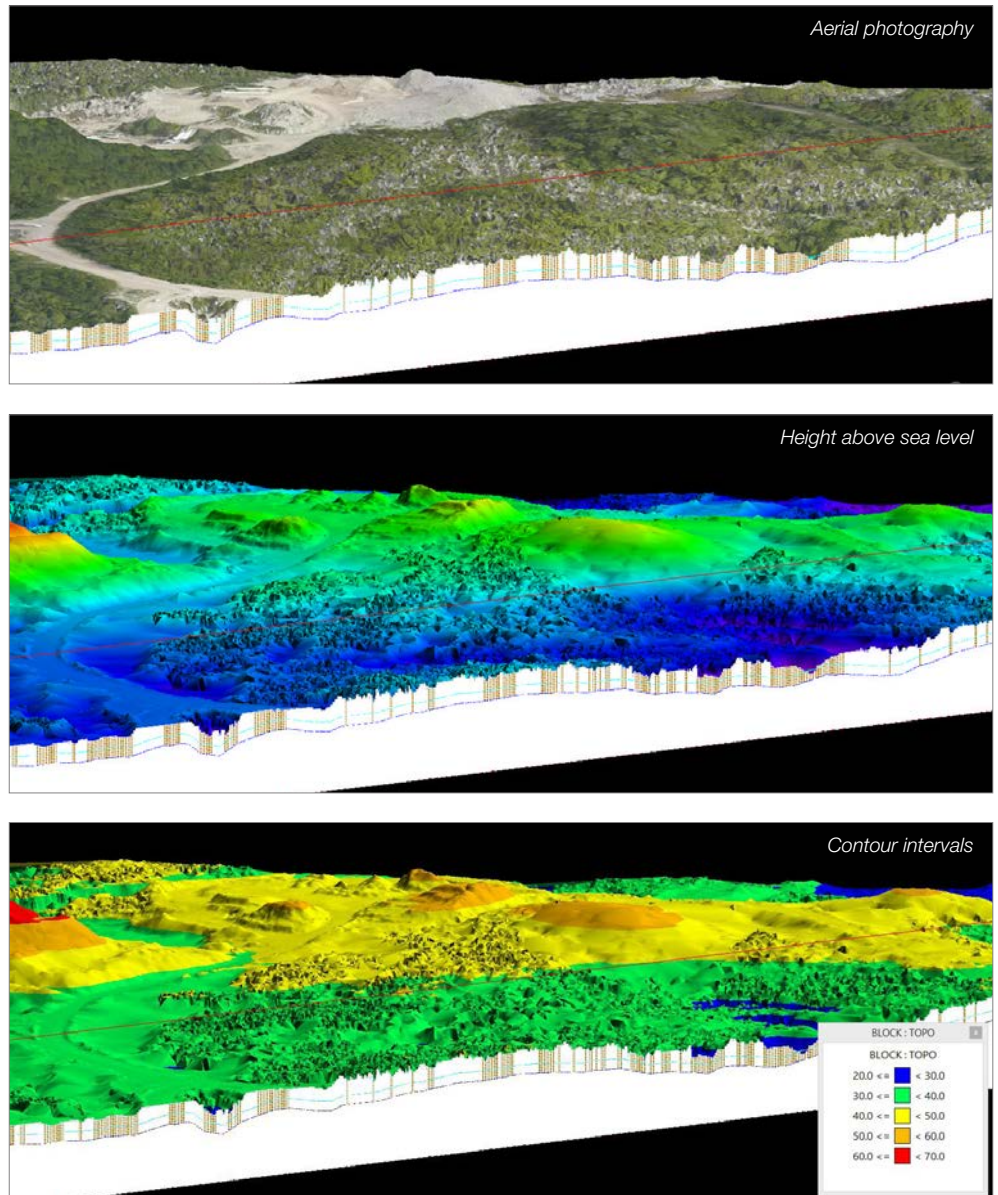'Without the LR3 we wouldn't be able to progress mining at a rate sufficient to make the operation viable. The ability to get our drillholes in exactly the right location first time is critical to clearing the pinnacles efficiently and minimising toe and associated rework.'

Haynes said phosphate mining had underpinned Nauru's economy for more than a century.

'Mining the remnant phosphate resource will allow royalties to continue to flow to the Government, landowners and the wider community. It will also provide capital for rehabilitation work.'

The company hopes the success of this project will help secure finance to continue mining and keep this vital element of Nauru's economy strong for decades to come.

Thanks to
Paul Haynes, Mining Manager
Republic of Nauru Phosphate Corporation

Aerial photography

Height above sea level

Contour intervals

BLOCK : TOPO

BLOCK : TOPO	
20.0 <=	< 30.0
30.0 <=	< 40.0
40.0 <=	< 50.0
50.0 <=	< 60.0
60.0 <=	< 70.0

Topography with cross-section showing limestone pinnacles

Efficient train loading and dispatch

An iron ore supplier in South Africa is using MineSuite to maximise the capacity available from their rail transport service provider.

A well-known iron ore supplier in the Northern Cape Region of South Africa is using MineSuite to meet the objectives of both their rail transport service provider and the mining operation.

In order to best utilise the capacity offered by the rail transport service provider it is essential for the mine to release product at the right time. The mine needs to ensure the trains are filled in the shortest possible time to achieve the agreed turnaround time. Numerous variables must be managed to achieve the desired product loading and train turnaround time.

With MineSuite operational in the beneficiation plant, as well as in product stacking and reclaiming, MinLog was the ideal partner to develop a Train Loadout and Dispatch solution (TLD). The goal was to manage the train loadout and dispatch process to minimise financial losses associated with lost dispatching slots.

MinLog workshopped the business requirement and problem statement with key stakeholders prior to the development of a web-based solution, providing for:

> Import of the Next Week's Business (NWB) schedule
> Capture of timestamps when the pre-configured train activity occurs i.e. at each point of the loading process
> Capture of delays impacting turnaround time
> Management of trains, rakes and consignments independently
> Viewing and validation of wagon weight distribution and wagon management i.e. decoupling and reassignment
> Workflow driven process from commencement to departure

Workflow process

The NWB schedule details the trains expected to arrive in the following week, together with consignments, products, target tonnages, and ETA and ETD attributes, allowing forward planning.

> Manual intervention is permitted for the schedule and an audit trail is kept.

With the schedule imported, the system will automatically notify the operator of the next train to arrive. The configuration specific to each site guides operators throughout the entire train loading process and permits them to sequentially capture activity times.

Delays arising from the mine or caused by external influences are accounted for within the system. Custom reports and multi-dimensional cubes are used to analyse and minimise these delays.

The train is split into manageable units called rakes, with a rake containing a predefined number of wagons. The wagons must conform to specifications relating to product, weight distribution tolerances and tonnages (attributes) which need to be fulfilled by the mine. Parameters related to these are imported by direct interface with third party solutions, and are viewed and managed through the TLD.

The system guides the user step-by-step through the process from pre-arrival through arrival, uncoupling, placing, loading, rectification, re-weighing and compiling, right up to departure and handover back to the transporter.

Efficient solution

The TLD system has streamlined processes and minimised financial losses for the mine. Integration with third party systems has improved data accuracy and visibility. This efficient MineSuite solution has enabled optimal management of the loadout station.

Get in touch with Maptek or MinLog to find out more about our mine information systems.

Previewing PointStudio

Maptek™ customers will see a new name and fresh ribbon interface alongside new functionality in the 2018 update of our intuitive point cloud processing software.
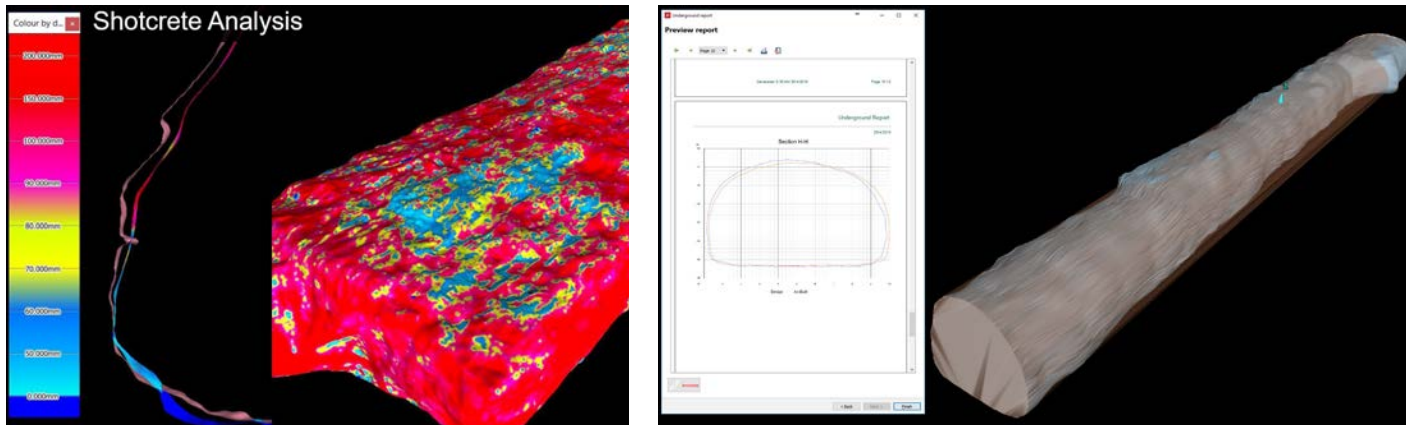
Maptek™ I-Site™ Studio software originated 20 years ago as a set of desktop tools to process large point cloud data from early laser scanners. Maptek™ PointStudio™ continues the logical progression to a new generation 3D platform for modelling, analysis and reporting.

PointStudio 8 features the latest software functionality in a ribbon interface. At the same time, customers will install the Maptek Workbench, which enhances interaction with data and improves access to other Maptek applications. Users can create their own toolbars, menus and shortcut keys to suit preferred work patterns. Animated tooltips display video tutorials on mouseover.

One of the benefits of moving to the Workbench is access to the Workflow Editor for building interactive command sequences. PointStudio users can link components to data to easily run automations in context. Customised components can be saved to reuse in other workflows.

A good example is the single-click registration workflow. This can be tailored to incorporate scan import and filtering, and multiple registration steps to provide a

registered point cloud ready for processing. Standard workflows will be included in PointStudio 8 for further site customisation.

Different Maptek applications can be run simultaneously on the Workbench. PointStudio users can undock windows and display views from either the same project or various Maptek applications on multiple monitors.

New features

A new Underground Reporting module will allow users to easily compare a designed solid with an actual surveyed or scanned solid to identify overbreak and underbreak in development drives, stopes or crosscuts. Benefits include reducing grade dilution, highlighting unstable areas and reducing costs by identifying unnecessary development and pre-blast issues.

A new Offset Line to Surface tool allows easier projection of toe/crest and other CAD lines at an angle onto a surface where it is not possible to acquire scan data due to ongoing mining operations.

Extending Discontinuity Planes to analyse blast block solids and pit advancement solids will be managed with a single click.

Textured surfaces will be more easily exported. Users will notice significant speed improvements in Despike and Simplify Surface tools.

Users will be able to take advantage of the Labs menu in PointStudio to trial and provide feedback on the in-development Fragmentation Analysis tool. This takes scan data and segments it by automatically identifying individual rock pieces. Viewing the particle size distribution opens up possibilities for post-blast analysis and future blast improvements. Plant efficiency can be increased by informing operators of the size of incoming material.

Maptek has been developing point cloud modelling and reporting software since 2000, and will continue to build mine measurement systems that target mining challenges.

Users of I-Site Studio 7 with current maintenance will transition to PointStudio 8 when it is released in October 2018. Details, including a timeline of our point cloud modelling history, can be found at www.maptek.com/pointstudio

Making geostatistical modelling masters

Maptek™ and the Adolfo Ibáñez University have collaborated to initiate a new Masters course, preparing mining professionals in South America to lead their industry.

The first Masters in Geostatistical Modelling of Mineral Deposits commenced on May 24 this year.

Taught by Maptek™ and the Faculty of Engineering and Sciences of the Adolfo Ibáñez University, the innovative two-year program aims to prepare industry professionals to implement cutting-edge tools for estimation, evaluation and simulation of mining resources.

In the last 15 years, geostatistical modelling and estimation of deposits has progressed from being a discipline dominated by a few experts, to becoming a skill widely spread among different professionals worldwide.

The participation of experienced academics ensures the course is well-founded. Professor PhD Clayton V. Deutsch is Director of the Center for Computational Geostatistics and Professor at the School of Mines and Petroleum of the University of Alberta, Canada, and Cristian Cáceres is Professor of the Faculty of Engineering and Sciences and Director of Civil Mining Engineering at the Adolfo Ibáñez University.

Classes are held at the Maptek offices and the Viña del Mar campus of the University, and will provide graduates with a unique set of competencies.

> Students will master the processes of estimation, evaluation and simulation of mineral resources and modelling the spatial behaviour of deposits.

The objective is to deepen their understanding of the main geostatistical methodologies, and update them on the improved tools available. They can then apply the new techniques in their companies.

The program, in which 26 professional mining students are participating, began with an Introduction to Geostatistics, providing context on topics such as the Geology of Mineral Deposits, Sampling Processes, and Construction of Sampling Nomograms.

Additional topics included Spatial Continuity and Future Development of Mining. Determining spatial continuity requires knowing the way in which any variable continues in space. The objective of the module was to determine the variogram calculation, interpretation and modelling to arrive at a spatial continuity model for all regionalised variables.

The importance of creating friendly relationships was not forgotten, and a cocktail party was held in the first week. This was a good opportunity to get to know each other and create bonds in a program that will last almost two years.

Graduates will distinguish themselves from other industry professionals as pioneers in Chile and Latin America in the use of state-of-the-art geostatistical tools. Their implementation of modern methods to model the spatial behaviour of deposits will substantially impact the mining business.

Mine planning education

Maptek™ Vulcan™ helps students at the Technological Educational Institute of Western Macedonia, Greece.

Mining has been at the forefront of new technology for decades. The constant need for improved efficiency, safety and profitability has always been the driving force for development and implementation of the latest technological advances. The mine planning area has traditionally attracted new algorithms and methods to address old and new problems.

Maptek™ Vulcan™ is one of the most advanced mine planning software packages available, consistently leading the mining software market with higher efficiency, integration and user friendliness. The importance of trained professionals who can effectively use sophisticated tools like Vulcan is widely recognised by the mining industry.

Vulcan has been installed for almost 20 years in the Department of Geotechnology and Environmental Engineering, and used to teach computerised mine planning to our undergraduate students.

A dedicated Mining Information Technology course is taught to third-year students, covering all aspects of mine planning with computer software. The friendly interface, advanced visualisation capabilities, clear workflow and high number of integrated algorithms make Vulcan the ideal environment for teaching mine planning to future engineers.

> Gaining hands-on experience with software used by thousands of mining professionals worldwide is invaluable to students.

The course notes have been developed over the years, keeping pace with software developments and providing a complete mine planning study through a set of sequenced exercises.

Last year, these notes (written in Greek) were published as a comprehensive reference book titled *Introduction to Mining Information Technology with Maptek Vulcan*, based on version 10 of the software. With over 500 pages printed in colour, it introduces students to the fundamentals of samples databases, geological modelling, resource estimation and block modelling, mine design, optimisation and scheduling.

In addition to the dedicated mine planning course, Vulcan is used to support other courses such as Geostatistics, Surface and Underground Mining. Several final year projects have also been based on Vulcan, providing students with further insight into specific mine planning problems.

The benefits of learning mine planning through Vulcan have been recognised by both students and academic staff. Many cases have been reported where our graduates were accepted for postgraduate studies or employment, largely due to the experience and knowledge of the software gained during their studies.

Thanks to
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Western Macedonia

www.***maptek***.com