MAPTEK™

Forge

September 2024 Newsletter

In this issue

Welcome to our Forge newsletter September 2024

In this issue of Forge, we learn how sites around the world leverage Maptek innovation to revolutionise their operations.

An iron ore mine in South Africa benefits from real-time reconciliation of material quantity and quality. Visual representations of stacked products and their qualities enables accurate reconciliation between stack and reclaim processes, while automated alignment and reporting of product beds ensures accurate, real-time data flow between mine and port.

In Mongolia, drill and blast specialists employ Vulcan and BlastLogic to optimise resources and improve productivity for their customers. Application of decision-support systems is helping them to achieve a data-driven approach that incorporates production metrics, vibration modelling and fly rock data.

A gold mine in Tanzania has gained significant improvements through real-time reporting and flexibility in defining mining sequences to optimise schedules, reduce downtime and enhance productivity.

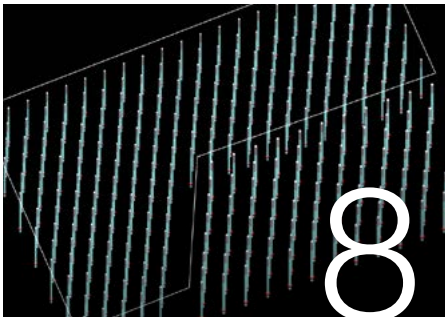
Maptek continues to invest in R&D, developing BlastMCF for automated blast design in a move that will lighten the engineering load for customers. A new BlastLogic API will extend access to valuable drill and blast data by third-party systems.

In the university space, post-grad researchers who participated in the Maptek sponsored integrated mining consortium reflect on their experiences and achievements.

We hope you enjoy these and other stories in this issue. Stay safe!

Eduardo Coloma
CEO

Contact us: forge@maptek.com



On the cover

Reconciling material quality and quantity from pit to port drives strategic operational decision making

Image courtesy Anglo American

Contents

Revolutionising operations

Maptek™ resource tracking is revolutionising operations at an iron ore mine in South Africa through real-time reconciliation of material quantity and quality.

Anglo American's Sishen operation is one of the largest open pit mines in the world. Located in the Northern Cape Province of South Africa, Sishen delivers various iron ore products to customer specifications.

Operational efficiency and accurate resource tracking are critical for productivity and profitability. Maptek™ has played a pivotal role in transforming Sishen Mine operations by implementing advanced tracking and monitoring technologies.

The Maptek–Sishen journey began in 2004 with the introduction of the former MineSuite system to the Dense Media Separation (DMS) plant, providing a foundation for real-time data acquisition and reporting, and improved operational transparency.

Expansion to include the Jig plant and the Modular plant laid the groundwork for comprehensive monitoring across different processing stages. Upgrades between 2018-22 incorporated automated inputs and reconfigured the active web reports platform.

A significant milestone was SAP integration, enhancing data flow and decision-making capabilities.

System robustness was further strengthened with the introduction of Maptek resource tracking and stockpile management in 2024, improving data analytics, real-time monitoring and automated reporting.

Complex value chain

The mine operation is a complex network involving production drills, blasting, load and haul, crushing, pre-beneficiation stockpiling, cyclones, modular DMS, beneficiation plants and shipping logistics to Saldanha Bay port.

Effective management of more than 400 parent processes and 2000 equipment pieces necessitates sophisticated tracking. Maptek solutions provided the requisite functionality for tracking equipment delays and operational metrics.

The control room infrastructure, integral to the monitoring process, expanded from two to ten control rooms, ensuring comprehensive oversight and coordination.

The system operates 24/7/365, on a four-shift system. About 50 control room operators book equipment delays in a 24-hour period, while operational and maintenance managers oversee daily operations, supported by a system analyst.

Data generation and use

Information generation and utilisation at Sishen Mine follow a rigorous process. Data is collected through systemised and manual inputs at eight-hour intervals, validated by shift supervisors.

Data includes production and delay metrics, essential for understanding operational performance.

Corrections and updates are handled at various levels, from immediate adjustments by all users to monthly reviews by super users and system analysts for complex issues.

> Data generation is easy, but data validation is crucial to sustain any data-driven system.

The reporting mechanism is equally robust, with systemised and emailed outputs facilitating real-time and historical data access. Key performance indicators, time allocation details, production reports and tonnage tracking are meticulously documented.

Integration with SAP and other systems ensures seamless data flow across departments, enhancing overall operational efficiency.

Automation

Material tracking and stockpile modelling have revolutionised the operational landscape. Automating the alignment and reporting of product beds ensures accurate, real-time data flow between Sishen Mine and Saldanha Bay port.

> Visual representation of stacked products and their qualities enables accurate reconciliation between stack and reclaim processes.

Automated emails and visual alerts highlight production discrepancies, enhancing accuracy and decision making.

Custom output reports were critical to the system's success, eliminating the need for manual report creation. This reduced operational bottlenecks and streamlined information flow.

Key drivers to success

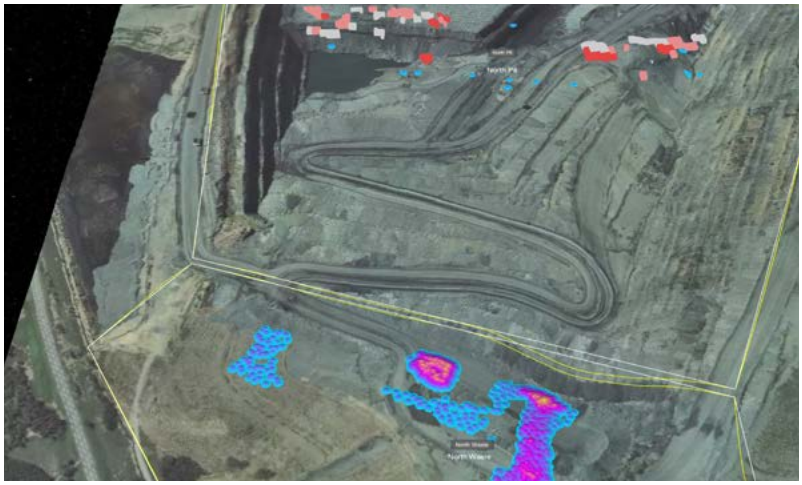
Successful implementation at Sishen Mine can be attributed to several key factors:

- Expert personnel: A system analyst with deep operational understanding ensures the quality and accuracy of information, providing continuous training and support.
- Engagement with supervisors and operators: Involving end-users in system design and rollout mitigated change management challenges
- Comprehensive system integration: Linking processing information with mining, laboratory and logistics data enabled more valuable reporting and decision making
- Consistency and accuracy: Routine reviews ensured the reliability of information across all departments.

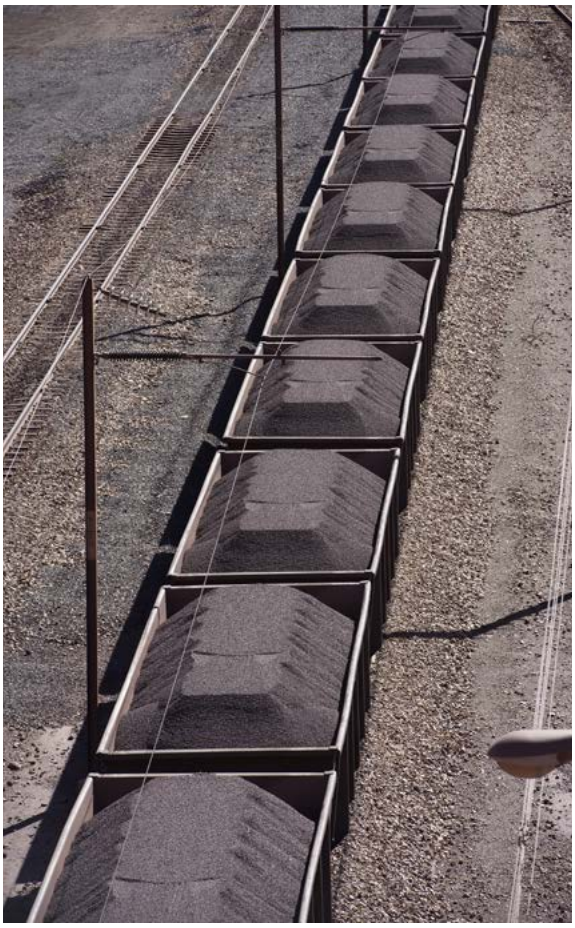
The collaboration between Maptek and Sishen Mine epitomises the way advanced technology can revolutionise mining operations. Through continuous upgrades and a focus on accuracy and integration, Maptek solutions have significantly enhanced mine efficiency and productivity.

Innovative approaches will continue to be pivotal in maintaining competitive advantage and operational excellence in mining.

Thanks to
Anglo American Sishen Mine



Measuring and validating actual material movements near-live at every stage of the mine value chain ensures greater visibility and coordination in eliminating production bottlenecks and delivering product on-specification and without delay.



Tactical scheduling

A gold mine in Tanzania has found that Maptek™ Evolution Epoch is ideal for optimising resources and enhancing productivity as part of its short-term planning strategy.

Barrick Gold Corporation owns the North Mara Gold Mine in north-west Tanzania. The combined open pit and underground operation commenced commercial production in 2002. The processing plant has an average daily capacity of 8000 tonnes of ore.

> Efficient scheduling is paramount to optimising resources and enhancing productivity.

Maptek™ Evolution Epoch has emerged as a leading solution for tactical scheduling.

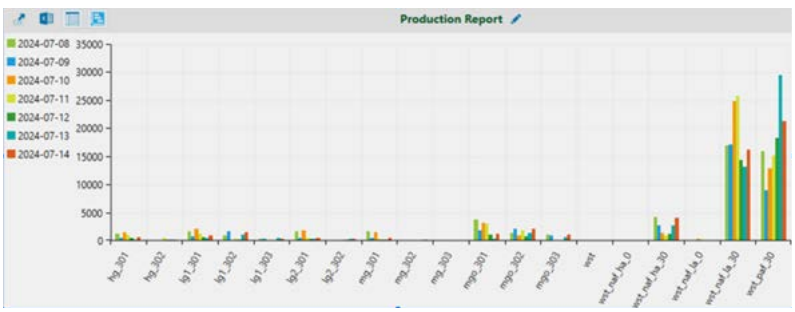
Advanced scheduling

Evolution Epoch is designed for activity-based and equipment scheduling. A flexible short-term planning environment enables the definition of mining sequences, facilitating the creation of schedules to guide execution.

Management of multiple activities, tasks and equipment incorporates various dependencies to optimise scheduling.

Key features

- Activity-based scheduling ensures that all tasks are planned with precision. This includes drill, blast, load and haul operations.
- Equipment scheduling ensures that machinery is utilised efficiently. This involves planning for maintenance and ensuring equipment availability aligns with mining activities.
- Flexible sequence definition is crucial in adapting to unforeseen changes in the mining environment.
- Dependency management across activities and equipment ensures that all elements of the operation are synchronised.
- Live dashboard provides real-time reporting and visualisation of scheduling data. This allows for immediate feedback and adjustments to the schedule.



Implementation

Evolution Epoch implementation at the North Mara Gold Mine aimed to optimise scheduling and enhance overall operational efficiency. The first step was integration of existing data into the system, including importing information across resources, equipment and planned activities.

Customisable equipment data, such as rim pull and retard curves, was imported via CSV files to ensure accuracy and relevance.

Calendars, which manage scheduling of activities and equipment maintenance were imported from CSV files to ensure integration with existing systems.

Detailed task sequences were developed, considering the specific requirements of the operation. This included sequencing of drill, blast, load and haul activities.

Live dashboard monitoring enabled real-time schedule adjustments to accommodate any changes in the operational environment.

Outcomes

Using Evolution Epoch at North Mara Gold Mine has yielded significant improvements in scheduling efficiency. The real-time reporting capabilities and flexibility in defining mining sequences ensured that operations were optimised, reducing downtime and enhancing productivity.

Integration of customised equipment data and efficient management of dependencies further contributed to successful implementation. The short-term planning team continues to rely on Evolution Epoch to complete daily and weekly plans.

Thanks to
Barrick Gold Corporation
North Mara Gold Mine

Pioneering drill and blast improvements

Maptek™ Vulcan™ and BlastLogic™ systems are being used effectively in Mongolia to streamline planning and optimise blasting operations.

Blast LLC, one of the pioneers in the blasting industry in Mongolia, employs Maptek™ Vulcan™ Drill and Blast options alongside the Maptek™ BlastLogic™ system to optimise blasting operations.

The Vulcan drill and blast tool enables precise design and execution of drill and blast plans, customised to fit specific geological conditions. This improves fragmentation and overall efficiency.

Additionally, BlastLogic offers advanced data management and real-time analytics, allowing for better decision-making and enhanced safety protocols. Together, these technologies streamline processes, ensuring cost-effective and high-quality outcomes for every project.

Further use of the BlastLogic application will improve workflow streamlining and data analytics regarding metrics, vibration and fly rock data.

Support and collaboration

Blast LLC appreciated the support of the Maptek team in offering timely updates and guidance on utilising their software effectively.

Maptek provided comprehensive training and resources through regional reseller IT Experts LLC, which was instrumental in optimising processes and workflows. A proactive approach in addressing needs and providing tailored solutions greatly enhanced operational efficiency.

Key benefits

One of the standout benefits of working with Maptek was the significant improvement in accuracy and efficiency of drilling and blasting operations.

The integration of Vulcan and BlastLogic not only streamlined the workflow but also provided precise data analytics, resulting in better decision-making and resource management. This has led to reduced operational costs and increased safety standards.

Future outlook

Looking ahead, Blast LLC plans to further integrate Maptek technology into their operations, particularly as they expand into new pit developments and undertake geotechnical studies.

Additional Maptek solutions are under consideration, to comply with new regulatory standards and to upgrade systems. Continued partnership will be crucial as projects scale and Blast LLC seeks to enhance technological capabilities.

Thanks to
Blast LLC
IT Experts LLC

Optimal blast performance

Maptek™ BlastMCF revolutionises blast design for surface operations, generating scenarios that consider competing objectives while engineers retain fine control.

Balancing the interrelated factors to optimise competing blast objectives is an iterative and time consuming process for engineers to manipulate the levers for localised conditions using current blast design tools.

Fixed aspects like geology, bench height and drill setup as well as variable inputs like geometry, explosives and timing all influence blast outcomes.

It is therefore typical for engineers to fall back on tried and tested design parameters and use simulation models where they can consider a single objective in isolation, and apply incremental improvements from learnt experience.

Innovation

A new solution is here. Using the Maptek™ Compute Framework (MCF) to leverage cloud computational power for rapid, on-demand results is a game changer for drill and blast engineers to efficiently generate optimal designs. The framework is already deployed successfully for geological modelling in Maptek DomainMCF.

Acute global shortage of engineering talent will increase demand for integrated automation technology that allows operational tasks to be performed remotely. Drill and blast design is an ideal candidate, with twin goals of easing pressure on intensive engineering tasks and generating optimal blast outcomes.

Automation

Maptek BlastMCF automates the creation of optimised and detailed blast designs encompassing drill pattern, per hole charging and timing. It makes optimal blast design outcomes more accessible to every mine, and represents a step change away from manual design methods.

Engineers can now spend more time on scenario analysis and fine adjustment, which is especially important given the substantial nuance and complexity inherent in drill and blast.

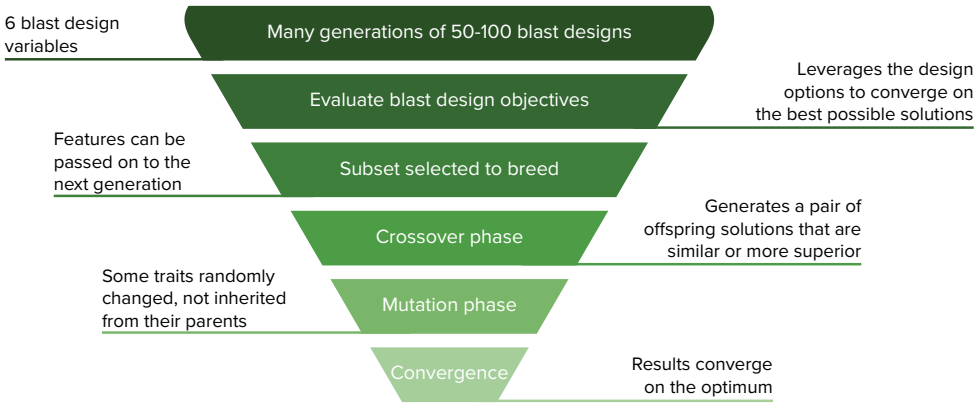
> Performing scenario analysis to objectively validate and verify design concepts will be welcomed by mine planners.

BlastMCF provides the mechanism to perform more scenario analysis in a fraction of the time of CAD-based design, with fine control of resulting designs before export to downstream applications.

Five design objective calculators are integrated with BlastMCF—cost, fly rock, powder factor, fragmentation and vibration—to measure the quality or fitness of each design generated. BlastMCF is configured to optimise competing objectives only after honouring the constraints. Where constraint thresholds are very tight, the design with the least violation is returned for review, allowing engineers to adjust the input design parameters.

BlastMCF requires only a polygon and surfaces to get started, together with user defined design bounds like min/max spacing. For targeting good fragmentation and low vibration objectives, hundreds to thousands of possible designs are generated, before converging on the most optimal. Engineers are presented with an array of 15 results for evaluation.

In this way, engineers can easily understand the trade-off in design parameters for every blast as they choose the optimal design. Integrated drill pattern editing tools are incorporated into BlastMCF for fine tune control, for example adding a double-stitched row.



Integration

Blast designs are readily applied downstream through native integration with Maptek BlastLogic™, whereby charge plans and timing designs can be refined before accurate execution on-bench. Export of designs to third-party systems is also supported.

A large iron ore mine tried a pre-release of BlastMCF for ease of use, speed to generate scenarios, and results, assessing it against day-to-day design and medium-term planning horizons. They found BlastMCF to be significantly more intuitive and easier to use than traditional CAD-based drill pattern tools. Optimal designs were achieved with fine tuning to remove, add or move holes in post processing.

According to Mark Roberts, Maptek Global Strategy Manager, BlastMCF is the first important step to orchestrate and automate blast design routines that incorporate measured outcomes.

Mines will be able to optimise the design to get closer to the desired outcome—low fly rock, good fragmentation, low vibration—based on what actually happens in production. Production and blast performance data will drive continual refinement of designs.

Process orchestration

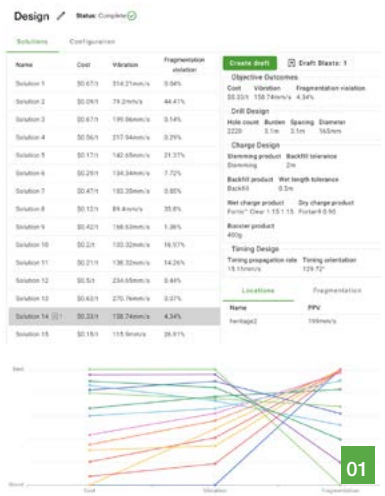
The Maptek cloud ecosystem is another key step, centrally connecting up-to-date data formats and sources using Open API, and triggering computation and transformation on a set cadence.

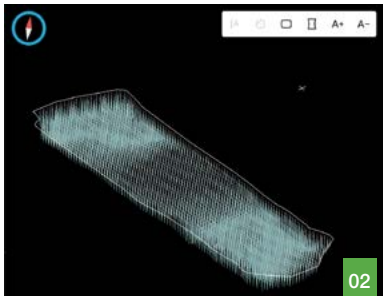
'Mines are investing heavily to measure key outputs across the mining value chain. By integrating these outputs with BlastMCF and our cloud ecosystem the future ability to orchestrate and automate blast design routines that optimise based on measured performance can be developed,' Roberts said.

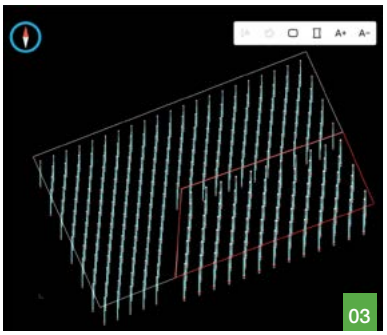
This approach is crucial for managing complex orebody knowledge or mine planning processes, and will deliver valuable insights that enable miners to make better decisions.

The Maptek BlastMCF web-based solution will be available soon, with native integration to BlastLogic Enterprise System (on-premise), and BlastLogic Single Site Cloud Access.

> Drill and blast engineers remain in control of parameters and targeted outcomes.







01 BlastMCF returns an array of design solutions based on the parameters set by drill and blast engineers

02 Visualising selected solution in the 3D window helps engineers balance competing objectives to guide decision making

03 Refining designs where different rock domains exist is easily handled by adding polygons as inputs to BlastMCF

Delivering best scheduling outcomes

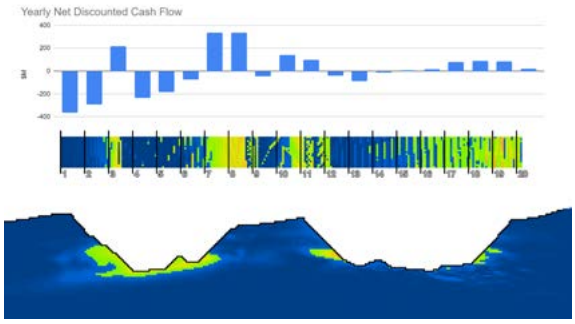
Tackling mine production scheduling with its inherent uncertainty, ambiguity and changing constraints is an ideal challenge for evolutionary computing.

Evolutionary computing is an approach to problem solving that takes inspiration from biology and the way populations of organisms adapt to their environment. By maintaining a population of different sub-optimal solutions to a problem, a program can evolve the solutions over time to become more optimal.

The machine learns how to solve a problem by itself, aligning evolutionary computing as a branch of artificial intelligence. Software engineers choose evolutionary computation for optimisation problems that are too difficult to solve easily—because the best answer is either ambiguous, ever-changing or difficult to find.

Consider the scenario for a mine with variable grade estimations at different locations. Calculating the best way to mine the ore to maximise financial returns is complex for all but the simplest orebody.

The answer is ambiguous because only an estimate of the ore is known, ever-changing because commodity prices fluctuate, and difficult to find because a huge amount of data is required to specify the problem in detail. Characteristics of the mining fleet and processing plant must be included as well as knowledge of the orebody and the non-linear relationships between the systems.



When a deleterious element exceeds a threshold concentration in the processing plant it causes the recovery of ore to drop sharply. However, recovery is barely affected if this element is below the concentration by an equivalent amount. The response of the plant to the concentration is non-linear.

Optimum solutions

Miners need secure ways to understand the true nature of their data and the problems they are trying to solve. Maptek™ solutions enable decision making informed by actual data, not based on linear trends or gut feel.

Maptek applies evolutionary computation to tackle the mine production scheduling problem the way it should be tackled—with its inherent uncertainty, ambiguity and changing constraints. Other software can provide precise formulations of a brittle model—the solution looks good on paper but cannot be realised with real data.

Economic forecasting is extremely difficult. The more tools you have to rapidly compute 'what if' scenarios, the more assured you can be that your plans will reflect the most probable scenario or that you have assessed the downside risks.

> This is not always the same as finding the optimum solution, which explores many solutions simultaneously, evolving towards optimality.

Like most businesses, miners typically underestimate the value to be gained of using already collected data in a smarter way. Integrating a continuous flow of the latest information can revolutionise the decision realm.

In a dynamic environment, when goals suddenly change, teams can be overwhelmed. Mine scheduling will never be free of surprises but when they appear, evolutionary computation will have unlocked understanding ahead of time, allowing an alternative near-optimal course of action to be chosen.

Time to focus on details is a rare commodity in mining. Maptek provides the automation tools and orchestration platform to swap focus from when and how to rework a mine plan, towards continuous re-evaluation of the schedule using live data.

Mining is overflowing with optimisation problems that are challenging to tackle. A data driven approach empowers miners to apply the knowledge gained across the mining value chain for better decision making.

Maptek recently sponsored GECCO 2024, the premier research conference for evolutionary computation. Head of Experimentation and Technology, Simon Ratcliffe introduced a new audience of researchers to real world mining problems in the Evolutionary Computation in Practice track.

Open integration for blast data

Access to Maptek™ BlastLogic™ data by third-party systems and tools is facilitated by a new API, creating potential for solving new challenges.

Maptek™ is aware that for customers to integrate and automate their mining operations, data needs to be more accessible to third-party systems and tools in a secure manner.

From September 2024, an easy-to-use Application Programmer Interface (API) will enable Maptek™ BlastLogic™ customers to read and write data more directly, while maintaining data integrity.

You own your data

The server is the central source of truth in the BlastLogic ecosystem, which is the foundation for continually improving drill and blast outcomes.

The server has strict rules about how data is written, and requires special knowledge to read and write. Applications such as the BlastLogic Tablet and Desktop clients read from and write to the server to perform data related functions.

Although one of the benefits of BlastLogic is 'You own your data', until now customers could only use data through the lens of Maptek applications.

For example, the companion application, BlastLogic Integration Service (BLIS) only allows for the scheduled import of drilling and custom hole data from a database, based on various rules.

Facilitating integration

A new API has been added to the BlastLogic Server to integrate third party systems, custom software, scripts and tools with the BlastLogic ecosystem.

> The API allows users to create custom workflows to facilitate adding backfilling, dipping and loaded charge deck data.

For example, a machine could measure holes of a blast and automatically send the measurement to the BlastLogic server through the API, without the need for it to learn how to use the Tablet application.

With the Public API wrapped as part of the Maptek Extend SDK update later in 2024, users will be able to write Python code to interact with the API. This will provide a seamless connection between other Maptek applications, via the SDK and the BlastLogic Public API.

Solving a problem

When two independent pieces of software can communicate with each other it's most likely through an Application Programmer Interface.

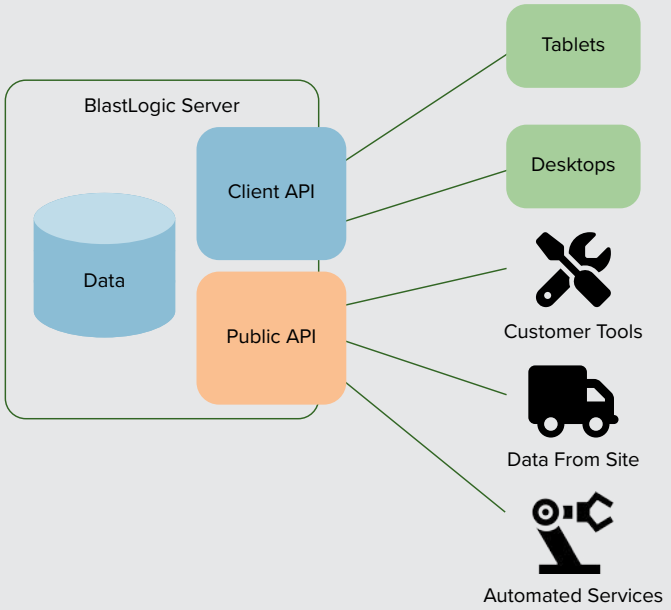
Drill and blast engineers have a growing appetite to integrate and automate their mining operations. Therefore, BlastLogic data needs to be more accessible to third-party systems and tools.

The challenge when designing any API is that anyone attempting an integration must be able to understand and use it with ease. Flexibility to integrate with multiple technologies and workflows is essential.

A unique challenge arose when demonstrating the BlastLogic Public API, which is an abstract idea to many people. A new feature usually entails new UI elements or a tactile object to operate that solves a problem directly.

'Walking in the shoes' of the customer helped Maptek to demonstrate a hypothetical solution using the API. This approach was better than just presenting the API specifications, and promoted understanding of its use cases and future value.

BlastLogic customers will be able to benefit from full open integration functionality in late 2024, contact Maptek to find out more.



Unlocking future copper resources

Researchers participating in the Maptek™ co-sponsored integrated mining consortium that wrapped up in August 2024 reflect on their experience and achievements.

An Adelaide-based consortium of universities, METS partners, mining companies and research groups has unlocked significant economic potential through innovative projects.

The initiatives aim to enhance copper recovery, throughput and production while ensuring operations are conducted safely, sustainably and with reduced water and energy consumption.

The Integrated Mining Consortium was established in 2017 and funded by the South Australian Premier's Research and Industry Fund (PRIF) to run under a banner of 'Unlocking complex resources through lean processing'.

The initial phase involved two programs that targeted challenges defined by end-user partners BHP and Oz Minerals (now part of BHP). The project life was extended into 2024 to allow for Consortium activities around commercialising the research.

> Translation partners such as technology providers Maptek™, Eka and Magotteaux were crucial in defining these steps, supporting research with software licensing, mentoring and real-world datasets.

The final report from the Consortium estimated that the research and commercialisation activities would deliver multimillion dollar savings predicated on a 2% increase in copper recovery, 15% increase in throughput and 17% increase in production.

Maptek is pleased to publish the reflections from several of the researchers that provide a snapshot of achievements arising from the project.

Let science make magic happen!

Postdoctoral Research Fellow Difan Tang helped to develop a new sensor that can measure and report, online and in real-time, the particle sizes of mineral slurries conveyed in pipes.

He was excited about minimising energy consumption and chemical usage while maximising valuable mineral extraction to ultimately boost profitability in the mining industry.

Tang relished that his work contributes to freeing operators from tedious manual sampling and examination of mineral slurries, which may be radioactive. He sees the potential to integrate the new sensor into control systems to automate mineral grinding and size classification.

Tang's young daughter thinks of his sensing rod as magic, since it 'makes money' for people, and his research has inspired her to become a scientist.

Maths enhances understanding

Applied Mathematician Kirsten Louw worked on a project that aimed to model diffusion of Fe^{3+} ions in metal organic frameworks and solve non-linear diffusion equations using symmetry analysis.

She reported that some non-believers thought the highly theoretical nature of mathematics would not be useful to the group, but were won over.

Applying mathematics to better understand the behaviour between a sensor and the metal ion it is sensing allowed Louw to recommend to chemists how changing sensor properties could optimise sensor readings.

Louw appreciated how cross-pollination of ideas from different areas can drive innovation. She enjoyed working on a project that could potentially also improve outcomes in non-mining industries.

Speed of AI cloud computing exceeds expectations

Dr Yerniyaz Abildin completed his PhD on a project comparing explicit, implicit and geostatistical modelling with machine learning. He highlighted the stunning speed of AI models generated with Maptek DomainMCF that exceeded his expectations.

Abildin notes that mining companies could do more to exploit the unused data that has been painstakingly collected. He hopes that they will increasingly leverage machine learning to optimise operations, reduce environmental impact, and enhance safety standards.

Although not a geologist, Abildin discovered useful features in geological modelling software, and has continued his postgraduate research in collaboration with Maptek.

Tailoring complex concepts to a wide audience

Postdoctoral Researcher Hirad Assimi hopes that mining companies significantly boost their support for innovation and research in electrification and digitalisation to meet the growing demand for carbon neutral production of minerals essential for green technologies.

PRIF The Mining Consortium

Unlocking Complex Resources Through Lean Processing

Computer scientist Assimi's specialist topic was resource heterogeneity modelling from trucking to multiple stockpiles to mill feed. His solution fine tunes stockpile management, resulting in smarter decision making, while undesirable properties stay within acceptable bounds.

He found describing outcomes and tailoring the message to audiences from diverse backgrounds as unexpectedly enlightening, especially when developing concepts ready for commercialisation.

Extending research into business performance

Postdoctoral Robotics Researcher Shi Zhao sees that expanding the use of robotics and AI across various stages of the mining process can increase efficiency, accuracy and worker safety, and reduce the environmental footprint.

His project aimed to optimise Load-Haul-Dump operations and provide precise quality control for Run-Of-Mine stockyards using computer simulated 3D stockpile models.

The proposed system alleviates stress for mine managers and promotes agile decision making for meeting the required quality and quantity within a small margin. The solution helps reduce greenhouse gas emissions by minimising reclaiming time.

He found that building 3D stockpile models in near real-time enabled assay results to be incorporated as they became available, improving the accuracy of quality assessments.

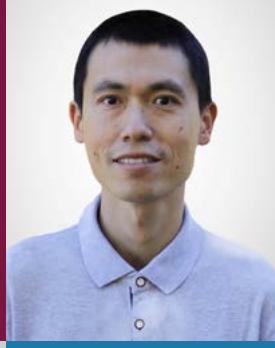
Read more about the Integrated Mining Consortium

140+ papers published

$49m additional funding leveraged

75 months of collaboration and research

Difan Tang



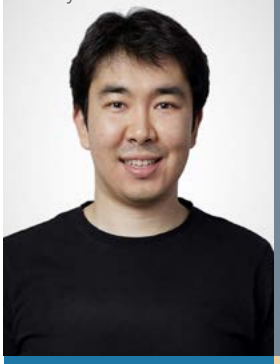
25 research and translation projects

18 young researchers upskilled

Kirsten Louw

1 commendation award

Yerniyaz Abildin



15 experienced mining and computer science researchers

10 higher degree by research students

21 collaboration partners

8 postdoctoral researchers

7 years since inception

4 commercialisation projects

Hirad Assimi

2 end-user partners

Shi Zhao

17 women in mining scholarships awarded

Global events

Maptek hosts and participates in key mining events around the world, continuing to track where the industry is going and how we can best serve our customers.


MAPTEK


DOUCE
Rebelle
Quartier centre


MTS


GeoSpatial Manager
MAPTEK
ROCKETDNA

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