

Virtual sanity

Finally the mining software industry is delivering on its virtual capability billing; while other developments include subscription based offerings in this cost conscious market, reports Paul Moore

Consolidation in the mining software industry has continued, but what are the real benefits? Raoul Jacquand, GEOVIA CEO at Dassault Systèmes, recently gave his take on this as far as GEOVIA having been part of Dassault Systèmes for a few years: “...external observers may ask a very legitimate question: how has this integration helped reshape the brand, or more importantly, how has it brought more value to its user base?” Arguably it has taken a while for the parent company’s ‘3DEXPERIENCE’ to fully transform GEOVIA’s offering but Jacquand says this is now coming to fruition. “It is actually with excitement that we prepare ourselves to introduce onto the market in 2017 new capabilities which will illustrate the benefits of integration to our customers. Indeed, GEOVIA is proud to announce that we will start bringing the 3DEXPERIENCE in the hands of our customers in 2017.”

He adds: “To put it simply, it is a business experience that is conducive to innovation. In more words, the 3DEXPERIENCE platform is the vehicle that Dassault Systèmes has provided to many industries, in order to successfully assist our clients drive their transformation agenda, through a set of rich applications leveraging the power of a social & collaborative enterprise-level platform. Starting in 2017, GEOVIA will be

enabling our Surpac, MineSched and Whittle users to benefit from the collaboration capabilities of the 3DEXPERIENCE platform through a seamless interface, allowing them to manage their intellectual property contained in the files managed by these applications.” He says the business benefits cover a large range, and include the following:

- Centralised control of the mining data providing a single source of the truth
- Program management of the mining workflow
- Possibility to apply collaborative task management
- Indexing of mining data and creation of ad-hoc dashboards
- Sharing mining content in 3D

“Furthermore, GEOVIA is introducing in 2017 to both our Surpac and GEMS customers a new cloud-based next-generation rapid geological modelling capability, to be delivered under an innovative SaaS [Software-as-a-Service] model. The seamless integration of this capability inside Surpac/GEMS will offer a powerful experience to our users, who will also benefit from important features such as version control, lifecycle management, scalability thanks to cloud computing, geospatial indexing – all this through a simple browser interface.”

In parallel to these exciting developments,

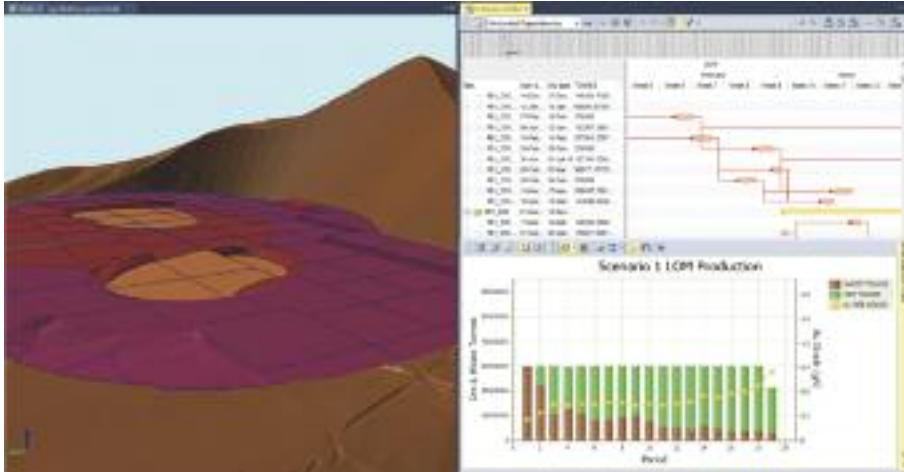
GEOVIA says it is really starting to bring the 3DEXPERIENCE benefits from Dassault Systèmes to its customers in 2017

GEOVIA is to continue to maintain its portfolio of desktop applications. Products such as Surpac, GEMS, Minex, MineSched, Whittle and InSite will also have new releases coming out in 2017, “with quality & performance improvements, as well as some select enhancements such as a point cloud integration capability in Surpac which will address the need expressed by our clients who make an expanding usage of drone-based surveys and LIDAR/photogrammetry technology for multiple purposes.”

More industry future trends

In more general terms on where the industry is moving, Marni Rabassó, Vice President, Natural Resources at Dassault Systèmes, recently talked about the key trends and the future of mining. “There are a number of issues that are top of mind for the mining industry – operational excellence and innovation. The former focuses on the desire for mining companies to make their operating mines leaner. The latter is about the need for the mining industry to innovate given the point it has reached, where its level of productivity in relation to profit margins is not sustainable. Both issues require significant changes in mining, but also the adoption of new kinds of technology in the industry to run its businesses and drive productivity. I’m really excited about the possibilities that the virtual world will unlock for collaboration and communication. Not only will virtual versions of mining operations provide people with a better understanding of how they work, and how they can be improved, I believe they will spark a lot of really interesting conversations that will trigger innovation. Through the virtual world provided by Dassault Systèmes, our customers will connect the best and brightest minds in their enterprise and ecosystem together to discover innovations and try them out and prove them before implementing them in the real one.”

On industry future changes and capabilities, MICROMINE told IM: “Within the 3D geospatial world of Micromine we are seeing increased experimentation with virtual- and augmented-reality. Although it is probably fair to say that no-one quite knows how these technologies will ultimately benefit the mining industry, they are undoubtedly here to stay. We are also seeing significant research into advanced automation techniques such as machine vision and machine learning. Given the visual and subjective nature of geological interpretation, these technologies have the potential to revolutionise geologists’ understanding of their rocks. Within the context of ongoing research into wireless networking



A Micromine 2016 Scheduling and Optimisation screenshot]

within mines, and the internet of things, future miners will have access to vast amounts of real-time information, with smart software having already extracted important knowledge from what would otherwise be an overwhelming mass of data.”

MICROMINE says there are also several other key factors that will affect the development of mining software which include:

- **Simplicity:** With the introduction of elements such as autonomous mining, the emphasis on reskilling the workforce to be more technology or software focussed is a relatively hot topic (given that people will lose jobs as result of this technology). Due to this, greater shift towards technology, the way in which software is used needs to be repeatable and robust, such that when different users are operating, the results are the same.
- **Accessibility:** As more personnel become interested in data, their want to view and analyse it increases. Providing tools that allow users to manipulate and interrogate data directly from its source system, in a way that will not comprise the integrity of those sources is essential. Analytics and dashboarding tools which are a collaborative source of sporadic data that is intrinsically linked will drive mining companies across their value chain.
- **“X”aaS:** service driven software architecture allows for fast delivery of software with flexibility to customers. Users want diversity, ease of use and bang for buck, with the delivery method allowing software to be purchased when they want/need without the large outlay of capital expenditure.
- **Distributed computing power:** Advanced analytics and algorithms to determine the best possible outcomes. As the requirement for data collection increases the ability to process and make “sense” of it is also

required. Continuing with manual analysis through spreadsheets is not the best use of time of effort. The need to have rapid return analysis which drives change in mining will

■ **Integrated hardware:** The requirement for all data, ensures that the collection methodologies are equally up to the challenge of integrating and interrogating asset information. Whether that asset is a large haul truck or dewatering pump, the data collected compounds the change in mining.

Mapek highlights flexibility in market uncertainty

Peter Johnson, General Manager at Mapek comments: “Mining software is central to mine design, planning and scheduling. This is not new! What has changed is the immediacy of the process. Where in the past, data collected was for end-of-period review, that is now considered too late for the dynamic planning and mining cycle. Data must be fed back in real-time into the mine production loop so insights gained from comparing designs to as-builts immediately leveraged. An Internet of Things approach, where systems can assimilate and analyse data from a wide range of processes, is valued over single application packages. Mapek provides an advantage here, as we apply the experience gained from a global, diverse commodity customer base across the mine design and planning disciplines to develop holistic systems. Our detailed 2017 technology roadmap outlines how we will deliver individual product capabilities alongside strategic plans for leveraging technology to create an integrated, connected and flexible technical user environment.

Better optimisation engines and smarter algorithms make results available sooner to decision making teams. Sophisticated modelling techniques are supported by advanced visualisation regimes for communicating alternative scenarios. Mining engineers no longer need to struggle with a single

unchangeable model. Dynamic design processes allow more efficient and effective workflows. For example, a 20-year life-of-mine schedule using a model containing 145,000 blocks can be calculated in Mapek Evolution Strategy in 90 minutes. If stockpile or rehandling parameters change, the revised schedule is available comparatively quickly. Other programs can take up to 24 hours for a model of similar magnitude and complexity.”

He adds: “Miners require systems which are flexible enough to support operational decisions in market uncertainty. Systems must provide: visualisation and display of large datasets and block models; on screen validation of ore and tonnages during the design process; redesign after adjustments as development proceeds; simulating schedules which account for waste haulage from day one; releasing cash flow early in the mine life by optimising haulage fleet; taking into account fuel burn; considering rehandling costs if walls are not dug to design.”

Whittle ever more advanced

The latest release of GEOVIA’s Whittle is now available with advanced simultaneous optimisation of cut-off grades, stockpile and blending to support multiple pits. In addition, an increased number of processing methods enables the next step in optimisation such as process plant calibration.

New Simultaneous Optimisation (SIMO) features are able to support the processing space, and multiple (up to 30) processing paths, to optimise the schedule, the cut-off and cut-overs between the various paths and stockpiles, and decrease the amount of waste. They can also synchronize the mining optimisation and the processing optimisation to improve NPV. The menu option supports Microsoft® Excel to easily view a large number of detailed reports. Also, the new version brings “significant performance improvements with the introduction of the COIN-OR Linear Programming (LP) engine.”

For a multi-mine block model, the Schedule tab includes mine information so users can specify whether a mine is to be included, and/or define the pushbacks for each mine used in SIMO. On the Advanced Optimisation Controls form (in the inhibit pushback table), users can see the pushbacks to which the mine belongs. “When creating a new pushback definition in a single or multi-mine scenario, you can set the min/max lead, and the max benches, per period using Pushback Definition Creation form.”

Finally, an unlimited number of constraints and variables may be used in a blend optimisation in order to optimise a broader range of blend scenarios.

Dassault Systèmes worked closely with the product’s namesake (and original developer of

the first Whittle software), **Whittle Consulting** on promoting the release of GEOVIA Whittle and the capabilities of SIMO.

“Capitalising on Dassault Systèmes 3DEXPERIENCE Mine and its extensive portfolio of mining software, as well as Whittle Consulting’s reputation and experience in the area of Integrated Strategic Planning, the collaboration provides solutions such as cross-functional facilitation, sophisticated modelling techniques and optimisation software to improve customer cash flow and NPV of a customer’s entire mining value chain.”

Whittle Consulting is assisting in the sale and implementation of the Standard and Advanced SIMO Modules – which have previously been considered advanced/specialized techniques – that are now available for mainstream use.

“This is the most significant release of strategic mine planning software in years,” says Gerald Whittle, Whittle Consulting’s CEO. “Whittle Consulting has refined the optimisation engine behind SIMO and perfected its use by applying it to over 100 mining projects and operations over a ten-year period. This is stable, proven technology that generates outstanding results.”

New developments at MICROMINE

Micromine 2016, released in May 2016 by MICROMINE, enables users to capture, manage and interpret critical data, and is relevant to all stages of the mineral extraction process.

“Micromine provides explorers with an in-depth understanding of their project so they can target prospective regions more effectively, increasing the chance of a project’s success. It gives miners easy-to-use modelling, estimation, planning and design tools to simplify day-to-day production tasks.”

Commenting on the upcoming release, MICROMINE’s Technical Product Manager, Frank Bilki, said, “After nearly two years of continuous development and many hundreds of individual changes, we’re close to finalising Micromine 2016.”

Micromine 2016 also incorporates several surface and underground mine planning-oriented enhancements, including:

- Auto Build Pit and Auto Re-align Pit Strings for rapidly prototyping and adjusting open pit designs
- Integrated pit optimisation charting and reporting tools for displaying and reporting optimisation results directly within Micromine
- A collection of tools for creating underground mine development solids from 2-D or 3-D linework (such raw survey data or CAD drawings)
- An all new long-term (production) scheduler, which complements the existing short-term

A long-term schedule optimiser that uses industry-standard linear programming solvers to optimise mining extraction

Micromine 2016 also included implicit modelling enhancements (including varying structural trends), and numerous utilities and workflow enhancements. Service Pack 5 for Micromine 2016 was available for download as of December 2016. “This year’s release has something for everyone. Many of the updates are Core features that benefit every user, not just those with extra modules. They include simple timesavers like being able to drop any supported file into Micromine from an outside location, and a Project Explorer pane that provides direct access to all of the files in a project.”

Service Pack 4.7 of Pitram 2015 was released in December 2016 which contained contains a variety of new administrator options, data acquisition; enter measures dialog and display measures, reference data editor, shift planner as well as a number of enhancements and bug fixes based on the feedback received from Pitram users.

“With the release of service pack 4.7, Pitram enables both underground and surface operations to reduce costs, increase productivity and improve safety and business intelligence.” Major features included:

- Administrator Options provide a consistent way to access restricted options for client applications such as Data Acquisition and the Event Editor
- The Enter Measures dialogue has been enhanced to include favourites that allow measures across different tabs to be selected as favourites and then grouped together on the same tab, thus providing greater user efficiency, when a combination of measures on different tabs need to be entered frequently
- Major Shift Planner functionality including; auto-complete location field for equipment task when equipment changed and from 'new task' option, use of location of primary equipment for secondary equipment task, automatic assignment of location based off the equipment and implement removal of notes in task
- Equipment measures are displayed even if the related Equipment Measure attribute is not deployed, in version 4.7 this has been changed so that if the value is not set, the measure will not be displayed for equipment
- Scheduled Reporting; the dependency on Crystal reports has been removed and is no longer required. Instead, the SAP Crystal Reports runtime engine must be installed:
- *32-bit Crystal Reports runtime engine needs to be installed on the server where the IIS server with the Pitram Portal web client are running*

- *64-bit Crystal Reports runtime engine needs to be installed on the machines where Data Acquisition is installed.*

MICROMINE told *IM* that the Pitram development team is currently working on Pitram 4.8 which is scheduled for release in early 2017 with Pitram 5 planned for late 2017.

Moving on to Geobank 2017, MICROMINE’s Product Strategy Manager, Mark Gabbitus said, “Geobank 2017 is the culmination of a lot of hard work by the product team recently to get new features, improved user experience and client requests out to all our clients, we believe that the new Sample Tracker functionality is going to be a real winner.”

The new and improved sample tracker enables batch loading of lab data, essential at operations with onsite labs, as well as several automated features designed to reduce configuration and management for the database administrators.

Demonstrating its commitment to markets outside of Australia the new Excel lab file importer is set to help clients in Russia, a huge emerging market for Geobank, Micromine and Pitram. “This is something our Russian clients have asked for and we have delivered” said Gabbitus. “The labs over there traditionally provide sites with analysis results in multi tab Excel spreadsheets. In the past, this required the database administrator to export the data to CSV and then import. Now it’s set and forget.”

The company adds that one of the big focus areas for Geobank 2017 has been improving the user experience “and many small but cumulatively exciting new features speaks to that mission. Improved workflows, reports and dialogs mean that the administrator and general users day to day experience of Geobank will be significantly enhanced.”

More Pitram and Geobank potential

Future developments for Pitram include short interval planning optimisation. Plans and schedules are created regularly to ensure the mine and its assets collaborate in such a way that the mine advances in a safe, calculated, proven and productive manner. Unfortunately circumstances occasionally prohibit this from occurring, machines breakdown, material is not blasted correctly, material grade is varied, people are sick.... the list goes on.

“Often planners, grade controllers and other technical staff maintain a spreadsheet with rolling 36 h plans, maintenance breakdowns and grade requirements. However, these spreadsheets often only dictate the desired outcome, rather than the way to achieve this, let alone if an interruption occurs. It is then left to personnel to make rash decisions and opt for the simplest answer, without the knock-on effects considered...short term interval control (SIC) will

allow a mine to forward plan and schedule as normal, however each element of that is scrutinised on a real-time basis. SIC provides insight into how operations are tracking in accordance with the plan and feeds information back to deliver realistic outcomes. Interruptions are captured and alternate scenarios can be planned in such a way that assets will move on to the next task, as if there was no interruption. The SIC provides the mine a way to deliver the desired outcome based on locations, machines and personnel, to ensure that mining is conducted in way that it is predictable. The predictability allows analysis to make incremental improvement step changes as you gain more control over the operation.”

On the future of Geobank, the company states: “Our significant investment into R&D also allows MICROMINE to empower clients through software that offers a positive user experience via intuitive, feature-rich functionalities and interpretive capabilities.” In working with Geobank clients, the development team has identified key areas of focus:

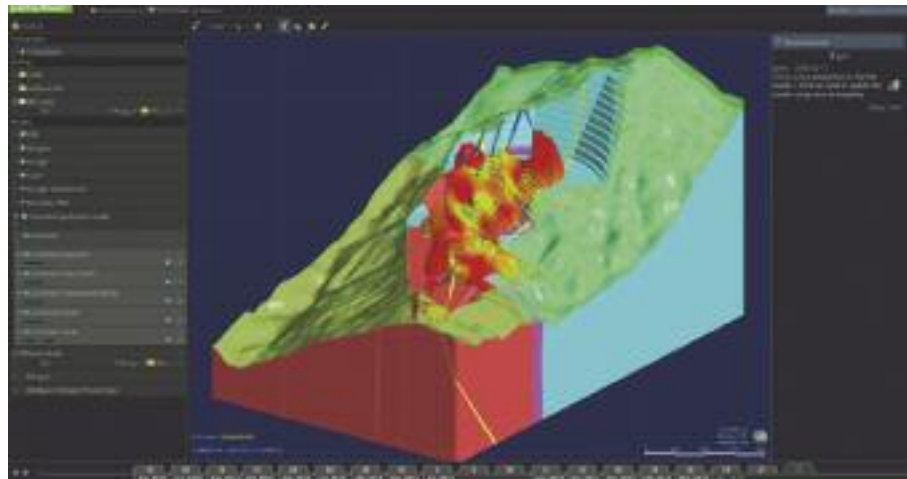
- Store data online (Cloud based SQL Server storage, Azure and AWS)
- Self-service reporting presented on the web
- Web frontend to Geobank for data viewing and entry

“Beyond the web work most of our current development plans involve adding extra functionality, creating a better user experience and integrating the product with more data sources. This last one is particularly interesting as automated data capture in the drilling arena is looking set to explode and we need to be ready for the volume and variety of data we are going to be needing to hook into.”

Subscription software and pay as you go

ARANZ Geo Ltd, developer of 3D geological modelling software Leapfrog®, has announced the introduction of Pay & Go Daily Licensing (Pay & Go), a new pre-paid licensing option which allows users to access and pay for the Leapfrog suite of products only when they need it. Pay & Go allows Leapfrog users to purchase a license online via a credit card, for a minimum of a day, without any further commitment. Users can download Leapfrog and start using it straight away as there’s no license dongle required. Pay & Go will initially be available for users in the USA, Canada, Australia, Papua New Guinea, Indonesia, Mongolia, Philippines and Singapore. Other countries will be added at a later date.

ARANZ Geo’s General Manager – Mining & Minerals, Nick Fogarty says: “Pay & Go Daily Licensing provides unprecedented flexibility for our users. Like a pre-paid mobile phone plan, it enables users to pay only for the time Leapfrog is needed, which is very handy when users have



peak work demands. It’s also great for new users who want to use Leapfrog but don’t need an annual license.”

Accessible through My Leapfrog (my.leapfrog3d.com), the Leapfrog community, “Pay & Go is a valuable addition to Leapfrog’s existing licensing options. Whether a user needs Leapfrog for a day or longer, Leapfrog has licence options to suit. Additional benefits for Pay & Go users include the ability to save models to open with the Leapfrog Viewer for ongoing viewer access, and access to free online training materials and the Leapfrog community via My Leapfrog.”

Fogarty says: “We constantly strive to innovate through not only our software products and services but we also consider the way we deliver them to our customers as being just as critical. Pay & Go is yet another way we can provide flexibility to our customers, to support their businesses and make it easy for them to access and use Leapfrog.”

ARANZ Geo has also announced the launch of ARANZ Geo Expert Services, a new team focused on applying the latest thinking to geological uncertainty. The senior geologists will provide expertise and guidance to unlock value for their clients in the global mining industry.

“ARANZ Geo Expert Services brings together the successful and trusted consulting expertise already within the ARANZ Geo group. Providing clarity from complexity, QG (acquired by ARANZ Geo in 2014), will join resource estimation and production specialists from Bloy (acquired in 2016). Adding a third dimension, Leapfrog masters will provide advanced modelling services.”

ARANZ Geo’s Managing Director Shaun Maloney says, “The combined forces of the new Expert Services team provide a broader range of capabilities to the market, and open up opportunities for collaboration across software and services. Aligning the team closer to the ARANZ Geo group will ensure they are at the forefront of mining industry innovation and technology.”

ARANZ Geo Ltd, developer of 3D geological modelling software Leapfrog®, has announced the introduction of Pay & Go Daily Licensing (Pay & Go)

The Expert Services team will provide consulting expertise in geology, geostatistics and geometallurgy from exploration through to mine production and reconciliation. Services will include consulting, training, mentoring and project assistance. Their expertise has been gained in a variety of international markets and sectors. All are geologists, with senior credentials. Team members are based near the world’s most significant mining areas and have extensive knowledge of their local areas. ARANZ Geo experts are located in Australia, Brazil, Canada, Chile, Denmark, New Zealand, Peru, South Africa and the UK.

Although QG is joining ARANZ Geo Expert Services, Principal Consultant Rob Stewart says: “It will be business as usual for our clients.” Stewart adds, “It’s an exciting time for us. We’re able to combine the diverse knowledge of our consultants with those of Bloy, together with ARANZ Geo’s technology excellence, and provide a broader range of services. This doesn’t mean we’ll only focus on the group’s software solutions. We will continue to utilise a broad range of software packages, appropriate to the challenge at hand.”

The consultants joining the Expert Services team from Bloy will bring a wealth of experience in the production end of mining cycle. Senior Resource Geologist Carrie Nicholls says, “we are looking forward to being able to offer clients more, with the opportunity for skill sharing across the wider team.”

Bloy, headed by Peter Bloy, will continue to operate as a specialist company within the ARANZ Geo group, focussing on developing its flagship Blockbuster® product. Blockbuster is a full-featured, off-the-shelf grade control solution.

Leapfrog Project Assistance is a new service offered by the Expert Services team to deliver

With Minemax subscriptions, users can have access to industry-recognised, best-of-breed mine planning and schedule optimisation software without worrying about how they are going to get budget approval for a capital item

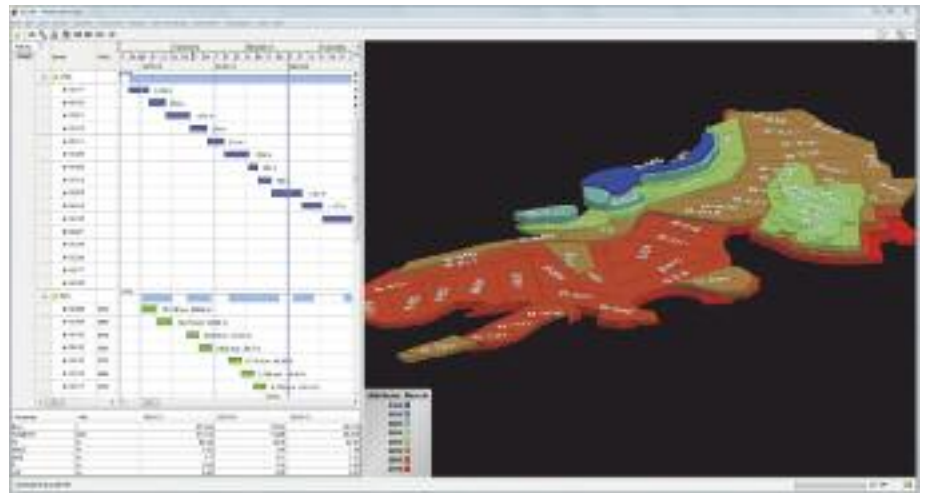
advanced Leapfrog prowess. “Services will include migration of models to Leapfrog, assistance with the build and implementation of dynamic modelling processes, and the building of complex and detailed geological models. These new services will be provided by senior geologists who are Leapfrog masters.”

The significant initial payment associated with traditional mine planning software purchases can be a real hurdle for mining companies in today’s market. This has driven a new subscription option for **Minemax** planning and scheduling software starting from just \$720 per month. With Minemax subscriptions, users can have access to industry-recognised, best-of-breed mine planning and schedule optimisation software without worrying about how they are going to get budget approval for a capital item. “Subscriptions usually come under your company’s operating budget and are far easier on your cash flow. Subscription sits squarely in between the traditional perpetual license purchase and short-term rentals. It’s a cost effective option if you know you need mine planning and scheduling software for more than a month or so, but would have trouble getting approval for the outright purchase of a perpetual license.”

According to Minemax CEO Jim Butler: “Our customers and other friends in the industry have asked for something that bridges the gap between a perpetual license and short-term rentals and we’re pleased to meet that request now with our subscription service. Subscribers will have access to the same fast and easy-to-use software, together with our responsive service, while maintaining a smooth cash flow.” Minemax will continue to provide perpetual license options and short term rentals for those customers who prefer these options.

Finally on its main product suite, the new release of Minemax Planner 4.2 brings two key functionality improvements – calculated fields and rotated models – allowing users to directly import their block model without any pre-processing. Working directly with the block model means the user can develop pit optimisation strategies with accurate results faster than ever before. “It’s very easy to import your block model into Minemax Planner and use expressions to automatically calculate additional fields. For example, you can now define calculated fields such as mining cost based on depth, and recovery as a function of material type and grade.”

In response to customer and industry feedback, Minemax Planner 4.2 also supports



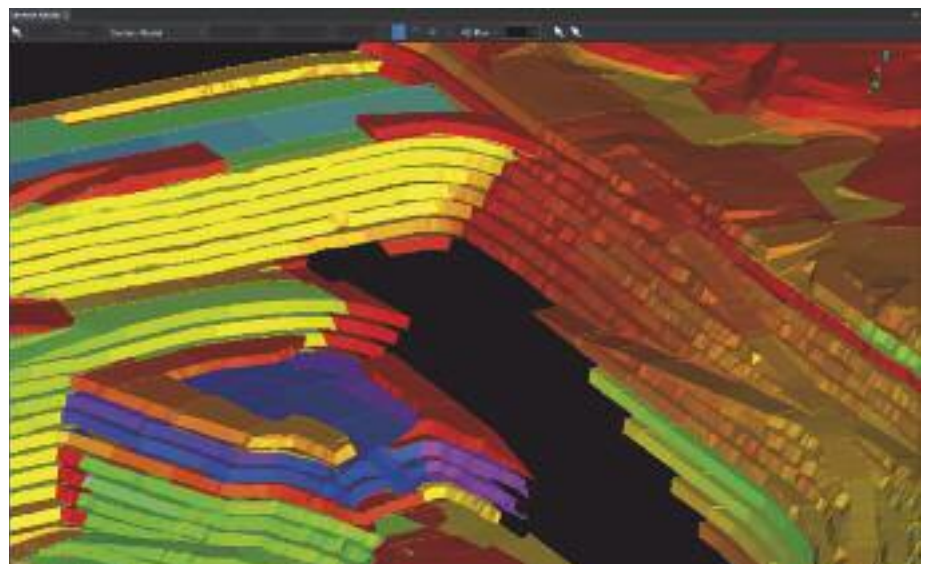
importing rotated models, “which eliminates the need to manipulate your rotated model before you bring your data into the software. Minemax Planner does all the work in the background, finds your ultimate pit, pit shells, pushbacks and schedule, and exports all your results with the original rotation bearing planner-4-2-dimensions. These new improvements, together with the previously added flexible bearing-based slopes and Planner’s easy-to-use guided workflows, make Planner a complete solution with everything a mine planner needs for pit optimisation.” This package is one of those available via the new subscription pricing offering.

Maptek looks forward to busy 2017

During 2016, Maptek released Vulcan 10 mine design software with the Maptek Workbench as well as new tools in Evolution scheduling and BlastLogic drill & blast management. Peter Johnson told *IM*: “Together with new functionality in our survey, monitoring and design conformance systems, Maptek has set the scene for exciting advances in 2017. New tools in

Maptek Evolution improve performance of mine scheduling processes and deliver greater project value. Evolution 4.5 features the stunning new graphics environment which already provides Maptek I-Site, BlastLogic and Eureka software users with a superior visualisation experience.”

Johnson says that the high performance graphics engine can display and manipulate large models of up to millions of blocks, along with the solids and triangulations that make up those blocks. “Scheduling is about ensuring value of your assets can be maximised at a strategic level. It is also crucial to ensure these plans are practical and can be implemented in a more tactical, shorter time frame. Evolution Strategy and Origin allow the engineer to achieve practical, high value schedules that can be implemented at a production level. Mines are complex environments and scheduling production is just as complex. Planners must consider cut-off grade, route and equipment allocation, cycle times, fuel burn and waste dump locations. Maptek products help present an integrated, holistic 3D view of a minesite by simultaneously displaying multiple models,



New tools in Maptek Evolution improve performance of mine scheduling processes and deliver greater project value

waste dumps, haul networks and topography.”

Evolution Phase is a new member in the family of Evolution products, allowing the engineer to build practical phases from a series of optimal shells very quickly, and rapidly cycle through this process to ensure value is maximised from pit optimisation through to schedule optimisation. “Evolution Strategy maximises net present value and generates cut-off grade optimisation policies. New options allow users to build blend constraints and to track and report multiple elements and contaminants per process and/or destination. Existing stockpiles can be modelled with tonnes and grade items.”

A global minimum cutoff can be specified, as well as minimum and maximum accumulation constraints for multiple processes. Users wanting to run Strategy without cutoff grade optimisation can fix their own cutoff grade policy. The optimisation process then determines the best extraction sequence for that setting. Importantly, this feature can be simply turned on and off on to determine the value adding capability of running with cutoff grade optimisation. Most cases show a significant uplift in value of up to 25%.

Evolution Origin generates detailed scheduling scenarios from life-of-mine to short term planning horizons and can apply optimisation policies generated by Strategy. Users can set maximum constraints per stage/group/period for manipulating sequences through the model. Specifying multiple truck types to work in the same mining area allows for mining different material types with different equipment.

Improved interoperability for haul network creation allows users to drag and drop a haul network created in Vulcan Envisage into Evolution to automatically configure the schedule network. Multiple digger fleets can also be allocated. Fuel burn is incorporated into optimisation runs alongside dynamic backfilling.

Johnson states: “The Evolution example demonstrates how software usability and variety confirms its place among next generation technology. Mines can schedule operations using Evolution advanced optimisation techniques, which by their very nature are designed to mimic reality and complexity. Interoperability with the resource model, integrated workflows and parallel processing technology, and now the latest visualisation engine delivers a truly world class scheduling solution.”

The Automated Pit Designer released in Vulcan 10 in 2016 allows mining engineers to transform optimised block model results into operational mine design contours in seconds. Contours can serve as a base for further design work or be used to generate more accurate pit-by-pit graphs and long term schedules. The design tool automates the tedious process of manually fixing crossovers, modifying lines, and offsetting lines

one segment at a time. The Vulcan mine design becomes a fluid entity, which can be updated as new data becomes available and adapted to changing economics. Different scheduling options can be reviewed, and different design parameters can be evaluated.

“Release of the Maptek Workbench in 2016, alongside Vulcan 10, launched a mission for 2017 that will ultimately provide a single, comprehensive platform for all spatial modelling, design and analysis tasks. The flexible Workbench interface comes into its own in a multi-screen environment. Docking database and design windows side-by-side allows interactive editing and viewing, with easy access to text, csv and script editing apps. Custom workflows across different applications will deliver another boost in productivity and facilitate hand-off between teams. Eureka will be hosted on the Workbench from 2017, followed by I-Site Studio, BlastLogic and Evolution. Ultimately users will choose from a Maptek toolbox representing best practice in survey, design, modelling, scheduling, drill and blast, monitoring, geotechnical analysis and reporting. Working on a single data model which is shared throughout the value chain and connected forward across event horizons to execution stages and upwards toward enterprise and resource planning will provide miners with holistic operational data for business decisions. The outcome will be transformational for the industry.”

During 2017, Maptek says it will focus on integrating workflows and data throughout geological modelling, mine design, planning, production management and reporting. Collecting data, automated if possible, from all operating devices and making this available to all planning and operational teams will effectively close the loop for driving performance and productivity gains.

“Mines will gain a focal point for technical analysis and operational planning. User efficiency and productivity will soar. Multi-disciplinary workflows will combine with product functionality to provide one common data model. Connections across event horizons to execution stages and enterprise and resource planning levels will allow miners to manage operations holistically. Maptek continually looks to add value by examining how data collection and analysis can extend across processes and beyond horizons. R&D into new applications is supported by adapting existing technology to target new solutions. The Sentry laser-based monitoring system is a good example. Sentry is exciting a lot of interest from open cut and underground operations, proving a reliable monitoring solution with versatility for field survey, and ensuring an early return on investment. Incorporating smart interfaces that recognise when to enter specific

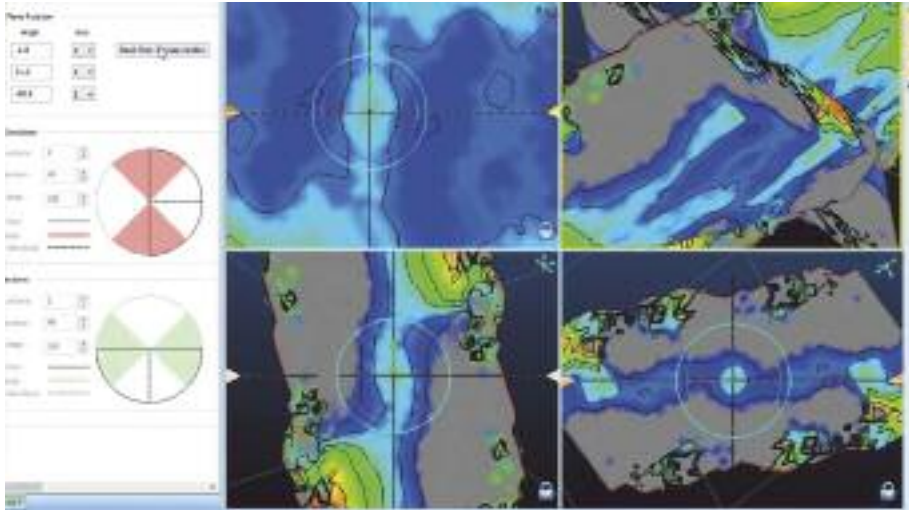
data types, auto-populating from defined data sources, implementing scripts on the fly and optimising calculations saves time and effort, allowing customers to apply their expertise and tailor inputs to run alternative scenarios for analysis. This is supported by the world’s best 3D visualisation environment for promoting understanding and interpretation of data. Maptek delivers solutions that make use of all available information in an Internet of Mining Things approach. This enables our customers to develop and evaluate mine designs which are structurally and economically viable and which can be planned and scheduled to optimise the value of the extracted resource.”

Datamine launches geostats module and addresses planning

Datamine’s recent webinar marked the official release of the much anticipated Studio RM module, Advanced Geostatistics. Hosted by Kathleen Hansmann, Datamine’s Senior Geosciences Analyst based in its Johannesburg office, the webinar took attendees on a comprehensive journey of estimation using the new workflow process incorporating the use of brand new features such as 3D variogram analysis and kriging neighbourhood analysis (KNA). The webinar culminated in a demonstration of the new co-kriging algorithm that have been incorporated into the new estimation engine which is over 100 times faster than the previous process.

“Now the module has been fully released and our consultants are busily giving demonstrations of the new functionality which is being well received. The Advanced Geostatistics module neatly packages the entire estimation process into a simple to use workflow which includes scenario management which is perfect for auditing previous estimations. In addition to the new workflow, the process incorporates a host of new functionality to further extend Datamine’s core offering of geostatistical tools”:

- Variography – Interpretation: The workflow incorporates a revolutionary approach of analysing the sample variance of the dataset in 3D. This is truly the best way to interpret anisotropy and assists in the selection of the most appropriate plane on which to calculate experimental Variograms
- Variography – Modelling: The tools to model experimental variograms have been completely re-written and now allow the use of dynamic lag adjustment, automatic variogram fitting as well as the modelling of co-variograms
- KNA (Kriging Neighbourhood Analysis): The workflow now incorporates a very simple-to-use tool for kriging neighbourhood analysis which is a technique where you can run a



Datamine's recent webinar marked the official release of the much anticipated Studio RM module, Advanced Geostatistics

series of tests against your dataset to determine the optimal parameters for use in estimation, such as the size of the search ellipse, numbers of samples to use as well as optimising for the most appropriate block size.

- **Estimation – Multivariate Estimation:** The new estimation engine caters for the use of cokriging. This technique is extremely useful for estimating variables which are poorly sampled by using their co-relation with another well sampled variable. "This allows you to produce meaningful estimates of your full range of variables despite inconsistencies in sample data."

- **Estimation – Light-speed mode:** The new estimation engine is multi-threaded, meaning that estimates are produced far more rapidly than before. In tests that Datamine have run on a 1GB model, the speed increases in the new engine were clocked at over 100 times faster.

Separately to the Advanced Estimation workflow, the Advanced Geostatistics module now also incorporates the Uniform Conditioning functionality. This was previously available as a separate module but now comes as standard in the new unified module.

From discussions with customers about emerging requirements, Datamine says it also recognises a need for a seamless transition between long term planning and short term operational requirements such as grade control, drill and blast and ultra-short term scheduling. "Traditionally these requirements have been met with manual systems or spreadsheets, but the complexity of modern mines and recent pressures on margins mean that more sophisticated solutions must be implemented to ensure long term value is not destroyed by short term decision-making. As a result, Datamine has

made several investments in both acquisitions and internal research and development in this area in the past two years, with new products for ore control, drill and blast and schedule optimisation seeing strong uptake in the market. Datablast was acquired in November 2016 and provides a robust and comprehensive system to consistently deliver quality blasting outcomes in open pit mines, perfectly complementing the highly successful Aegis drill and blast system for underground operations."

Studio OP now works seamlessly with a CPLEX-based solution for multiple-objective short term scheduling problems, and a new automated pit design solution will be released in early 2017. Ore Controller is now installed at over 25 mine sites and can deliver upwards of \$20 million per annum to the bottom line through reduced ore loss and dilution. Datamine says it also continues its focus on transparency, data sharing and high performance computing via its Summit cloud platform. "This solution now delivers data storage, processing, analysis and reporting on all browsers and device types as a result of an update to HTML5. Processing-intensive tasks can be hosted and performed on the cloud, with increasing connectivity to the Datamine desktop products, allowing users to work seamlessly across platforms and utilise the most appropriate computing power for the task at hand."

For underground planners, MSO v3 for automated stope design was released in late 2016, the first commercial delivery of the most recent AMIRA collaborative research outcomes. Throughout 2017 various releases of updated underground design and scheduling products are planned, starting with a major upgrade to EPS due for release in February.

The company says a number of customers around the world have made substantial roll-outs of Datamine products in recent months including a mid-tier gold and silver producer in the S&P500 that has standardised on the Fusion exploration database technology, delivering field data from

across the Americas to a central corporate database instantly with in-built governance, quality assurance and reporting. A top-tier diversified global mining company purchased the Aegis drill and blast system for underground mines in Africa, Central Asia and Australia. The automation features in Aegis allow engineers to design underground blast layouts, charging and initiation timing in under half the time taken with other packages. A leading Russian gold producer and a large Latin American silver producer implemented Datamine's geology and mine planning solutions at new mines entering production. "In both cases the adoption of the existing standard within the group made the training and implementation phase rapid and cost-effective, with all data outputs easily compared across operations." Finally, an emerging metals producer establishing a new mine has implemented the full suite of Datamine's geology and mine planning products, enabling a seamless flow of information across departments and from strategic through to short term operational planning horizons.

Deswik addresses planning and tracking

Deswik most recently announced the launch of Deswik.OPS, its new operational shift planning and tracking tool. Directly integrating with a variety of systems that maintain longer term schedules, planned KPIs and production data, "this new tool is set to revolutionise the way mines manage their daily operations."

Deswik.OPS enables production planners to rapidly create detailed, activity-based shift plans directly from the less detailed shorter-term schedules. Longer term schedules can also be imported to ensure the shift schedule remains on track with the organisation's longer term goals.

"Throughout a shift, users can import from third-party systems or manually capture real-time production data and events, mapping them to the activities and resources. By providing a live view of how the shift plan is progressing, the work can be better managed, resulting in higher productivity. In order to deal with the continual change in an operational environment, dynamic updates to the shift schedule are also possible."

Designed to meet the daily requirements of short-term engineers, production engineers, shift bosses, control room personnel and site superintendents, this new web-based tool "will provide a centralised, collaborative interface and have everyone working towards common goals."

Deswik.OPS has been implemented at two beta sites, one in Northern Europe and another in Western Australia. Deswik engineers have been working closely with the clients to ensure that the system was not only set up to meet their specific requirements, but also tested extensively



Deswik most recently announced the launch of Deswik.OPS, its new operational shift planning and tracking tool

in an operational environment.

“With the increased focus on productivity and efficiency improvements in mining operations, Deswik.OPS offers a solution that enable mines to move away from spreadsheet-based shift planning and take advantage of integrating the various systems that capture data on a mine. Deswik.OPS can turn that data into information that can be used to effectively manage the complex activities and interactions occurring in a shift.” explained Adam White, Deswik Technical Director

ThreeDify’s year of optimisation

Following 2015, what it calls its year of integration, 2016 has been the year of optimisation for the ThreeDify product line. The company told *IM* it has been focusing on broadening the scope and strengthening the robustness of its optimisation tools while continuing to expand its product portfolio. “As the reserve in an open pit gets depleted, many medium to large open pit mines face challenges in determining the best cut-over point from open pit to underground mining for projects that have the potential to be mined by a combined method of open-pit and underground mining. The year 2016 witnessed the introduction of Optimizer, a new, unique open pit to underground transition module that determines the optimal transition zone from open pit to underground mining with the objective of maximising total NPV of the entire mine.” Optimizer is built upon two of ThreeDify’s mature optimisers: FlowPit for pit optimisation, and Stopemizer for stope and block caving optimisation. Combined with iScheduler for development and production scheduling, ThreeDify says Optimizer offers the following benefits to mine planners:

- Defines the optimum transition zone from open pit to underground mining, eliminating the needs for a trial and error process and thus greatly improving productivity

- Maximises NPV (or other variable) by defining the best overall option considering infrastructure development and mine preparation with the aim of ensuring plant feed (ramping up, stockpiling, etc) within one integrated software package, GeoMine.
- Fast integrated design and scheduling of both open-pit and underground mines with resource constraints
- Supports different mining methods including all stopping methods as well as the block caving method (support for longwall and sublevel caving is underway)

ThreeDify OptimCut, a former standalone product, is being integrated directly into iScheduler. OptimCut is a Constrained Dynamic Programming package which optimises cut-off grades and production rates over the whole life of mine. This integration will allow the power of OptimCut to be leveraged by iScheduler’s long term mine schedules for both open-pit and underground mining.

The company says that it has also achieved a significant speed-up for ThreeDify’s implementation of the RBF (Radial Basis Function) algorithm, the engine that underpins GeoModeler’s implicit modelling module. With a big data set, “What used to take hours now takes minutes. With this speed-up, geologists can now

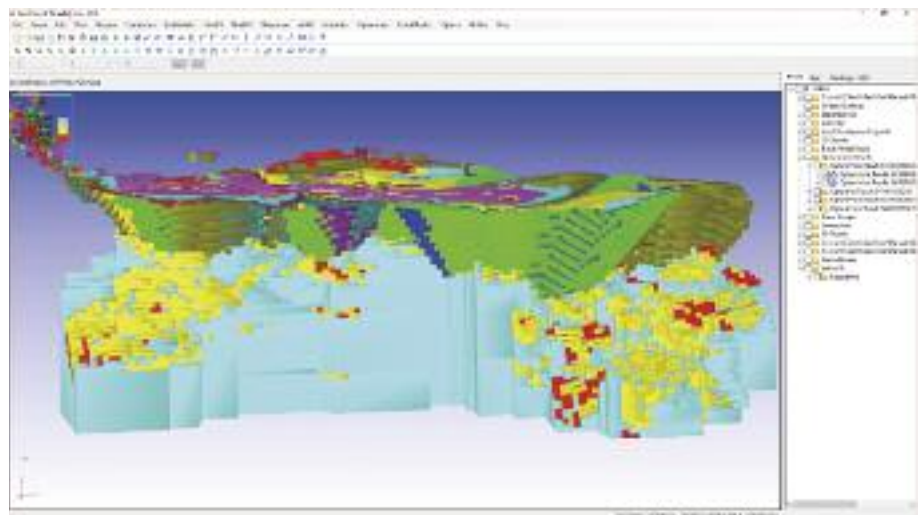
automatically compute dynamic anisotropy surfaces from a big block model quickly and easily, affording the time to conduct what-if scenarios with dynamic anisotropic interpolation within GeoMine.”

ThreeDify further enhanced its XLCoreBlock, a Microsoft Excel Add-in 3D drill hole visualiser and simplified resource estimator, with the sped-up RBF-based implicit modelling module. Furthermore, besides the support for assays and lithology, the Company has overhauled XLCoreBlock to allow the user to import, composite and interpolate both continuous and categorical attributes directly from their Excel worksheet(s). This opens the door for visualising and modelling non-assay data types directly within the user’s familiar Excel interface.

ThreeDify has also announced the bundling of GeoMine with the already mentioned Aegis, the underground drill & blast design and analysis software developed by iRing Inc. Aegis is a powerful drilling and blasting design tool that is capable of creating drill and blast patterns for an entire stope in seconds, and optimising ring patterns to maximise profit. ThreeDify says: “With the addition of Aegis, the GeoMine solution is now a one stop shop for all your mine planning needs. Whether you are a resource geologist facing orebody modelling challenges for your big deposit or a mine planning engineer looking for fast and robust optimisation, design and scheduling tools, ThreeDify GeoMine is an ideal solution.”

MineRP reinvents the planning cycle

MineRP is headquartered in South Africa with offices in Canada, Chile and Australia. MineRP the system is a spatially dimensioned ERP equivalent framework that integrates and aligns Mining Technical Systems (MTS) and ERP domains and the company says “delivers unrivalled capabilities to manage mineral assets, do rapid unified business planning, and



ThreeDify GeoMine optimal open pit to block caving transition example

orchestrate operational execution.”

John Megannon, Executive VP for Strategy at MineRP, explains: “The Mining Technical Systems Industry has traditionally focused on developing standalone, discrete applications that each serve a specific business need and are complex and expensive to integrate. In stark contrast, MineRP’s Enterprise Framework is based broadly on ERP platforms such as Oracle ERP and SAP, with the caveat that it pertains to mining technical systems (think geology, mine planning & scheduling, survey etc.) integrated to ERP systems through an elegant framework of Extensible Mediation Platforms, modelled on a typical Enterprise Mediation Bus. The closest analogy to MineRP’s approach is that of an ERP system, but one where the client has the option to retain their external original planning and geo-scientific systems as ‘modules’ to the Spatial ERP. MineRP integrates with and amalgamates data from current MTS systems in use on mines, unifying all mining technical data within the MineRP Spatial Database. Integration is bi-directional - meaning spatial data can be published from the MineRP Enterprise Framework back to the source systems for discipline-specific work to be done.”

Whether for green or brown fields operations, mine planning across any time horizon is time consuming and laborious. This means mines are typically able to create and assess only one mine plan per annual planning cycle, and shorter term planning is mostly a non-iterative process. Manually drawing CAD mine designs to be sequenced and scheduled is the major bottleneck, and the handover between design and financial costing and budgeting can be ‘spreadsheet hell’, says Megannon. “Over the past two years, MineRP has invested heavily in R&D to transform mining planning from traditional silo-based planning to modern, Parametric (Parameter Driven) Unified Business Planning. We will announce the release of MineRP Planner 2017 in January 2017, formally replacing our popular Mine2-4D, MineCAD and CADSmine products over time.” MineRP Planner is a framework based mine planning solution and promises several paradigm-shifting capabilities:

- Rapid Mine Planning: Parametric Mine Planning enables complete mine planning from detailed design to sequence and schedule, fully constrained to the latest geology and as-builts in as little as 15 minutes
- Team Collaboration and Version Management for local or global teams means regional and head office mining and financial executives can collaborate interactively on project and operational planning alike using the MineRP Framework’s integrated workflow capabilities
- The centralised spatial database hosted

locally or in the cloud contains all standards and rules required to enable standardised planning processes and standards effectively. Moreover, design and scheduling information is readily accessible in standardised formats for integration with other systems in the enterprise

- Web-based 3D Visualisation and Analysis of all plans, including animation, comparison of plan versions and 3D visualization of any MTS data against the plan, geological models etc is supported out of the box

According to Empie Strydom, VP Marketing at MineRP, another major new development in MineRP’s unified business planning solutions includes native integration between Mine Planning and Business Planning (ERP financial enumeration of mine plans). MineRP and global ERP provider SAP have joined forces in a SAP Co-Innovation Laboratory program to deliver results in 2017, based on MineRP’s patented GeoFinance concept. With MineRP Planner and MineRP GeoFinance mine plans are persisted as detailed financial and operational plans through SAP IBP (Integrated Business Planning) into SAP BPC (Business Planning & Consolidation). MineRP and SAP have already engaged the first global mining house to implement this solution in the first half of 2017, and are looking to deploy the solution to mines spanning various regions, minerals and mining methods.

“This dramatic new development natively integrates the technical and financial domains for bi-directional planning and optimisation. The approach delivers true optimization from the order book through geology – ie order book to pit to port including all material flow and logistics, in a rapid response to varying economic, price, environmental, and other external conditions or operational events that may arise unexpectedly. With MineRP Planner and MineRP GeoFinance, mines are able to create comprehensive business planning alternatives persisted into the SAP financial management modules, executable as works orders with concomitant bills of material at lightning speeds. While at first blush it may seem like the improvements to mine planning claimed by MineRP Planner merely enable mines to do more of the same things, just quicker, MineRP claims are significant benefits that can be achieved by doing unified resource planning:

- The mine planning process becomes a real-time, iterative, business-case driven business process involving technical, financial and other disciplines. This means that for the first time ever, it is now possible for mines to be agile, responsive organizations able to immediately adjust production plans whenever material changes in market conditions or production capabilities occur
- Being able to rapidly generate planning

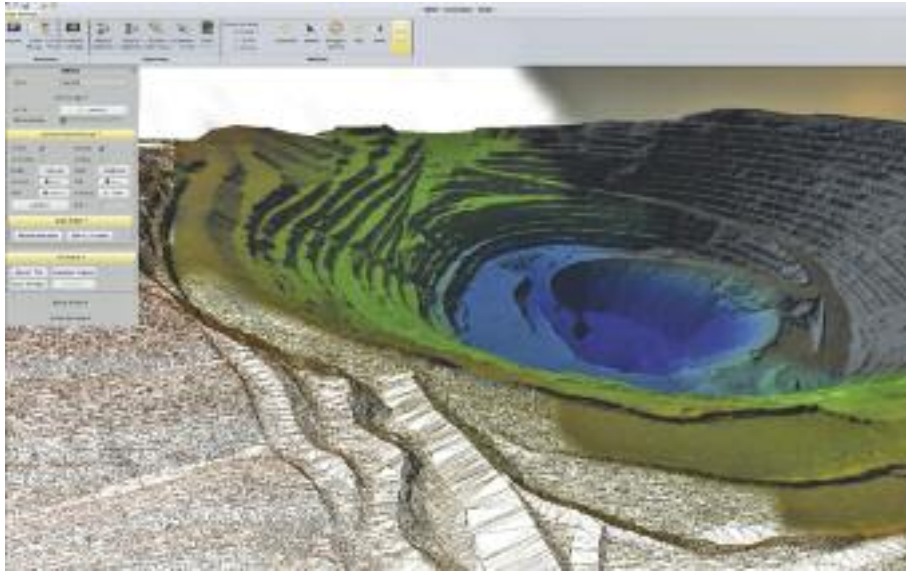
alternatives does not only affect productivity on individual operations, but also gives multi-asset organisations the capability to simulate capital distribution strategies, the effect of cost-curtailement programmes and other strategic initiatives across entire portfolios or segments thereof

- Moreover, the direct, granularly aligned integration of actual mining and production activities with SAP work breakdown structures and costs codes implies previously unheard of capabilities to do enterprise-wide area and activity based cost and revenue management – with the ability to spatially drill down to the smallest production unit and visualise its effectiveness and efficiency in 3D
- Lastly, the capability to rapidly provide parameter driven, auto-generated planning alternatives does not only create the expected benefits of technical excellence and more cost effective processes, but experience has shown that more options more often than not delivers unexpected benefits which manual, traditional planning approaches would never have tabled for testing.

“The next greatest weakness in planning, in our opinion, lies in the lack of integration of the various Operating Technologies (OT/ Industrial IoT) into the planning cycle and paradigm. When combined with MineRP’s Enterprise MTS integration platform, hyper-computing based advanced analytical and cognitive solutions are able to deliver real-time planning responses to actual production realities. MineRP believes mines can be run like real-time factories. The systems and data we need is out there - it is merely a matter of orchestrating it. Currently, the many different mining disciplines with their respective schedules operate in isolation, leaving supervisors to sort out the shortcomings of the lack of integrated environments. MineRP is working with partners such as IBM, SAP and equipment manufacturers like Sandvik to introduce the concept of a single, integrated planning environment utilising a central CAT (Capabilities, Activities and Time) database. With MineRP CAT, resource allocation and availability can be understood instantaneously in a single domain. MineRP and its partners are already engaged in several Digital Orchestration Centre (DOC) projects. These projects firstly utilise MineRP’s Enhanced Production Scheduler (EPS) to bring some of the higher priority schedules together in one application. Combining schedules also lays the foundation for a Master Business Schedule (MBS) and integrated operational control.”

Carlson enhances 3D offerings

Carlson Software through its mining vision says that those seeking to operate mines with



The new 'Supersonic' 3D Viewer for loading surfaces from Carlson Software was developed to give engineers a quick way to view and evaluate designs

increased productivity, advanced materials tracking and enhanced on-site safety, look to the company for its automated mining software. "While providing approximately 90 percent of the US coal industry with powerful mining solutions, Carlson Mining has expanded beyond coal into phosphate, trona, salt, clay, limestone granite, and other markets throughout the world. In the ever-changing world of mine development and reclamation, enhancing mining software is an ongoing process. The Carlson Mining Division has seen through some recent improvements in their products such as expanded 3D abilities within surface equipment timing, added support for underground solids, and significant redesign of the haul truck cycle analysis routines."

In 2016, Carlson added new mining software to the innovative Precision 3D product line, P3D Drill and Blast. Utilising the newest 3D design technology with game-like ease of use, Drill and Blast allows users to quickly layout drill hole patterns on a new, faster, interactive 3D engine with enhanced textures, transparency, lighting, and rotation.

"Drill and Blast allows for quick and easy blast pattern layouts, with real time 3D editing and instant feedback," says Director of the Carlson Mining Division, Grant Wenker. "Criteria such as distance from the highwall face, or comparison of design versus as-drilled hole locations are analysed along the entire length of each hole and color coded warnings indicate if there is a discrepancy."

Carlson has also taken 3D underground with Carlson eXtract, a new software which generates models of mine cavities and tunnels from survey data or point cloud scans. Carlson eXtract generates watertight 3D solids by "shrink-

wrapping" clouds from the outside. By doing so, solids can be created without cleaning the cloud of unnecessary data points of people, vehicles, tripods, pipes, wires or roof bolts. 3D environments such as Precision 3D and eXtract allow users to design, analyse, and receive feedback much faster, which in return, saves time and reduces the chance of errors. "Mines are looking for cost effective, easy-to-use software to cut costs, become more efficient, and to get the job done in a timely manner," says Wenker. "They need software that works together for the entire workflow – from surveying, drone mapping, cavity mapping, photogrammetry, modelling, GNSS machine control to build it, and reclamation to close it."

3D visualisation software has also proven to be very valuable and opportunistic for the mining industry. Drone and UAV technology makes it possible to quickly gather data by analysing large areas with a very high level of detail. Realistic equipment simulators paired with virtual reality headsets allow for an immersive experience in a controlled environment. With such interactive technologies available, 3D design tools are becoming the expectation rather than the perk. Carlson believes it has been the frontrunner in 3D design by developing tools to meet this demand; and will continue to deliver cutting edge mining solutions in the future.

Finally, the new 'Supersonic' 3D Viewer for loading surfaces from Carlson Software was developed "to give engineers a quick way to view and evaluate designs. With the performance breakthrough of the Supersonic Viewer, even the largest models are handled with ease. Users can load up a surface model and within seconds say: hold up, that design TIN is far too steep in this area. Let's rethink that design."

The program's designer, one of Carlson's new, young programmers, says: "3D isn't just for deliverables anymore," noting that future users

are coming out of college with the desire to be able to work within the 3D environment. Carlson says it is working to meet their needs. Feedback from customers tells Carlson that not only is it fun to use, but that it is also fast and easy to use. "It gives a big turbo boost that breaks the sound barrier on viewing large models," says Dave Carlson, VP of Development for Carlson.

Supersonic can work with large and complex datasets, including massive LIDAR scans, even on mobile systems that have very little memory and no dedicated graphics cards. Besides speed, Supersonic has sharp graphics, including detailed backgrounds to choose from and surface textures by slope. **IM**