

# Destination data

**The continual adoption of new software is allowing operators to gauge not only the value of data, but also the accuracy of the hardware used to generate it, Dan Gleeson says**

The confluence of OT and IT appears to be closer than it has ever been, with the introduction of new hardware into the mining space underpinning the need to underwrite this with increased software oversight and the required layer of cybersecurity.

Akin to the requirement to break down silo mentality in the plant and pit, mining operations are realising that any ‘disconnected’ technology they choose now will inhibit their future goals around asset optimisation.

### New Year resolutions

Hexagon’s Mining division, which produces both the sensor technology and the guiding software, is all too aware of this. This is why it has a goal of ensuring there is a seamless connection between the mine plan and its execution, creating a feedback loop that allows for better, quicker and more sustainable decision making.

“Ultimately, this approach will have a positive impact on our customers’ revenue and costs, which, in turn, means we’re also being more sustainable with the resources we use, leaving a smaller footprint,” Jesse Forgues, Head of Product, MinePlan, told *IM*.

Harnessing the offerings within parent company Hexagon AB, the company is pursuing

this goal through several avenues, including artificial intelligence and machine learning, while leveraging decades of knowledge and experience building and executing mine planning solutions..

Artificial intelligence (AI) and machine learning have been present in mine planning for some time, with the use of mixed linear inter-programming aiding in the mine planning process for over a decade, according to Forgues.

He sees these tools continuing to gain in popularity – especially for optimisation work in the long-term planning space – in line with an increasing number of potential use cases to augment the mine planning engineer with better decision-making capability.

A recent use case for AI in mining came from the company’s Blast Movement Intelligence (BMI) solution.

Launched last year in partnership with Augment Technologies, Hexagon BMI is billed as boosting blasting efficiency and providing high visibility into ore dilution for informed ore and waste delineation, post-blast. This leads to the safe production of an accurate block model of the muckpile and, ultimately, an uplift in yield, the company claims.

BMI’s powerful abilities come via the integration of an AI-based physics model that

*Next Gen SHOTPlus’ capabilities are a representative example of Orica’s advances in developing spatiotemporal digital twins to manage “material, four-dimensionally through time and space”, Matthew Craft says*

allows engineers to accurately predict the movement of post-blast material in 3D, producing what the company terms as the “post-blast muckpile”. Such an asset provides the needed resolution to the grade control geologists around the ore and waste movements within the blast itself and gives rise to better decision making on ore and waste boundaries, ultimately increasing the resource that can be recovered, Forgues says.

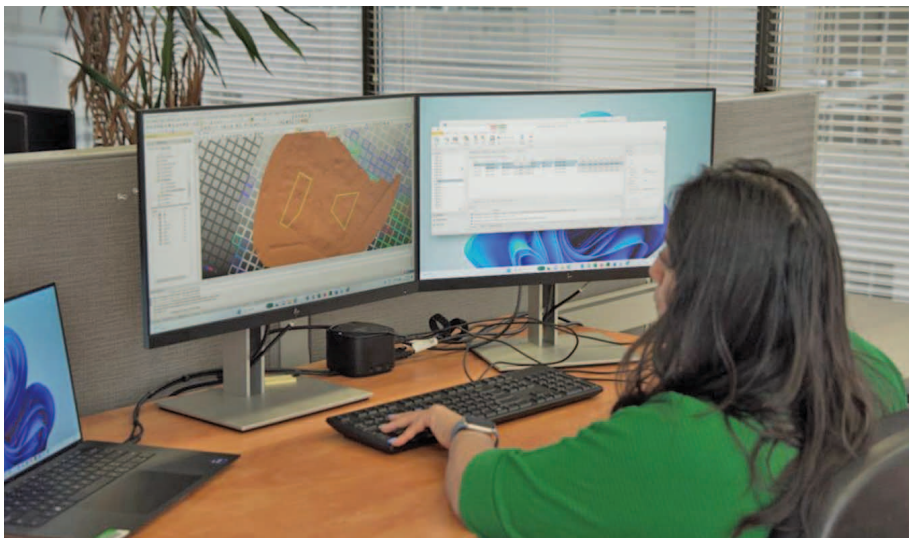
This same AI model and its outputs have been integrated into the mine planning suite, completing an end-to-end workflow that benefits grade control geologists, according to Hexagon.

“This not only gives them (geologists) better resolution and data for decision making, but, by embedding it into the workflow, we’ve drastically reduced decision-making times from hours to minutes,” Forgues says. “This ensures that the right information reaches the right people at the right time, allowing for faster and more accurate decisions.”

Hexagon has been looking at bringing digital and physical data together for decades, says Forgues.

“As our resolution of that digital environment becomes greater and greater, we will see more use cases and applications across mining,” he said.

This is where Hexagon’s reputation for



*Launched last year in partnership with Augment Technologies, Hexagon BMI is billed as boosting blasting efficiency and providing high visibility into ore dilution for informed ore and waste delineation, post-blast*

providing digital twins could be scaled to its mining clients.

“[This could] bring together our operational data and our planning data to allow our customers to make more informed decisions, to have better visibility of their risk and ultimately lead to a more sustainable and efficient mining operation,” Forgues said.

Hexagon is progressively facilitating the move towards more sustainable and efficient mining operations, with the 2024 Release 1 for Hexagon MinePlan a case in point.

This solution, which provides geologists and engineers with powerful 3D modelling and data visualisation, now allows for the modelling of battery-electric vehicles, including the requirement for “negative generation” due to downhill momentum, Forgues explained.

The feature isn’t limited to just battery-electric vehicles; it also allows other types of energy modelling/consumption within operations to be monitored.

“This is something we’ve historically excelled at with fuel (diesel), which has been the predominant energy source for moving equipment in the past,” Forgues explained. “Our integrated haulage package, alongside our schedule optimiser and activity scheduler products, has made this possible with the same strategic goal of reducing energy consumption, which equals cost.”

One would expect this type of modelling optionality to be integrated with Autonomous Haulage Systems (AHS) in the future, allowing for trade-off studies that can help companies evaluate the benefits of different mine models and the setup of their operations in tandem with their fleet energy plans.

### **An off-the-shelf first**

The drill and blast process has also been identified by **Orica** as an area ripe for advancements, with the recent launch of Next Gen SHOTPlus™ looking to equip drill and blast professionals with the tools they need to quantify the impact of engineering decisions on both drill and blast and associated downstream impacts in near real time.

Powered by the Orica Digital Solutions platform, Next Gen SHOTPlus unlocks the power of the Model Through Time: a cloud-hosted, spatiotemporal, digital replica. This effectively represents a customer’s digital mine through space and time, providing a dynamic, data-driven replica of their mining operations to enable real-time tracking and storage of spatial data for enhanced and collaborative blast design and modelling, Orica says.

Matthew Craft, Senior Manager Technology – Software Products and Development, Orica Digital Solutions, says Next Gen SHOTPlus’ capabilities are a representative example of the company’s advances in developing spatiotemporal digital twins to manage “material, four-dimensionally through time and space”.

He explained: “A spatial twin managing material characteristics, densities and attributes simultaneously (such as the Model Through Time) requires significant data management not seen in an off-the-shelf product in our market before.”

Designed as a hub and spoke data management application that provides blast design control as a focal point, Next Gen SHOTPlus integrates with Orica products, such as Advanced Vibration Management, OREPro™, the Orica Digital Solutions Platform physics movement model and more.

“This is in addition to open integration with geology, mine planning and fleet management providers,” Craft said.

Even with “mature digital twin products” such

as IES (Integrated Extraction Simulator) in its offering, Orica sees a future where more proprietary digital twins such as the Model Through Time are developed to enhance other products, with Craft naming BlastIQ™ Underground and OREPro specifically.

At the same time, Orica Digital Solutions has been integrating new hardware into its offering via the recent acquisition of Terra Insights.

Terra Insights is now an integrated part of Orica Digital Solutions, under the product category Geosolutions. It includes RST Instruments, which supplies geotechnical, structural and geospatial monitoring solutions including inclinometers and piezometers; Measurand, which covers geotechnical deformation monitoring with its ShapeArray inclinometers; 3vGeomatics, which uses InSAR (radar) to monitor subsidence and geohazards; Syscom Instruments, which covers vibration and seismic monitoring using vibration monitors; and NavStar Geomatics, which supplies vibration and seismic monitoring using GPS/GNSS.

Orica Digital Solutions Geosolutions are widely used in mining, particularly for tailings dam monitoring and slope stability monitoring.

Craft says the addition allows the company to further connect the upstream and downstream parts of the mining process.

“As a blasting company, we are responsible for disrupting the orebody’s structural and geotechnical integrity and, now, with these technologies complementing our Orebody Intelligence acquisition, we can manage both ends of the value chain spectrum,” he said.

Synergetic product development has already begun, with basic prototypes entering customer operations to leverage complementing products, according to Craft.

“As momentum gains, the value these development opportunities provide will continue for our customers,” he added. “This includes data from RST Instruments, Measurand, 3vGeomatics, Syscom Instruments and NavStar sensors, as well as GroundProbe’s radar information, which adds another unique layer of insight to an ever-growing database.”

More broadly, Craft sees Orica’s ongoing ability to develop leading hardware solutions as a defining factor in refining its software developments.

“We do see our hardware footprint as a strength because a software solution or digital twin is only as good as the data ingested,” he said. “Even though instrumentation exists in key areas of interest, we see opportunities in capturing, organising and using the data better. We can make hardware more valuable by improving data acquisition time, short interval controls and the right data supplementation to provide the correct macro workflows and

insights.

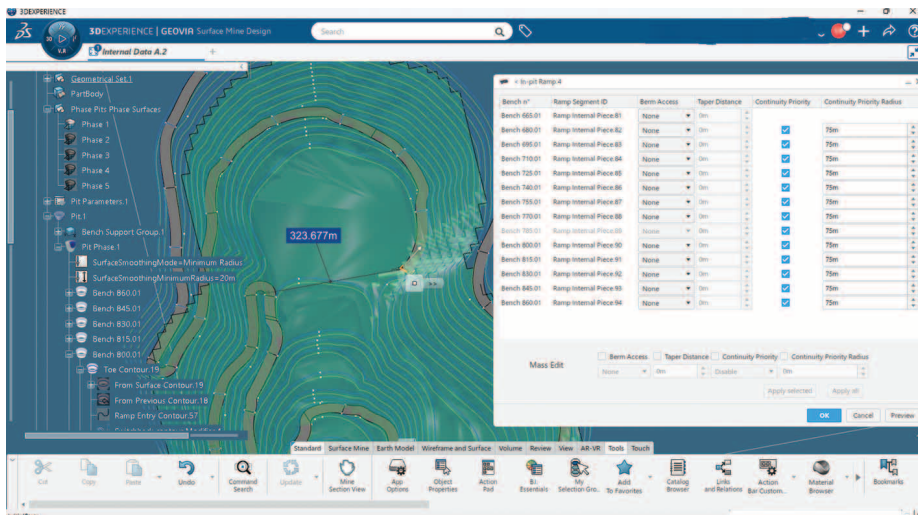
“Specifically, we see improvements arriving for underground with better connectivity to charging units, a better understanding of borehole deviation and overall improvement in our understanding of blasted inventory material movement, which does not have many reliable advanced solutions outside of those offered by FMS providers.”

**A unified digital environment**

Glenn Barlow, GEOVIA Industry Process Expert Director at **Dassault Systèmes**, says ‘virtual twins’ within the 3DEXPERIENCE ecosystem are helping mining companies effectively collaborate internally and externally to progress mining developments and asset optimisations.

The Dassault Systèmes’ 3DEXPERIENCE platform integrates and automates mining processes, dismantles silos and enables executives to focus on higher-value areas and optimised geotechnical, economic, productivity and ESG parameters. The optimisation ensures positive cash flow or net present value while adhering to sustainability and compliance goals, the company says.

“Our clients rely on virtual twins to simulate and optimise mine designs, assess feasibility and streamline operations,” he told **IM**. “Engineering and design firms use the platform to create detailed and robust designs for mining



*Dassault Systèmes’ life of mine planning tools provide pit optimisation, phase generation, schedule optimisation and parametric mine designs which allow for instant updates and changes to be incorporated*



infrastructure, from pit layouts to processing plants.”

This allows them to test various scenarios to ensure their designs meet operational and

environmental goals.

“Construction partners, meanwhile, benefit from the integrated project management tools, which allow them to plan and execute

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infrastructure development and expansions efficiently,” he said of 3DEXPERIENCE platform’s capabilities.

Technology providers and consultants, meanwhile, leverage the platform to integrate data and perform scenario analyses, enabling them to offer specialised solutions and actionable recommendations to their clients.

On the environmental side, regulatory stakeholders and community representatives use virtual twins to visualise and assess potential environmental impacts. “This capability is invaluable for ensuring compliance with regulatory standards and facilitating meaningful engagement with local communities,” Barlow says.

He added: “The beauty of the 3DEXPERIENCE platform lies in its ability to connect all these stakeholders in a unified digital environment.”

A platform such as 3DEXPERIENCE which supports the retention of knowledge through revisions, issue management and requirement management means mining companies can see a history of how they arrived at a given decision to change the estimation parameters for a resource model or the equipment requirements for pit optimisation, according to Barlow. It means this specific domain knowledge becomes instead part of the company library of knowledge.

“However, managing the ‘why’ and the ‘how’ of mining project data is only one aspect of how the

3DEXPERIENCE platform assists our mining clients,” he said. “They also utilise our geological modelling tools to analyse their drilling data and process it into advanced implicit geological models and resource models.”

And, in engineering departments, the company’s life of mine planning tools provide pit optimisation, phase generation, schedule optimisation and parametric mine designs, which allow for instant updates and changes to be incorporated.

“By bringing together solutions to manage requirements, tasks, sign-off, modelling, optimisation, design and monitoring in one platform, we are able to transform our mining clients’ operations in a similar way to how we have transformed client operations in other industries,” he said.

Dassault Systèmes serves several different industries across a wide number of disciplines, which has allowed it to present cutting-edge technology from other industries to the mining sector, according to Barlow. An example of this is the adoption of generative design where it runs large numbers of simulations to generate design options, which may not have been considered if generated manually.

“We will also be deploying more advanced AI solutions within the 3DEXPERIENCE platform, such as the ability to ask questions through our SWYM application which will then return

technical answers from our user assistance pages and user communities,” Barlow says. “This makes it even easier to find the best resources and information from the stored company knowledge that is built up within the platform.”

Barlow sees several parallels with other industries in Dassault Systèmes’ client base, such as civil construction and infrastructure. These industries, like mining, operate in complex, capital-intensive environments and face challenges requiring innovation, efficiency and sustainability.

“These industries have successfully adopted virtual twin technology and simulation tools to optimise operations and improve efficiency,” he said. “Using geospatial applications to spatially index their data, expose it within the context of regional and even continental geographic information system data and share these views in 3D with all stakeholders is valuable for any clients that work over large expanses of land.

“Similarly, mining can learn much from the way these other industries simulate site conditions, predict outcomes and test innovations without disrupting operations, which allows them to minimise risks and costs.”

There are sustainability initiatives in energy to reflect on too, with this sector having embraced data-driven decision making and predictive analytics to optimise resource usage and reduce environmental impacts. “Mining companies can



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apply these practices to manage their ecological footprint while maintaining productivity,” Barlow said.

There is also potential to incorporate advances from outside of the Dassault Systèmes’ sphere, with the 3DEXPERIENCE platform available to be customised and to integrate solutions from other technology providers.

“I think we will see over the coming years a number of new entrants into the mining software segment; these new providers will focus on niche technology looking to provide solutions to single areas of the mining value chain,” he said. “We welcome these new entrants as they will push forward innovation in their areas of expertise, but we feel that you can only truly transform the mining industry by focusing not only on the single workflow or silo but instead on the total business process.

“The value of software platforms and virtual twins is not just in making the work of a single user more efficient or productive but instead in being able to re-engineer the whole process, making improvements in each step.”

### Maptek Compute Framework expands

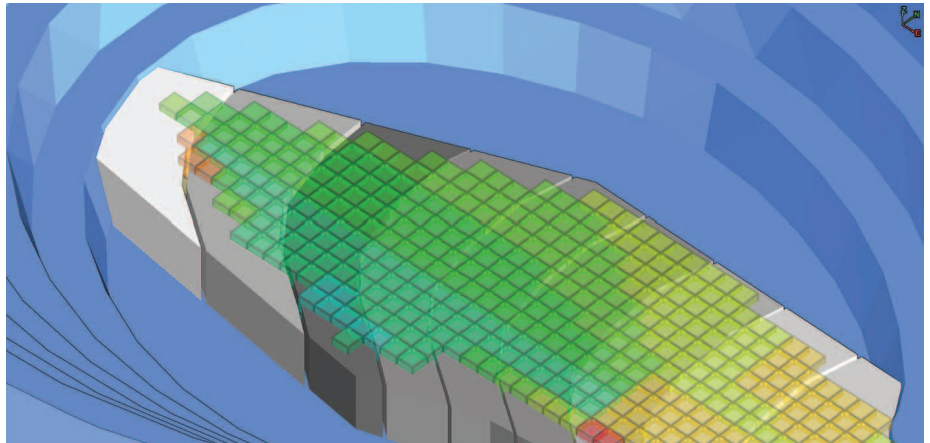
Maptek says its most recent launch for the blasting design space was a targeted response to industry observations that the engineering-intensive load in this segment of the market was being magnified by a shrinking engineering workforce.

Eduardo Coloma, Maptek CEO, explained: “Blast engineers reported they had little or no time to evaluate how different blast design parameters would impact the outcome of their next blast. It also took too long to create a single design using standard parameters, with traditional CAD tools perceived as too fiddly and slow.”

BlastMCF, being launched this quarter, confronts this by offering an automated blast design solution for surface operations, generating scenarios that consider competing objectives while engineers retain fine control, according to the company.

BlastMCF uses the Maptek Compute Framework (MCF), which is built on the premise that any complex process can be solved in a way that minimises intensive human interaction. Being able to leverage MCF’s cloud computational power for rapid, on-demand results within BlastMCF is a game changer for drill and blast engineers, allowing them to efficiently generate optimal designs, Maptek says. The same framework is already deployed for geological modelling in Maptek DomainMCF.

“BlastMCF simplifies design through a repeatable workflow, with common parameters built-in for generating practical outcomes in minutes,” Coloma says. “Confidence in the



process is fostered through the ability to consider competing blast objectives, readily trade-off and choose the best design parameters while retaining fine control over editing. Setups are saved centrally to be used again or adapted and referenced alongside the resulting designs.”

Another recent addition to the Maptek portfolio is the Maptek Vestrex ecosystem for automation and orchestration.

On the back of successful demonstrations at *MINExpo* in September, Maptek announced last year that Vestrex would be open for early access to customers.

Vestrex creates value by making connections between diverse data sources without constraints of product, application, process or format, Maptek says. Data in the cloud encourages stakeholders across mining roles, teams and organisations to collaborate and explore new use cases for their technical data beyond traditional applications.

In the Vestrex ecosystem, automation streamlines operations through real-time data and process integration and accelerates decision making processes, while orchestration builds on computational power and automated workflows to unlock value from technical data and mining systems.

Coloma told *IM* that Vestrex was anchored by three pillars – Data Systems, Computing Framework and Process Orchestration – with customers able to combine any or all of the services alongside Maptek software or third-party tools.

One of the scenarios Maptek Vestrex is helping with involves incorporating measurement while drilling (MWD) data into the customer void modelling process.

In this process, data from various sources, including MWD, is imported into the Maptek Data System and invokes transformation into a format that can be ingested by Maptek DomainMCF for modelling. The DomainMCF model is then converted into a customer-defined format, such as GeoTIFF, with the subsequent files sent to the “customer data lake”. The GeoTIFF files are automatically converted into polygons and

*Maptek Epoch Dynamic Solids will bring users closer to their model data and reduce data movement between applications, Eduardo Coloma says*

pushed into Maptek Vulcan as design file layers or into Maptek GeologyCore for incorporation in the void modelling process. “All of the steps are automated, with no manual intervention required once the specifications are set up,” Coloma says.

This process incorporates data from desktop applications, drill hole data in a third-party application and existing models.

“Simulations can be run in the MCF, with multiple block models feeding into the data system,” Coloma said. “Geologists can be alerted by the Maptek Orchestration Environment to review models and publish to downstream processes for additional automations such as reserving or grade control.”

The ability to automatically run processes in response to new data and events, and invoke multiple business processes simultaneously on shared input data, will revolutionise mining operations, according to Coloma.

These are not the only planned enhancements to the Maptek ecosystem, with two significant mine planning updates involving Vulcan – its 3D geological modelling and mine design software – and Evolution Epoch, a dedicated short-term planning tool for managing multiple mining activities, tasks and equipment, and applying dependencies, in the works.

“In response to customer feedback, we have reimagined the Vulcan process of creating scheduling solids to make the tool easier to use and the process more consistent,” Coloma said of the former.

The introduction of Mining Solids will require far fewer inputs while delivering improved results, and performance and quality of output, he claims, greatly reducing the overhead to initialise mine schedules for planners.

The major enhancements to Evolution Epoch aim to improve schedule preparation workflow.

“Epoch Dynamic Solids will bring users closer to their model data and reduce data movement between applications,” Coloma says. “The

functionality in Epoch will deliver a new source model type and greater interactivity through user-defined cuts to achieve schedule targets. The improved flexibility and better integration with existing Maptek data types will release time to spend on scheduling and generating outputs.”

**acquire providing the GIM Essentials**

acquire has been focused on geoscientific information management for more than 25 years and is currently expanding its software offering into environmental, social performance and drilling data management solutions that help companies tackle their complex data challenges in these areas.

It reinforced this aim recently with the acquisition of BlackFox, which has a cloud-based drilling management system on its books.

“BlackFox software enables mining companies and drilling companies to effectively manage the collection of quality information at the drill rig and have insights into crucial drilling performance information,” Alison Atkins, acquire CEO, told *IM*. “Whether drilling organisations are collecting data for their customers, or mining and exploration companies are collecting information from drilling companies, both parties can have the right reporting and metrics they need to manage contracts and drilling statistics.”

On top of adding BlackFox to the software contingent, acquire has been looking to offer a



*Upgrades to the acquire GIM Suite that occurred in 2024 focused on extending capabilities further into the web and mobile environment, with enhancements in drill hole logging, workspace management, SQL views and more*

solution for companies not yet ready for an enterprise-level geoscientific information management (GIM) solution like its GIM Suite but do need the fundamentals of good data management to help define its resource.

This is called GIM Essentials.

Atkins explained: “There are many geologists

and geology teams who are having to ‘make do’ with the array of geological data they are collecting with often limited, rudimentary or unreliable tools. When working on a drilling program, they’re under time pressure and stretched thin.”

If there’s no reliable “single source of truth” for their data, trying to validate, access and check data from multiple spreadsheets or locations can waste precious time and money, and block geologists from making faster and confident decisions in the field, Atkins says. The flow-on effect is not having timely access to

the correct data for reporting findings and interpretations back to the market.

“These are all challenges we have witnessed in the mining sector and GIM Essentials is built to tackle them,” she said.

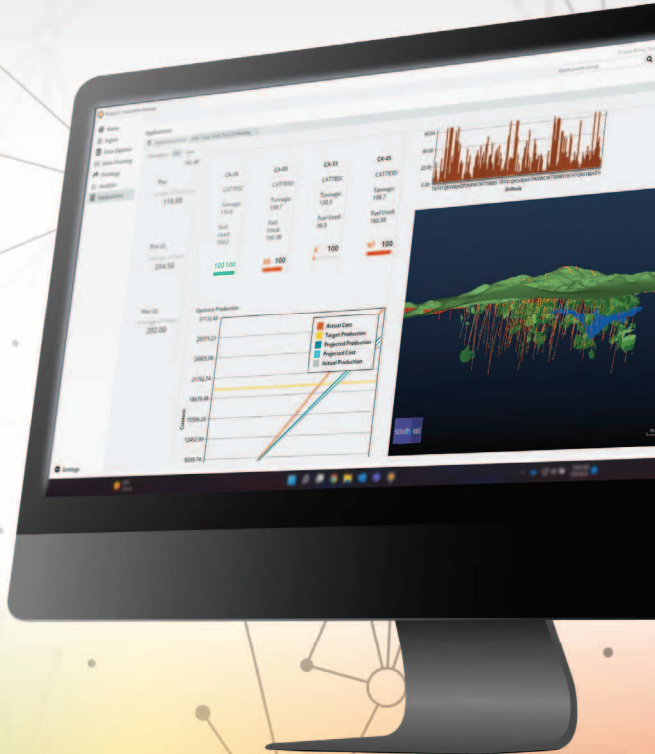
GIM Essentials offers easy, accurate and accessible geological data management, covering the fundamentals and instilling trust in the data’s quality, according to the company. Data validations and rules built into the software ensure geologists are working with quality data

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from the point of collection, through the lifecycle, acQuire claims.

“Companies can get up and running faster with their geological data management, with limited scoping requirements, fast deployment and minimal ownership overheads required with GIM Essentials,” Atkins added.

While the development of GIM Essentials is facilitating straight forward and simple data management for its clients, acQuire is also continuing to evolve GIM Suite.

Last year, the company released GIM Suite REST API to enable other technology organisations to connect with the solution and provide more flexibility to customers with how they want to access the data within the solution as well.

“Connectivity has always been a core focus at acQuire and, over many years, we have fostered long-standing technology partnerships for GIM Suite,” Atkins said. “This ensures the transfer of geoscientific data is seamless, and safeguards data integrity and business rules, between GIM Suite and third-party software used by our customers.”

Outside of the REST API, upgrades to GIM Suite that occurred in 2024 focused on extending capabilities further into the web and mobile environment, with enhancements in drill hole logging, workspace management and more.

acQuire’s environmental data management

solution, EnviroSys, received enhancements to enable users to monitor, assess and report on environmental compliance more efficiently, with improvements made across sample management, data loading and data feeds and field data collection.

Insite, acQuire’s social performance data management solution, also received regular upgrades to continually enhance the user experience when managing social compliance information, the company says.

**Integrated modelling, planning and simulation**

ThreeDify’s GeoMine platform benefitted from new updates in 2024, all of which were designed to generate actionable insights from massive datasets.

ThreeDify GeoMine is a fully integrated, all-in-one platform to process these datasets with speed and accuracy. It offers tools for geological modeling, mine optimisation, design and scheduling, haulage simulation and predictive analytics, according to the company, empowering users to make data-driven decisions to boost operational efficiency.

The GeoMine platform comprises 20 integrated yet independently licensed modules, ensuring that, for instance, geological modelling, mine planning and simulation are linked to enable users to evaluate geological

uncertainties, environmental, social and governance goals or greenhouse gas emission reduction variables.

The company told *IM*: “GeoMine’s integrated approach to technical and economic modelling transforms mining decision making. The platform facilitates scenario analysis and optimisation by integrating geospatial, operational and economic factors. It allows users to evaluate system-level trade-offs between mining efficiency, energy consumption, emissions and financial performance, accelerating the adoption of sustainable mining strategies.”

In terms of decarbonisation initiatives, the company recently started looking at customer feedback around the need for customised configuration files to meet unique mining operation requirements in this area.

GeoMine-DigiSIM addresses this challenge with integrated resource modelling, mine planning and simulation tools that require minimal or no customisation, the company says. Designed to adapt to mines of any type, size, or location, GeoMine-DigiSIM seamlessly interfaces with GeoMine’s geological modelling and mine planning modules, with changes in mine design automatically propagated to the simulation module. This also allows the results to directly inform the planning system for iterative improvements.

“This systematic approach accelerates the



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## Thriving in an AI-driven business world

**Eclipse Mining Technologies** built the SourceOne® Enterprise Knowledge Performance System for mining companies to leverage all their data and transform it into information that can aid all levels of decision makers in all parts of the mining value chain.

SourceOne is differentiated from the rest of the solutions on the market in its ability to work at “every data level”, providing context to this data through the identification of its interrelationships and characteristics, the company says. This helps transform data into actionable information and knowledge used in all domains of the mining industry.

The system underwent a major redevelopment in 2024, with further enhancements in functionality expected in the coming months. Much of this is focused on its Knowledge Graph system, which prepares clean, AI-ready data, all while addressing common data integration issues and providing a strong basis for incorporating AI – both old and new.

**IM** spoke to the company to find out more.

### **IM: What has changed with the EKPS with these adaptations in 2024?**

**Eclipse:** SourceOne’s design focuses on a central Knowledge Graph. We’ve continued to polish this idea to create a system that can handle complex relationships and analytics, not just interconnect data from disparate sources. This starts with storing data in an organised manner, storing not just the data itself but also understanding how the data relates to each other. This organisation forms a domain ontology, an understood ‘structure’ of not only what the data is but other facts that can be logically inferred from that data.

Domain ontologies are formal representations of knowledge within a specific field or industry. They define concepts, categories and relationships between entities in a structured manner. For AI implementations, domain ontologies provide a crucial element: context that helps machines understand and interpret data more effectively. There are many benefits to incorporating domain ontologies, including improved data interpretation, which allows AI systems to understand industry-specific terminology and concepts, and enhanced data integration, as ontologies provide a common language for merging data from diverse sources. And better reasoning capabilities where AI can make more accurate inferences based on domain-specific relationships.

A Knowledge Graph structure providing context to data makes it much easier for humans and computers to do further work and analysis.

Similarly, Knowledge Graphs are interconnected networks of entities, their attributes and the relationships between them. They provide a powerful way to represent and query complex, interconnected data. In the context of AI implementation, knowledge graphs offer several advantages, including contextual understanding, as they capture the intricate relationships between different data points, flexible querying, where complex ‘questions’ can be answered by traversing the graph, and improved machine learning, as knowledge graphs can enhance the performance of AI models by providing structured background knowledge.

With the Knowledge Graph in place, Eclipse is building more tools



*SourceOne is differentiated from the rest of the solutions on the market in its ability to work at “every data level”, providing context to this data through the identification of its interrelationships and characteristics, Eclipse says*

around it to maximise its value.

### **IM: Why did you need to incorporate these changes?**

**Eclipse:** Mining companies are increasingly turning to advanced technologies like ontologies and Knowledge Graphs to streamline operations, enhance decision making and drive innovation. They have already invested time and energy in documenting business goals and processes but have not integrated this with their operational, AI, or analytical systems. By including it, AI systems can have a much clearer understanding of the broader implications of their decisions and generate more relevant answers.

While traditional data management focuses on storing and organising data, advanced knowledge systems go further by adding context, relationships and domain-specific understanding to the data. Advanced knowledge systems significantly boost the capabilities of predictive analytics by identifying hidden patterns through the representation of data in a more contextual and interconnected manner, which can help uncover non-obvious relationships. They also help improve feature engineering, where domain ontologies can guide the selection and definition of relevant features for predictive models. The structured nature of Knowledge Graphs makes tracing and explaining AI predictions easier.

### **IM: What are the expected results from these changes?**

**Eclipse:** The integration of generative and predictive AI, empowered by SourceOne EKPS, presents a transformative opportunity for companies across different domains. Organisations can unlock the full potential of these technologies by building robust domain ontologies, comprehensive Knowledge Graphs and AI-ready data infrastructure. The journey towards AI adoption may be complex, but the rewards – improved performance, innovation and competitive advantage – make it an essential undertaking for forward-thinking companies. As the AI landscape evolves, those investing in strong knowledge foundations will be best positioned to adapt and thrive in an increasingly AI-driven business world.

circular analysis of mine haulage systems and their impacts on the mining value chain,” ThreeDify says. “It helps advance the industry toward zero waste and higher ESG/GHG emission reduction performance.”

A range of new modules and features were added to GeoMine recently.

GeoMine v6.5 expanded its block model

universe to  $2^{40} \times 2^{40} \times 2^{40}$  (1 trillion x 1 trillion x 1 trillion) blocks, with ThreeDify saying the “astronomical scalability” eliminates concerns with incorrect block model placement and enables the integration and simultaneous optimisation of multiple satellite deposits. “Furthermore, this evolution provides a robust foundation for advanced technologies such as AI

and machine learning, facilitating seamless data analysis and actionable insights for tackling complex mining challenges,” it added.

GeoMine leverages AI and machine learning not as isolated tools but as integral components of its ecosystem, streamlining processes and enabling real-time data analysis, pattern recognition and optimisation across various



mining processes. For example, GeoMine-OreChaser empowers geologists and investors to optimise infill drilling strategies, enhancing resource conversion while maintaining budgetary efficiency, the company claims.

GeoMine-OreController is designed for open-pit grade control, optimising and sequencing truck-by-truck dig-units using 3D blast movement modelling to minimise dilution and ore losses. OreController v2.0 introduces new optimisation options, incorporating measured material displacement data for improved mapping from pre- to post-blast states. Its fine-grained classification (eg 0.5 x 0.5 x 0.5 m) complements sensors on shovels built to determine if an entire shovel payload is ore or waste, further enhancing resource recovery and reducing dilution or ore losses. “Ongoing developments focus on AI and machine learning to better predict and control rock fragmentations and blast movements,” the company added.

The cloud-based ThreeDify GeoBase solution is a 3D drill and blast hole database platform to facilitate logging, visualisation, QA/QC, sharing and versioning of drill and blast holes. GeoBase’s real-time blast hole analytics API, underpinned by a MWD database, enables advanced AI and machine-learning applications, unlocking the potential of real-time data, ThreeDify says.

Last year also saw significant advancements in GeoMine’s capabilities for drill and blast designs with two new modules: GeoMine-QuickRing and GeoMine-QuickPattern. The former introduces a rapid drill and blast ring designer for underground blasting, supporting both automatic and interactive modes; the latter is built for open-pit blast planners to provide rapid blast pattern and pre-split hole design capabilities.

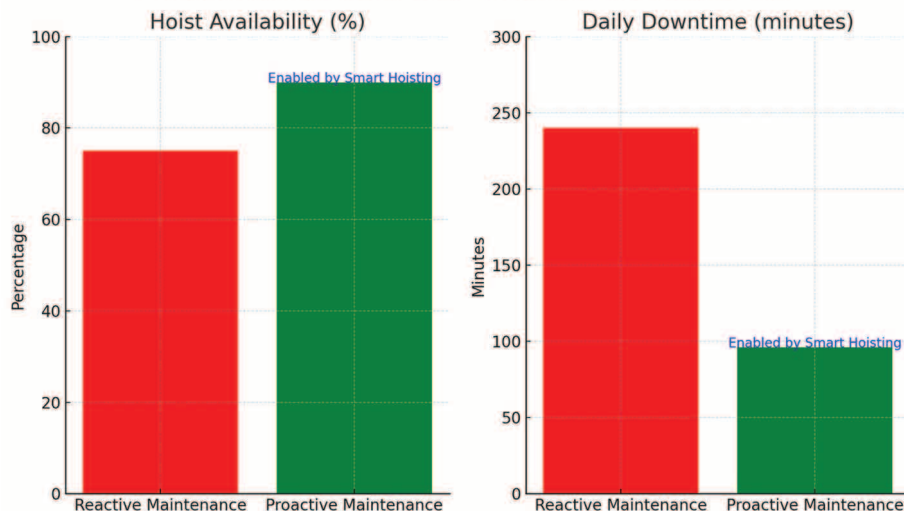
More widely, ThreeDify says it remains committed to refining its core technology and integrating cutting-edge AI and machine-learning capabilities into the GeoMine platform. It says: “These innovations position GeoMine as a leading software solution for mining companies aiming to optimise operations, embrace sustainability and harness the full potential of their data.”

### Tackling underground complexity

It is the release of a new solution for underground mining that has Micromine CEO, Andrew Birch, excited. During the announcement of its 2025 Release late last year, Birch highlighted the upcoming arrival of Micromine Advance, a new mine planning solution.

He explained: “We’re thrilled to expand Micromine’s product ecosystem with Micromine Advance – the first and only dedicated tool designed to model the operational complexity of underground operations.”

**Impact of Maintenance Strategy with Smart Hoisting as Enabler**



This solution has been crafted to help engineers create realistic and detail-driven plans, according to the company. Using modern technology and purpose-built tools, it enables engineers to take a resource-driven approach to scheduling, providing the capability to confidently model intricate underground environments with new precision.

Key features of the solution include the ability to tackle complex problems by breaking everything down to first principles, and then creating dynamic and realistic schedules from there. The company explained: “When your mine plans are built this way, you can be confident in your decisions, knowing you can trace everything back and understand each interaction in your plans.”

Micromine Advance also allows users to handle scenario management free from fragmented project structures and complicated auditing processes, with the solution allowing users to animate these scenarios side-by-side and compare the specifics with real-time reporting, the company says.

More realistic schedules can be built by accounting for inventory constraints that may impede mine production over time. This is achieved through an integrated approach to inventory management that allows users to forecast operational requirements over time.

Micromine Advance has in-built tools to allow users to quickly highlight problem areas and implement solutions before a mine schedule is up and running, saving time and the need for manual work, according to the company. The software also provides new and creative ways to set dependencies and use them to enhance the quality of mine plans.

Design network validation tools automatically audit mine design strings, prompt users when errors are detected and suggest solutions for consideration. “This allows for a much more proactive approach to network validation that

*ABB Ability Smart Hoisting is used as enabler and driver for proactive maintenance strategies, ABB says*

saves time and frustration later in the scheduling process,” Micromine added.

### Software-enabled hoist servicing

ABB is also seeing the benefit of looking to optimise hardware through the insights identified by software, with its most recent developments in hoisting making for a good example.

ABB Ability™ Smart Hoisting is a vital enabler of the World-Class Mine Hoist Maintenance (WCM) standard, seamlessly integrating digital tools to align with best practices for maximising safety, reliability and productivity, ABB says. The WCM standard, built on insights from a benchmark study of leading mining companies across six regions and eight commodities, highlights that over 90% of maintenance activities should be proactive to achieve the highest availability. It also emphasises the importance of predictive maintenance strategies, which can reduce costs and failures by 50% while increasing equipment lifespan by 30%.

The benchmark study identified that customers using more proactive maintenance strategies benefitted from 15% greater hoist availability than those using mainly reactive approaches, while, in the WCM standard, more than 90% of maintenance activities should be scheduled.

Over the course of a year, this might add up to 52,560 minutes of increased uptime, equivalent to 36.5 extra operational days per year.

“By utilising real-time monitoring and predictive algorithms, Smart Hoisting ensures maintenance is proactive and dynamic, aligning with the WCM recommendation and improving hoist availability by up to 15% compared to reactive approaches,” Veselin Donchev, Global Product Manager, Hoisting Service, ABB, says.

The software continuously tracks the condition of hundreds of key hoist elements across electrical, mechanical and automation subsystems, directly supporting the WCM standard's focus on holistic and systematic maintenance to minimise risks.

Donchev added: "The digital platform provides comprehensive analytics and diagnostic reports that help operators prioritise maintenance tasks and avoid catastrophic failures, implementing the predictive maintenance roadmap outlined in the world-class maintenance report."

The insights from Smart Hoisting also directly feed into ABB's customised Care agreements, providing mining companies with a structured pathway to adopt and sustain the world-class maintenance framework.

Donchev concluded: "In essence, ABB Ability Smart Hoisting not only fulfills the requirements of the WCM standard but also enables its practical implementation, empowering mining companies to achieve significant improvements in operational efficiency, safety and cost-effectiveness."

### Principled software development

Datamine's product strategy is guided by its customers and shaped by foundational principles, including Amara's Law, introduced by Roy Amara in the 1970s, and the Adjacent Possible, introduced by Dr Stuart Kauffman in 2002.

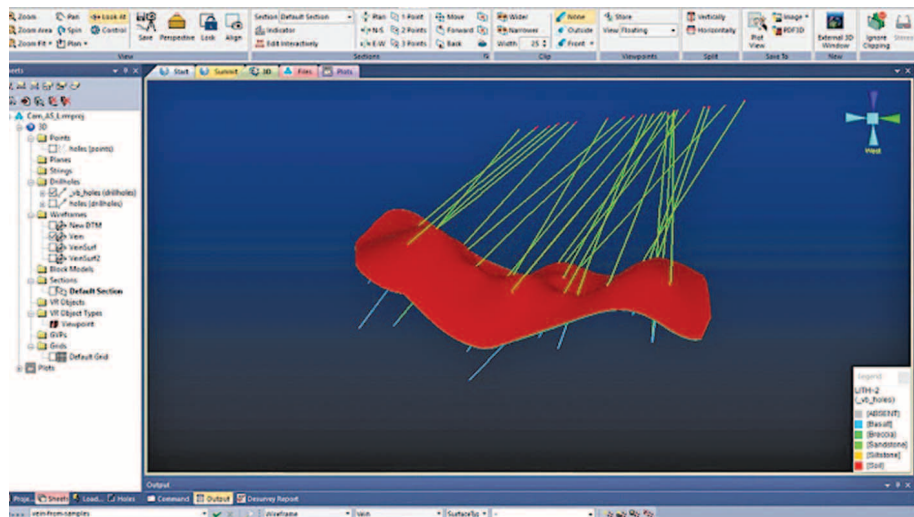
Amara's Law states that we, as a society, tend to overestimate the impact of technology in the short term but underestimate its long-term effects. The Adjacent Possible principle highlights that innovation occurs incrementally, expanding what is achievable based on current technology and knowledge.

Scott Carpenter, Director of Technology, APAC, for Datamine, says a current example of the former is the rapid adoption – and possible overhyping – of generative AI technologies over the short term, and, on the long-term underestimation front, the take-up and expected benefits associated with electric and autonomous vehicles.

In terms of the Adjacent Possible, Carpenter cites the evolution of drone technology. "Initially used for simple aerial photography, drones have now become indispensable tools for real-time data capture of both imagery and 3D data feeding into geological modelling and high-precision mine planning," he said.

Carpenter says the company's modelling solutions are playing an increasingly important role against this backdrop, helping address operational complexity, sustainability pressures and regulatory demands to optimise performance across the entire mining value chain.

He listed some examples.



*Studio RM has been specifically designed to match the workflow of resource and reserve evaluation, Datamine says*

Solutions in this space include Isatis.neo for geostatistical capabilities that integrate machine learning and advanced simulations for recoverable resource modelling. Carpenter added: "Its extensive library of tools, from variography to grade-tonnage curve generation, supports accurate risk analysis and long-term planning."

MineScape provides stratigraphic modelling and geostatistics integration – especially effective for complex stratigraphy like coal seams.

Minemax Scheduler in the strategic mine planning space provides the ability to simultaneously optimise mining, processing and transport constraints. "It supports decision making for cutoff grades, capital expenditure and stockpiling," Carpenter explained, with its visualisation tools allowing users to animate pit development.

Studio RM, also in the Datamine offering, has been specifically designed to match the workflow of resource and reserve evaluation. Inside the software, Studio RM contains algorithms and geostatistical techniques, alongside workflows for building and updating geological models with implicit modelling. "Studio RM delivers auditable, repeatable processes to reliably produce resource and reserve statements," Carpenter says.

The company can also offer up Studio Geo, Datamine's geological modelling software; Supervisor for advanced variography and simulation tools for geologists; Studio Mapper to bridge field data capture and geological modelling; and Sirovision to turn drone-based 3D imagery into structural and geotechnical models.

He concluded: "Together, these specialist solutions providing and supporting modelling reflect Datamine's commitment to empowering

operators to address today's operational needs and evolve and adapt to the future."

### Polymathian furthers BOLT functionality

Polymathian, a Deswik Company, has decided now is the time to enhance its BOLT multi-commodity blending and logistics optimisation software.

This solution helps mining operations mathematically optimise planning and decision making across all stages of the value chain.

The recent enhancements centred around improving workflow, control and usability, are set to further streamline the critical mine-to-market planning process, while maximising margins, it says.

BOLT has, first off, improved data integration options via a more user-friendly API. The upgraded API enables users to push data from their data warehouse to BOLT, and have BOLT send back published plans.

Tao Vink, BOLT's Product Manager, said: "BOLT's new API makes it easy for users to create many scenarios and run what-if analysis. By generating alternative options for mine plans or maintenance profiles, users can explore different 'what-if scenarios' and assess the potential outcomes, to anticipate and mitigate risks more effectively. This level of holistic flexibility empowers users to experiment with different strategies, facilitating innovation and continuous improvement within supply chain operations."

Scenario comparisons, a new feature, allows users to evaluate the impact of different decisions on KPIs, helping identify the most appropriate course of action.

The time taken to create and run scenarios have improved with a substantial reduction in pre-solve network generation time, meaning users can optimise and plan much larger models with ease, the company claims.

Vessel planning enhancements now see the BOLT team prioritise modelling improvements in

relation to vessel sequencing and LAYCANS.

Vink explained: “For instance, users can dictate that vessel 1 must be loaded before vessel 2, while vessel 3 can be loaded at any point.” This gives users more control, while allowing BOLT to minimise demurrage costs.

The latest enhancements to BOLT also include support for co-shipping where vessels carry multiple products.

BOLT’s Live module, meanwhile, estimates stock levels and grade quality by tracking material movements on and off stockpiles in near real time.

Polymathian, part of the Digital Mining Technologies division within Sandvik Mining and Rock Solutions, says additional features and enhancements are already in development to ensure BOLT remains the supply chain optimisation tool of choice, now and in the future.

The tonnes-weighted averaging stockpiling feature that will offer alternative aggregation methods for stockpiles beyond FIFO and LIFO is well into development, for instance.

Vink says: “The addition of flow fields will introduce a new constraint type giving users the ability to enforce constraints on both tonnages and material composition. This will facilitate more nuanced and effective supply chain rule adherence.”

And, with the increasing integration capabilities offered, further automation will become the next core focus. Vink concluded: “The ability for the BOLT system to automatically pull the latest data, optimise and then have plans ready for planners to review when they start in the morning, is where we see BOLT developing next.”

### RPM arms planners with new tools

RPMGlobal came out with two significant releases at the recent *MINExpo 2024* in Las Vegas, Nevada.

The first, FleetOptimiser, offers a product designed for customers to calculate and optimise their trucking requirements for a shift, the company says. The solution combines a 3D, visual user interface with RPM’s universal fleet calculation wrapped up in a secure, web accessible, cloud-based solution.

The company explained: “FleetOptimiser uses the RPM travel time calculation engine, the industry standard, that is embedded across many of their mining software solutions. It calculates productivity for trucks across a haulage network while matching truck productivity to targeted loader productivity.”

Up until now desktop models and spreadsheets have been used to calculate the viability of the mine plan. This creates downstream issues with difficulty maintaining



data, accuracy issues and version control, RPM says. Several products have provided truck-limited scheduling over the years, which works well in a long-term horizon, however applying the same techniques to the more detailed short-term space has always fallen short. As a result, engineers have been dreaming about this product for years, according to Michael Baldwin, RPMGlobal’s Chief Commercial Officer.

“There has always been conflict between planners and operations with respect to what an achievable plan actually is,” he said. “FleetOptimiser lets the planner optimise realistic targets for the upcoming shifts while operations can use FleetOptimiser to reconfigure fleet throughout the shift as parameters change, all through a web-based 3D intuitive user experience.”

Mine planners who use XECUTE, or other execution scheduling applications, can rapidly react to changes in truck availability by simulating the impact on load productivity, and then incorporate the required changes in their plan.

The solution also provides the user with functionality to update and maintain the current road network if required, while calibrated fleet settings can be controlled through the solution, allowing for standardisation across the entire organisation.

The second RPM release is in the mine scheduling field.

Here RPM has leveraged its XPAC mine scheduling engine to develop what it says is a next generation mine scheduling solution in the form of RPM MinePlanner.

RPM MinePlanner is built on the foundation of XPAC, the world’s most used mine scheduling engine, RPM claims.

MinePlanner includes a complete core redesign of the scheduling engine that underpins the product. The release introduces Smart Scheduling, a heuristic-based scheduling engine that combines automated, manual and hybrid approaches and tools. Smart Scheduling

*RPMGlobal’s Adam Price gives a live demonstration of FleetOptimiser at MINExpo 2024 in Las Vegas*

provides a streamlined user experience and adds flexibility by, RPM says, eliminating restrictions on the scheduling methodology being used at any point of the schedule.

David Batkin, RPMGlobal’s Executive General Manager of Product Strategy, said: “RPM MinePlanner takes the complicated mine planning process and simplifies it so engineers can focus on generating value. The team has provided more sophistication within the product while making it easier to use.”

Unlike other scheduling tools, MinePlanner has advanced heuristics fully integrated into the product, RPM says. It can be used for any commodity and is 100% script-free. This package includes reserving, dump and destination scheduling, equipment modelling, haulage modelling, product optimisation and reporting all rolled into one integrated mine scheduling solution. The smarts of MinePlanner really come to the fore when the scheduling engine is run as all components are considered in parallel rather than in series, the company says.

Reporting also gets a major upgrade with the introduction of live reporting always in sync with the scheduling engine. The inclusion of “Breakpoint Scheduling”, which RPM says it pioneered in 2021, has been strengthened with the addition of live reporting. Users now get immediate feedback on current scheduling results every time a breakpoint is reached.

Another new feature of MinePlanner is “Schedule Locking”, which allows the user to lock portions of the schedule they are finished with, avoiding the need to reschedule when refining future periods. Schedule locking significantly reduces the time needed to complete a schedule by eliminating unnecessary reprocessing of scheduling periods that have already been successfully scheduled. 