

# Mine Planning Software Empowers Grade Controllers

*User-friendly, collaboration-enabling, data-devouring modeling tools and functionalities eliminate guesswork and simplify sharing*

By Jesse Morton, Technical Writer

In an effort to increase productivity, more miners are turning to orebody modeling software to generate accurate models, maps, plans and forecasts. These systems create 3-D models of orebodies based on drill hole sampling and other data, which can impact every downstream process from planning production to predicting the changes in head grade for the plant.

Many of today's software and solution offerings provide accurate, dynamic and user-friendly orebody and subsurface mapping. Three of the biggest are discussed below.

## Vulcan Integrates and Optimizes

Last April, Maptek released Vulcan Version 10, which featured a number of new tools. Those include the Automated Pit Designer, Data Analyzer, Uniform Conditioning, Maptek Workbench, Interactive Block Planner and Split Pit Solids.

Maptek Vulcan assimilates numerous and vast datasets to create 3-D, animated, custom models, on which virtual operations can be tested. "Data sources in-

clude sample data, face mapping, grade models, reserve reports and plans, assay and geological data, drilling (exploration and production), channel and grab samples," the company reported. "A grade control model is generated in minutes via an automated specification-driven process. The grade control model can be reconciled against the exploration block model to generate accurate tonnage, grade and ounces, accurate reserves reports, profit information."

Dynamic animations enable simple expression of complex information that can then be conveyed and used across an enterprise, Robert Slade, senior vice president, sales, said. "A picture speaks a thousand words. We can combine all of the relevant data into one 3-D working window ... that is not only the data from the drill holes," he said. It also captures "all of the topography, the current mining faces. You also have enormous amounts of data from other pieces of information: The dump areas, the roads, the accesses. Where was the face on Friday morning? Where is it now?"

Illustrated working reports for use elsewhere in the enterprise can be extracted from the digital mine. Vulcan gives users "the ability to access the model and hover over any of the drill holes and the data and to visualize and interrogate. The interpretation of the blast is very clear in the colored blocks, which give you the high, low and waste designation," Slade said. "Using very standard tools, it can give you a reserve report instantly," which presents the bench polygons "that are sent to the surveyors. The surveyors go out and indicate where those polygons are on the blast. Alternatively, for GPS- and/or Wi-Fi-connected mines, this information can be instantly accessed by equipment operators to guide excavation and material dispatch."

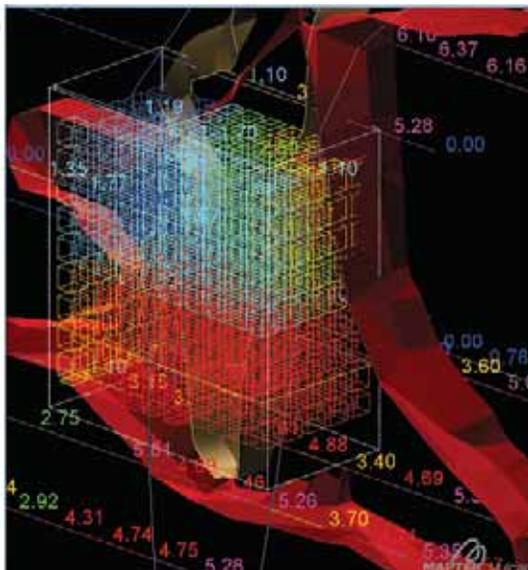
One of Vulcan's selling points, Slade said, is the integration of Exploration to Scheduling tools in one user-friendly and powerful interface. "Vulcan's time-tested and proven exploration database, CAD, triangulation and block modeling toolsets now incorporate productivity and optimization tools like never before. These include the latest implementation of the Stope Optimizer module (Version 3) now incorporating Risk Analysis, plus 6- and 8-point stope shape capability," he said. "Mine Planning advancements include the latest release of Vulcan's Gantt Scheduler and Maptek's Evolution Mine Scheduling suite, incorporating genetic algorithms and distributed cloud processing." When it comes to the toolset integrated and accessible from the platform, Slade added, "Vulcan has the best in the industry by far."

Take for example, the Vulcan Gantt Scheduler tool, described by Slade as a game-changer. "Imports and exports are a thing of the past with our latest integration developments," he said. The tool features functionalities offered by Microsoft Project. And it integrates all the power and functionality of Vulcan's mine design and modeling capability to deliver animated

RECLASSIFICATION REPORT  
Block (Prod\_100) - Grade-Block (A) HicClassification Report.

Material	Volume	Tonnes	(%)
OPER	0.000	0.000	( 0.0%)
WSP	1774.100	8187.112	( 46.4%)
MSD	1484.370	6464.213	( 48.1%)
BLENDED	55.054	262.110	( 1.5%)
BLST	146.800	484.392	( 3.0%)
Total	3460.324	13398.433	(100.0%)

Material classified as (MSD):



Depending on the volume of information incorporated, Vulcan can develop a block model in minutes, the company reports. "Once a model is generated for a stope, several reports can be created for storing grade block data in output databases. Reports can be produced immediately after grade block creation and customized for managers, metallurgists, engineers and geologists," the company says. (Photo: Maptek)

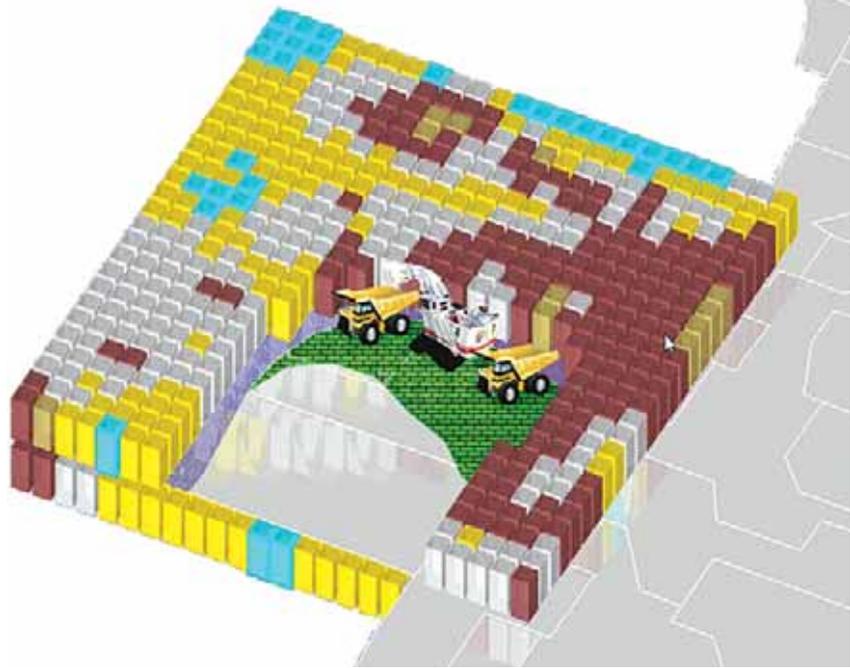
mining sequences that empower users to conduct tests, plan operations, hone processes, and make forecasts, Slade said. These animations convey more information than Microsoft Project Gantt charts. Plus, they are more user-friendly, he said.

“Not everyone understands a (Microsoft Project) Gantt chart. They don’t relate to where your development is at the end of May, where your stopes have progressed to at the end of June,” Slade said. “Where should we be at any point in time? What is the amount of metal we are going to realize from that work? What year is metal production going to drop and for what reason? Those sorts of questions can be answered and illustrated with those animations, those 3-D moving pictures, which go beyond a Gantt chart representation.”

Maptek reportedly is primed to release an update to their new Grade Control package that will enable automated generation of bench “block out” polygons. “Our future is the automation and optimization of polygon shapes that are used to produce the grade control result, meaning identifying the tons and grade of each ore classification, high grade or low grade,” Slade said. “Drawing the material destination shapes by hand is really the only tedious part of this whole process. A user has to come in and make that call, iterating through multiple combinations. What if they could hit a button and then that line would automatically pull out exactly the optimum line or shape?”

Slade said Vulcan can give a miner a competitive advantage in a period of general uncertainty within the sector. He pointed to Lundin Mining’s Eagle mine in Michigan, for example, which deployed Vulcan in 2014. “[It] is being used by all technical services departments including engineering and geology,” the miner told *Forge*, Maptek’s technical magazine. “The mine needed to produce an on-the-fly block model outlining higher grade zones as well as lithology changes within a single stope. Engineers also wanted to determine mineable stope shapes based on current metal prices.”

Lundin was motivated by the same economic forces that are compelling other miners to adopt state-of-the-art geology, grade control and mine planning software packages, Slade said. “Mining has become marginal over the past decade. It’s been difficult. Prices have been low. Capital is hard to find,” he said. “However, it is also



Minesight’s grade control solutions simplify the acquisition of information for cut planning and daily reporting, the company reports. ‘MineSight has comprehensive reserve and modeling utilities that are integrated throughout all of our planning tools,’ Seth Gering, software quality assurance engineer, says. ‘This means that MineSight users can use the same resource estimation methodology and data for all parts of the planning and grade control process without having to manually transfer data between projects.’ (Graphic: Hexagon)

a good time because it puts pressure on everyone to do things better and faster.”

## MineSight Empowers

Acquired by Hexagon in 2014, geology and mine planning software platform MineSight made headlines last August with the latest release of MineSight Planning Suite Version 9.6, which the company said featured “improvements” to the MineSight Schedule Optimizer (MSSO) software.

With the update, the company reported, MSSO now provides a complete planning, operations and safety workflow. It fully supports stratigraphic models, also known as Gridded Seam Models. “Mining geometries [polygons or solids] can be imported into MSSO either from MineSight 3D viewer or from an existing MineSight Planner project,” Hexagon reported. “Through integration with MineSight Reserve, reserves associated with the geometries along with a list of mining seams available in the GSM are used for proper reserve allocation.”

The version features cashflow constraints, “allowing you to define cashflow limits,” Hexagon said. “It also allows for customized benching with options for defining elevation range for polygonal geometries.” Other highlights include advanced

constraints relaxation; fixed cost by phase and destination; ability to export cut geometry to MineSight 3D (MS3D) objects and MS3D End-of-Period tool; and speed improvements for reserve calculation.”

This and an optimization tool for stope design to be released in the near future “will bring together powerful visualization, modeling, scheduling and reconciliation all into one single user environment,” Seth Gering, product manager, operational planning, said. “We are looking forward to improving workflow.”

Simplified, MineSight, like its competition, is a cyber hub, a platform that enables distant users to operate in a centralized location, and to deploy a software suite to manage data and generate a 3-D digital twin of a mine. What separates it from the competition, Gering said, is its dynamism. “Our clients are collecting information to make better decisions using a variety of different systems, so our tools allow users to connect to virtually any source through a configurable interface,” he said. “For example, we had one client that had spent a lot of time building and populating a fragmentation database and wanted to use that information coupled with their grade control system for data analysis and making better decisions. This was not a

problem because we could easily connect to assay, geology, survey or other systems through the configurable interface.”

MineSight facilitates information-sharing and collaboration. “Although most systems are now SQL or API based, there are many that still require ASCII or DXF for data transfer. Our solution is easily configurable and scalable so that operations can share information using any format they have today and in the future,” Gering said. “We often implement grade control systems during the early stages of the mining process when not all Fleet Management Systems (FMS) or other systems are in place. However, because our system is configurable, we can easily incorporate new systems in the grade control workflow as they are implemented or come online.”

The savings are real, he said. Information and data-sharing enables engineers to spend less time manually transferring data. “I’ve seen sites where users are manually copying tonnages, grade, and plant information or using a variety of Excel sheets and csv files,” Gering said. “This takes time and could compromise data integrity. Engineers should be spending time analyzing data and improving processes instead of copying data manually.” Consider for example, Gering said,

one operation that was spending more than 20 hours per week manually transferring data between planning, assay and FMS. “With MineSight, they were able to integrate information from fragmentation, planning, drill and blast, and FMS sources that both reduced staff downtime and increased truck load/dump cycles by about 13% or 100 trucks per day.”

“A U.S. mine that implemented MineSight-optimized grade control and drill and blast systems arrived at an innovative grade control workflow that was presented at our annual MineQuest conference and resulted in a 12% cost savings for the drill and blast teams,” Gering said. “All of this was done by the users themselves and reinforces our goals for making tools that are easy to use and easy to implement.” Therein lies the utility of the platform. It empowers users to gain control of their workflows and to make them “faster, easier and safer,” he said. “MSSO continues to add value to the mine planning workflow in many areas.”

### Dassault Offers Virtual Reality

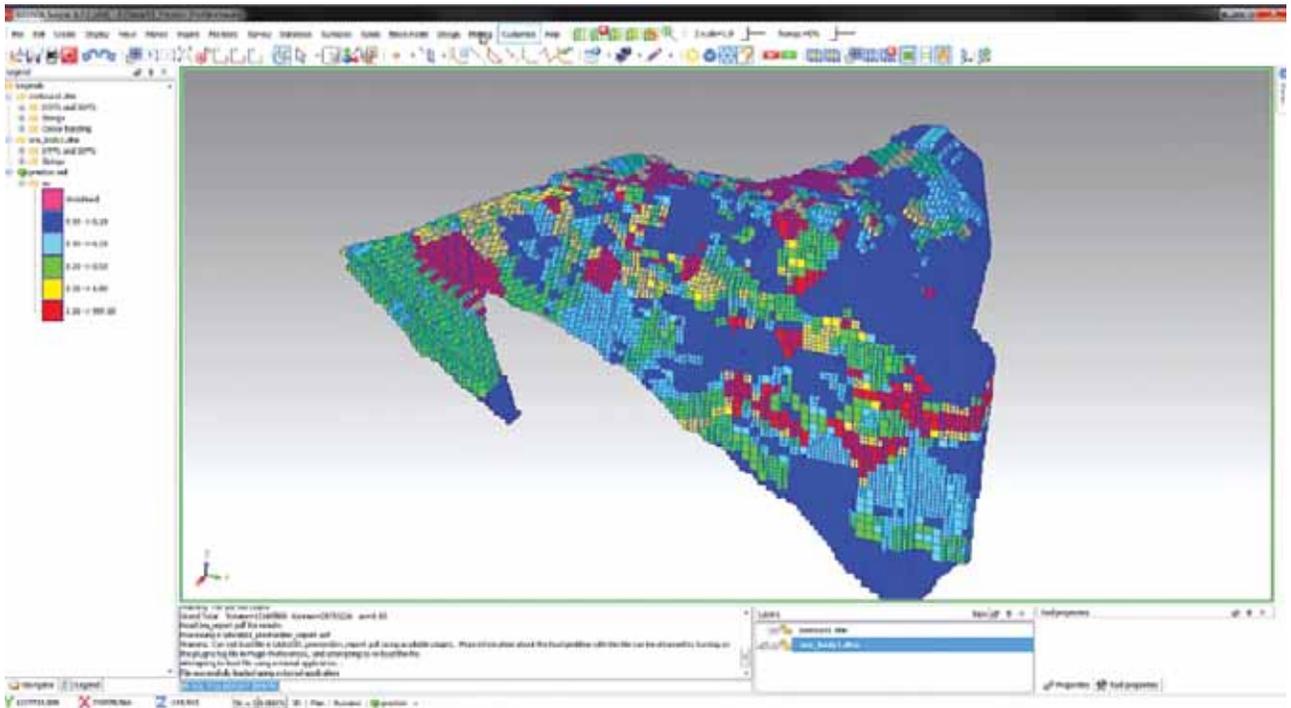
Centered on geology and grade control, Surpac is one of Dassault Systèmes’ mine planning software applications offered under its Geovia brand, which also includes

GEMS, a geology and mining collaborative system engineered to support cross-functional teams within an enterprise.

At the core of Dassault Systèmes’ offerings is the 3DEXPERIENCE Platform, described as a “business experience platform,” which the company reported in September had reached its 10,000<sup>th</sup> production user. Nicolas Jeannée, senior manager, natural resources industry solution experience, said the platform, which serves as a cyber hub and can be premises- or cloud-based, enables users at disparate locations to access “a single version of the truth.”

The platform “is really about technical collaboration, data management and continuous innovation” he said. “Being able to ensure you are centralizing and sharing data that are reliable and up-to-date is a key expectation of mining companies, and this is something we are providing through the 3DEXPERIENCE Platform.”

The platform facilitates fluid navigation to the apps, including social and collaborative apps, intelligence apps, simulation apps and 3-D modeling apps, like Surpac. The company described Surpac as “the world’s most popular geology and mine planning software,” which “delivers efficiency and accuracy through ease-of-



Surpac, geology and mine planning software under the Geovia brand, is slated for two updates in 2017, Andy Mulholland, Dassault Systèmes, portfolio management director, says. ‘The future for GEOVIA in mining centers on the Dassault Systèmes 3DEXPERIENCE platform, a unique business platform delivered both on-cloud and on-premises, and which will facilitate collaboration and integration across the entire mine value chain.’ (Photo: Dassault Systèmes)

use, powerful 3-D graphics, and workflow automation that can be aligned to company-specific processes and data flows.”

Drilling data, as well as performance data captured by the equipment, is assimilated and managed by the 3DEXPERIENCE Platform. Like its competition, Surpac reconciles drill hole and sampling data with virtual mine models, and can create user-friendly, 3-D graphics, to include short-term block models that are data-rich, colorful and scalable. These models are further informed by data from mines “all over the world to ensure a grade control framework that provides a clear understanding of grade variations, and allows for improved decision making to drive profitability,” the company reported.

GEOVIA technology allows users to import data from various sources, manage survey station data and interface with data collectors, Andy Mulholland, portfolio management director, said. “Selecting from a variety of instrument types and reduction techniques, surveyors can establish profiles to streamline the data entry process or download measurements directly from total stations and GPS recorders,” he said. “Triangulated surfaces can be created from status maps and then used to determine volumes moved between two or more working periods.

Data can also be used directly from other formats with the data plug-ins module.”

Geovia software is “the recognized world leader of integrated geology and mine planning solutions,” Mulholland said. “MineSched delivers interoperability through integration with every major geology and mine planning software package on the market. ... InSite integrates with almost any data source, providing a single view of the truth with a holistic view of the operations from pit to port.”

Make that virtual pit to port. Dassault Systèmes announced January 5 that “3DEXPERIENCE Platform users can now view, explore and validate product designs in immersive virtual reality at any stage of the product development process with support from the HTC Vive Business Edition virtual reality system.” Users don a headset and work at their desktop, from which they can “access, view and explore a native virtual model,” giving an “enhanced spatial impression for a deeper understanding of an object’s depth, solidness and design that cannot be achieved with a computer screen alone,” the company reported.

Broken down, this means a decentralized enterprise can operate out of a centralized cyber hub, the 3DEXPERIENCE Mine, and use a common software suite to shape its digital twin, which can now

live in a virtual reality environment. In short, miners can shape a digital mine so real they can virtually blast it.

The concept of a digital twin is a true singularity whose significance has been marginalized in the ceaseless eruption of high-tech innovations comprising the ongoing space age revolution. Its conceptual predecessor is the “legal entity,” defined by Black’s Law as “an entity, other than a natural person, who has sufficient existence in legal contemplation that it can function legally, be sued or sue, and make decisions through agents as in the case of corporations.” Whereas maritime law birthed the legal entity, big data birthed the digital twin, a dynamic but defined cyber entity, be it a person or a company, with sensor and sampling data instead of blood, and pixels instead of skin cells. Users can operate and experiment on it. From it they can extrapolate and forecast.

If the digital twin is the logical outcome of the rise of the Internet of Things (IoT) and the resulting deluge of data that has purged mining of guesswork and estimates, then the 3DEXPERIENCE Mine is the ark for plying those waters, Jeannée said. “Mining companies are facing larger and large databases all the time,” he said. “We are talking about big data and IoT. That is why it is crucial to leverage all this data together using a single appropriate framework. That is the idea of the 3DEXPERIENCE Mine.”

Three updates to the Geovia brand in 2017 are expected, Mulholland said. “GEOVIA is introducing a new cloud-based next-generation rapid geological modeling capability, to be delivered under an innovative SaaS (Software-as-a-Service) model on the 3DEXPERIENCE platform and seamlessly integrated to GEOVIA’s desktop applications,” he said. “Additionally, 2017 will see the introduction of advanced point cloud technology into Surpac for processing and utilizing the vast amount of scanning information available from unmanned aerial vehicle drone surveys and vehicle mounted underground survey equipment. Also coming in 2017 is a new algorithm for GEOVIA Whittle that greatly reduces the time taken to develop a strategic mine plan thus allowing input sensitivity analyses to be completed in rapid succession giving the mine planner a readymade library of off-the-shelf plans that can be used as and when the operating environment changes.”



The HTC Vive Business Edition headset enables 3DEXPERIENCE Platform users to ‘plug and play an HTC Vive Business Edition head-mounted display and work at their desktop with natural navigation in a stereoscopic virtual reality environment,’ Dassault Systèmes reports. (Photo: HTC)