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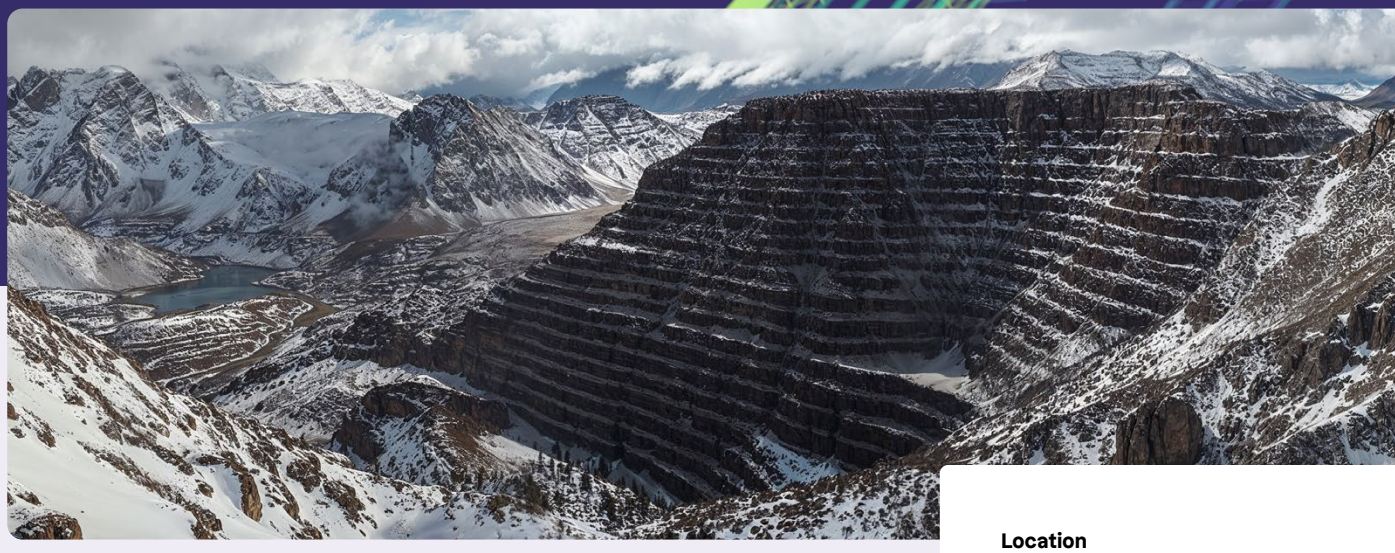
Mine planning transformation at Veladero cuts schedule creation times by 40%



The Veladero mine is Argentina's largest open-pit gold and silver mining operation

Situated in the San Juan Province, at the heart of the Andes, Veladero mine is Argentina's largest open-pit gold and silver mining operation. Positioned at elevations ranging from 4,000 to 4,850 meters above sea level, it is also one of the world's highest situated gold mines. The mine operates under a 50/50 joint venture between Barrick and Shandong Gold.

The operation mining rate ranges around 70 to 83Mtpa, forecasting a gold yield production of 450,000oz per year. Material from the open-pit is either sent to the crushing plant, longer term stockpiles for later processing or to a designated dump location. The crushed ore is then hauled by trucks to the leach valley located some 6.5km south of the mine. This activity utilizes approximately one third of Veladero's fleet.

Production is achieved with a fleet of five shovels, two loaders and 52 trucks, each with a 230t payload target.

While haulage capacity was sufficient to meet production targets, any bottlenecks in the haulage network that changed cycle times had a significant impact on the overall efficiency of the operation.

Location
San Juan Province, Argentina

Elevation
4000 - 4850m

Ownership
Barrick and Shandong Gold

Primary Commodity
Gold, Silver

Mining Method
Open-pit

Production
70-83Mtpa

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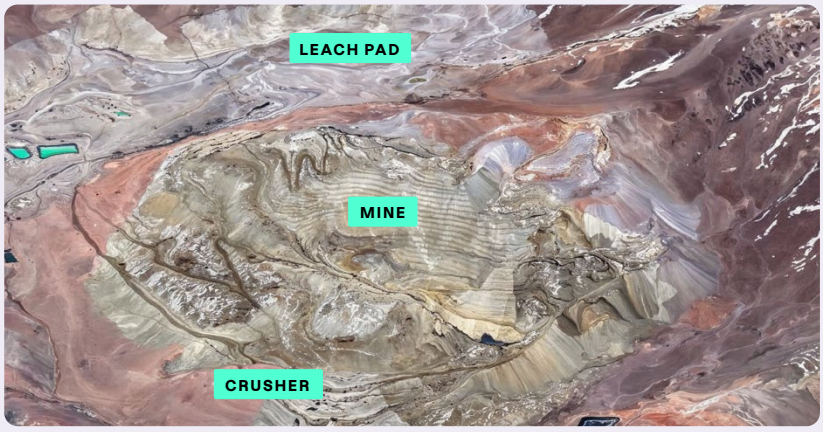
Micromine Solution

Approximately one third of the fleet was utilized moving material from the crusher to the leach pad.



Carlos Meza

5 Front Shovels **2** Front-end Loaders **52** Trucks / 230t Payload **210** ktpd mined 74 Mtpa **85** ktpd crushed 27 Mtpa **450** Koz rec/ year

As a result, Veladero needed a mine planning system that could replicate their haulage network with accuracy, assess truck cycle times, forecast fuel burn, and also be integrated with their short and medium term mine plans.

Working in the remote Argentinian Andes also poses several challenges in developing a robust mine planning system.

The company required a mine planning solution that could be implemented quickly, catering to the complex decision processes at the operation, and be user-friendly without demanding extensive training.

"Some of the problems that we faced at Veladero in relation to mine planning was the quality of data we had to work with, problems in effectively communicating the plan, and standardization of the plan between planners," said Carlos Meza, Mine Planning Superintendent.

"A robust planning system needed to be developed: not just the platform, but everything that makes up the plan."

"Everything from how to collect, enter and check the input data, how to check the block model, and whether the maintenance plan is correct. In other words, it was important that the entire ecosystem of planning itself was optimal."

"We also needed to overcome the challenge of training local staff in the implementation and operation of the planning system," he added.

"We had two different levels of professionals at site: experienced staff, and young professionals just out of college."

"We wanted a system that didn't require a doctorate to operate it. The plans should be easy to replicate, and the system should be auditable and easy to maintain."

Carlos and his team evaluated a variety of planning solutions and eventually settled on **Micromine Alastri**, which is designed specifically to model the intricate open-pit hard rock mines operating today and those being designed for the future.

Veladero's planning system criteria

Veladero had six criteria for their mine planning tool: modularity; a well-defined workflow; accurate algorithms that had optionality; a user-friendly user interface; the ability to extend functionality with scripting if needed; and importantly, vendor relationship and support.

While Micromine Alastri met all six criteria, another major factor that influenced the decision was the lower business risk compared with other solutions, where the initial model development was performed by the vendor, resulting in additional implementation costs.

"Most competing providers charge for model building and testing – and once the prototype has been developed you pay hourly for a consulting service for tuning the models," said Carlos.

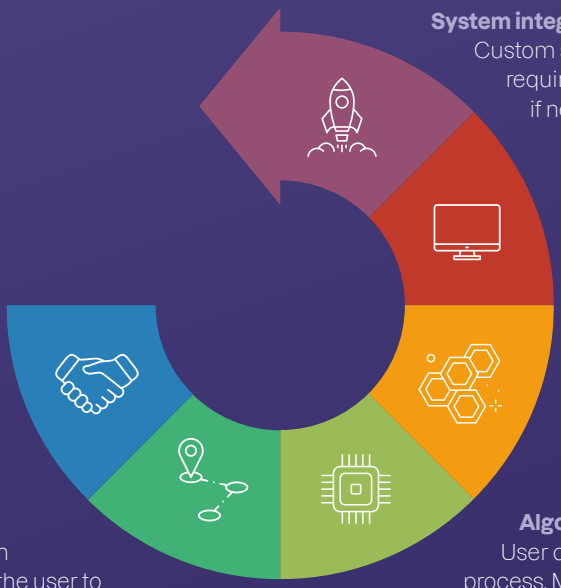
"With Micromine we had zero risk because we were able to build the model, and if the initial model didn't work, it would have cost nothing but the time used."

In contrast, Micromine worked in partnership with Veladero to build the original model at zero cost. In this way, both Veladero and Micromine had a shared incentive to get the model up and running quickly."

Data security was also a factor: "The Micromine Alastri product does not require that the vendor has access to the data, unless the user wants to share it," said Carlos.

"In some products, data goes to a central repository and results come back. With Micromine Alastri, the user is in full control of the data."

Why Micromine Alastri?



System integration and customisation
Custom setups for site-specific requirements are available if needed.

User / Software interface
An interactive Graphical User Interface to troubleshoot and validate the model inputs/outputs.

Modularity
Integrated modules exist for haulage and reserving, allowing users to piggyback off previous work.

Algorithms
User controls the optimization process. Multiple modes of optimization (grade, trucks).

Defined workflow
A defined modelling structure with system warnings allowing the user to quickly troubleshoot.

Service
Quality support is needed to enhance the results from the tools.

Achieving a new benchmark in implementation speed, onboarding time and team efficiency

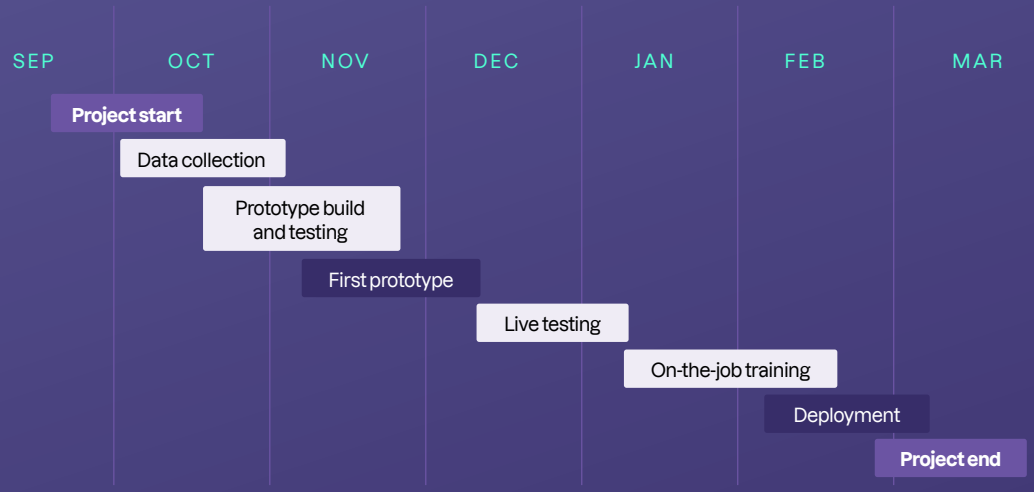
The initial implementation of **Alastri Production Scheduler** at Veladero took four months. Data collection for the model ran from late September to mid-October, and the prototype model was built by mid-November.

"The data collection involved debugging and checking that the information was correct, that it covered the extension of the model, that at least the topography covered the extension of the block model, and that the block model had the correct variables that we wanted to model," said Carlos.

"We also had to make some decisions regarding the operation of the model, that is, the flow of materials (if it leaves the pit, where does it go), planned destination of multiple ore types and waste, physical restrictions and the structure of the plan itself."

Testing and refinement of the model were done in parallel and was completed the following January.

Alastri Production Scheduler implementation timeline



"Once we were happy the prototype was representing and solving our questions, we started the training phase," said Carlos.

"Training took about one month. In my experience, within about two to three rotations it is possible to have a good understanding of what the tool is."

"After three rotations, we have a degree of autonomy in using it without knowing everything."

"I recommend on-the-job training first and then formal training to increase understanding."

Project rollout was delivered in the first half of February.

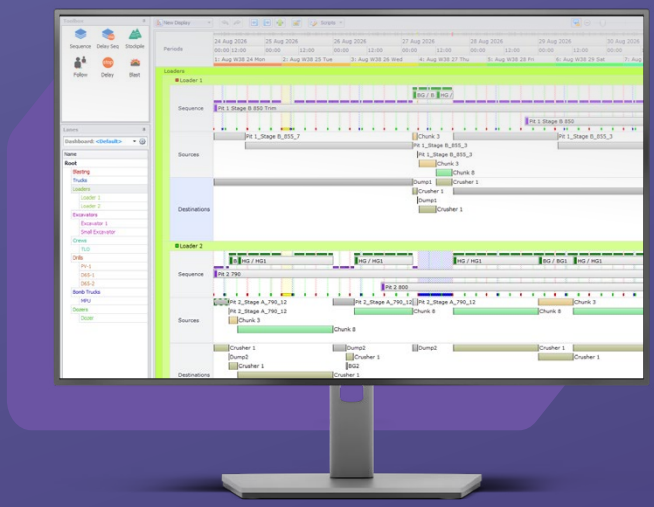
The speed of implementation and staff training enabled the Veladero mine to begin autonomously and productively applying the software to their operation quickly.

The project set a new benchmark for software implementation at the site.

"Training took about one month, with a good understanding of the tool established within two to three rotations."

Efficiency served up by user-friendliness, modularity and consistent workflows

Reflecting on the implementation journey, Carlos believes the integrated nature of the Micromine Alastri tools, and their guided workflows were key aspects that helped his team produce results quickly.



"The modularity of the system results in significant time saving," said Carlos. "We can replicate, for example haulage models, and re-use them in various planning horizons, all automatically updated with new or changed data."

"Short-term information can be used to infer longer-term results, which was especially useful in the early stages of mine planning."

When developing plans, users are also held to a consistent workflow, eliminating planning errors.

"Micromine Alastri forces users to work in an orderly manner: it's not possible to proceed to the next step until the previous step has been validated," said Carlos.

"Failures are reported with error messages, and it's possible to click on the error and find the cause: error detection and resolution are much more dynamic than in other packages."

Intuitive workflows also enhance productivity from the planning teams at a greater speed.

"We do not need to know the entire menu from the beginning, and we're not going to do steps out of order that will cause the model to fail," added Carlos.

"Having a workflow allows you to work in a standardized way and quickly resolve problems when they arise." The user interface of Micromine Alastri also contributes to both efficiency and rapid onboarding.

"The software uses a graphical interface similar to a game," said Carlos. The 3D view allows users to see decisions that are being made in real time."

Having a workflow allows you to work in a standardized way and quickly resolve problems when they arise.

"For example, a user can simulate the haulage route selected between source and destination and over time calculate whether the route achieves the desired goal."

"We can also visually audit what is happening inside the software, and understand whether rules and calculations are correct."

Digital twin enables a data-driven approach to haulage management

Haulage represents a major operating cost for most open-pit mines.

Given the distances between the mine, crushing plant and leach valley, the team at Veladero needed a robust approach to model haulage cycles and assess them over time.

Haul Infinity allows mine planners to accurately model the mine's haulage network in the form of a digital twin.

The model is then integrated within Micromine Alastri's Production and Tactical Schedulers, which manage short and tactical mine plans respectively.

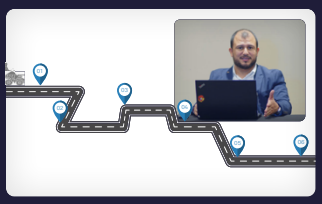
Users can then assess specific scenarios for their haulage mix and incorporate the best results within their mine plans.

The team at Veladero approached this in a systematic way to ensure the results reflected the real-world dynamics of their haulage network.

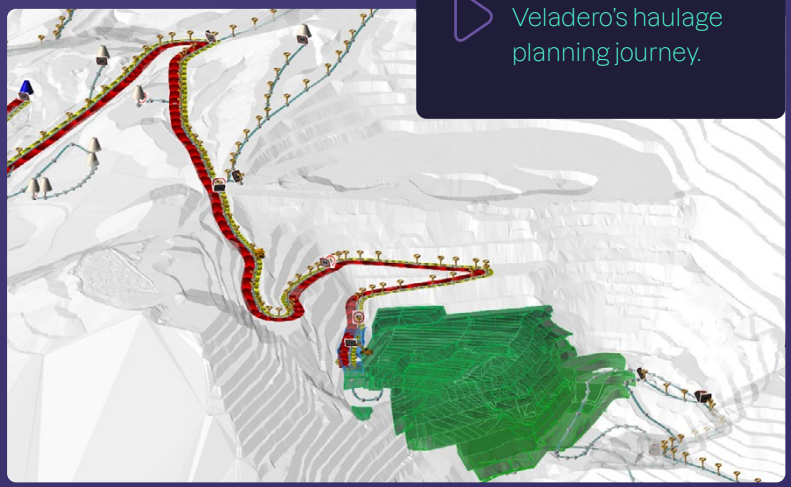
This involved replicating their haulage network in Haul Infinity, calibrating haulage cycle and travel times before integrating this within their mine plans and reconciling results with data from their fleet management system.

All of this was done while developing the skills of the planning team and upskilling them with the tool.

Haulage was a critical factor to consider and effectively manage within the sites mine plans.



Take a deep dive into Veladero's haulage planning journey.



Cutting planning time by 40% and leveraging skills in other places

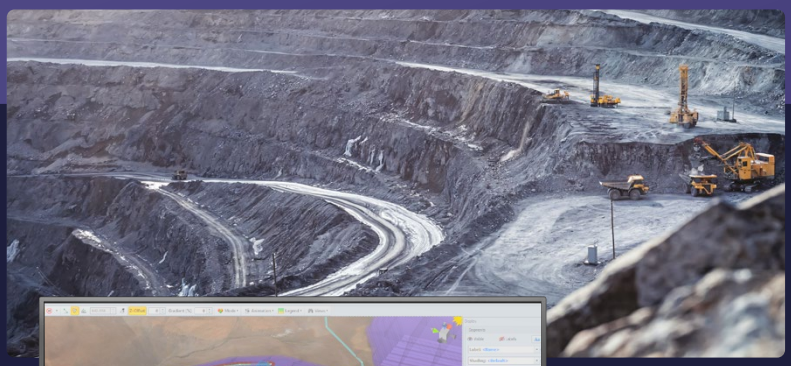
Carlos Meza and his team at the Veladero mine were able to rapidly integrate a new mine planning system into their operation in just four months, revolutionizing their planning processes and team efficiency.

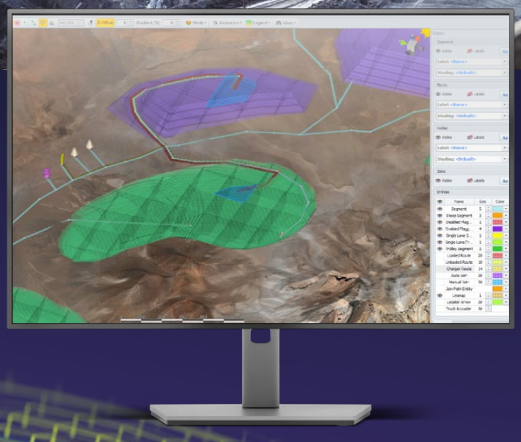
The implementation methodology, consistent and enforced workflows, modularity of the Micromine Alastri products and the approach to haulage integration were all key components of this success.

According to Carlos, this has all culminated in time savings that allow his team to design more comprehensive mine plans and work on other important projects.

"We had both senior and junior engineers who were trained and proficient using the tool in just four months. We also managed to cut 40% off the time we used to generate a plan."

"By freeing up the engineers' time it allows them to dedicate themselves to other activities – such as designs, reviews, calibration and visible leadership in the field – rather than spending too much time at a computer doing the planning."





Want to know more? Speak to the Micromine Alastri team here and see how this technology can be applied at your site.