MINE TWIN
CASE STUDY

MINETWIN: FROM STRATEGIC DECISION SUPPORT TO VERIFYING QUARTERLY AND ANNUAL MINE PLANS

THE CHALLENGE

The underground fluorite mine faced significant complexity due to unpredictable geology and a complicated haulage network. To support a production increase, the company needed clear answers to two key questions:

- Would the planned capacity upgrade of a shaft ensure sufficient mining and haulage throughput?
- How many additional trucks and loaders were required for the planned production growth?

After MineTwin provided reliable answers, the client continued using it to validate quarterly and annual plans, foresee bottlenecks, and guide equipment-purchase decisions.

THE SOLUTION

We developed a MineTwin simulation model based on:

- Full mine layout, including stopes of 2 different mining methods, headings, muck bays, ore passes, and skip hoists.
- Equipment interactions for mucking, drilling, hauling operations.
- Geology unpredictability in the form of random variable distributions of drilling durations, fragmentation rates and blasted ore quantities.

We imported Vulcan designs and validated the simulation logic.

THE RESULTS

Simulation provided insights across all tested initiatives and:

- Improved annual planning accuracy by 10%
- Confirmed that the shaft capacity upgrade could deliver a 3% increase in mine throughput
- Determined the required number of loaders and trucks for the mine's future state

THE CLIENT

The client operates one of the leading underground fluorite mines in the Americas.

Due to the sensitive nature of the project, the company will remain anonymous, and all data shown has been fully sanitized to remove any identifying information. The screenshots included are illustrative examples taken from a comparable, but different, mine.

Background

The client operates a large underground fluorite mine, characterized by complex production processes, variable geology, and shared use of critical equipment such as LHDs and mining trucks. The mine relies on multiple extraction methods, several transfer points, and two skip shafts, making the haulage system highly interdependent and sensitive to bottlenecks.

Because production performance depends non-linearly on equipment allocation and the movement of mining fronts, the mine required a more reliable way to assess operational constraints and plan for a future production increase.

Objectives

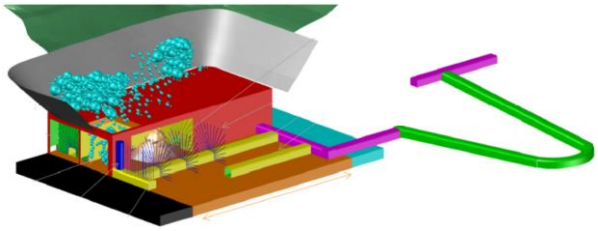
The project aimed to introduce a simulation-based decision-support tool capable of validating medium-term mine plans (1–12 months) and answering several critical production-increase questions, including:

- Whether improvements to one of the shafts' availability would ensure the haulage system could support the first stage of production growth.
- How many additional mine trucks would be needed to meet the planned production targets.
- How changes in crew schedules would affect overall productivity.
- Whether constructing an additional skip shaft could reduce the truck fleet size by shortening haul distances.

A long-term goal was to establish a center of competence enabling the client to continuously apply simulation for strategic and mid-term planning.

Why MineTwin

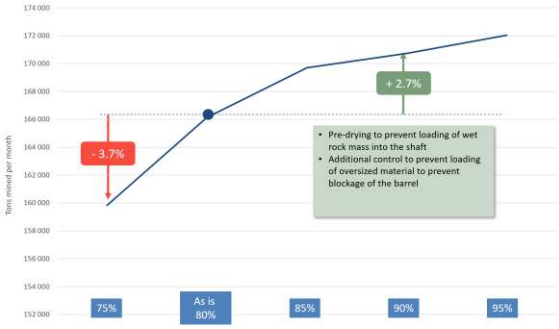
MineTwin was selected because it provides a high-fidelity simulation of underground mining operations, capturing equipment interactions, haulage routes, delays, and the dynamic behavior of the mine. Compared with Excel or industry standard planning tools, MineTwin offered superior customization, accuracy, integration potential, and rapid simulation speed, allowing the model to reflect the unique conditions and constraints of this specific mine.



Determining Benefit of Additional Infrastructure

MineTwin simulations evaluated whether measures to increase shaft's availability — from 80% to 95% — would effectively raise mine's throughput. The model showed that at higher shaft availability levels, mine output could increase by up to 2.7%, confirming that the planned capacity upgrade was justified.

The model also assessed the effect of adding more mining trucks. Scenarios ranging from +1 to +5 trucks were tested, allowing the mine to determine the optimal fleet size required to support the planned production increase and avoid unnecessary capital expenditures.



Supporting Ongoing Planning

After receiving clear, data-driven answers to the strategic questions, the client expanded the use of MineTwin as a core tool for ongoing planning. The simulation model now supports:

- Validation of quarterly and annual production plans
- Early identification of bottlenecks across extraction, haulage, and hoisting
- Optimization of equipment fleets for both short- and long-term horizons
- More accurate decision-making and forecasting at all operational levels

The project was completed in four months, resulting in the creation of an internal competence center that enables the mining company to independently use MineTwin for continuous decision support.

What Is MineTwin?

MineTwin is a configurable, simulation-based decision support tool designed for both underground and open-pit mines. It captures the majority of operational constraints and interdependencies found in real-world mining environments.

How MineTwin Works

MineTwin builds a simulation model—a high-fidelity digital representation of an actual mine's operations.

It is the only platform on the market that integrates discrete-event simulation with linear programming and combinatorial optimization, enabling the creation of realistic digital twins of mines.

What Tasks Is MineTwin Best For?

Check the **feasibility of mining plans** and evaluates the impact of improvement initiatives by using a dynamic model of mining operations. Able to capture non-linear factors like queuing, dynamic ore pass stocks, coordination standby delays, etc.

Provide the means for **comparison of several potential future states** of an existing or future mine. Estimates the operational and financial KPIs of every option.

Provides the scenario analysis functionality for determining **equipment fleet configuration and size**.

Allows mine planners to verify and adjust plans and schedules based on **foreseen bottlenecks** (lack of mining fronts to work in, insufficient blasting frequency, ore and waste flows imbalance, insufficient backfill rate).

Learn More

Visit us at https://minetwin.com

North American Representative

MOSIMTEC LLC
297 Herndon Parkway, Suite 302, Herndon, VA
contact@mosimtec.com
+1 (855) 677-3342

Mine Twin

MineTwin – Amalgama Software Design
Office 150, Al Diyar, Al Wasl, Dubai, UAE
info@amalgamasimulation.com
Middle East: +971 056 208 6327
Europe: +351 911 999 319