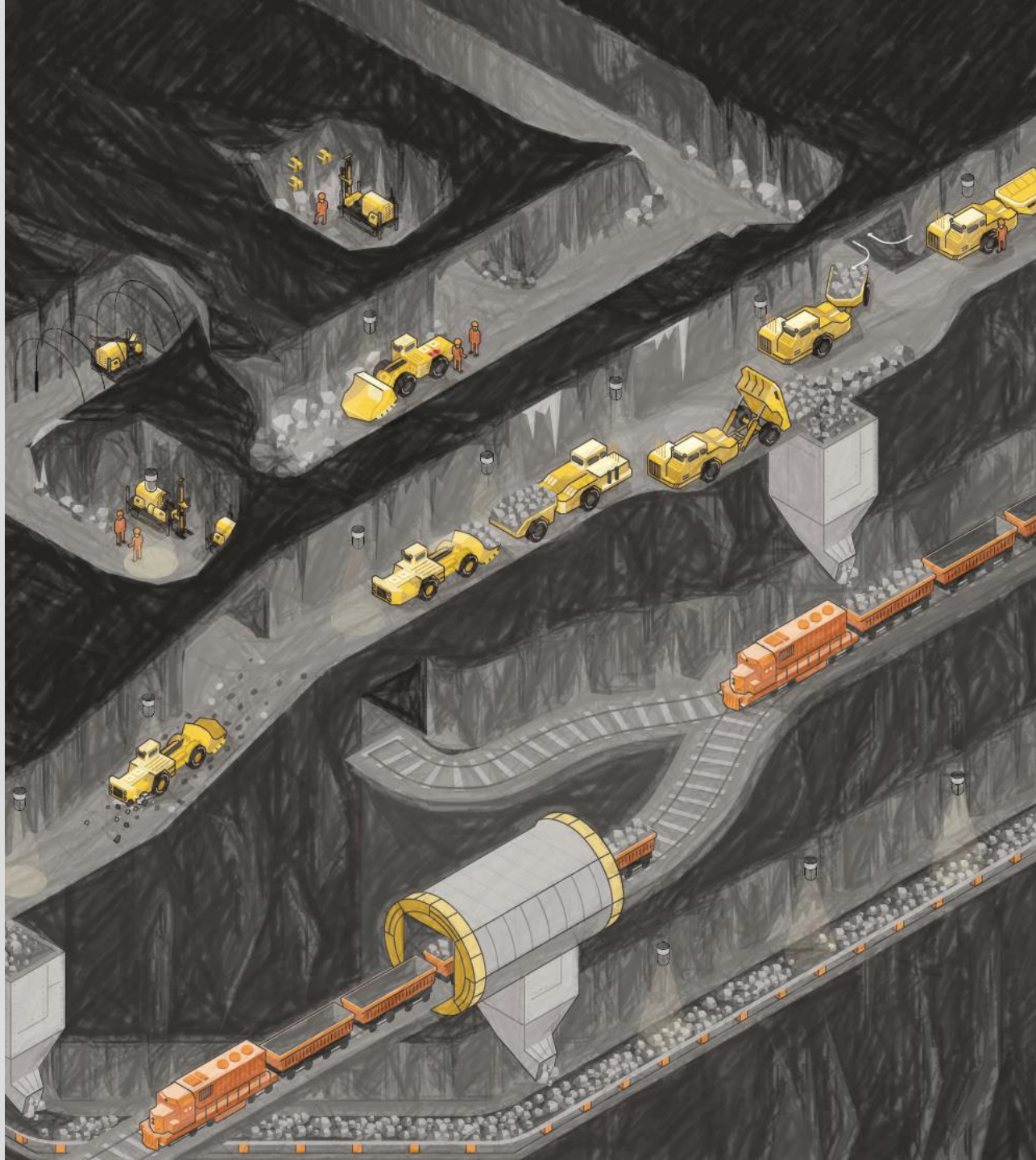
MINE TWIN

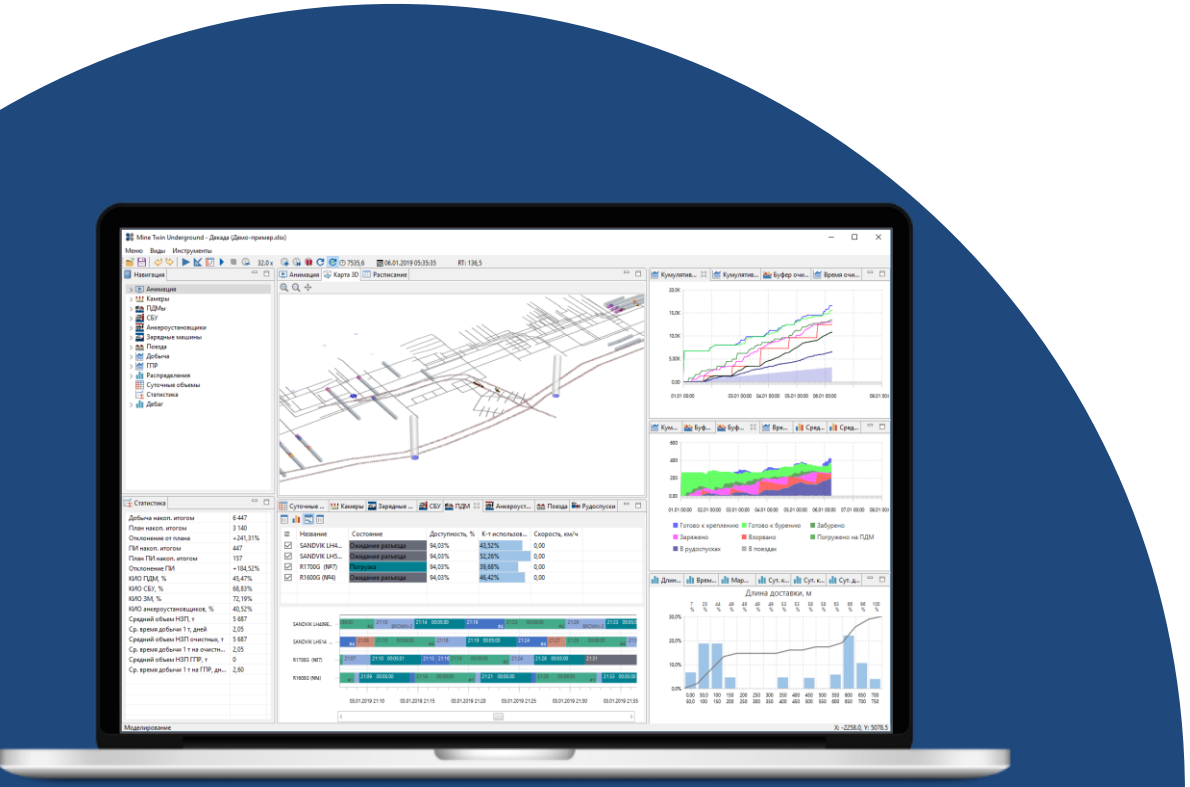
SIMULATIONS OF OPEN-PIT AND UNDERGROUND MINES

https://mine-twin.com/



The Solution

MineTwin is a configurable simulation-based decision support tool for underground and open-pit mines
MineTwin uses Amalgama® platform and libraries to provide fast and adequate simulation models of underground and open-pit mines.



MineTwin considers most constraints and interdependencies of real-world mines, including:

- Development and production mining
- Dynamic evaluation of stopes reachability
- Flexible rules of shift-to-shift scheduling
- Drilling, blasting and bolting
- Loading and bogging, vehicle priorities and bypass positions
- Road surface quality and slopes
- Transloading and using intermediate ore buffers
- Queuing in front of ore passes
- Scheduling rail operations and rail transportation
- Crushing and hoisting the ore
- Dependencies between processes in the same stope and between stopes
- Delays caused by de-watering, ventilation setup and other supporting activities

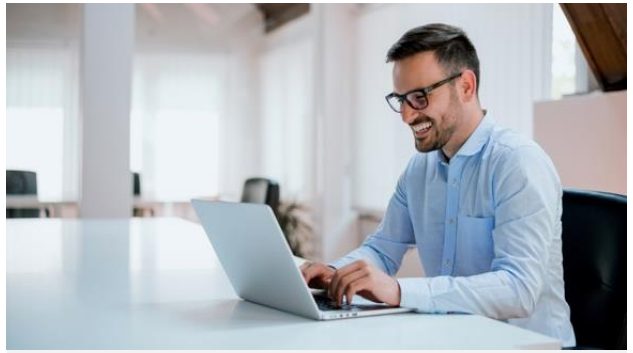
Who Is MineTwin For?

MineTwin helps mining companies with open-pit and underground mines at all phases of mines' life cycles in the following circumstances:

- Company plans to implement new technological solutions. Operational and financial impact of the implementation is hard to estimate
- Mining plan is often not fulfilled due to sub-optimal planning and inefficient allocation of equipment. Bottlenecks are not properly predicted
- Company needs to accurately estimate the reachable performance of a future mine or an existing mine after expansion
- High costs of buying and operating the mining equipment. Low transparency in justification of requests for new equipment units

MINE TWIN

MineTwin Can Be Used by Various Stakeholders on Different Phases of Mines' Life Cycles



Strategic planning department

CTO / Mine management

Investment committee

Greenfield / Brownfield

Company plans to start operation of a new open-pit or underground mine

Operation

Company needs to constantly validate the feasibility of mining plans and identify potential bottlenecks before they impact the operations

Expansion and Upgrade

Company plans an expansion of an existing mine, equipment fleet upgrade, or implementation of new mining technologies

MineTwin Helps Solve the Following Problems

- Increased costs for purchase and operation of mining equipment
- Unbalanced value chain – excess ROM volumes, wrong mix of grades in stopes or blocks, starvation of haulage or drilling equipment
- Suboptimal planning and scheduling of teams and equipment. High congestion, lack of development mining, high volumes of rework and rehandling
- Inability to justify the impact of new or innovative mining technologies (such as conveyor systems, railveyors, autonomous equipment, remotely operated trains, surge loaders, etc.)

How MineTwin Works?

The key difference of MineTwin is use of a simulation model

Simulation model is a detailed replication of a real mine inside a computer

This model is used for scenario analysis instead of traditional static calculations with spreadsheets or linear programming tools. It allows users to consider most constraints and interdependencies of real-world mines

Checks 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.

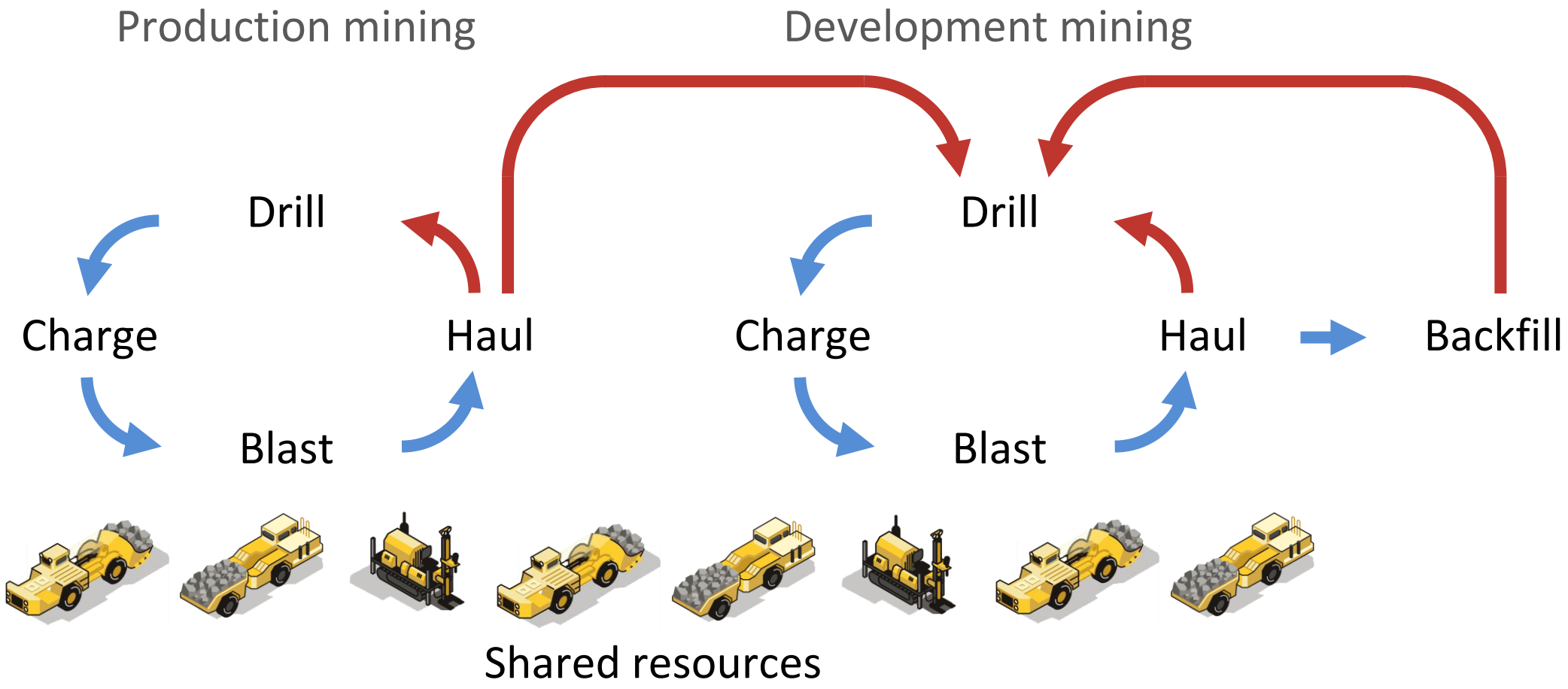
Provides the means for comparison of several potential future states of an existing or future mine. Estimates the operational and financial KPIs of every option

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)

Why Simulation?

Simulation captures non-linear and cyclical dependencies. These dependencies are very hard to capture by traditional calculations without a simulation



What Results Did MineTwin Clients Achieve?

01

10% cost savings for purchasing and maintenance of loaders and trucks

02

Reduced monthly mine planning error by 10%

03

Increased mining volumes by 3% to 5% due to more efficient equipment allocation

04

Implemented operational improvements that lead to 12% increase in production without capital expenditure

05

Obtained objective data for mining teams' bonuses calculation

MINE TWIN

Case Study #1

MINETWIN WAS USED TO CREATE A CONFIGURABLE DIGITAL MODEL OF 6 UNDERGROUND COPPER AND NICKEL MINES

One of the world's top nickel, platinum, and palladium producers. Copper producer

PROBLEMS

- Head office cannot check the number of equipment units requested by the mines
- Mines complain that they do not have enough equipment to meet the plan
- ROI of new mining and ore transportation technologies is hard to estimate due to multiple moving constraints and non-linear dependencies of the underground mines

SOLUTION

- Check the feasibility of mine plan and evaluate impact of new technologies with simulation models
- Perform scenario analysis in MineTwin to determine the required number of equipment unit to purchase each year

RESULTS

- Savings of $262M due to equipment fleet optimization
- MineTwin ROI exceeds 800% due to more optimal scheduling and redistribution of equipment between mines
- Determined ROI of 10 innovative initiatives, including using fast borers, railveyors, hot-seat shift changes, etc.

Case Study #2

MINETWIN WAS USED TO SIMULATE OPERATIONS OF AN OPEN-PIT IRON ORE MINE AND JUSTIFY THE INTRODUCTION OF CONVEYOR TRANSPORTATION SYSTEM

A global steelmaking company, one of its biggest iron ore mines

PROBLEMS

- Hard to determine the number of trucks for the future configuration of the mine where conveyors will replace rail transportation
- Unknown impact of the new transportation scheme on the variability of ore grade, as there will be less blending points

SOLUTION

- Performed the scenario analysis with a simulation model created in MineTwin

RESULTS

- It was determined that at least 37 trucks of the currently used model will necessary to sustain operations without negative impact on grade variability
- It was additionally determined, that if current trucks are replaced with bigger 220-ton trucks, then 25 trucks are sufficient to perform the same required haulage volumes

Case Study #3

USED MINETWIN TO CREATE A DECISION SUPPORT SYSTEM FOR POTASH MINES

A European potash mining company

PROBLEMS

- Uniform weekly targets for mining teams do not consider real-life situation. Some teams are not properly incentivized, while others receive unfairly high bonuses
- Mining plan is not fulfilled due to sub-optimal borers allocation and moving bottlenecks in complex system of conveyor transportation

SOLUTION

- Use simulation to calculate the reachable mining volumes for teams depending on their location in the mine and potential conveyor systems interaction
- Validate and adjust monthly mine plans in MineTwin
- Use simulation to explore and justify operational improvements

RESULTS

- Increased the accuracy of monthly mine planning by 10%
- Used simulation to determine targets for mining teams, as a result increased production by 3-5% due to more incentivized mine workers
- Tested and implemented operational improvements that lead to 12% increase in production without capital expenditure

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