Use of Modeling and Simulation in Mining and Natural Resources Industry

May 2013
Develop abstract model to represent existing or planned system

Learn more about the system

Use Simulation to …

MAKE INFORMED DECISIONS
Improved decision making* ...

You use simulation when...

- It is too expensive, destructive, or risky for live tests – feasibility analysis
- There are complex systems to analyze for which change is being considered and unanticipated change is often the norm – supply chain optimization, reliability analysis
- Predicting variability across processes offers efficiency gains or cost reduction – capital investment (comparing apples to oranges), resource allocation
- There is only incomplete data – scheduling system
- You need to communicate ideas and plans – stakeholder communication
- The system has several sources of uncertainty or randomness

* Advanced analytics identified as one of Gartner’s Top 10 Strategic Technologies for 2010
Can be applied in multiple settings –

- New and existing facilities,
- Capital investment or operational decisions,
- Underground, surface, processing plants, supply-chain, executive dashboards

Used to represent the details, complexities, and tradeoffs of the system being evaluated, including key processes, equipment and infrastructure

Detailed scenarios and what-if analysis highlight performance levels, bottlenecks and opportunities for improvement
Simulation Output

1. **Animation & Visualization** - Key to proving practical results of new approaches & processes

2. **Statistics** - Ability to measure results

3. **Dashboards** - Present concise, relevant, and actionable information to decision-makers

4. **Decision Support Data** - Outputs become key inputs to MIS and enable informed decision-making
All models developed using Simio Simulation Software

EXAMPLE APPLICATIONS OF MODELING AND SIMULATION IN MINING
Visualization through Simulation

Infrastructure and Operations

Provide a visualization tool to serve as a communication medium of planned mining operations and supply chain. Subsequently apply this tool to help with engineering design and process improvement.

- Utilized advanced analytical tool with 3D animation to develop a dynamic model of planned operations.
- Model included mine pit, equipment, buildings, plants and transportation system across **covering the entire mining value chain**.
- Developed invaluable quantitative and qualitative insights:
  - Getting enterprise excited about the initiative.
  - Communicating to external stakeholders (buy-in)
  - Feasibility level validation – “see” the operation in action and inform silos of engineering teams.
  - Afford opportunity to look across different options to develop site – impact on logistics, fleet, supply chain.

**Benefits lie in the Journey, as well as the Destination**
Visualization through Simulation

Bottom-line…

Communicate site plans and facility designs to stakeholders with analytical driven animation.
Evaluate the supply chain to test performance under a range of different situations, events, and constraints. Also focus on key areas including cost, capacity, equipment, inventory, transit time, and other areas, along with risks, bottlenecks, and their potential impacts.

- A complete model of the supply chain was developed, including detailed data analysis on 40+ output categories covering a base case and 10+ scenarios.
- The first 10 years of system ramp-up, through steady state, was represented and different scenarios configured for this period.
- The process reduced and delayed the CapEx investment in train sets.
- The project also reduced the planned CapEx for storage and changed the timing of the CapEx, saving millions of dollars.
Complex System Design

Bottom-line…

Most robust method for analyzing operations within a mine site, a specific area of operation or across a process.
Evaluate plans for new underground mine. Focus on reviewing the capacity constraints and infrastructure of the material handling system to ensure that the system is robust enough to meet expected needs and contingencies.

Some key conclusions:

- The material handling system meets defined needs, but requires ongoing control and communication.
- A ~38% cut in planned number of miners achievable, while still meeting required plant throughput (>USD10 million capital investment saving.)
- Planned capacity of certain conveyors exceed base case tonnage needs and related capital investment could be mitigated.
- Planned capacity of storage adequate to handle expected needs, though limits periodically tested.

The model also highlighted areas requiring diligent and methodical planning (resource scheduling) and assumptions and decision rules (including triggers for turning assets on and off) that have major impacts on results.
Capacity Analysis

Bottom-line…

Best predictor of system operation taking into account inherent dynamic behavior of system components.
MOSIMTEC provide leading edge dynamic simulation capabilities in the mining industry.

LEARN MORE ABOUT MOSIMTEC
Virginia based small business

Authorized Simio representative

Industry partner of Virginia Modeling and Simulation Center (VMASC)

Provide advisory services, support & training

Focused on modeling & simulation

Extensive experience in multiple industries

Helping industry to make informed decisions by applying Modeling and Simulation Engineering (MSE)
Extensive experience…

- Solutions for new/existing operations
- Applications across multiple industries, including mining, healthcare, transportation, chemicals, and manufacturing
- Multiple geographies – U.S., Canada, Africa
- Conduct workshops, publish in academic journals, and host training on Simulation

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