MineSight Strategic Planner v3.00

MineSight Strategic Planner (MSSP) is a comprehensive long range mine planning and scheduling tool for open pit mines. It develops life-of-mine schedules that maximize the project value subject to user-defined conditions and constraints. The conditions and constraints include economic parameters, phase reserves, truck and shovel parameters, destination capacities and material types, phase mining rates and vertical advances, destination dumping rates, phase and destination precedence, and production targets.

MSSP follows the "mining the next best" philosophy with lots of optional user controls built in. It adopts an enumeration plus linear optimization approach. The scheduling unit is a bench within a phase, stockpile, or stockpile lift. Enumeration determines the bench, and the phase in which it is mined. Linear optimization computes the reserve bin material routing and stockpile mining. Economics rank the phases for better economic returns so the optimal solution can be achieved period-by-period and the project net present value can be maximized with emphasis on the near future, and not at the end of the mine life.

MSSP is fast, producing runtimes in minutes and allowing engineers to quickly control and evaluate life-of-mine schedule developments. Engineers can choose between fully automated schedule runs and fully manual schedule runs, and anything between. MSSP outputs provide a suite of information, including phase mining results. These results show the following:

- The elevation to which a phase is mined and the proportion by which it's mined.
- Cutoff policy for multiple grades and multiple material or destination types (material mapping).
- Truck and shovel usage, haulage and loading hours.
- Capital investments.
- Automatic equipment replacement schedule.
- Destination usages, including stockpile intake, reclaim, and balances.
- Cash flow calculations with detailed cost parameter setup providing project net present values up to any given period.

These results can be exported to an EXCEL file or a database for customized reporting.

This article discusses new functionality in the recently released version 3.00. We'll also discuss new features coming in version 4.00.

New in MSSP v3.00

A better interface for scheduling setup and dialog navigation, plus the new and popular EXCEL data editing, are among the improvements in MSSP v.3.00. Additional features include:

- End-of-period maps for phase mining and destination usage using MS3D.
- Excel-based reports and charts.
- Detailed economic calculations for cash flow, allowing MSSP to model complex mining operation revenue and cost calculation requirements.

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- Ability to combine existing underground schedules with open pit scheduling.
- Automatic reserve bin material routing to multiple destination types and stockpile reclaim (Auto mapping).
- True blending of ore materials using ore class targets.
- Waste blending of acid generating and acid neutralizing materials or coarse and fine materials.
- Downstream product modeling (e.g., concentrate and smelters).
- Realistic multiple lift destinations for multiple types of schedule materials with detailed haul cycle times.
- Stockpile balances, intake, and reclaim by Average, First in first out (FIFO), and Last in first out (LIFO).
- Ability to compute truck and shovel usage, including automatic fleet replacement schedules and shovel priorities by period.
- Scheduling controls such as variable mining rate by phase by period or by phase by bench and destination dumping rate or vertical advances by destination by period.

Several of these features are highlighted below.

INTERFACE FOR COMPLEX SCHEDULING SETUP

Figure 1 shows a possible MSSP v3.00 interface layout. The menu items on top will start actions. For example, click **Schedule Calculation** to start the scheduling engine. In Figure 1, the **Exploring Project** pane on the left indicates which dialog is active via the green "traffic light". The active dialog (**Define Target Constraints** in this example) is to the right.

Move to the next or the previous dialog by clicking the **Next** or **Previous** buttons at the bottom, or jump to any dialog by clicking the dialog name in the **Exploring Project** pane.

Help for each panel is available via the **Help** button at the bottom. Help for all dialogs is also available using the **Help** menu item.

Inputs are stored in a resource file or a run file, and are available in subsequent launches of MSSP.

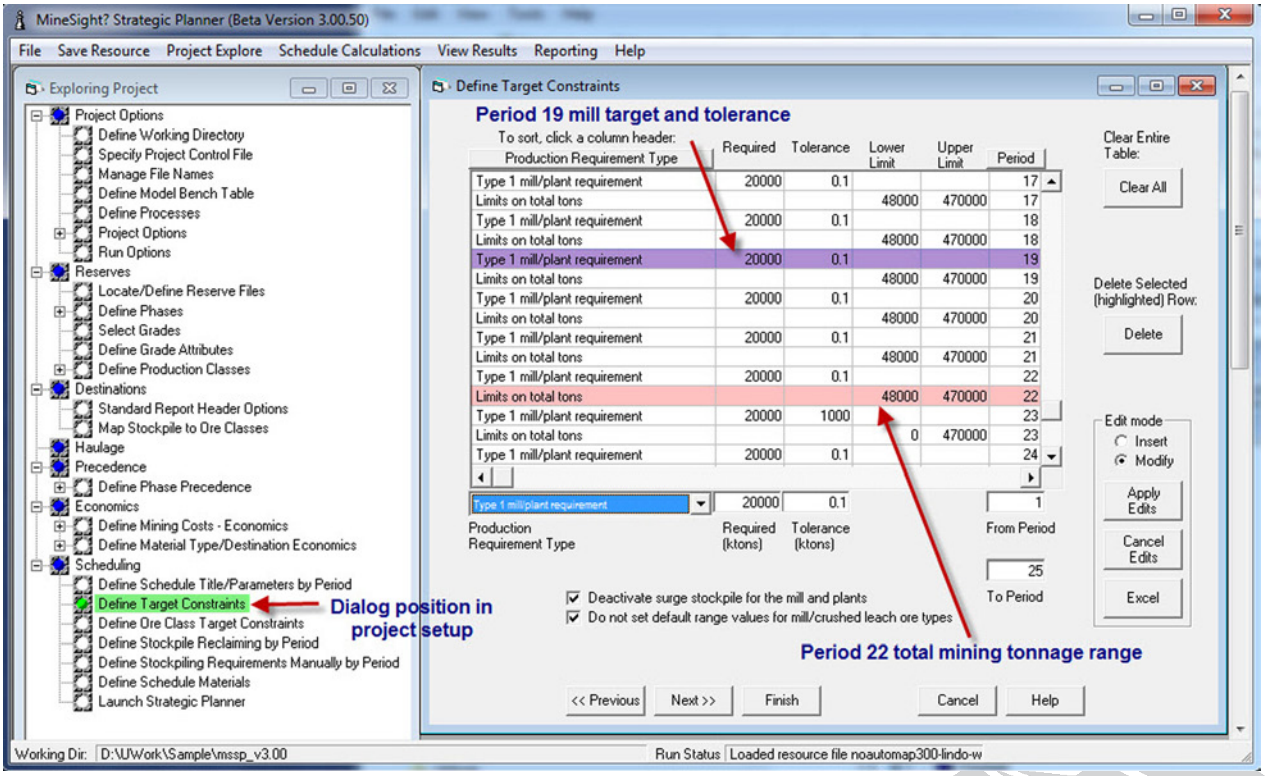
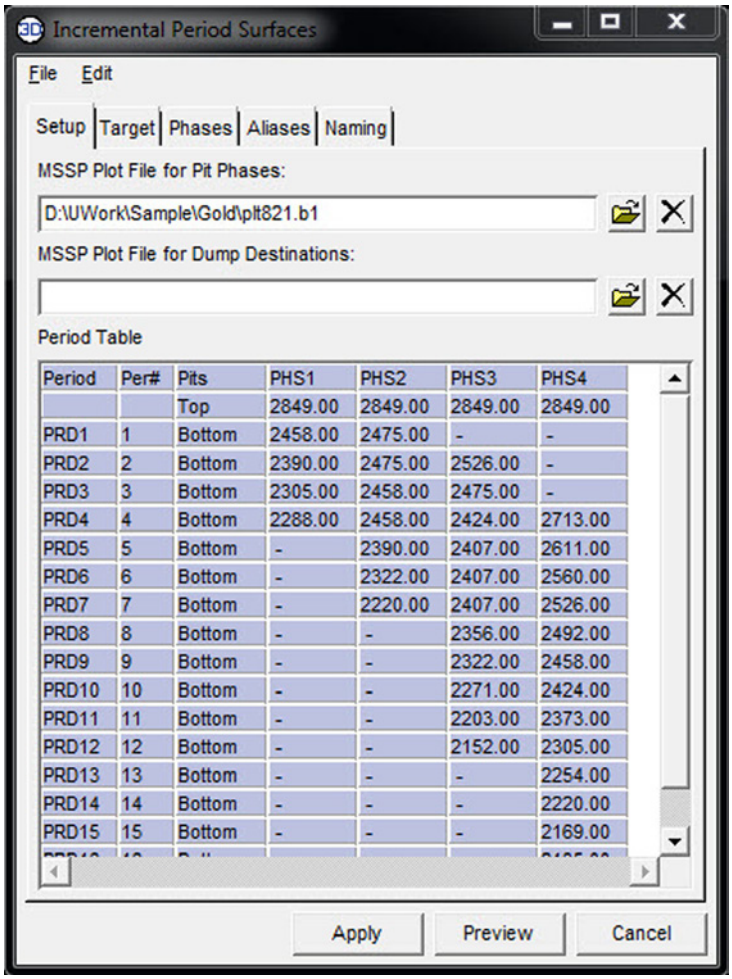


Figure 1 Sample layout of MSSP v3.00 interface

END-OF-PERIOD MAPS FOR PHASE MINING AND DESTINATION USAGE

A plot file is produced by MSSP. This plot file can be loaded into MS3D (**OP Eng Tools | MSSP Period Map Tool,** as shown in Figure 2). After selecting phases and topography (Figure 3), the resulting map is shown in Figure 4. Optionally, destinations (e.g., dumps) can also be plotted.



Period	Per#	Pits	PHS1	PHS2	PHS3	PHS4
		Top	2849.00	2849.00	2849.00	2849.00
PRD1	1	Bottom	2458.00	2475.00	-	-
PRD2	2	Bottom	2390.00	2475.00	2526.00	-
PRD3	3	Bottom	2305.00	2458.00	2475.00	-
PRD4	4	Bottom	2288.00	2458.00	2424.00	2713.00
PRD5	5	Bottom	-	2390.00	2407.00	2611.00
PRD6	6	Bottom	-	2322.00	2407.00	2560.00
PRD7	7	Bottom	-	2220.00	2407.00	2526.00
PRD8	8	Bottom	-	-	2356.00	2492.00
PRD9	9	Bottom	-	-	2322.00	2458.00
PRD10	10	Bottom	-	-	2271.00	2424.00
PRD11	11	Bottom	-	-	2203.00	2373.00
PRD12	12	Bottom	-	-	2152.00	2305.00
PRD13	13	Bottom	-	-	-	2254.00
PRD14	14	Bottom	-	-	-	2220.00
PRD15	15	Bottom	-	-	-	2169.00

Figure 2 Imported MSSP end-of-period plot file

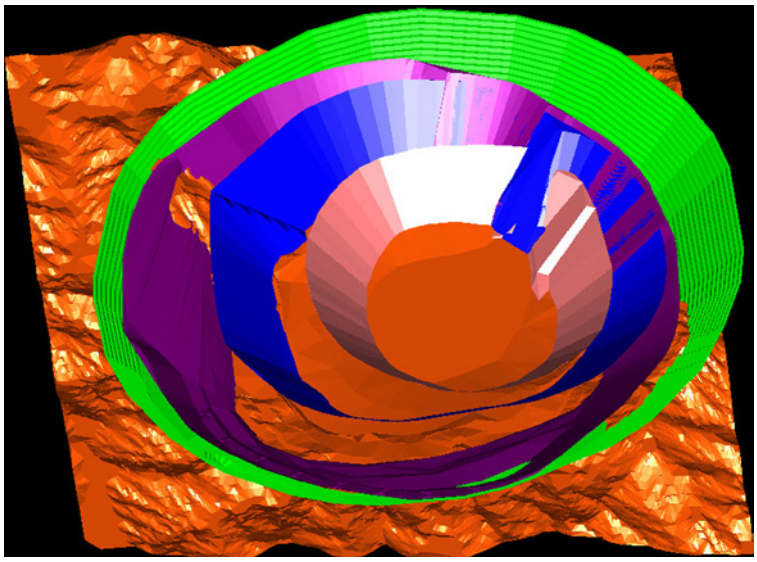


Figure 3 Selected phases and topography

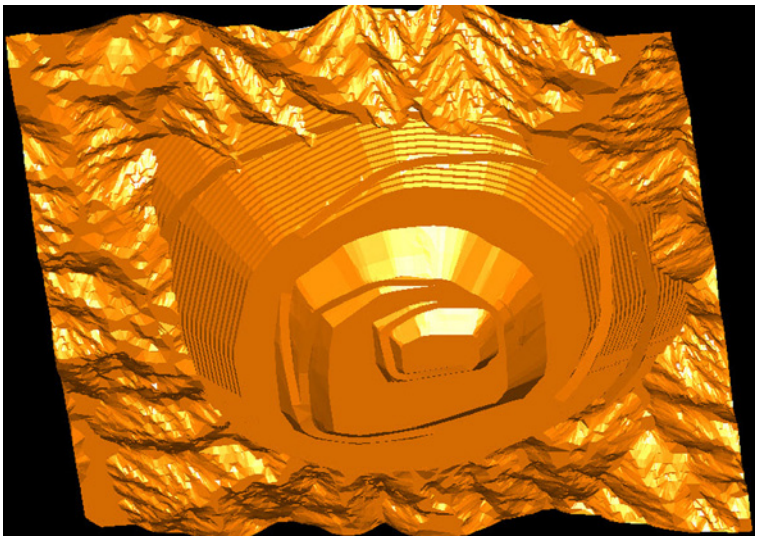


Figure 4 Period end map

AUTOMATIC RESERVE BIN MATERIAL ROUTING TO MULTIPLE DESTINATION TYPES AND STOCKPILE RECLAIM

A reserve bin material (e.g., 5,000 tonnes with 2.0% Copper and 0.05% Molybdenum grades) can be mined as mill ore, crushed leach ore, run of mine ore, or stockpile ore, based on the costs to mine and process the materials, the computed revenues, and destination capacities. By treating a stockpile or a stockpile lift as a reserve bin, stockpile reclaim is done automatically.

Optionally designate a reserve bin to be routed as any one of the schedule materials. MSSP honors the designation and automatically routes other reserve bins considering the schedule constraints.

Ore Classes are defined for true blending (e.g., a mill processes two types of materials at designated proportions: 70% Fresh and 30% Oxide). For example, Fresh reserve bins with copper grades at 0.9% and 1.0% are defined as Fresh (one Ore Class). Oxide bins with copper grades at 0.5% and 0.6% are defined as Oxide (another Ore Class). Stockpiles are tagged as Fresh or Oxide as well so that Fresh stockpiles will feed the 70% portion of mill feed and Oxide stockpiles will feed the 30% portion of mill feed, as illustrated in Figure 5.

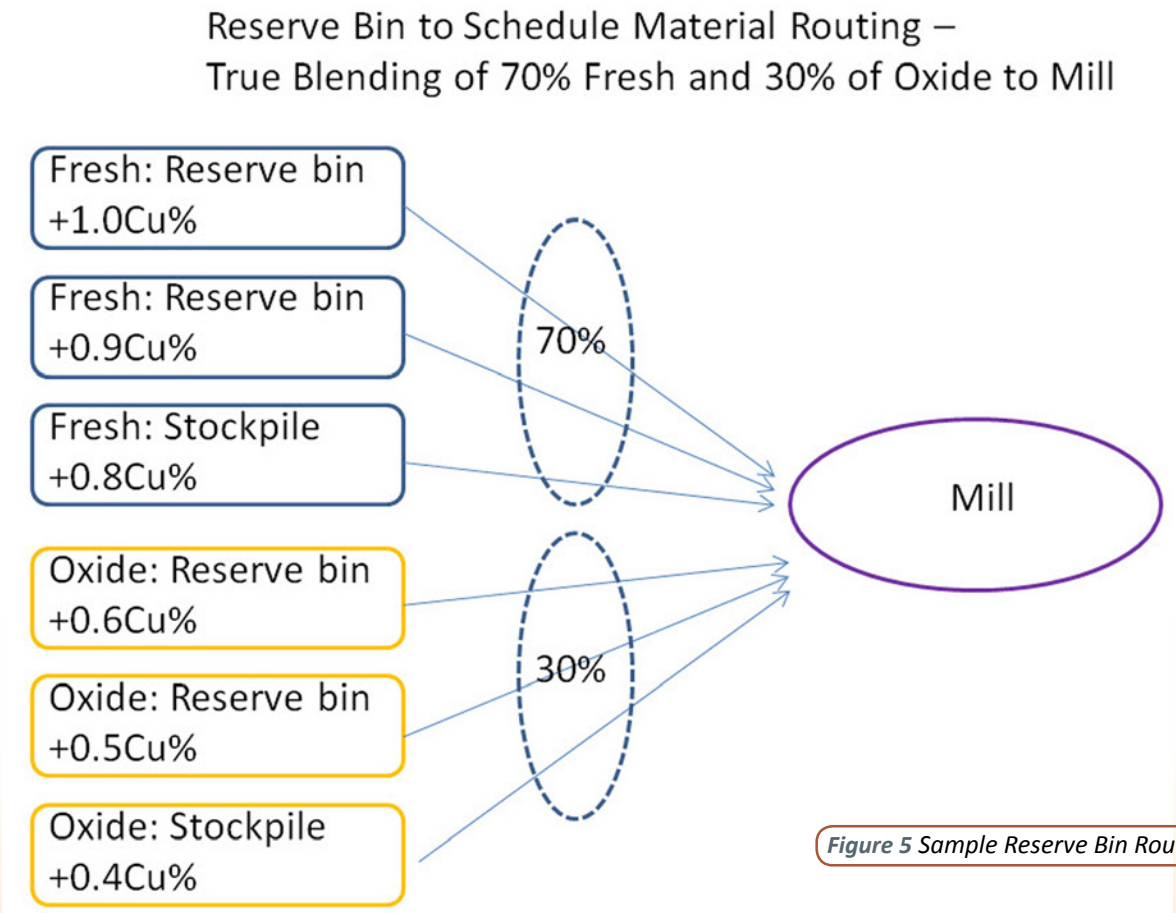


Figure 5 Sample Reserve Bin Routing

DYNAMIC PROGRAMMING ALGORITHM IN MSSP V4.00

The MSSP scheduling approach is well suited for multi-period, forward-looking scheduling using a Dynamic Programming algorithm or another method, such as Genetic Algorithm.

Currently, MSSP chooses one optimum solution among all feasible solutions for a given period, updates the reserves, and then proceeds to the next period. Version 4.00 will allow all or a user-defined number of feasible solutions to be kept for a period. Each of these solutions will be used as a starting point for feasible solution searches in the next period. For each subsequent period, the number of feasible solutions could expand or shrink depending on scheduling conditions and constraints for the period. In general, the number of feasible solutions for subsequent periods increases. At the end of a scheduling run, the feasible solution with the highest cumulative project net present value will be selected to be the optimum solution. This is the Dynamic Programming approach which guarantees an optimum solution for a given set of stages and states, which for MSSP corresponds to periods and feasible solutions, respectively.

Thus MSSP v4.00 will perform multi-period, multi-solution scheduling, which will provide an optimum solution for up to any given period (e.g., period 5, period 10, or life-of-mine). This is the nature of Dynamic Programming. The underlying scheduling approach assures the ability to do blending schedules, smooth productions, and control the schedule development.