INDUSTRY OVERVIEW

Open pit mine project evaluation is vital for mining and other companies investing in metal assets (or other bulk commodities) when making final go/no-go investment decisions. Traditional mine project evaluation is based on input averages to plan, design and value a mine project – this is done assuming that average inputs are good representative for future reality.

Current market downturn, however, have shown that the uncertainty in future metal prices, metal grades and production costs (among others) are some of the main causes for project failure, revealing the “flaw of averages” in ore resource/reserve estimation and mine strategic planning.

This is the reason why the mine evaluation process must cope with chance and uncertainty, to minimize the risk for losses and maximize the potential for revenue. One solution is to build a probabilistic reasoning into the mine evaluation process to assist mine planners and engineers to produce risk robust mine plans and designs over time.

KEY BENEFITS OF ATTENDING

- **Introduce the concepts** of quantitative risk and real options analyses (“QROA”) and decision making valuation methods in open pit mine project evaluation as complement of traditional DCF analysis.
- **Demonstrate** that QROA provides a viable alternative technique for strategic mine planning, design and evaluation in the face of uncertainty.
- **Show** how the lack of flexibility impacts the valuation of projects avoiding mine engineers and mine managers to identify opportunities, develop strategies and increase project value.
- **Show** how the application of QROA for open pit mine project evaluation enable better connection & communication between operational, financial and managerial levels.
- **Utilise** options and real options techniques to aid in final investment decisions.

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**Open Pit Mine Project Evaluation in the Face of Uncertainty: A practical Approach**

Seminar / Workshop  Brisbane October 3-5 2016  BOOK TODAY!

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**Have an insight into the SGeMS software for ore resource modelling**

**Learn how to use the Crystall Ball to run a Monte Carlo analysis**

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R&O ANALYTICS PTY LTD
Tel: +61 (0) 439 903 728  Fax: +61 7 3378 6034  contact@randoanalytics.com
IN THIS 3-DAY SEMINAR/WORKSHOP YOU WILL:

- Have a quick introduction to ore resource and reserve estimation using both the SGeMS geostatistical software and the SimSched engine for open pit mine plan and design;
- Utilise the Crystal Ball (Oracle) tool for modeling and quantifying data uncertainty;
- Implement a quantitative risk assessment based on traditional Monte Carlo simulation and the Upside/downside potential analysis;
- Assess the effect of geological metal grades, metal prices and operational cost variabilities in project economics;
- Develop and implement a quantitative real options framework for evaluating open pit mine projects;
- Assess and value different project real options, such as the option to defer, abandon, expand, and strategic decision pathways determining their financial viability and feasibility;
- Schedule and prioritise decision pathways or projects based on a qualitative and quantitative metrics;
- Value optimisation by assessing different decision paths under certain conditions, or determining how using a different sequence of pathways can lead to optimal strategy.
- Developing investment timing strategies including optimal trigger values, cost or revenue drivers.

PRESENTED BY:

“Strategic thinker and doer, innovative and creative decision maker with a passion for creating value based on reliable & practical strategies”.

Dr. Luis A. Martinez

Luis has more than 18 years working in the mining industry, and holds two master degrees in open pit mine planning from the WH Bryan Research Center – SMI, The University of Queensland, and a PhD in advanced mine project evaluation using real options from the schools of Economic and Finance and Mathematics – Queensland University of Technology. Luis has presented this course nationally and internationally for over four years and has presented numerous papers on project evaluation in the face of uncertainty.

WHY THIS COURSE IS UNIQUE

This course is unique because it is a hands-on in the open pit mine project evaluation process using advanced techniques to account for technical, operational and economic uncertainties.

PLUS.....

Receive a 30 day trial license of the “SimSched” mine planning engine...
## COURSE FORMAT

The course/workshop comprises 12 chapters with respective workshops where the attendee will apply the theory in a real copper mine data set. To achieve this, the attendee will use the SGeMS software for resource estimation, the SimSched engine for mine planning and design, the Crystall Ball add-in Excel for quantitative risk analysis, and Excel Spreadsheet for real options analysis.

### SYLLABUS DAY 1: Base case analysis

1. Introduction – the importance of assessing the effect of uncertainty in open pit mine project evaluation – Is it worth to do the extra effort?
2. Ore resource estimation (kriging) and simulation (Sequential Gaussian Simulation) - generalities;
   - **WORKSHOP 1:** Introducing the North project drill-hole data.
     - Using the “SGeMS” software to estimate the North project resource block model;
3. Mine plan and design traditional (Lerch-Grossman based) versus operation research techniques;
   - **WORKSHOP 2:** Introducing the “SimSched” engine for open pit mine planning.
     - Planning and designing the North project open pit mine plan – long term production scheduling.
   - **WORKSHOP 3:** Building a cash flow model for the North project.
     - Estimating project net present value (NPV), internal rate of return (IRR), pay-back period.
5. Identifying sources of uncertainty – Sensitivity analysis and tornado charts.
   - **WORKSHOP 4:** Building a sensitivity model for the North project (bubble charts).

### SYLLABUS DAY 2: Uncertainty and risk

6. Introduction to uncertainty and risk – Monte Carlo simulation;
   - **WORKSHOP 5:** Building a quantitative Monte Carlo model for the North project KPIs.
7. Quantifying metal grade uncertainty using simulations techniques;
   - **WORKSHOP 6:** Assessing the effect of metal grade uncertainty in project KPIs.
     - Applying the Sequential Gaussian Simulation to quantify copper grade uncertainty – using the SGeMS software.
8. Quantifying metal prices using traditional and advanced techniques for Precious and base metals.
   - **WORKSHOP 7:** Assessing the effect of copper price uncertainty in project KPIs.
     - What if copper prices behave erratically over time?
     - What if copper prices behave as mean reverting over time?
9. Introduction to decision tree scenario analysis.
   - **WORKSHOP 8:** Building a decision tree analysis for the North copper project.

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**Learn how to use the Crystall Ball to run a Monte Carlo analysis**
WHO SHOULD ATTEND

This course/workshop is addressed to all professional involved in the appraisal and valuation of open pit mining projects specially mining managers and analysts, geologists and engineers working in the mining industry, fund and asset managers working in the mining industry, bankers investing in mining, and exploration managers, or investors wishing to learn the process of valuing open pit mining projects.

SYLLABUS DAY 3: Quantitative Real Option Analysis


WORKSHOP 9: Pricing financial options using binomial trees (lattices) – Black-Scholes.

11. Introduction to real options analysis – analogy to financial options – types of real options;

WORKSHOP 10: Understanding real options with a simple example.

- Estimating the value of flexibility to invest in a project.
- Applying the Black-Scholes to value flexibility to defer.

12. Defining decision making as a function of direct cost of investment and both current and future commodity prices;

13. Implementing a ROA in the North project

WORKSHOP 11: Building a real options model for the North project.

- Assessing the joint effect of metal grades and metal prices in the project KPIs – No flexibility.
- Valuing the North project with flexibility to close.
- Valuing the North project with flexibility to defer (1 year) investment.

14. Final comments and end of master class.

REGISTRATION/ENQUIRE FORM:

For Registration: 3-day seminar/workshop fee is AUD$2600 + GST per person. This includes all notes (e-notes) and excel exercises developed in classes. It also includes a 30 day trial of the SimSched software for open pit mine planning, as well as teas/coffees, and lunches.

Experience
Participants do not require advanced mathematical skills to understand and apply the course material. However, they should be familiar with:

- Excel spreadsheet;
- Basic statistical concepts such as expected value, variance, and standard deviation;
- Basic concepts for mining processes and cash flow valuation;

EXPRESSION OF INTEREST
For general enquiries and general information about the location of the course, please contact us at:

Phone: +61 (0)439 903 728
Fax: +61 7 3378 6034

Or Email us your details to: contact@randoanalytics.com