MineRP GeoInventory and GeoFinance
Controlling Process, Inventory and Money

Whitepaper

MineRP

Executive Summary

In the midst of the biggest investor confidence crisis in the history of mining, fuelled by increasing costs and low commodity prices, mining as an industry cannot afford to rely on what is effectively a disjointed planning model executing to a single-scenario Business Plan.

MineRP (Mine Resource Planning) has broken with the convention followed by the Mining Technical Systems (MTS) Industry of focusing on standalone expert systems and has developed a platform to amalgamate aboriginal or source data from all Mining Technical Systems into a single Mine Resource Planning system.

Executed over the past seven years, this strategy and the resultant platform has progressed to the point where MTS and Enterprise Resource Planning (ERP) systems are able to collaborate in the vernacular of the respective systems and maintain integrity across the entire mining value chain.

There are a number of reasons that limit the ability to do scenario planning delivering optionality for both design and scheduling. These include:

•   Mine designs and concomitant geological information are abstracted from aboriginal/source systems.
•   The resultant data is used as a single planning premise. Heavily reduced to averages and aggregates, it is remodelled mathematically to provide an ostensibly optimal extraction plan.
•   This model is based on costs extracted from the ERP System, averaged and aggregated to align to the mathematical model and applied to generalized mining parameters.
•   Any scenario based on such a process is so far removed from both the mine design and the financial accounting and planning systems that scenario outcomes need to be mannually recreated in both.
•   The result is an over simplified model that can only be changed or updated through a re-enactment of the entire strategic scenario planning process.

MineRP's Solution to the Problem

MineRP platform collaborates with IBM and SAP to expose the business processes and related mining data to the ERP system and to mainstream analytics and scenario modelling solutions.

MineRP applied to patent the following three systems and methods to underpin the integration between MTS and ERP domains:

•   GeoInventory
•   GeoFinance – WBS
•   GeoFinance – Charter of Accounts

This paper will describe these three solutions in more detail.

Challenge: Disconnected Planning

The efficacy of an Enterprise Resource Planning (ERP) platform depends on comprehensive access to information across the total Business Value Chain, to create a Business Ecosystem encapsulating all aspects of business planning, production and accounting.

In the case of the mining industry, the business value proposition of ERP solutions has been severely diluted by the lack of integration between the ERP and Mining Technical Systems (MTS) domains and hence the disconnect between the two domains in all horizons of Business Planning and Accounting.

Mining technical systems, by their very nature, work against the foundational principles of enterprise resource planning by their predominantly standalone nature, leading to the many challenges associated with silo-based information.

The result? Information flow is disconnected and data is aggregated or inappropriately averaged as a basis for Scenario and Business Planning. Globally utilized ERP modules such as SAP's Business Planning and Consolidation (BPC) are undermined as business, planning and scenario modelling tools. Companies are forced to do Scenario Planning by reverting to spreadsheet or other proprietary mathematical modelling tools disconnected from both the Mining Technical and the ERP platforms.

Scenario planning is thus typically performed on the basis of:

- Mining quantities, volumes and extraction rates abstracted from the Mining Technical Systems for scenario modelling. This includes the abstraction of geological models for subsequent evaluation of these scenarios.
- Financials abstracted from the ERP System for scenario modelling, most often in spreadsheets or alternatively in disconnected, proprietary mathematical modelling tools.
- Disconnected modes of modelling where costs are averaged and aggregated, mining rates are averaged (irrespective of spatial location) and mining companies end up modelling:
  - Averaged extraction volumes over
  - Averaged geological values against
  - Averaged costs with
  - Averaged constraints and capacities

Further complicating the process is the fact that any scenario needs to be manually captured into or recreated in the aboriginal mine planning systems as a Mine Design and Extraction Plan. It cannot be persisted into either the MTS or ERP systems, since the modelled outcome has been totally disconnected from the original mine planning systema through aggregation and disjointed mathematical modelling,

The typical level of data granularity in the ERP system does not reflect that of the operational activities and patterns of cost incurred in the business.

Whilst companies are able to mathematically model alternative scenarios, these are all effectively executed against a single base premise of averages. The reality is that most often only a single mine design and extraction plan is created and the process is thus not robust against changing economic climes and external business influences. In addition the plans cannot be rapidly redone, re-evaluated nor realigned to such changing business and economic demands.
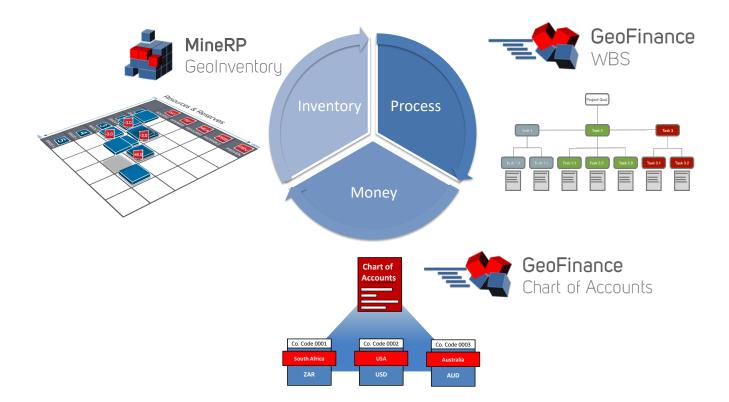
Controlling Inventory, Process and Money

At the risk of over-simplifying the complexities involved in mining; the foundation of control in any business lies in end-to-end control over the following three rudiments:

- **Inventory**: The "product" the business deals in. In mining, this relates to the physical inventory of the commodity mined and conventionally reported on as Resources and Reserves. Inventory in this sense is traditionally controlled in the MTS domain.
- **Process**: The activities comprising the enacted business model. In mining, the core activities related to mineral extraction are controlled in the MTS domain.
- **Money**: Control over revenue and cost elements comprising the transactional planning and information flow within the business. In mining this is controlled within the ERP domain albeit the majority of transactions are based in the execution of mining activities.

As opposed to developing the control systems for the above within the MineRP platform we have collaborated with IBM and SAP to expose the business processes and related mining data (pertaining to the above three rudiments) to the ERP system and to mainstream analytics and scenario modelling solutions.

Inventory

MineRP GeoInventory

It is clear from the requirements of international resources and reserves reporting codes that a number of factors are to be considered in the classification of Mineral Inventories.

Time, infrastructure, accessibility and financial outcomes to name a few are all considered to a more or lesser degree throughout the process of R&R classification. Accurately keeping track of such inventories and their classifications is a complex, time consuming and very expensive task.
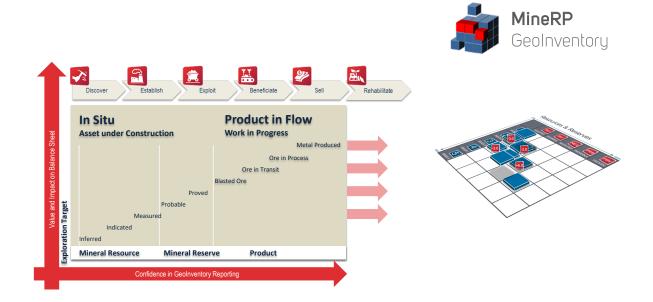
The tediousness of resource and reserve analysis and management is mainly due to the time consuming nature of manually integrating and interpreting the underlying mineral resource management data that describes the state and status of the mineral asset and extraction strategies.

GeoInventory is the patent pending system and method whereby MineRP translates individual Resources and Reserves categories with their mineral content to equivalent virtual inventory within the ERP's Materials Management module.

❝ MineRP's GeoInventory solution allows you to demonstrate the real value of your mineral asset at each stage of its development and lifecycle. **❞**

Resources and Reserves can thus be treated as inventory of raw materials. Each technical and mining activity is translated into an equivalent inventory transaction and posted to the ERP platform on a real-time basis.

Aside from the obvious benefit of being able to report Resources and Reserves natively from the inventory system, the real benefit lies in being able to bring to bear conventional ERP functionality on the resultant inventory.

Furthermore, a history of all interactions is carried within the ERP platform, ensuring unprecedented auditability across the total mining value chain while being traceable to the original system in which the activity was planned, executed or recorded.

MineRP
GeoInventory

Process

MineRP GeoFinance - WBS

In mainstream business processes and control systems all processes are reflected in Work Breakdown Structures (WBS). A WBS is effectively a formalized structure in which work is controlled in scheduling and management platforms as well as the basis on which work processes are aligned in financial control systems.

MineRP applied to patent a system and method whereby we analyse and translate mine designs and plans into a WBS conforming to globally accepted business conventions. This is done to the lowest level of activity in mining and aligns the MTS System and ERP to a common process and level of data granularity.

There are two primary benefits in the translation of mine designs and plans to a WBS:
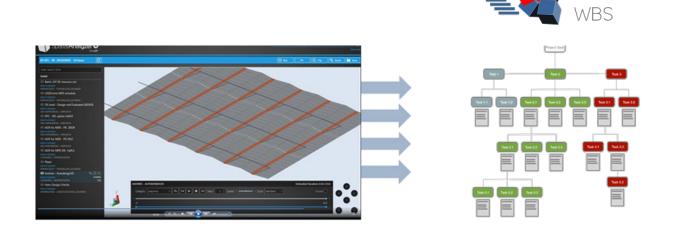
- By publishing the core mining schedule as a WBS we are able to leverage industrial strength scheduling and optimization platforms such as IBM's iLog solution as a Master Business Scheduling tool and integrate all peripheral and supporting activities into a single schedule. Simulation and analytics solutions are then utilized to create an optimized schedule of activities in line with practices and techniques used successfully in other industrial domains.

> **❝** Whether your organization has chosen to implement SAP or indeed another ERP solution, MineRP is able to integrate with your enterprise systems. **❞**

- A WBS is one of the foundation elements of Enterprise Resource Planning and forms the basis for integration between work activities and related financial controls within ERP systems. Basing our WBS structures on the lowest level of activity within core mining extraction processes facilitates previously impossible activity and area based costing, budgeting and accounting.

The mine design, including activity sequencing is leveraged in the MineRP Template Aided Design solution which allows for the rapid design (minutes per half-level!) of mining layouts draped to geology and based on the individual mining operation's rules.

The resultant design is automatically sequenced for extraction based on the combination of rules pertaining to the mining method. The mining activities are then scheduled based on governing constraints such as capacities, capital, crew availability, etc.

Money

MineRP GeoFinance – Chart of Accounts

Sucess in business management depends largely on the abiity to measure and control revenue and cost at the required level of detail. In the mining industry however, it was long thought impossible to align the granularity at which physical mining activities are planned and executed with the level at which financial and manangement accounting solutions are able to attribute and account cost and revenue.

The ability to translate the mine design, sequence and schedule into a structured WBS enables the translation of a mine design into a Cost Centre structure, with the correct company Chart of Accounts((CoA) as attributes.
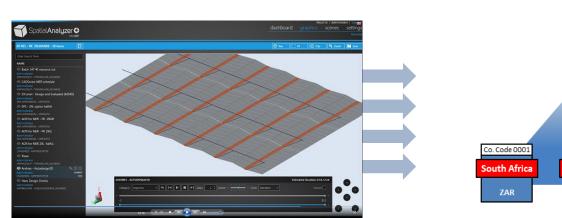
This in turn allows for budgeting at a previously impossible level of granularity for role, activity and area based costing.

By leveraging the SAP Project System (PS) module, this cost centre structure is published to the ERP system and, in the case of SAP BPC can be used for business planning on an exact instance of the mining activities.

Given the high prevelance of SAP in the top 40 largest mining companies, MineRP has gone to great lengths to ensure that it's GeoInventory and GeoFinance solutions are both SAP ready.
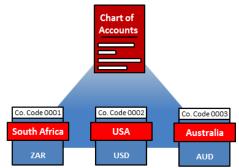
This does not mean GeoInventory or GeoFinance are SAP dependant. MineRP is able to integrate with your enterprise system of choice.

The biggest reason for this ERP agnosticism is the fact that MineRP interacts with ERP solutions through a translation layer built into the MineRP framework. This translation layer translates standardized mining terminology and measurables into ERP-speak via an Outbound Book of Standards.

The Outbound Book of Standards (BoS), is configured during project implementation to ensure that information from your mining technical solutions flows freely to and from your ERP, and can be consumed in the ERP without the typical intesive customization required to facilitate interaction between MTS and ERP.

Business Benefits

For the CEO and CFO

Mining stakeholders want consistent, predictable and reliable returns. They want mining companies to stick to the production and performance promises the CEO and CFO make.

Demonstrating how value is added with every cent of applied capital requires on-demand access to accurate resource and reserve reporting in compliance with global regulatory and audit codes.

Vastly reduce the cost and duration associated with reliable and auditable resource and reserve reporting, and meet the promises you make.

With MineRP GeoInventory, accurate data is available on all aspects of the mineral inventory to inform the best financial and strategic decisions at every level of the enterprise.

For the COO

Planning, modelling and simulation is every COO's business. GeoInventory lets you optimize your operational efficiencies beyond anything possible to date.

To effectively manage a complex domain, the modern COO needs on-demand, visually integrated operational and commercial information.

Mining technical systems (geology, plannning, survey, safety, etc.) are extremely fragmented by nature. MineRP provides an end-to-end integration and collaboration platform.

This allows the COO continuous control of the mineral asset with real-time visualization, reporting and analytics capabilities on all technical and financial aspects.

For the CIO

Tasked with governance and information management for both internal and external clients, CIOs must provide uninterrupted, accurate and auditable access to real mining data.

Modern economies require information to be available on-demand, to any destination, and on any device imaginable.

MineRP provides a platform for mining technical systems collaboration, translating the entire mining technical dataset into an integrated dataset that seamlessly relates to the ERP domain.

Simplify, standardize, collaborate, vizualise, analyse and optimise: All from one domain with no need to change source systems or retrain users.

Inventory, Process and Money in Scenario Planning

Scenario planning the process of targeting a specific outcome through the simulation of extraction of **Inventory** with the consideration of multiple permutations of **Process** constrained by capacities and competencies and modelled to reflect the **Money** involved either as cost (capital or operational) or as revenue based on sale of product.

Through the combination of the products referred to here, MineRP has partnered with IBM to develop specific optimization and simulation solutions for the mining industry allowing for the rapid building and valuation of multiple (100's of) scenarios within a very short period of time. This is done while maintaining full mining technical and financial integrity as all scenarios are based on actual designs and operating parameters instead of abstracted averages and aggregates.

The elected scenario is automatically persisted for execution into the aboriginal MTS planning & control systems as well as the ERP systems.

World's first Proven ERP / MTS Integration Platform

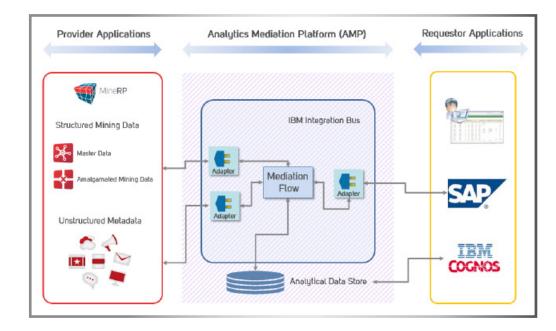### Bringing mainstream information technology to bear on mining

Although a big consumer of technology, mining has not been a primary driver for the proprietors of mainstream information technologies. This is largely due to the lack of integrated data in the primary business of mining as it is created in disparate mine technical systems.

MineRP has developed global relationships with technology companies such as IBM and SAP to complement the functionality available within our own applications with superior products, solutions and services proven across large, global industries and complex technical processes.

Information exchange between ERP systems and MTS platforms for purposes such as advanced analytics and simulation is now available for use in the development of mining scenarios to the benefit of mining companies.

> **MineRP and IBM have joined its significant capabilities in developing versions of GeoInventory and GeoFinance built on a combination of best in class technologies contributed by both companies.**

MineRP and IBM have co-funded the development of mining-ready GeoInventory and GeoFinance solutions created on these two MineRP patend pending solutions.

Brining together specialist teams in MineRP MTS integration, SAP MM-IM, IBM AMP, Cognos, and a host of other technologies, both companies invested significantly in the development of minimum viable prototypes thad will lead to ground breaking joint solutions in 2015.

The MineRP / IBM Solution Architecture

Integrating the MTS and ERP domains was achieved in this instance through the IBM Analytics Mediation Platform (AMP).

Other options for direct integration with SAP MM/IM or other ERP solutions are also available.

MineRP GeoInventory & GeoFinance
Integrated solutions from MTS to ERP

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