



**3DEXPERIENCE<sup>®</sup>**

# Mine Production Management

**Ben Farquharson:**  
**Vice President GEOVIA, Asia Pacific South**

# Our Company



## a Scientific company

Combining **Science, Technology** and **Art** for a sustainable society



## 13,300 passionate people

- 117 nationalities
- One global R&D / 56 labs
- Game changing **3DEXPERIENCE** solutions



## 190,000 enterprise customers

- 12 industries in 140 countries
- >10 million on premise users
- >100 million online users



## 10,000 partners

- Software, Technology & Architecture
- Content & Online Services
- Sales
- Consulting & System Integrators
- Education
- Research




















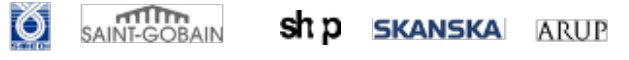






## Long-term driven

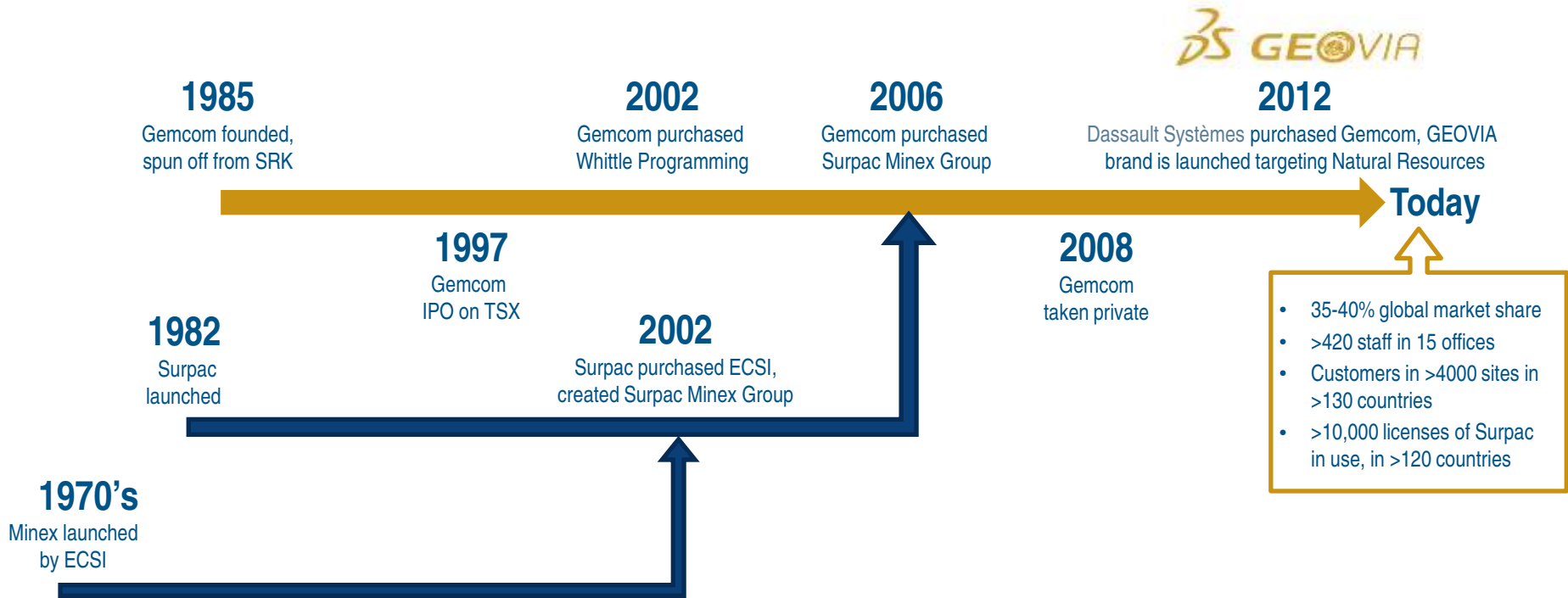
- Majority shareholder control
- **Revenue:** \$3.2 Bn\*
- Operating margin: 29.8%\*

\* Figures as of FY 2014 / Non-IFRS

# Our Clients: Industry leaders at the heart of Innovation

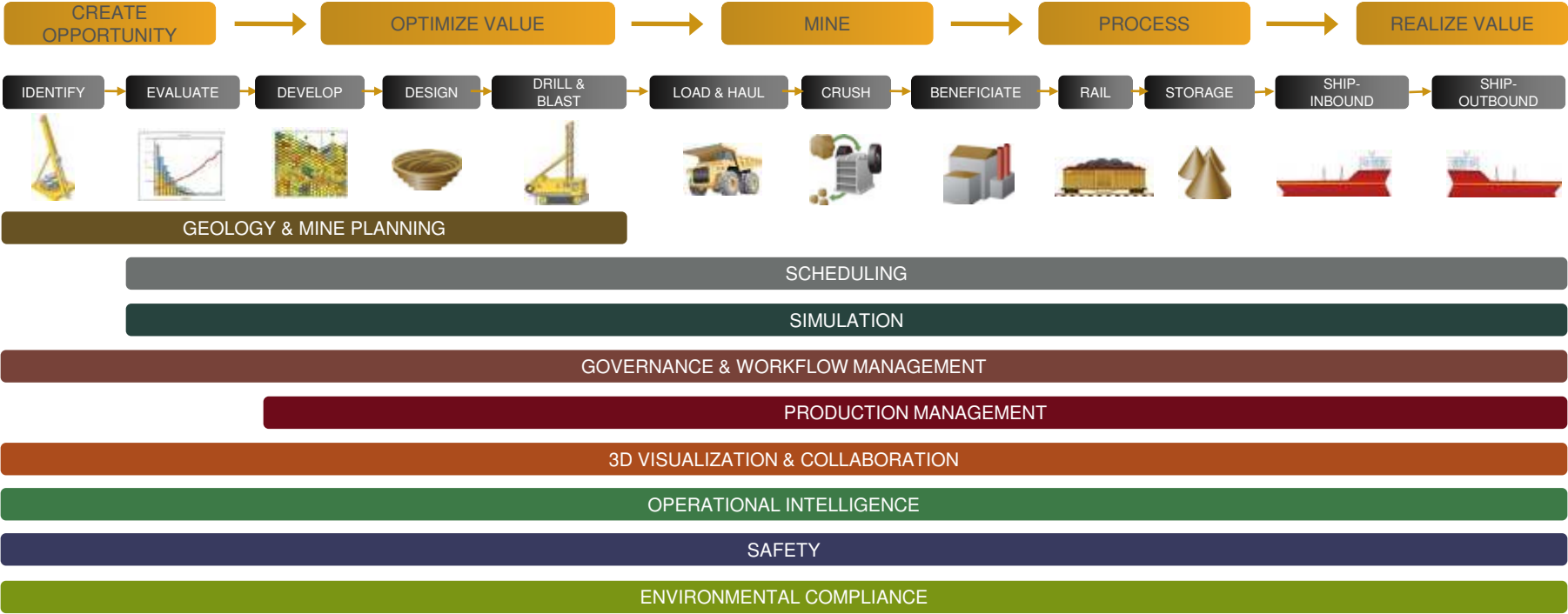
	<b>Transportation &amp; Mobility</b>	
	<b>Aerospace &amp; Defense</b>	
	<b>Marine &amp; Offshore</b>	
	<b>Industrial Equipment</b>	
	<b>High-Tech</b>	
	<b>Consumer Goods - Retail</b>	
	<b>Consumer Packaged Goods - Retail</b>	
	<b>Life Sciences</b>	
	<b>Energy, Process &amp; Utilities</b>	
	<b>Architecture, Engineering &amp; Construction</b>	
	<b>Financial &amp; Business Services</b>	
	<b>Natural Resources</b>	

# The Evolution of GEOVIA



# Mining Execution Management

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# GEOVIA – The Leading Mining Portfolio

EXPLORATION

EVALUATION

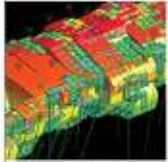
PLANNING

ENGINEERING

MINE PRODUCTION MANAGEMENT AND RECONCILIATION

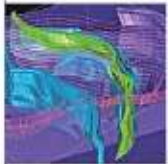
SERVICES

## GEOLOGY AND MINE PLANNING



**GEOVIA | Surpac**

Surpac is the world's most popular geology and mine planning software. It delivers efficiency and accuracy through ease-of-use, powerful 3D graphics and workflow automation.



**GEOVIA | GEMS**

GEMS provides collaborative geology and mine planning capabilities that support cross-functional teams involved in exploration, modelling, mine design, long-term planning and production scheduling.



**GEOVIA | Minex**

Minex provides the best geology and mine planning tools for coal and other stratified deposits, ensuring resources are evaluated accurately and mined efficiently.

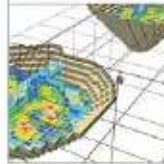
## BLOCK CAVING



**GEOVIA | PCBC**

PCBC is used by virtually every major mining company involved in block caving, who rely on its comprehensive functionality to assist with feasibility studies, design and production management.

## STRATEGIC MINE PLANNING



**GEOVIA | Whittle**

Whittle is the world's most trusted strategic mine planning software used to determine and optimise the economics of open pit mining projects.

## SCHEDULING



**GEOVIA | MineSched**

MineSched provides long- and short-term scheduling for surface and underground mines of all sizes and types, improving productivity and profits beyond what's possible in manual scheduling.

## MINE PRODUCTION MANAGEMENT AND RECONCILIATION



**GEOVIA | InSite**

InSite collates progress of production activities against the plan. Advanced reconciliation tools allow mining operations to address and understand the cause of variance.

## SECURE REMOTE COLLABORATION



**GEOVIA | Hub**

Hub provides secure remote collaboration that organises, centralises and enables the reliable sharing of exploration, planning, and production data over low-bandwidth connections.

## SERVICES



**GEOVIA | Services**

When you don't have the time or in-house resources available, GEOVIA's global Services team can provide geology, engineering, and operations assistance.



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# What is GEOVIA InSite™

Introduction



# What is GEOVIA InSite™

- Tracks the **quality** and **quantity** of materials across your operations
- Manages material **stockpiles**
- Built for the Mining Industry
- Full auditability
- Transactional database for all activities and movements in near real time
- **Material Balance** allows variances to be managed with more confidence
- InSite **activities** can have **costs** associated (equipment, personnel and consumables)





# GEOVIA InSite™ Architecture





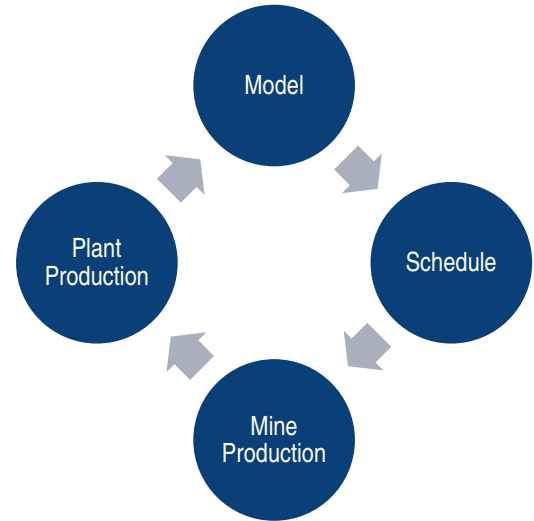
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# GEOVIA InSite

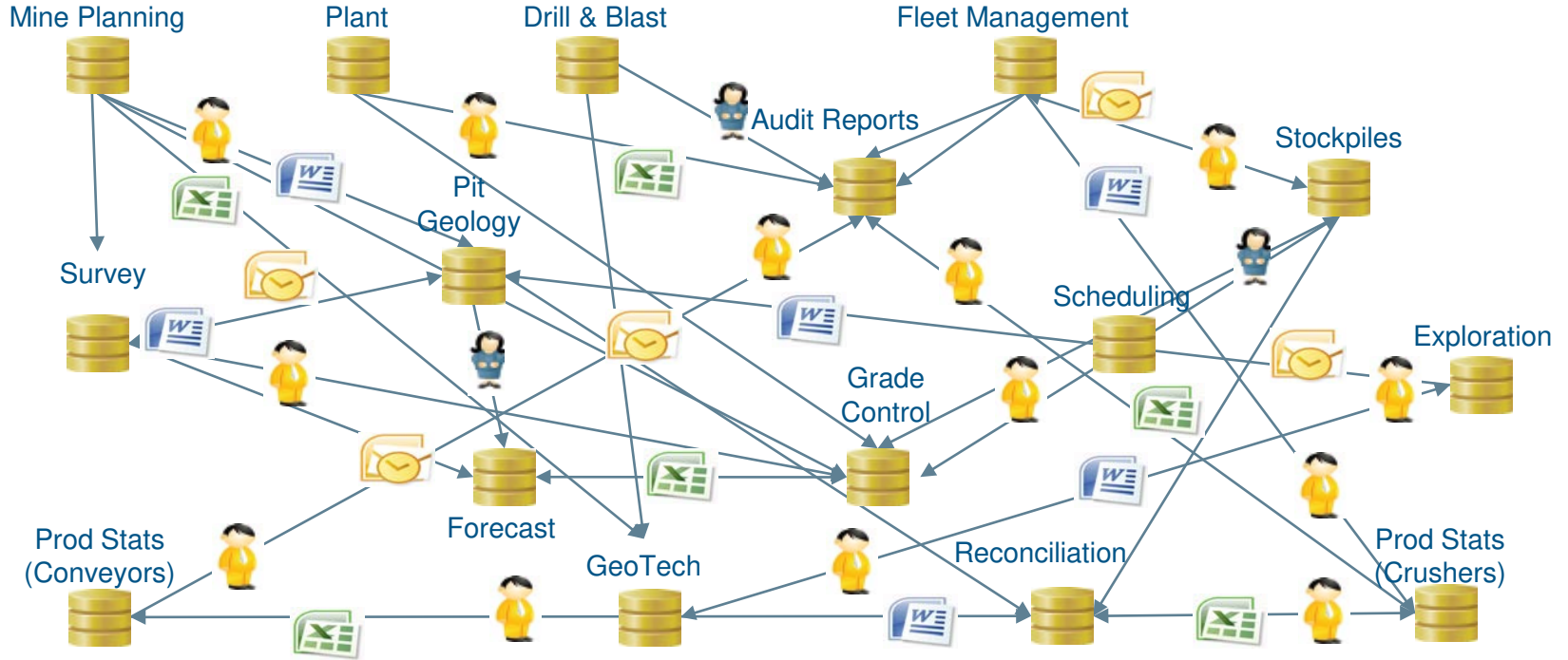
Conformance to Plan

# Common problems with existing systems

- Time spent preparing data
- Data confidence
- Managing the discrepancy between claimed and actual
- Understanding where and why there are differences between forecast and actual, and actual and actual



# Information Pathways – Before GEOVIA



# Common Problems Manual Data Capture – Excel/Paper

- Data
  - Confidence
  - Validation
  - Accuracy
  - Document control
- Spreadsheets are common
  - Time
  - Sharing
  - Errors

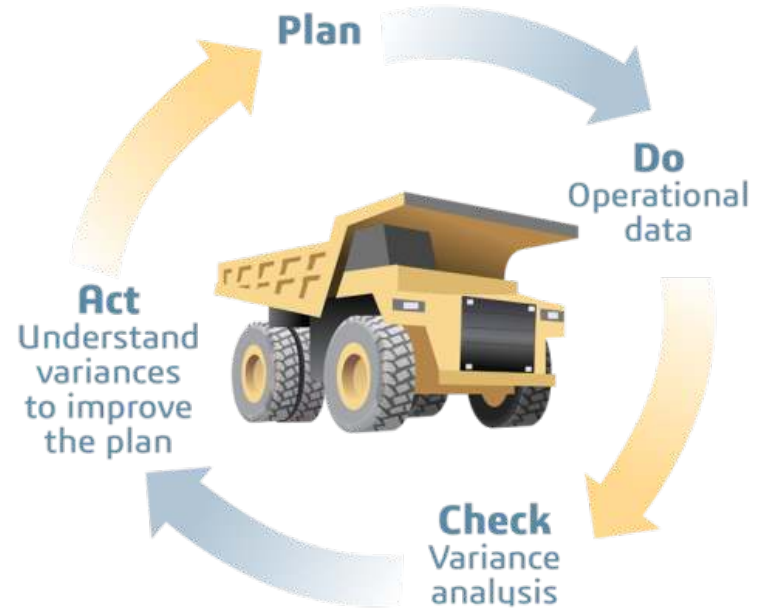


*“While people are about 95% to 98% accurate when they make spreadsheet cells entries, they are only about 50% to 80% successful when they attempt to detect if there is an error in a cell” [Panko, 2010b].*

<http://arxiv.org/ftp/arxiv/papers/1009/1009.2785.pdf>

# Offering an alternative

- A configurable software solution that can
  - Plan and allocate mining activities at shift level
  - Integrate with automated operations management data sources or collate data manually
  - Monitor current progress of any mining or production activity
- Advanced tools that
  - Compare plan against actual in near real-time
  - Analyse the variance





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# GEOVIA InSite

Conformance to Plan



# Types of Data Acquisition

## Automatic

The screenshot shows the 'Integration Monitor' web interface. It features a sidebar with navigation icons and a main content area with several data cards. Each card displays a large numerical value, a unit, and a status indicator (green checkmark or red X). Below the cards is a table with columns for 'Status', 'When', and 'Action'.

Metric	Value	Unit	Status	Last run time	Records Processed
Adapters	44	none	Success	03/03/2014 14:14:14	20
Material Balance Volume	2	none	Success	04/09/2014 13:00:54	0
Surplus	6147	none	Failure	06/27/2014 14:07:00	0
Truck factor	1051	none	Failure	06/27/2014 14:00:00	0

Status	When	Action
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X
Success	18/03/2014 20:00:00	X

## Manual

The screenshot shows the 'Data Entry' application interface. It includes a toolbar with icons for Upload, Sync, Insert, Clone, Cancel Changes, Open Grid, Close Grid, Activities, and Rejects. Below the toolbar are several tabs for different data categories. The 'Hauling Activities' tab is active, displaying a table with columns for Status, Truck, Operator, Loading Unit, Source, Material, Destination, Loads, and Comments.

Status	Truck	Operator	Loading Unit	Source	Material	Destination	Loads	Comments
Success	Dump Truck 0	Aeron Thayer	EX01	9724-132-1	HGO	HGO S/P	36	
Success	Dump Truck 0	Oliver Ross	EX04		HGO	HGO S/P	14	
Success	Dump Truck 1	Gabriel Larkin	EX05		ORE	Plant MILL	04	
Success	Dump Truck 1	Sabathan Will	EX08		ORE	Plant MILL	46	
			EX09					
			EX11					
			EX12					
			EX16					
			EX18					
			EX19					
			EXXX					

# Data Entry

## Data Entry

- Replaces spreadsheets with fast and easy interface
- Record data when electronic data unavailable
- Accurate and validated data

Site: OCUJ, Period: D/S, Date: 08/01/2012, Data Entry: Andre

Batch Data Entry

Upload Sync Insert Clone Cancel Changes Open Grid Close Grid Activities Rejects

Server Row Editing Details Grid Online Enquiries

Fuel and Lubricants Road Train Haulage Watering Mill Summary Undergr  
Drilling Status And Duration Drill Production and Consumables Blast Summary Mine - Load and Haul

Hauling Activities

Status	Truck	Operator	Loading Unit	Source	Material	Destination	Loads	Comments
	Dump Truck 0	Aaron Thayer	EX01	9724-152-1	HGO	HGO S/P	36	
	Dump Truck 0	Oliver Ross	EX04	3-1	HGO	HGO S/P	14	
	Dump Truck 1	Gabriel Larkins	EX05	=	ORE	Plant MILL	64	
	Dump Truck 1	Sebastian Will	EX08		ORE	Plant MILL	46	
			EX09					
			EX11					
			EX12					
			EX16					
			EX18					
			EX19					

# Inspect and Correct

## Inspect and Correct

- Analysis tool to query data captured.
- Highlights any compromised validated data
- Allows users to make the changes
- All changes are audited including from & to values

The screenshot displays the 'Inspect and Correct' web application interface. The main view is a table for 'Hauling' operations on 21/03/2014. The table is organized into sections: WASTE, CAN\_B-5375-CLEAN, and Ex33. The 'WASTE' section shows a total of 3592.3. The 'CAN\_B-5375-CLEAN' section shows a total of 7000.4. The 'Ex33' section shows a total of 7000.4. The 'Grand Total' row shows a total of 7000.4. The table also includes columns for various equipment types (DT11-DT34) and their respective values. A 'Details' section at the bottom shows specific transaction data for 'CAN\_B-5375-CLEAN, Ex33, Clean Waste, N | WASTE, 21/03/2014 00:00:00, DT11, (blank) | 3592.3'.

View:	Hauling	From:	21/03/2014	To:	21/03/2014	WASTE Total	Grand Total				
21/03/2014 00:00:00 Total											
DT11 Total DT12 DT12 Total DT13 DT13 Total DT34 DT34 Total											
(blank)			(blank)		(blank)		(blank)				
CAN_B-5375-CLEAN											
Ex33											
Clean Waste											
	3408.1	3408.1		4421.3	4421.3	4052.9	4052.9	11882.3	11882.3	11882.3	
N	3592.3	3592.3	2671.2	2671.2	2487	2487	552.7	552.7	9303.2	9303.2	9303.2
Clean Waste Total	7000.4	7000.4	2671.2	2671.2	6908.3	6908.3	4605.6	4605.6	21185.6	21185.6	21185.6
Ex33 Total	7000.4	7000.4	2671.2	2671.2	6908.3	6908.3	4605.6	4605.6	21185.6	21185.6	21185.6
CAN_B-5375-CLEAN Total	7000.4	7000.4	2671.2	2671.2	6908.3	6908.3	4605.6	4605.6	21185.6	21185.6	21185.6
Grand Total	7000.4	7000.4	2671.2	2671.2	6908.3	6908.3	4605.6	4605.6	21185.6	21185.6	21185.6

CAN\_B-5375-CLEAN, Ex33, Clean Waste, N | WASTE, 21/03/2014 00:00:00, DT11, (blank) | 3592.3

Details

From Location	To Location	Period	Equipment	To Equipment	Employee	Material	Best Value	Approval	Period End Date
CAN_B-5375-CLEAN	WASTE	N	Ex33	DT11		Pit Clean	39	PENDING	21/03/2014 00:00:00
CAN_B-5375-CLEAN	WASTE	N	Ex33	DT11		Pit Clean	3553.333333333333	PENDING	21/03/2014 00:00:00

Number of items: 2 | Modified: 0 | Deleted: 0



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# GEOVIA InSite

Production Inventory Accounting (PIA)

# Production Inventory Accounting

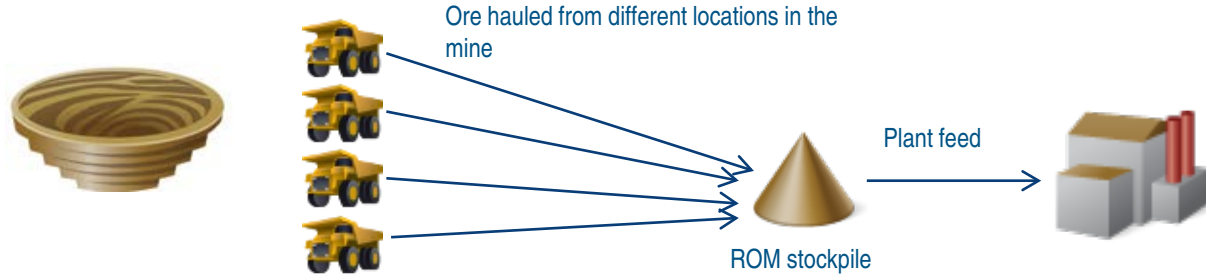
## Mining Problem

- Set up of complex algorithms difficult to maintain
- Is assay data entered accurately
- Reconciliation details not auditable

## How InSite helps

- Accurate view of stockpile mass and grade
- Stockpiles updated with accurate surveyed volumes
- Confidence in data – Validation rules and manual data entry validated
- Quality provided Automatically or Manually
- Stockpile data linked with materials balance

# Stockpile Management

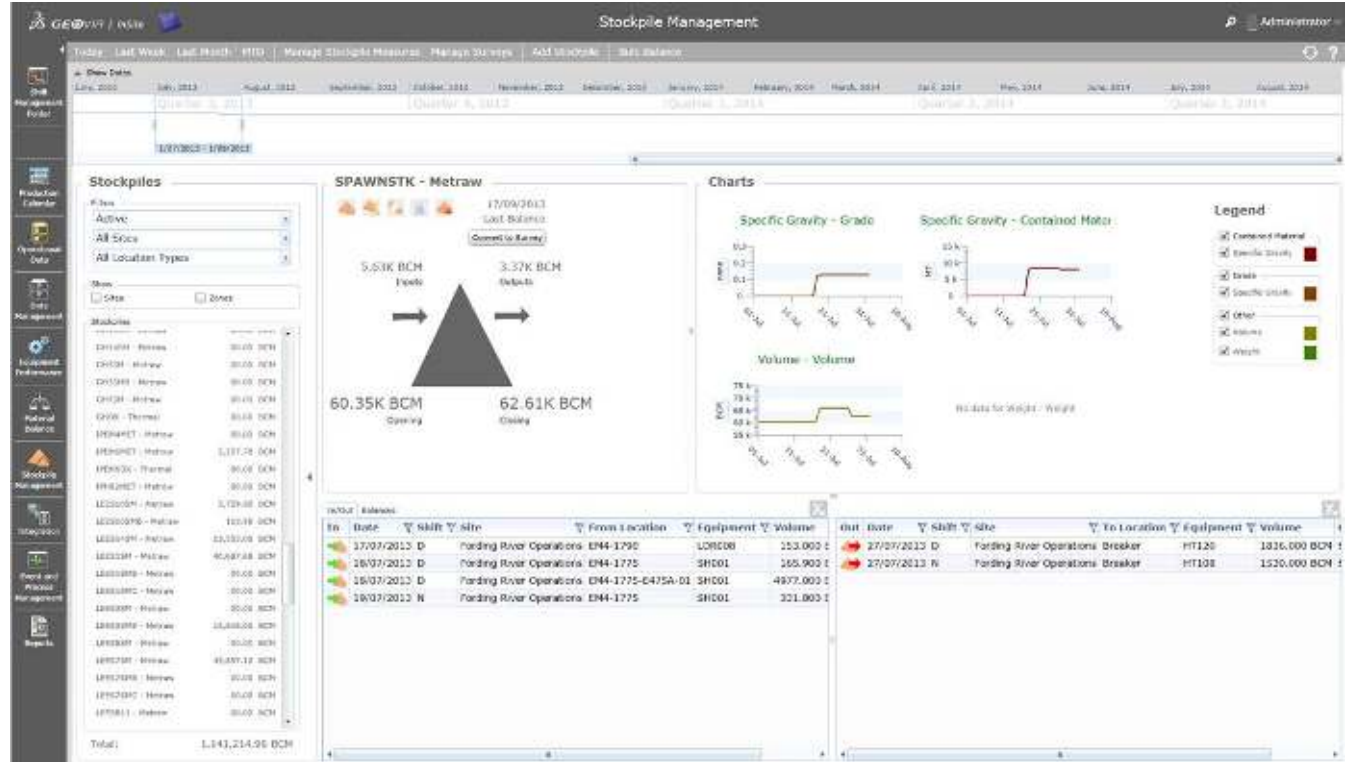


- Stockpile management is required because:
  - To accurately report monthly mine production, material held in stocks must be accounted for
  - Plant performance requires predictable feed of ore at known tonnes and grade
- Tonnes in a stockpile is automatically calculated based on the sum of material movements.
- Grade is calculated using either FIFO, LIFO or weighted average
- Due to measurement inaccuracy, regular surveys are performed to adjust calculated stocks

# Stockpile Management

## Stockpile Management

- Confidence in reported tonnes and grades
- Integrates directly with materials balance
- Calibrate stockpiles with survey data whenever it is available





# Stockpile Management

## Stockpile Balances Report

- Provides a summary of balances and movement to and from stockpiles.
- Includes opening and closing balances for the selected period.
- Includes movements to and from the stockpile.
- Includes tonnes and grades.

### Stockpile Balances

11/07/2013 to 31/07/2013

 **GEOVIA** | InSite

Stockpile	Material	Total Mass				Contained Gold			
		Opening (t)	Input (t)	Output (t)	Closing (t)	Opening (oz)	Opening (g/t)	Closing (oz)	Closing (g/t)
Coarse Ore Stockpile	Ore	1,000			1,000	35.3	1.1	35.3	1.1
Crusher	Ore	1,212	2,018		3,230	42.4	1.1	114.5	1.1
Grizzly	Ore	1,000			1,000	42.3	1.3	42.3	1.3
ROM	Oxide Super High Grade	1,931		85	1,846	67.9	1.1	64.9	1.1
	Oxide High Grade	1,482	3,293		1,482	52.3	1.1	52.3	1.1
	Oxide Medium Grade	1,483			1,483	41.3	0.9	41.3	0.9
	Oxide Low Grade	1,483		212	1,251	20.6	0.4	17.6	0.4
	Fresh Super High Grade	1,309		1,093		55.4	1.3		NaN
	Fresh High Grade	1,182		28	1,153	41.7	1.1	40.7	1.1
	Fresh Medium Grade	1,351			1,351	38.1	0.9	38.1	0.9
Waste Dump	Fresh Low Grade	1,351			1,351	19.1	0.4	19.1	0.4
	Fresh Mineralised Waste	2,925			2,925	10.3	0.1	10.3	0.1
	Oxide Mineralised Waste	2,925			2,925	10.3	0.1	10.3	0.1

# Material Balance

## Material Balance

- Reduce variance in planned vs actual
- Direct link with stockpile + production data
- Compare factors with reality, modify with evidence

Compound: SG Balance Order: Descending

Envelope	Volume	Σ Ctd Metal
Stage	-280,150	0,00
CANO_B-5350	-15,984	0,00
CANO_B-5375	-16,789	0,00
CANO_B-5400	-16,705	0,00
CANO_B-5425	-6,352	0,00
CANO_B-5450	-30,068	0,00
CANO_B-5475	-18,430	0,00
CANO_C-5200	-29,100	0,00
CANO_C-5225	-26,854	0,00
CANO_C-5350	-999	0,00
CANO_C-5450	-1,042	0,00
MAGELLAN_A-5300	-6,203	0,00
MAGELLAN_B-5300	-13,027	0,00
MAGELLAN_B-5325	-34,635	0,00

Envelope - Stage	Volume - BCM
Opening Stock	0,00
Inputs Declared	0,00
Inputs Actual	0,00
Outputs Declared	270,915,10
Outputs Actual	280,150,10
Stock Adjustment	0,00
Closing Stock	0,00
Balance	-280,150,10

Automatic Adjustment: Inputs Outputs

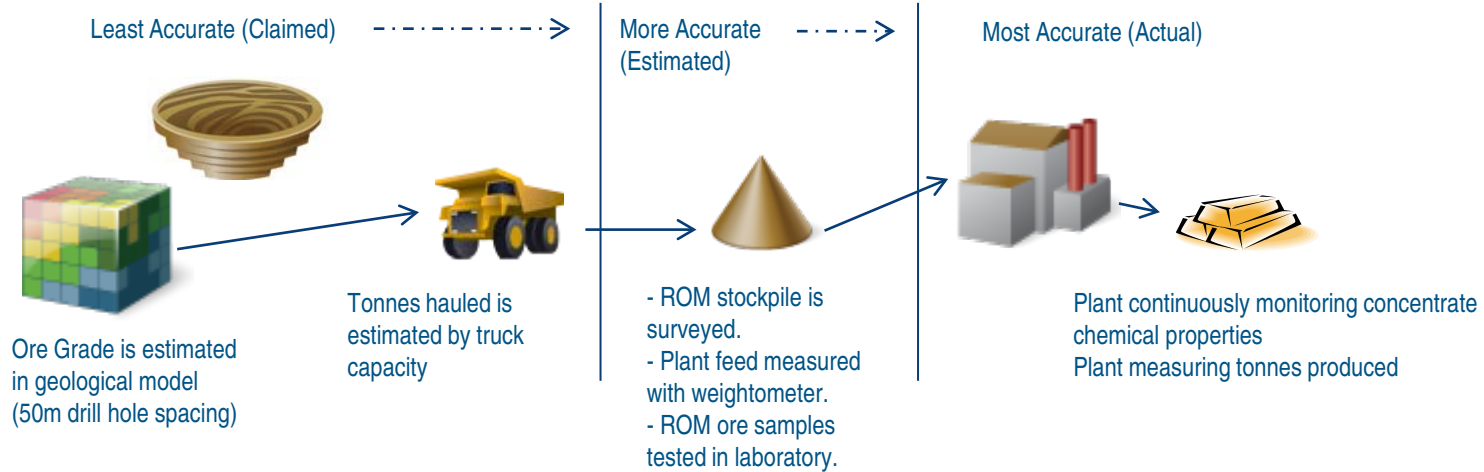
Details

Inputs Outputs Stocks Comments

Drag a column header here to group by that column.

Location Code	DECLARED Volume - BCM	-ACTUAL Volume - BCM
Grand Totals:	Total = 270,915,10	Total = 280,150,10
WASTE	91,221,70	94,331,28
DIRTYDUMP	34,841,20	36,028,87
FINGERB	29,097,90	30,089,79
MGSPILE	28,698,70	29,676,99
MWBUEMAG3	23,316,30	24,111,11
MWSPILE1	22,924,00	23,705,44
FINGERA	8,914,40	9,218,28

# Material Balance



- In a mine production process, the same data is measured several times with different accuracy. Accounting for inaccuracy is a key concept in mine production management and reporting
- Measurements are typically more accurate later in the production process (in the plant)
- Material balance divides the production process into “envelopes”. Material movements between envelopes must balance.
- Material movements from more accurate envelopes will adjust measurements from less accurate envelopes so that they balance

# Daily Production Summary

## Daily Production Summary

- Provides a summary of all information captured on a *daily* basis and structured by activity.
- Includes daily and month to date data.
- Includes planned and actual values and calculates variance from plan.

		Current Date			Month to Date			
		Actual	Plan	Variance	Actual	Plan	Variance	
<b>Blasting</b>	Average Depth	m	15.0	18.0	-17 %	15.0	38.0	-58 %
	Burden	m	5.0	3.0	67 %	5.0	3.0	67 %
	Diameter	mm	50.0			50.0		
	Drilled	m	100.0			100.0		
	Holes Number	qty	5.0			5.0		
	Mass	kg	10.0			10.0		
	Spacing	m	3.0			3.0		
	Subdrill	m	5.0			5.0		
Volume	m3	3.0			3.0			
<b>Crusher Feed</b>	Contained Material	oz	2.7			6.8		
	Mass Dry	t	211.7			324.6		
	Number of Loads	qty	15.0			23.0		
	Volume	m3	135.0			207.0		
	Wet Mass	t	216.0			331.2		
<b>Hauling</b>	Contained Material	oz	0.0			0.0		
	Mass Dry	t	0.0			0.0		
	Number of Loads	qty	15.0			15.0		
	Volume	m3	3,000.0	368.5	742 %	3,000.0	948.3	218 %
	Wet Mass	t		982.5	-100 %		2,580.4	-100 %
<b>Loading</b>	Contained Material	oz	0.0			0.0		
	Mass Dry	t	330.7			330.7		
	Number of Loads	qty	12.0			12.0		
	Volume	m3	162.0			162.0		
	Wet Mass	t	345.6			345.6		

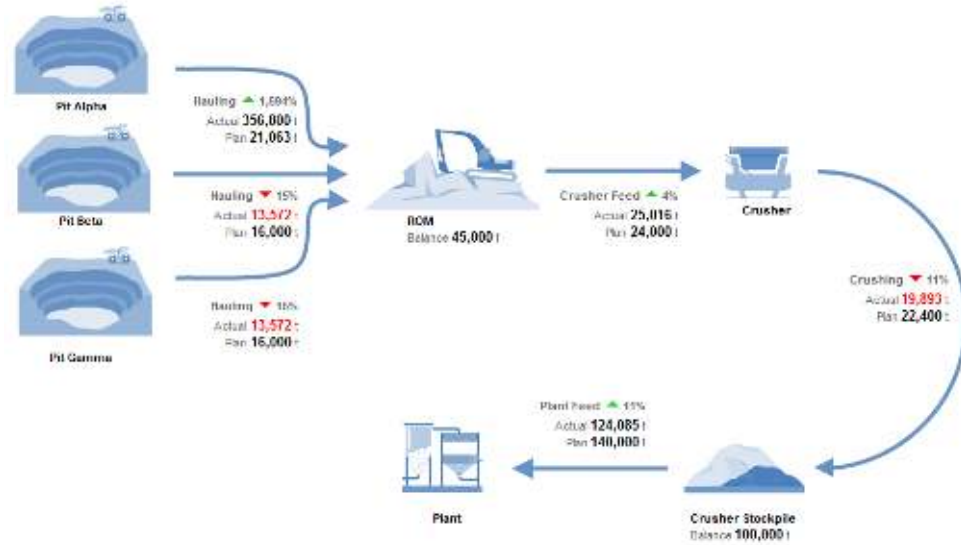
# Material Flow Dashboard

## Material Flow Dashboard

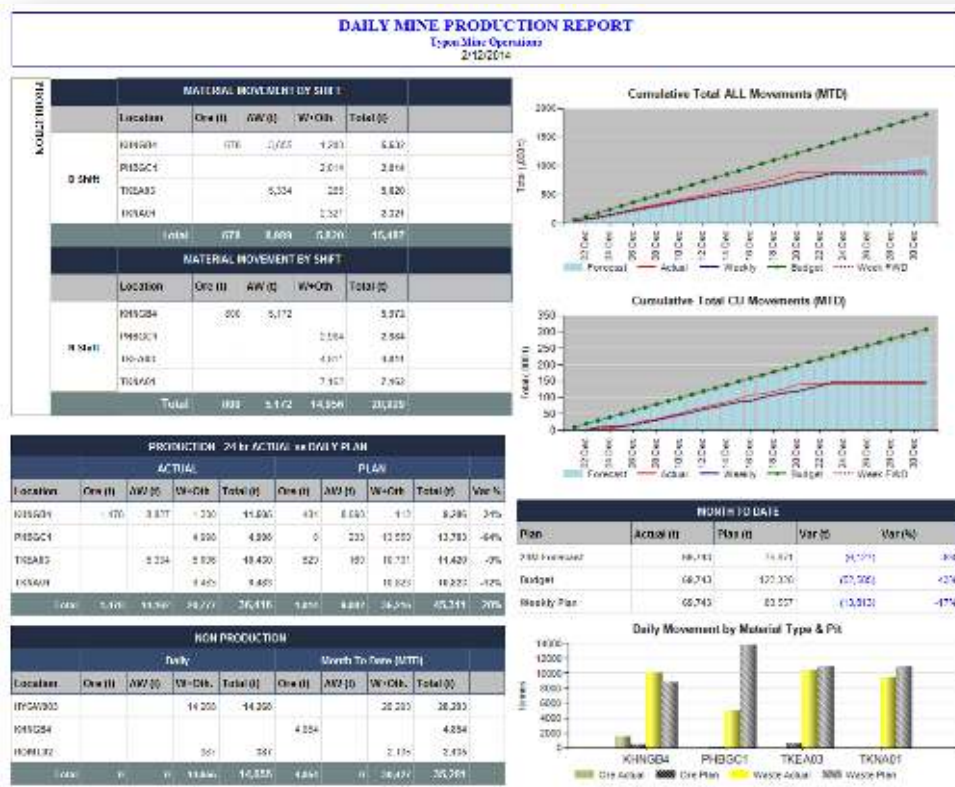
- Provides a visual overview of the material moved.
- Includes daily data for hauling, crusher feed, crushing and plant feed.
- Includes planned and actual values and calculates variance from plan.

### Daily Material Flow

Wednesday, November 27, 2013



# InSite Reporting







# Variance Analysis

## Variance Analysis

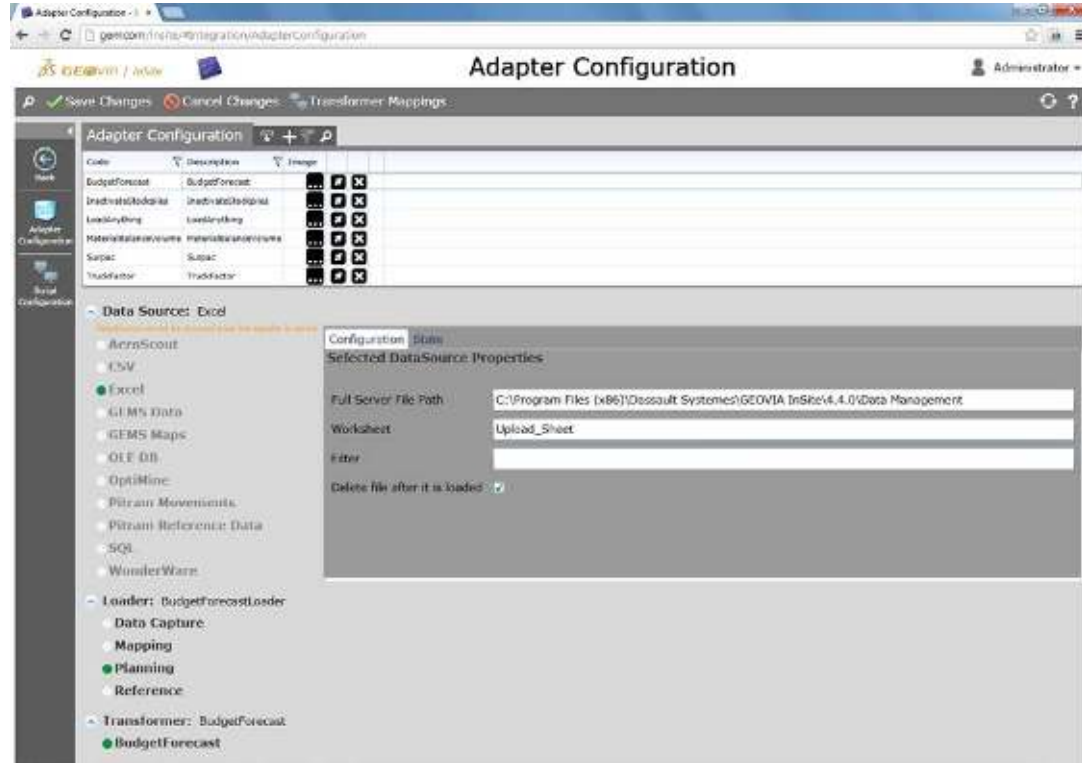
- Graphically represent Plan vs. Actual per activity per shift
- View all Activities in one screen
- Track trend of plan versus actual to pickup trends



# Integration Adaptor Configuration

## Adaptor Configuration

- Easily to configure within the tool
- Changes can be made by authorised staff
- Allows new data to be mapped easily for integration and loading



# Integration Monitor

## Integration Monitor

- Easy to review the status of integrations
- Can be configured to alert specified staff
- Allows jobs to be resubmitted where appropriate
- Full history of integration runs

The screenshot displays the Integration Monitor web application. The main dashboard shows a summary of 44 runs and 70 records processed. Below this, four adapters are listed: MaterialBalanceVolume (2 runs), Surpac (6147 runs), and Trackfactor (1051 runs). A table at the bottom shows a history of runs with columns for status, adapter, and time. On the right, a detailed view of the Trackfactor adapter shows the status of its components: Extract, Transform, and Load, each with sub-steps like 'Create DataSource' and 'Running DataSource'.

Status	Adapter	Time	Actions
✓	MaterialBalanceVolume	03/03/2014 02:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 07:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 09:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 07:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 08:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 04:00:30	🔄 🗑️
✓	MaterialBalanceVolume	03/03/2014 03:00:30	🔄 🗑️



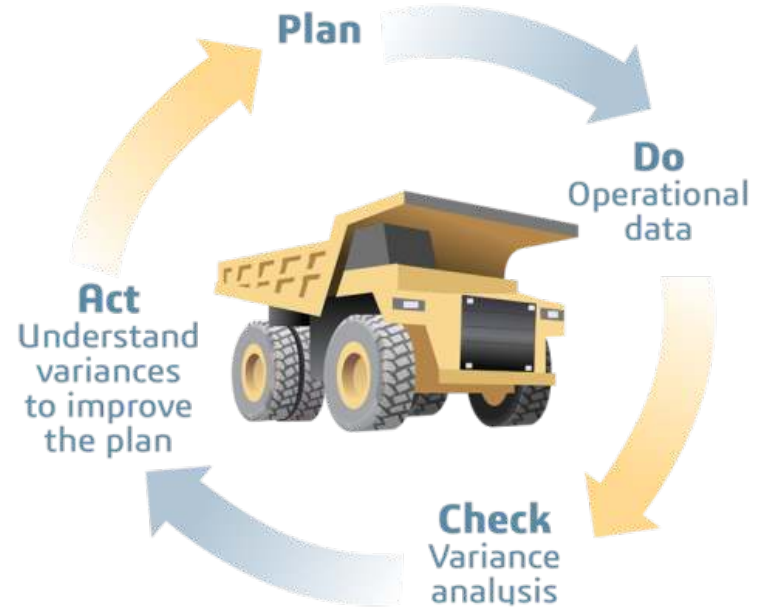
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# GEOVIA InSite

Asset Utilisation

# Offering an alternative

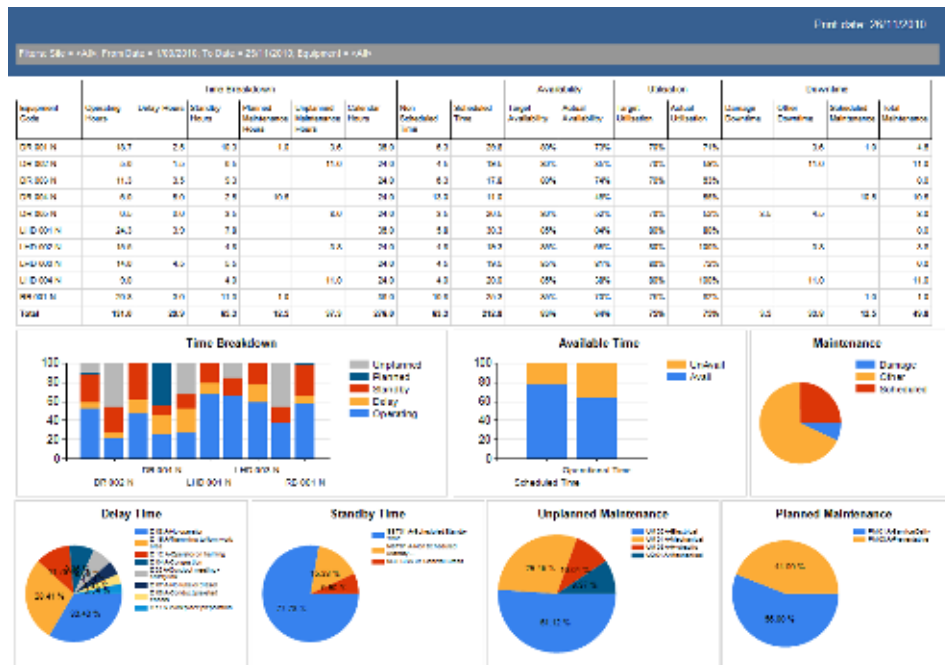
- A configurable software solution that can
  - Integrate with automated operations management data sources
  - Collate data manually
- Reduce IP Risk
- Streamline EOM process through integration & reporting



# Equipment Performance

## Equipment Performance

- Increase production and equipment utilisation
- Understand equipment usage
- Historical analysis of equipment performance



# Activity Based Costing

## Activity Based Costing

- Assign cost of equipment, employees and consumables
- Visibility into cost of operation and production
- Trends and changes can be monitored

Equipment Cost							
Print date: 12/11/2012							
Filters: Month = Year = November - 2012, Site = Generic, Site for Equipment							
Equipment	Equipment			Operator		Total Cost (\$)	
	Hours	Rate (\$/h)	Cost (\$)	Hours	Rate (\$/h)		Cost (\$)
<b>Bulldozer</b>	<b>Bulldozer</b>	<b>2,204.09</b>		<b>484,154.37</b>	<b>2,204.09</b>	<b>0.00</b>	<b>484,154.37</b>
	DZ02	524.40	241.00	126,380.40	524.40	0.00	126,380.40
	DZ03	325.10	213.00	69,246.30	325.10	0.00	69,246.30
	DZ04	455.99	213.00	97,125.87	455.99	0.00	97,125.87
	DZ09	135.00	213.00	28,755.00	135.00	0.00	28,755.00
	DZ12	288.20	213.00	61,386.60	288.20	0.00	61,386.60
	DZ15	57.00	213.00	12,141.00	57.00	0.00	12,141.00
	DZ20	323.70	213.00	68,948.10	323.70	0.00	68,948.10
	DZ21	94.70	213.00	20,171.10	94.70	0.00	20,171.10
<b>Dump Truck</b>	<b>Dump Truck</b>	<b>16,471.25</b>		<b>4,268,281.85</b>	<b>16,471.25</b>	<b>8,388.09</b>	<b>4,216,689.94</b>
	Dump Truck 08	364.00	236.00	85,904.00	364.00	0.00	85,904.00
	Dump Truck 09	419.31	236.00	98,957.16	419.31	0.00	98,957.16
	Dump Truck 10	229.70	261.00	59,951.70	229.70	0.00	59,951.70
	Dump Truck 11	493.40	261.00	128,777.40	493.40	0.00	128,777.40
	Dump Truck 12	540.13	261.00	140,973.93	540.13	0.00	140,973.93
		3.60	261.00	939.60	3.60	63.45	228.42
	Dump Truck 13	542.70	261.00	141,644.70	542.70	0.00	141,644.70
	Dump Truck 14	491.00	261.00	128,151.00	491.00	0.00	128,151.00
	Dump Truck 15	55.60	162.00	9,007.20	55.60	0.00	9,007.20
	Dump Truck 17	20.50	162.00	3,321.00	20.50	0.00	3,321.00
	Dump Truck 20	339.40	261.00	88,583.40	339.40	0.00	88,583.40
	Dump Truck 21	458.00	261.00	119,538.00	458.00	0.00	119,538.00

## Consumable Cost

Print date: 03/09/2012

2012, Site = Open Cut

Type	Consumable	Rate (\$/unit)	Units	Cost (\$)
Boosters	BOOSTER HDP 400 PE SHELL	1.00	3,846.00	3,846.00
Explosives	EMULSION TITON 5070	1.00	545,643.00	545,643.00
Fuel and Lubricants	Fuel Diesel	0.91	1,127,324.20	1,025,865.02
<b>Total</b>				<b>1,575,354.02</b>

End of Report



# Key InSite Implementations



# The Benefits of GEOVIA InSite

- Improved forecasting
  - Understand variance from plan and reforecast faster
- Improved efficiency
  - Free Geologists and Engineers from Excel and allow them to analyse in real-time
  - Manage consumables and unplanned down time
- Increased accuracy in reporting
  - Better data validation, reports & decisions made quicker
- Improved visibility into operations
  - Understand the cost of mining each ounce
  - See correlation between mining and plant production
- Centralising enables Activity level comparison between sites
- Standards
  - Supports Master Data Management
  - Consistent identification and measurement against best practise
- Provide a basis for continuous improvement

# Live Demonstration

Contact us at; Dassault Systemes GEOVIA



