



Reduce Production Costs with Pitram

Managing production costs is key to ensuring a profitable mining operation. Technology that facilitates the effective management of an operation’s assets should be viewed as a necessary investment. MICROMINE’s mine control and management reporting solution, Pitram, provides tighter control over an operation’s cost base.

Most of a mining operation’s budget is spent on equipment, personnel and consumables. To manage these assets effectively, management must first collect good quality and reliable data. Once the data is collected it must then be presented to management in a meaningful and timely manner. Pitram measures and reports on key performance indicators (KPIs) including availability and utilisation of equipment, operator performance, production metrics and consumable usage.

Knowing how an operation’s assets are performing allows management to identify problem areas and understand the reasons for any constraints on achieving targets. Pitram provides the tools to assist in this process. Improvement plans can then be implemented which lead to increased production and/or reduced production costs.

Pitram stores production data which can be used to analyse all aspects of an operation, including operators, shifts, fleets, drive profiles and ring designs, over extended periods of time. Data can be used to identify trends and measurable improvements. Through trend analysis significant business improvement savings can be realised.

“Each preventable 10 minute delay in production, such as time spent waiting for spotters or waiting for a surveyor to complete their work, could potentially cost around one to two loads per shift. If no action is taken, each of these delays could add up to millions of dollars lost over the course of a year.”



Through Pitram, operations can monitor how different equipment models have performed and ensure the most efficient fleet is acquired.

Pitram can provide information on many aspects of the operation, including:

EQUIPMENT
- Equipment performance
- Optimised truck usage
- Equipment KPIs
- Equipment performance reason analysis
- Budget/ Plan/ Forecast variation reporting
- Equipment location at shift change
DEVELOPMENT
- High face utilisation
- Location/ Heading status tracking
- Consumable usage KPI reports
- Conformance to plan
PRODUCTION
- Production performance analysis
- Mis-dump prevention
- Optimisation of the shovel/ Haul truck allocation
- Grade control and stockpile management
- Optimising the haul truck payload
PERSONNEL
- Personnel performance and KPIs
- Operator qualification and training status
SAFETY
- Prestart safety checks
- Restricted areas and zones

Equipment

Equipment performance

Availability and utilisation KPIs are essential for ensuring physical targets are met as well as maximising the Return on Investment (ROI). Unavailable or under-utilised equipment often means avoidable costs are incurred. Pitram can track operating, idle, corrective and preventative downtime to produce detailed timeline and equipment performance reports.

By knowing exactly how different equipment models have performed, operations can make informed decisions regarding purchasing or hiring of replacement equipment. This ensures that the most efficient fleet is acquired.

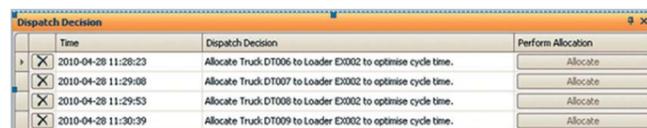
Pitram can record start and end times of dry hire equipment to ensure payment matches the exact usage time of the equipment.

Optimised truck usage

Pitram's dispatch functionality uses data provided by on-board Pitram computer units to monitor the location of each truck in the truck-cycle. This ensures that any deviations from planned allocations can be corrected if required.

Dispatch uses priority equipment assignment and real-time data to calculate the optimum allocation of trucks to loaders. When loading is complete, Pitram automatically dispatches the truck to the appropriate dump destination for the loaded material. Any deviations to the haul route or dumping area result in a warning to the truck operator, control room operator and supervisor. This ensures ore security and avoids ore loss and possible dilution.

Real-time equipment re-allocation optimises truck usage and production, reduces wait time and brings deviated tasks back in-line to plan.



Time	Dispatch Decision	Perform Allocation
2010-04-28 11:28:23	Allocate Truck DT006 to Loader EX002 to optimise cycle time.	Allocate
2010-04-28 11:29:08	Allocate Truck DT007 to Loader EX002 to optimise cycle time.	Allocate
2010-04-28 11:29:53	Allocate Truck DT008 to Loader EX002 to optimise cycle time.	Allocate
2010-04-28 11:30:39	Allocate Truck DT009 to Loader EX002 to optimise cycle time.	Allocate

Pitram's dispatch functionality ascertains the location of each truck in the truck-cycle.

Equipment KPIs

Equipment KPIs provide another tool for analysing performance and the ROI of mining equipment. Pitram can track a variety of equipment KPIs in real-time, including the production rate of equipment. Pitram can also display graphs which show the performance of each piece of equipment. Time stamped information about the equipment's operating status is stored in the Pitram database for detailed operational analysis.

Development

It is essential that the development of a mine is conducted efficiently and adheres to plan to ensure targets are met. Because development activities and statuses can be recorded in Pitram, it is possible to identify in near real-time delays and other factors that could signal missed targets.

Tracking the utilisation and availability of development and production locations is as critical as understanding equipment performance KPIs.

Pitram can automatically track the status of a location, providing information about activities performed by equipment at the location as well as information which is not specific to equipment.

Equipment may be operating but underperforming. Pitram can be used to identify areas for operational improvement. For example, analysis of the data may point to excessive queuing times or a requirement for additional operator training.

Pitram's flexibility allows users to configure additional data capture requirements if more detail is needed to analyse a problem. Additional measurements can be captured for a discrete period then easily reduced to the standard data capture levels.

Each preventable 10 minute delay in production, such as time spent waiting for spotters or waiting for a surveyor to complete their work, could potentially cost around one to two loads per shift. If no action is taken, each of these delays could add up to millions of dollars lost over the course of a year.



Pitram can track equipment KPIs in real-time for detailed operational analysis.

Equipment performance reason analysis

Understanding excessive delay, idle or down (delay) times is critical to managing an efficient mining operation. Pitram can record any number of delay reasons and can provide the tools to analyse those delays. Events can be watched in real-time and monitored against shift plans, allowing a visual identification of variations to plan, especially in relation to 'wait-for' statuses.

In addition to Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR), other KPIs can be generated such as mean time to failure after preventative maintenance.

Budget/ Plan/ Forecast variation reporting

Pitram reports can compare data collected against any user-defined targets, showing variations to those targets.

Equipment location at shift change

The working location of vehicles is stored in Pitram. This information can be shown on a screen as a report or displayed on a 3D map. This is very useful at shift changeover as operators can check the status and location of their allocated equipment unit. Time is not wasted looking for 'lost' equipment. Pitram allows operators to log their activities as they occur via radio communication or an on-board touch-screen computer.

For example, work at a location is delayed because there is no power or because the vent bags have not been installed or are waiting for inspection. Warnings can be displayed if a location is 'idle' for a period of time, or if development tasks such as drilling or ground support are taking longer than planned.

By tracking location states, bottlenecks and inefficiencies within the development cycle can be highlighted and appropriate improvement plans put in place. The utilisation of production stopes in terms of blasting and bogging activities can also be tracked.

High face utilisation

Pitram's ability to help achieve higher face utilisation is unique, and essential to ensuring mine development targets are met. Information about a location which is independent of equipment activities can be recorded in Pitram. This is especially meaningful when locations have different 'wait-for' statuses. These delays can be viewed on the screen and are dynamically updated as durations increase and new information is received by Pitram.

Headings can be prioritised so that on-screen displays and reports show the headings in priority sequence.

All activity duration is measured so that assumptions made during the planning process can be tracked in real-time. Activities can be set and alarms activated when thresholds are exceeded.

Location/ Heading status tracking

Pitram can track location statuses in order to maximise the face utilisation of production critical headings, for example declines, draw point and development headings etc. Pitram helps populate and update location statuses more effectively. The main goal of this module is to closely monitor and minimise all the 'wait-for' location statuses in order to maximise the face utilisation of production critical headings. This provides management with a unique tool for analysing progress in development headings. Reports can be provided in heading priority sequence and compared to targets related to those headings.

Production

Production performance analysis

By recording activity data related to equipment, locations and operators, and comparing this data to target values, management can gain greater control of the production process. The 'who', 'what' and 'where' of mining activities are displayed for mine controllers and management to monitor and respond to events as they occur. Analysis of delay reason codes provides management the tools to eliminate obstacles affecting the achievement of targets.

Mis-dump prevention

It is estimated that in mining operations not using a mine control system, 5-10% of all dumps are mis-dumps. Pitram can help operations prevent mis-dumps.

Zone alarms ensure operators transport the mined material into correct destinations. In the automated mode, truck operators are warned if they enter a stockpile area where the material being carried is incompatible with the material on the stockpile. Mine controllers receive the same information and can see on a plan where the offending truck is located.

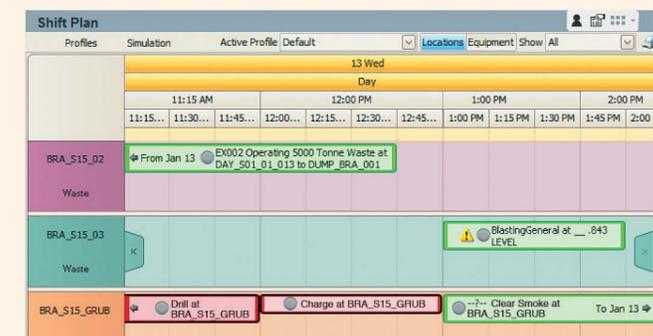
With the voice solution, the mine room controller is warned of the same incompatibility when entering data and can advise the truck driver accordingly.

Consumable usage KPI reports

Pitram can record the usage of consumables by equipment, location and operator/ crew. These measures can be compared to design requirements to provide a variety of KPIs, for example, to monitor the effectiveness of blast design, ensure safety requirements are met, monitor shotcrete volume usage per specified area, and reconcile consumable consumption.

Conformance to plan

Pitram's shift planning functionality allows the planning of shifts, either by location or equipment, into distinct sets of activities at an appropriate granularity. Once the plan is released it can be tracked in real-time against data being received from operators, allowing long delays or inactivity to be acted upon immediately.



Pitram's short-interval control components plan and track shift activities.

Optimisation of the shovel/ Haul truck allocation

Pitram helps operations increase their truck-cycles per shift through optimisation algorithms which maximise production by reducing truck queuing times and wait on truck times from the shovel.

An increase of a single truck-cycle per shift over the course of a month or a year can make a considerable contribution to an operation's bottom line.

Pitram offers a variety of tools which can help increase production, for example data analysis and knowing where equipment was parked at shift change. Even a simple report that shows the time of the first and last truck-cycle can help introduce improvements.

Grade control and stockpile management

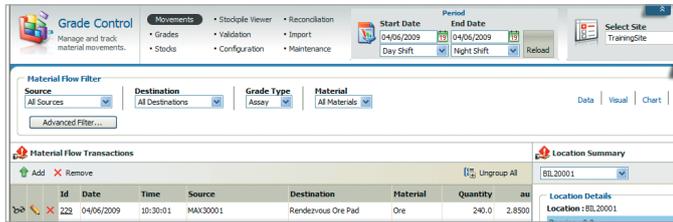
Pitram can accurately track the entire material flow, dynamically updating grades and weight of stockpiles as each new set of material movement data is received. The accurate management of stocks and grades allows better planning and easier reconciliation. This provides upstream users an overview of the material in the pipeline so they are better positioned to determine the best blends for optimal recovery/throughput.

Stockpile grades can be calculated as first in first out (FIFO), last in first out (LIFO), or as weighted average grade (WAG). Pitram is able to track ore parcels from source through to final destination. This provides a much better estimation of the material grades delivered up stream and eventually to the processing plant.

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Grade control and stockpile management (cont.)

Additionally, Pitram reconciliation uses the processing plant head grade and weight to balance mine claimed deliveries. The reconciliation application allows the weight and grade variation



Operators can see the quantity and grade of ore, and where the ore parcels are moving within the mining system.

to be factored back from the process plant to the source of the ore be it individual bench, development or production locations.

Optimising the haul truck payload

To ensure haul trucks are loaded to the maximum designed capacity, the shovel on-board system can interface to the on-board payload system of the haul truck. Under-loading the haul truck by 5-10% is very common. The average payloads of the hauling fleet should be monitored on a continuous basis.

Because management can detect if haul trucks are being under or over-loaded, action can be taken. For example, operations can invest in further training, ensuring loader operators have the necessary knowledge to optimise haul truck payloads.

Personnel

Personnel performance and KPIs

Shift changes should occur quickly and efficiently so that resources are utilised effectively, production is maximised and shift change delays are avoided. Data collected in Pitram allows the start and end times of a shift change to be analysed to show the shift's first and last material movements by equipment and operator. This highlights the delay between the start of shift and the initial material movements, as well as the 'dead time' at the end of shift. By identifying areas of

improvement, users can implement changes to eliminate inefficiencies and costly shift delays. A number of standard reports are available which report on operator/crew KPIs.

Operator qualification and training status

Pitram can check the validity of an operator's tickets/licences/certifications to operate equipment. Warning messages are displayed on the on-board console and/or the mine controller's screen if the licence is no longer valid.

Safety

Safety is a major focus in all mining operations. Improved onsite safety ensures that costly operating delays are avoided.

Pitram can track the position and activities of personnel via a third party tracking interface or through working locations recorded in Pitram. If an Incident occurs the last known position of all personnel is immediately available, allowing for a safer and more effective management of mine emergencies. Tag readers in refuge chambers provide an immediate list of who is in which refuge chamber.

To ensure that only qualified and suitably trained staff operate equipment and perform hazardous tasks, Pitram tracks the qualifications, certifications, work permits and licences of all personnel. Management is alerted when operator qualifications are identified by the solution as insufficient.

Prestart safety checks

Due to the importance of the prestart safety check and the subsequent result, Pitram can ensure that the check is always conducted.

Operators record the outcomes of the checks in Pitram using the touch-screen in the cab or via the radio to mine control where it will be recorded in Pitram.

Restricted areas and zones

Pitram can help ensure operators don't enter restricted areas or, if they need to enter a restricted area they have the correct PPE and specific instructions to follow.

Equipment with on-board consoles provides a warning in the cab and at the mine control, notifying personnel that they have entered a restricted zone. Operators utilising equipment without on-board computers will see the danger tags and radio mine control. Mine control can then advise operators about the safety requirements of restricted areas. Pitram can record who has entered restricted areas, and at what time personnel have entered a restricted area. Pitram will subsequently notify the mine controller if there has been no contact from those entering restricted areas within the designated time duration.



MICROMINE
Intuitive Mining Solutions

www.micromine.com

MICROMINE Corporate
174 Hampden Road
Nedlands WA 6009 Australia
T: +61 (0)8 9423 9000
E: marketing@micromine.com

MICROMINE Africa
MICROMINE Brazil
MICROMINE Canada
MICROMINE Central Asia
MICROMINE China
MICROMINE Indonesia
MICROMINE Mongolia
MICROMINE Russia
MICROMINE Turkey
MICROMINE Ukraine
MICROMINE United Kingdom
MICROMINE USA

Tel: +27 (0)87 150 7580
Tel: +55 31 3347 5904
Tel: +1 (604) 646 8924
Tel: +7 727 225 18 72
Tel: +86 1861 079 8400
Tel: +62 21 7590 5333
Tel: +976 7011 3889
Tel: +7 (495) 665 4655
Tel: +90 312 241 5571
Tel: +380 44 332 3858
Tel: +44 (0) 203 176 0080
Tel: +1 (303) 996 6270

mmafrica@micromine.co.za
mmbrazil@micromine.com
mmcanada@micromine.com
mmkz@micromine.com
mmchina@micromine.com
mmindonesia@micromine.com
mmmongolia@micromine.com
mmrussia@micromine.com
gssiyok@micromine.com
ababynin@micromine.com
mmuk@micromine.com
mmusa@micromine.com