

# STATE GROUP PRESENTATIONS

As part of the five year plan we are to encourage state groups to publish papers from some of their technical presentations in this journal. We hope that groups will take this opportunity, and forward to us papers for inclusion under this heading.

## MOBILE MINER MM130 DEVELOPMENT

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Presentation to Victorian Group of the AGS  
Wednesday 10th June, 1992

### PROJECT STATUS

Pasminco will be conducting extensive field trials of the Mobile Miner MM130 at Broken Hill throughout most of 1992. The underground trials are taking place in country rock on the five level of the southern operations where the machine is producing a development drive having a width of 6.5m and a height of 4.1m.

It should be noted that the drive has a low priority in the mine plan and its excavation is a by-product of developing the machine and its support systems. Pasminco has contracted Robbins to conduct the field trials thereby adding to a history of formal agreements between the two Companies all aimed at the long term objective of developing a hard rock mining process offering significant cost advantages over existing technology.

FROM	TO	DESCRIPTION	TO	FROM	DESCRIPTION
0.0	5.5	Muscovite-rich Pelite; coarse muscovite flakes are ubiquitous. Lesser fine garnet and a few 3-5mm feldspar augens. Thin band of sphalerite and galena at 3.9 m.	24.9	28.2	Interbanded Psammite and Psammopelite. Very fine garnet throughout.
			28.2	32.4	Slightly retrogressed Psammopelite, highly fractured. Sericite on fracture faces and replacing biotite.
5.5	8.1	Retrogressed Pelite with abundant fine sericite and fine garnet.	32.4	36.3	Psammopelite with some alteration of biotite to sericite. Lesser fine garnet.
8.1	12.1	Psammopelite containing sillimanite knots and lesser fine garnet.	36.3	36.9	Broken and retrogressed Psammopelite.
12.1	15.6	Pelite with ubiquitous 3mm feldspar augens. Abundant sillimanite and lesser fine garnet.	36.9	37.4	Blue quartz Lode with minor fine sphalerite. Sericite after biotite.
			37.4	52.4	Psammopelite containing fine garnet. Sericite after biotite and lesser partially altered 5mm feldspar augens.
15.6	18.3	Psammite.			
21.0	22.1	Pelite with ubiquitous 2mm feldspar augens. Abundant sillimanite and fine garnet.			

Figure 1: Log of first 50 m of drive

## HISTORY OF MM130

The MM 130 had its first tentative swings at the rock face on the 30th April marking the most significant milestone in the development of the machine which evolved from Pasmenco's design specification delivered to Robbins in December 1986.

The prior involvement by Pasmenco in monitoring the operation of the first Mobile Miner, MM120, at Mt. Isa was invaluable in formulating the design requirements. Specifically the specification concentrated on inherent reliability with a required fatigue life of 25,000 hours and a tight operating envelope to be achieved through automation.

By August 1987 Robbins had done sufficient work on modifying the MM120 configuration to believe that it was possible to build a machine consistent with the design requirements. However it was a full year before Pasmenco could appropriate the funds to proceed with the project.

Robbins were given approval to undertake the design in August 1988 but early work on the proposed configuration revealed limitations that could not be resolved. This caused an intensive review with three groups in Seattle and the original patent holder, Dave Sugden, in Australia working on alternative configurations.

Sugden's radical departure from the MM120 configuration was first presented to Pasmenco in December 1988 and its merits were immediately apparent.

The new configuration offered much better force management as well as more easily automated restroking and guidance controls. Design work proceeded through 1989 and Pasmenco was sufficiently confident of the results to approve manufacture in May of that year.

Perry Engineering of Adelaide were contracted to build the machine and after more than two years of challenging work produced the MM130. The machine tipped the scales at 280 Tonnes prior to its shipment to Broken Hill in February 1992.

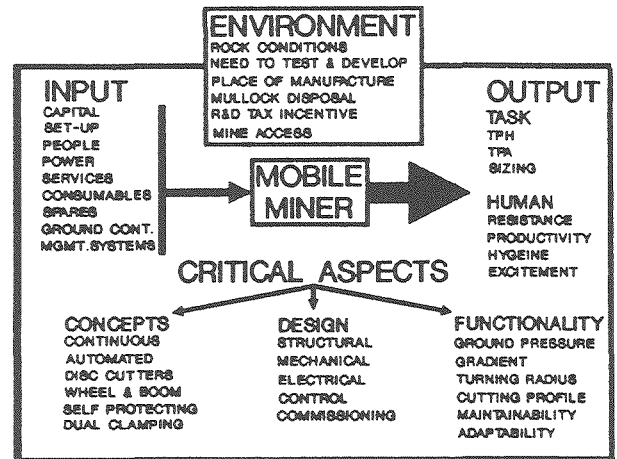


Figure 2: Engineering concept

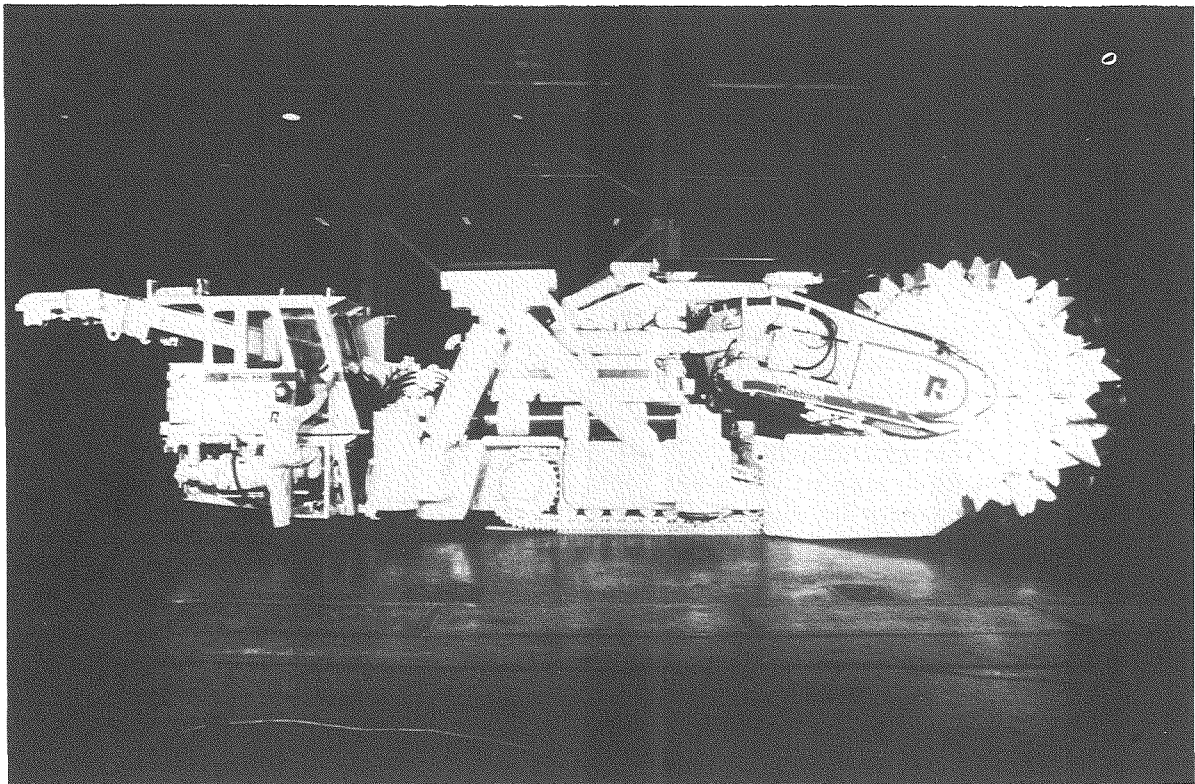
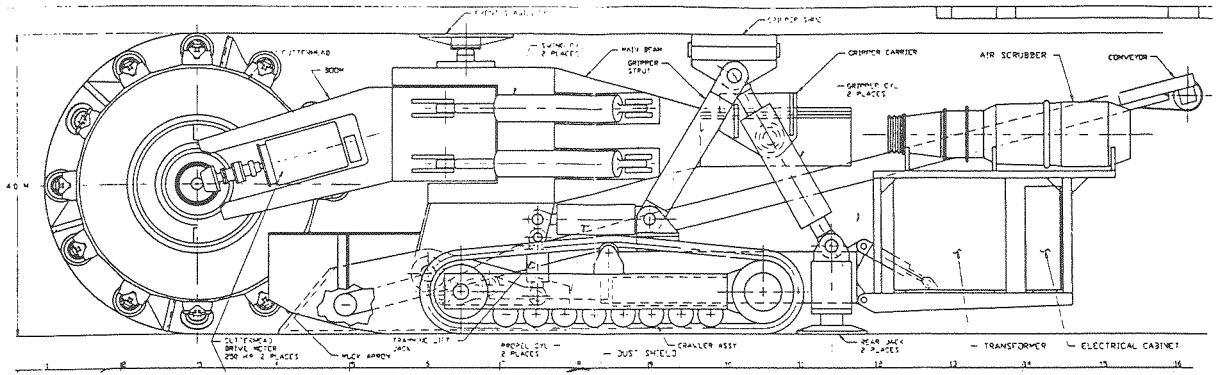
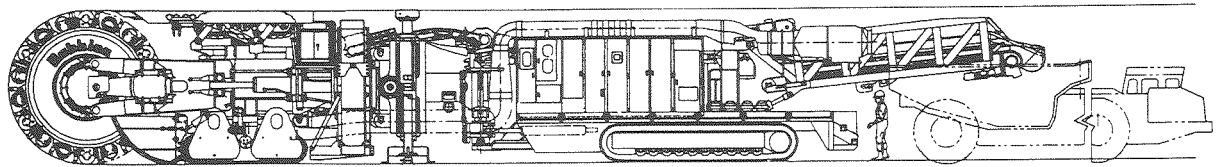


Figure 3: Mobile Miner MM120



**Figure 4: Proposed MM130**



**Figure 5: MM130 as designed**



**Figure 6: MM130 on transport**

Surface trials proceeded through March and April to verify the machine's turning and climbing ability before going underground in mid April. The history of the MM130 demonstrates the research and development process. The machine as built is vastly different from the machine initially envisaged and early indications are that its performance is well above the original expectations.

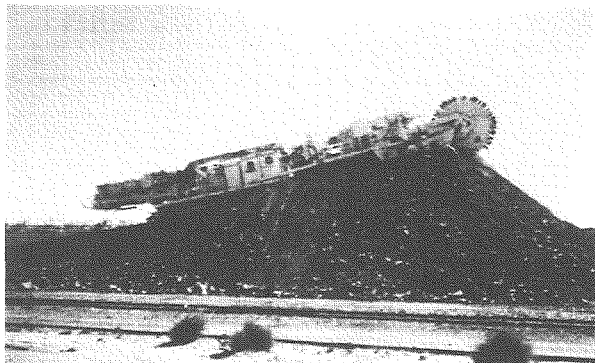


Figure 7: MM130 on 1.5 ramp

### JUSTIFYING THE EXPENDITURE

When considering process development it is educational to compare existing practice with what would be achieved idealistically. Pasminco examined the hardrock underground mining process in 1987 making comparisons with underground civil construction and underground coal mines. An example of this work is the study of the workhorse of underground mining - the LHD. The sample investigated was the fleet of 8 yd LHD's in use in the southern operations at Broken Hill comprising fourteen machines that had been built up since the first purchase in 1982.

The poor utilisation of this fleet provided a staggering insight into the lost opportunities.

Since 1987 notable improvements have been achieved with the existing process by:-

- \* Completing the surface decline in 1990
- \* Adopting a more preventative attitude to maintenance
- \* Continuing to reduce the influence of traditional practices.

However the Mobile Miner offers the potential to make further cost savings through its automation and inherent reliability achieved by good design and on board condition monitoring. The project justification provided sensitivity analysis of the performance parameters significant to the operating costs. In order of priority they are:

1. Machine utilisation
2. Cutting rate
3. Cutter costs
4. Number of support crew.

The field trials are directed at building up the knowledge base constantly applied through the machine and its control system. The well structured software based system lends itself to rapid industrial engineering which will increase utilisation and advance rate while reducing cutter costs and the number of support crew.

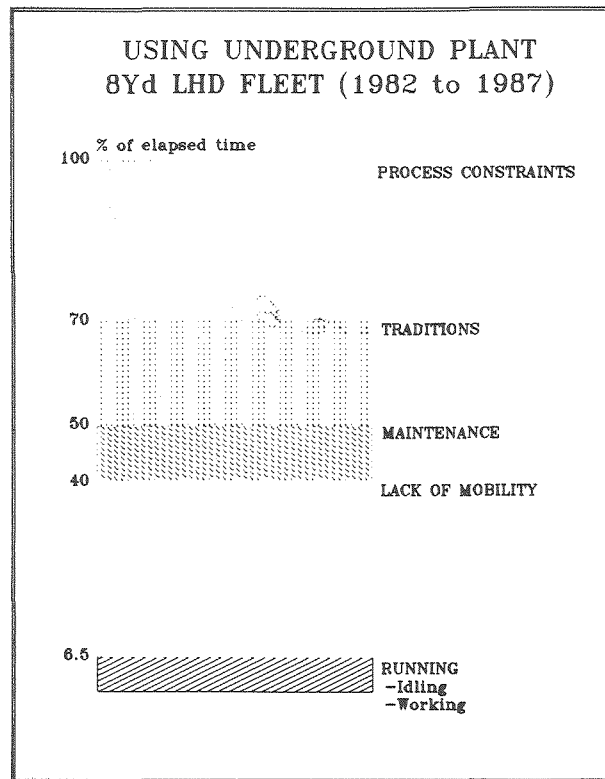


Figure 8: LHD utilisation

### MM130 OPERATION

MM130 has six 435 mm rolling disc cutters mounted on the rim of the rotating cutterhead which, in twin, is swung across the rock face. The major design objective is to roll the cutters down the face with a precise depth of cut and accurate displacement of successive cuts across the face. During the design work it was recognised that the machine should achieve the positioning accuracy of a lathe and as a result the 25 T cutterhead can be restrained within 1 mm of the desired position.

The geometry of the cutterhead and its support endowers the mobile miner with the unique ability to optimise rock cutting by selecting the optimum cut at the beginning of the swing and then continuously varying the swing speed to optimise cutter path spacing. Hence the Mobile Miner can work to its potential within design limits over a wide range of rock types.

Rock cut from the face enters the machine conveyor through the opening in the muck blade. It then transfers to the rotating carousel conveyor which lifts it to the bridge conveyor then transfers to the hopper loading conveyor and finally to the storage hopper

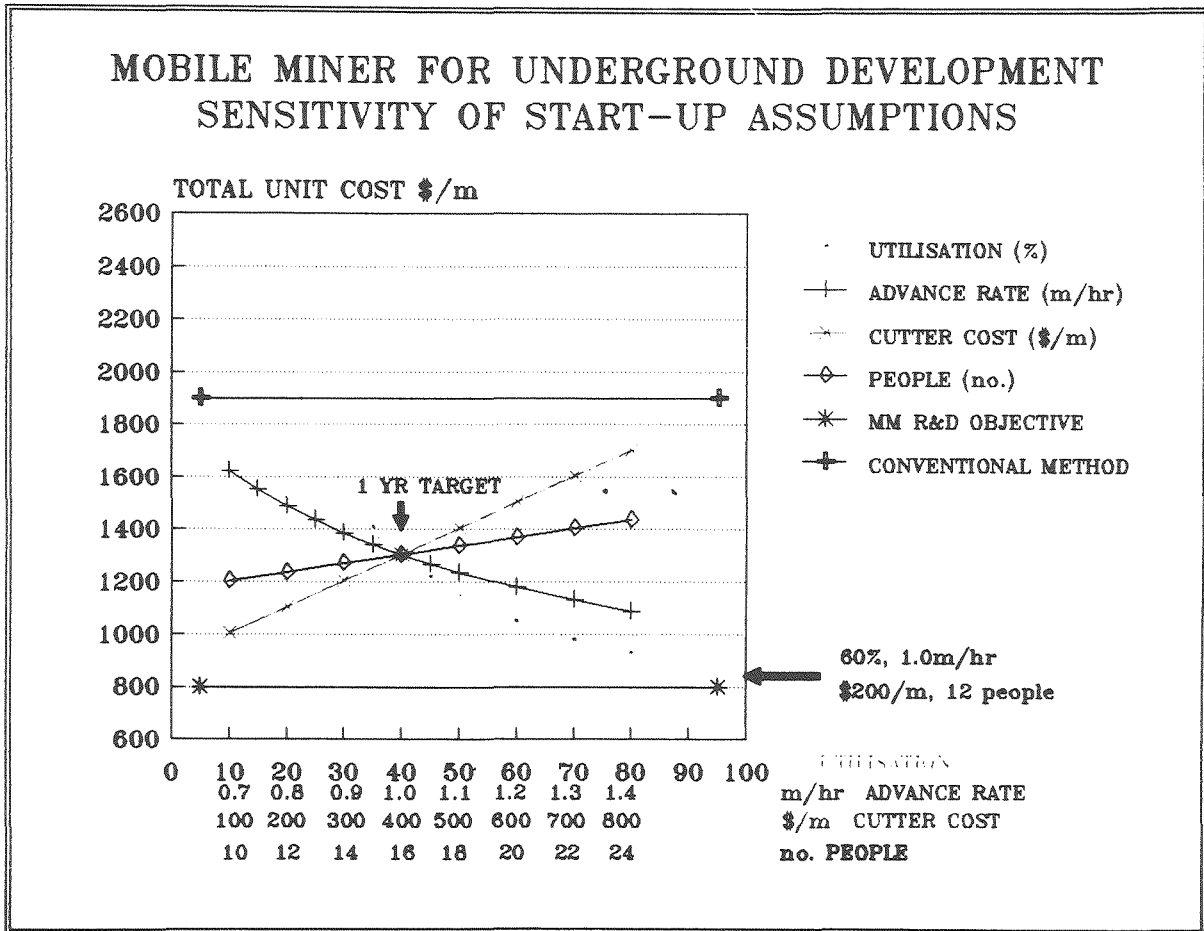


Figure 9: Sensitivity analysis

ready for discharging to a truck. This tortuous path eliminates steeply inclined conveyors enhancing the machine's ability to work on a decline.

The machine is plunged forward at the completion of each swing by thrusting from the rear. When the 750 mm stroke is completed the rear gripper is released and drawn forward to be re-gripped. During the re-grip cycle the machine remains locked in the tunnel by maintaining upward thrust on the tracked stabiliser and this is reacted through the lower tracks. The machine can correct its line and grade by manipulating the guide tube within the rear gripper. This enables precise adjustment of line, grade and camber of the tunnel.

#### FUTURE REQUIREMENTS

Initially the Mobile Miner operation will be disrupted by the need to rock-bolt the roof so a number of options are being investigated to provide non-disruptive ground support.

One area being considered is on-board monitoring which could accurately assess roof conditions and therefore the need for immediate support. In most cases it is not necessary to provide support at the machine but unless conditions can be accurately assessed the potential losses through roof failure balance the decision in favour of immediate support.

#### PROCESS UNDERSTANDING

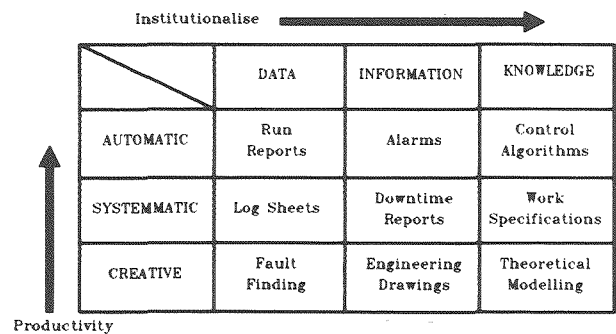
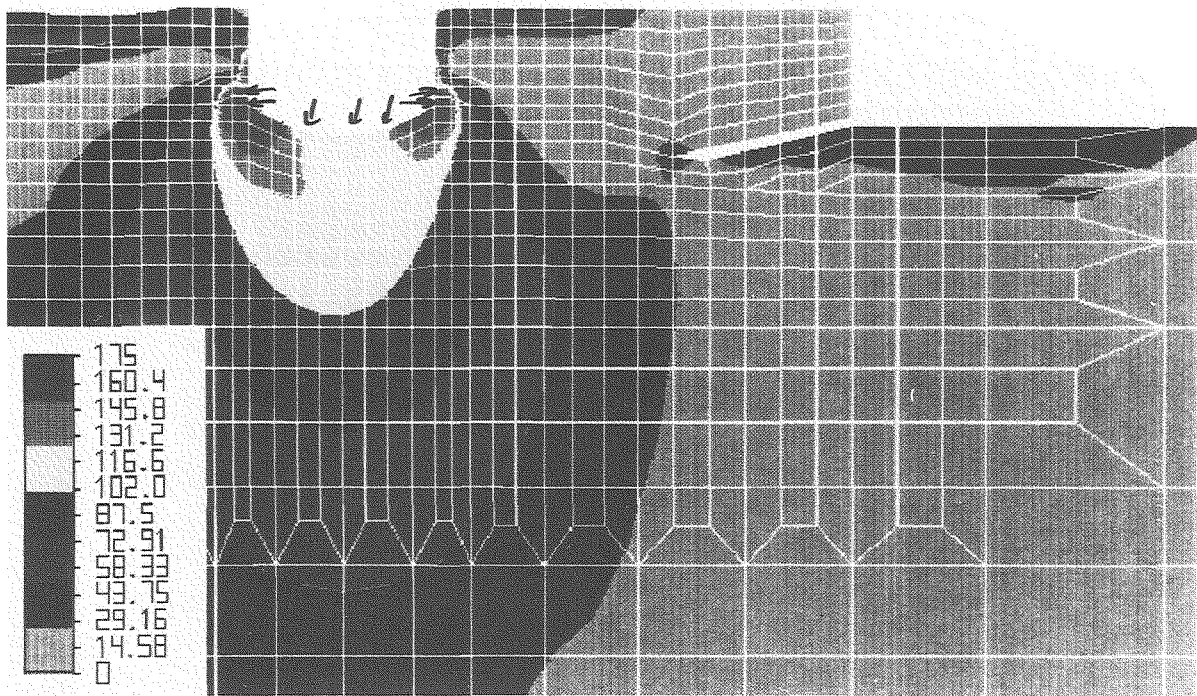


Figure 10: Application of knowledge

Hence ground assessment and on-board ground support are areas for development in the immediate future.

A significant aspect of the Mobile Miner is the relatively small and consistently sized muck produced. The material is immediately suitable for conveyor transport. Accordingly route flexible and extendable conveyors are being assessed for their applications to materials handling behind the machine.



**Figure 11: FEA of Rock**

As a mining machine it is envisaged the Mobile Miner will work in a cut-and-fill operation. All machine ground pressures have been designed to enable operation on fill. However guidance of the machine through the orebody to achieve optimum recoveries is a task which should be readily automated given the proper information and tools for collecting it.

#### **ACKNOWLEDGMENT**

MM130 is a significant advancement over MM120 and as such represents a large risk. Many people contributed to the innovation apparent in the design but two people stand out in providing the wisdom necessary to achieve major milestones in an R&D project of this scale.

Reg Fraser ensured a supportive corporate environment and Dave Sugden bettered the most difficult engineering challenges.