Black Star Open Cut
Void Management

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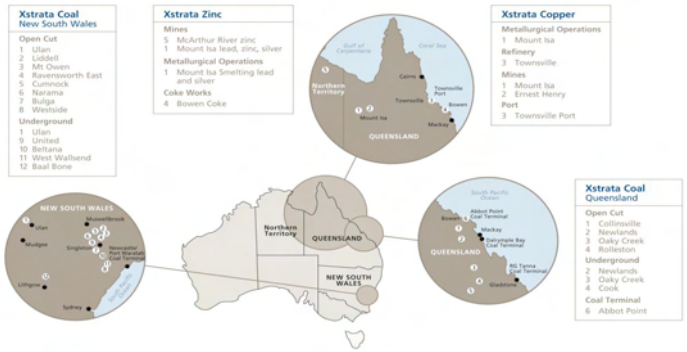
Black Star Open Cut
August 2006

Location – Black Star Open Cut



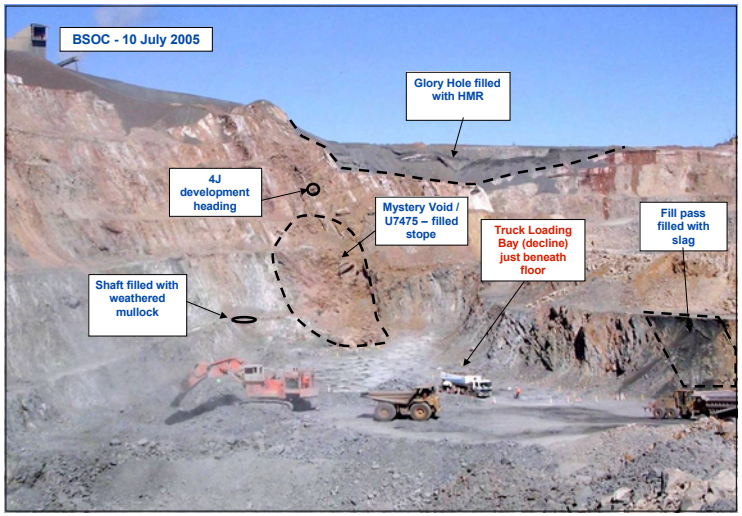
Location – Black Star Open Cut

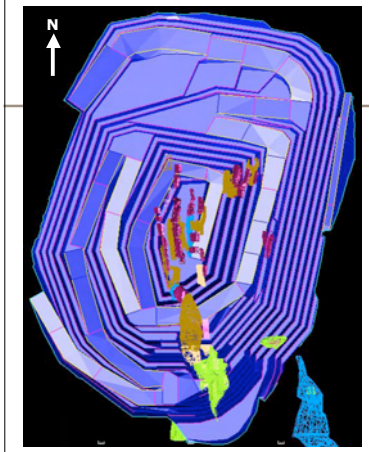
Introduction

- Mining is complicated by underground workings from past Lead Mine activities.
- The problem was identified during the Black Star Open Cut Feasibility Study
- They are a source of danger to personnel and equipment.
- Historical information of these workings is generally well recorded.
- Procedures have been developed to minimise risk to personnel and equipment when they are in areas of previous mining activity.
- Technology plays a pivotal role in risk minimisation

Past Mining

Past Mining





Stage 3 BSOC Pit Shell

Stage 3 Voids

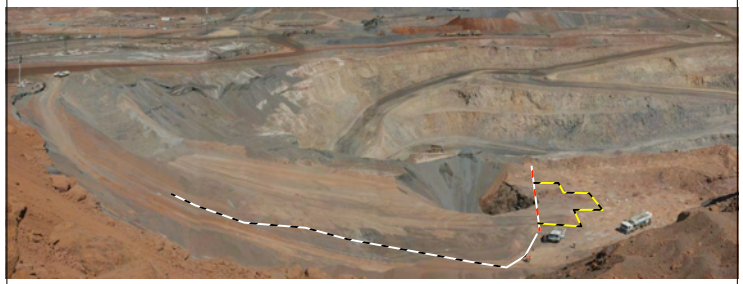
Void Issues in Stage 3

- All red stopes are unfilled.
- Other stopes are completely or partially filled

Providing Focus

Providing Focus

Procedure



Procedure - Delivery

BLACK STAR OPEN CUT

MINING THROUGH HORIZONTAL DEVELOPMENT AND VERTIAL OPENINGS ON 3400-3408 BENCH

19TH & 20th, 23rd & 24th May 2006

Presented by:

Void Management Team

3400RL - 4H Development Being Mined

4H Development on 3408RL Prior to Mining – 9th May 2006

•Plan to drill and blast the development, caving the crown into the void. Then mine out the voids to regain access across/within the B&Y.

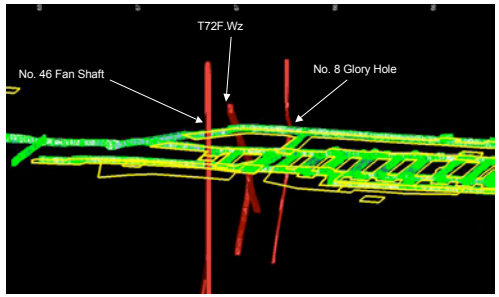
4H Development on 3400 & 3408RL During Mining – 19th May 2006

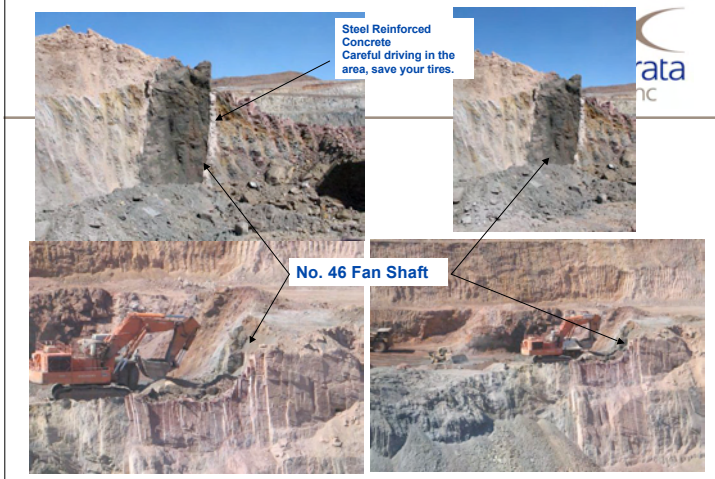
•A large portion of the B&Y has been removed after blasting and mining through the development.
•Development was surveyed with the backs of the drives 0.7m above the digitised model.

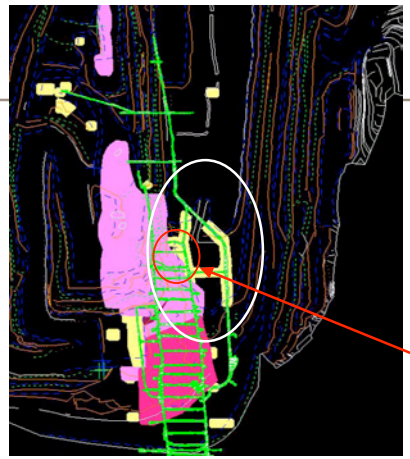
Portion of the development removed after mining.

4H Development Being Mined

No. 46 Fan Shaft – Mined into on 3400RL – 19th May 2006







Continued Mining:

Plan to advance to the south on 3400RL until ground is too hard.

Re-access 3408RL for drilling and blasting – mine.

Probe drill Red and White markout to delineate the void.

No parking of equipment or Light Vehicles on western edge of bench. Avoid the Void Hazard

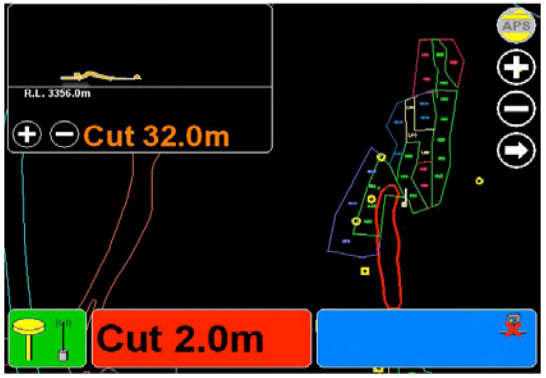
Using Technology - Systems

Systems Summary:

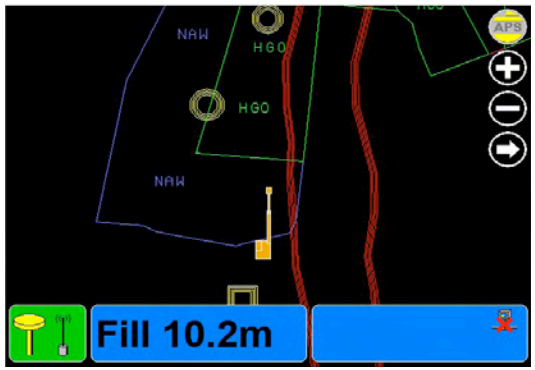
1. High Precision GPS
2. Radar
3. Cavity Surveying
4. Micro Seismic Array

Using Technology - GPS

Using Technology - GPS



Using Technology - GPS



Using Technology - Radar

- The Ground Probe Slope Stability Radar uses differential interferometry to measure sub millimetre movement in the rock mass.
- Wall and stope crown stability is a significant risk to Black Star operations.
- The system was seen as potentially being able to provide an early warning of subsidence events at Black Star.
- This was based on experience with the equipment at the Sishen Iron Ore Mine in South Africa
- The Black Star unit has detected a subsidence event in the pit floor since its installation

Using Technology - Radar

Ground Probe:
• Fully self contained mobile unit.

Using Technology - Radar

Using Technology - Radar

Using Technology - CALS

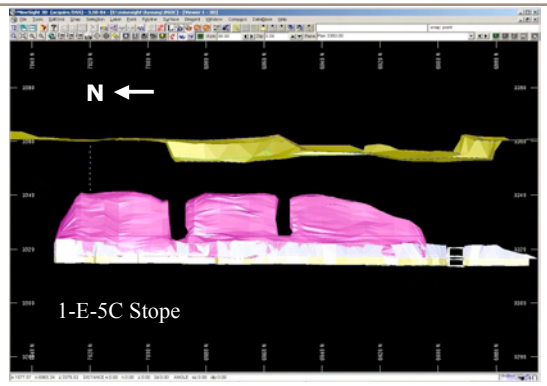
• Some stopes within the Black Star pit are over 50 years old.

• Ground does not stay static over time

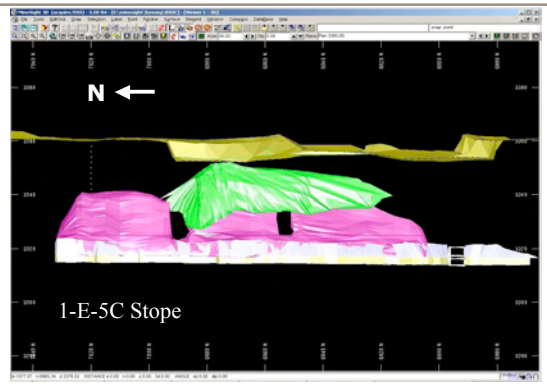
•The CALS cavity monitoring system is a “down the hole” instrument that allows Black Star to truth ground conditions.

• This in turn enables management of void filling and excavation

Using Technology - CALS



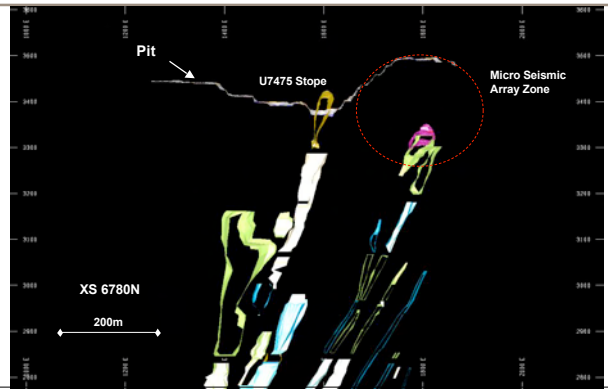
Using Technology - CALS



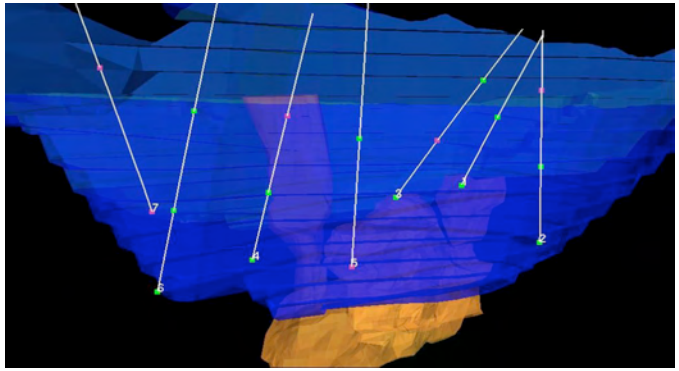
Using Technology – Micro Seismic

- The excavation of Black Star changes ground stress conditions
- Stable stopes may start to failure
- The Micro Seismic Array will “listen” for this movement
- Currently 7 holes planned for array
- Installation will occur this quarter
- Project is targeted at giving longer term warning of stope reactivation

Using Technology – Micro Seismic



Using Technology – Micro Seismic



Conclusions

- Mining through previously mined areas is a complex and high risk task
- No one system or technology can provide the redundancy required to minimise that risk
- Black Star has to date successfully implemented a robust procedure incorporating these multiple technologies to minimise the risk to its personnel and operation

QUESTIONS?