Site Profile

St Barbara’s Southern Cross Operations are centred at Marvel Loch located 30 km’s south of the town of Southern Cross and 260 km’s west of Kalgoorlie, Western Australia. Current operations are based at the Marvel Loch underground mine. Southern Cross Operations produce approximately 150,000 ounces of gold each year.

Marvel Loch Underground

The Marvel Loch underground mine is the mainstay of St Barbara’s Southern Cross Operations. Gold mineralisation extends over a 1.3 km strike length and has been identified to depths of over 700 metres below the surface. The ore body comprises multiple lodes, those currently being mined include Sherwood and Undaunted to the North; Exhibition at the centre; and East and New to the South. Mining methods include a “Core and Shell” type, where uphole benching and sub level open stoping is utilised until a mass firing recovers remaining pillars with dry rock fill Introduced.

The Situation

At the culmination of the stoping sequence St Barbara applies a mass blasting process to recover in-situ pillars.

The successful extraction of the pillars shown in Fig. 2 was complicated due to the lack of access directly above due to existing voids. The design included a combination of conventional “top hammer” long hole drilling and in-hole-hammer (ITH) machines. ITH drilling was utilized in the drive adjacent to the crown level (Fig 3 indicates drilling area of crown) to achieve the accuracy required with some hole lengths in the vicinity of 80 metres.

Orica was approached by St Barbara to assist with the extraction of the pillar as shown in Fig. 2 below. Orica assisted in the drill design, completed the charge and initiation designs. With more than four months of planning and the combined efforts of St Barbara’s Engineering team and Orica Technical Services team the blast was successfully fired on schedule on the 8th December 2010.

Fig 2: Mass blast area showing some of the drill holes.

The blast holes needed to be drilled to extract 430,000t of ore from three separate rib pillars and a crown pillar. This would then allow waste rock fill from the overlying stopes to flow in and support the void. Whilst drilling was being carried out failure of the crown pillar occurred above pillar #three, this impacted on the void area available to move the blasted rock into.
The continuing concern with further failure of the remaining crown pillar made the scheduled firing date even more important. Close monitoring of the remaining crown pillars was carried out to ensure that sufficient void would be available to compensate for a 30% swell factor of rock once fragmented.

Technical Solutions

The blast design incorporated specialized cratering charges needed to blast the crown pillars. Orica utilized the i-kon™ electronic blasting system and Subtek™ Velcro underground bulk emulsion delivered by the Orica Mining Services Hypercharge™ Total System to fire the mass blast. The ikon™ system provided a high accuracy of timings with a high degree of flexibility. This event utilized two mobile charging units with eight member operations team, with support from the product technical specialist team. In one 24 hour period over 23 tonnes of explosives were placed. The blast was timed in such a way that the rib pillars one, two and three would be fired in two separate directions directly into the existing voids.

On the 6th December the team was faced with the issue of further deterioration of the crown pillar limiting void space and initiation sequence, which made the firing on the 8th December even more critical. The crown above stope two started failing prematurely filling the void required to blast pillar #two. Using Shotplus-i™ UG software the initiation sequence was changed thereby best utilising available void space. The team was confident that there was still sufficient void space remaining to go ahead with the firing.

Figure 3: Shows location for drilling and charging of the crown

The Result

Blast vibration monitoring was carried out in two locations on the surface. Vibration levels where kept within environmental limits with a maximum detected PPV recorded of 2.85mm/s.

On the 9th December Orica and St Barbara personnel went back underground to review the area and encountered minimal damage to the crown level and even less damage to the extraction level. This was a great result as it reduced the amount of time required for rehabilitation works and allowed production bogging to commence soon after the blast.

St Barbara personnel were pleased with the results and the removal of material was made easier by good fragmentation resulting in a finely blasted material. While the removal of ore is continuing the final result will not be realised until the completion of bogging and an assessment of the void can be done.
Testimonial

The level of planning and commitment from Orica Mining Services in partnership with our site personnel and contractors was the key to make the pillar blast project a success, on time and to plan. We look forward to the next pillar firing in our mining sequence with the confidence that Orica will deliver the result we require.

Acknowledgements

Orica Mining Services wishes to thank the customer Orica Mining Services team would like to extend its gratitude to Nicholas Reed (Mining Superintendent – Marvel Loch) and his staff for their support of the project to achieve a great result. Also thanks to the Barminco Team who provided much support for the success of this blast.