Black Star Powers Ahead in Safety and Efficiency using Electronic Initiation

Project Summary

UNKNOWN MISFIRES ELIMINATED, SAFETY ENHANCED, BLASTS IMPROVED

Non-electronic initiation at Mt Isa's Black Star Open Cut Mine had its advantages but posed a higher than satisfactory level of risk. The mine was averaging one unknown misfire each month, partly due to its unpredictable geology, as well as regular blasting around old underground workings.

After evaluating recent unplanned detonations of unknown misfires during the excavation process at other mines around Australia, in March 2010 Black Star Mine decided to move from NONEL® pyrotechnic initiation systems to SmartShot® electronic detonators. This change eliminated unknown misfires and associated safety risks. It also improved the drill and blast processes by providing the tools to design larger, more complex blasts, incorporating the old underground workings without impacting dilution, fragmentation or movement. Finally, it provided complete visibility throughout the blasting cycle, which is now vital to any competitive mining operation.

Background

ONE OF THE WORLD'S LARGEST UNDERGROUND MINING COMPLEXES

Located in Queensland's Gulf Country region, Mt Isa is Australia's largest and one of the world's largest underground mining complexes. It has produced copper since World War II. Mount Isa Mines Limited (Xstrata Plc) now operates two separate mining and processing streams, copper and zinc-lead-silver.

The zinc-lead-silver operations include the George Fisher, Black Star and Handlebar Hill mines, a 6.5 Mt/a capacity zinc concentrator, a lead smelter and a zinc filter plant. Together they produce more than 226 000 t/a zinc concentrate and 125 000 t/a lead and 8.26 Moz silver in lead bullion.

The Black Star Open Cut Mine began operating in September 2004, extracting lead-zinc ore using conventional cut-back/stage mining methods. Black Star's processes are complicated, as its orebody has been extensively mined over 60 years by Xstrata and its predecessor, Mount Isa Mines. This has resulted in voids throughout the orebody where precious high grade ore has been extracted.

Project Goals

ELIMINATE UNKNOWN MISFIRES, IMPROVE EFFICIENCY

With increasing demands to extract more ore safely, complete visibility throughout the blasting cycle is vital. This requires full two-way communication with every detonator during the testing and programming cycle, as well as inside the firing window.

Concerned about unknown misfires on sites across Australia, Xstrata Zinc had a quantified risk at Black Star. While standard non-electric initiation systems are reliable and comfortable to use, shotfirers cannot identify misfires after stemming due to the inability to communicate with the detonator. Once a hole was loaded at Black Star, various factors could then influence the initiation system's integrity, with no signs of trouble at the hole collar. This project aimed to use the latest in initiation technology to eliminate unknown misfires and to improve overall blast efficiency.

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Additionally, after blasting, unless there was hard evidence, such as an uninitiated NONEL shock tube protruding from a hole, there was no way for even the most experienced shotfirer to guarantee the absence of misfires. The mine wanted to eliminate this risk.

Technology Applied

UPGRADING TO THE SMARTSHOT INITIATION SYSTEM

In March 2010, Dyno Nobel sent a conversion team of experienced SmartShot shotfirers to train Black Star blast crews and introduce electronic detonators. The implementation was completed in only two months.

The SmartShot system allows advanced blast design and implementation. Detonators cannot fire unless they receive the correct instructions via a secure, digitally coded signal, as well as the blasting voltage. The unique daisy chain design of the SmartShot system allows easy hole-to-hole connection and full programmability to 20 seconds in 1 ms increments. This provides timing flexibility not possible with pyrotechnic delays.

The mine was also provided with initiation design software to directly load timing designs from the computer onto the tagger for added ease of use by the blast crew. The mine now operates the system independently, and it has become the method of choice of all shotfirers regardless of experience.

Value Added

SAFER AND MORE EFFICIENT BLASTING

The SmartShot system, backed by a detailed implementation plan and high staff engagement, has proved to bea big success at Black Star. While some bench loading practices had to be modified first, the SmartShot system quickly eliminated unknown misfires and improved safety and efficiency.

Challenging ground conditions on-site mean detonator leads may still be damaged in hole, but these are now classified as known misfires, as they are identified before the shot is initiated and are surveyed in. Night blasts are also safer, as there is no need for high-risk clearing of shots post-blast in the dark. Total visibility during the loading and firing processes was exactly what the Black Star Mine was looking for and it has had a significant impact on safety.

The accuracy and precision of electronic timing provides the drill and blast engineers with almost untold design flexibility to match the ground conditions. They can design complex and larger blasts, particularly around voids, without having to trade off dilution, fragmentation and movement.

DNAP Electronic Initiation Systems Senior Technical Consultant Steven Combrinck said that good training had also proved vital. “Equally important for success is a high level of engagement from the mine, as was the case at Black Star,” he said. “The shotfirers embraced the technology and quickly saw it was the solution to their issue of eliminating unknown misfires.”

Results:

- Unknown misfires eliminated.
- Shotfirers can communicate with every detonator, with non-communicating detonators identified prior to blasting and classified as known misfires.
- Safety and efficiency greatly improved.
- More timing flexibility when blasting around voids.
- Blast engineer can design larger and complex initiation sequences that do not impact movement, fragmentation or dilution.
- Blast engineers can produce designs without having to account for surface burning fronts or the inaccuracy of long downhole delays.

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