METALS CASE STUDY

Electronic Wins Blast-Off

PROJECT SUMMARY

SUPERIOR BLASTING AND EXPECTED BENEFITS

Dyno Nobel's trial at a West Australian gold mine set out to measure the practical superiority of the electronic detonator system over the existing NONEL® shocktube system. The mine Engineering and Geology Departments selected sites of consistent geology.

The blast results were recorded using video footage, vibration monitoring throughout the mine, spot heights of muck-pile swell to provide heave profile graphs and PITRAM data.

The expected benefits of using electronics were:

- improved fragmentation in the ore body's top flitch (with vibration and air blast levels at or below current levels),
- improved overall fragmentation and productivity and;
- less oversized rocks and crusher downtime.

The electronic system's high-precision timing demonstrated improvements in all areas.

The trial site was at the northern end of the main pit, known for gently dipping high-strain shear zones and production of undesirable oversize in the ore body's top flitch.

Due to the bench development, the NONEL blast had seven rows, compared to the electronic blast's eight rows. In addition, two sections of pre-split were fired at the same time as the NONEL blast.

The WA gold mine site's muck-pile

PROJECT GOALS

A WIDE RANGE OF SUCCESS INDICATORS

The key blast performance criteria were:

Productivity
The main objective was to increase productivity, particularly in the top flitch, by improving fragmentation.

Electronics realised an increase to dig rate of almost 16% in the ore body (bcm/hour), nearly an additional 1500 bcm over an 11 hour shift.

Instantaneous dig rates were 119 bcm/hour higher using electronics. Bucket fill factors increased by 4% and excavator dig rates 6% due to blasting improvements.

Fragmentation
Dig rates from both observed and calculated sources showed increased and improved fragmentation from the electronic blast.

Oversize
While not directly comparable, as the top two flitches of the electronic blast are compared with the top flitch only of the NONEL blast, 195 buckets of oversize were loaded from the electronic blast compared with 143 buckets from the NONEL blast.

Crusher
Crusher staff said they had not seen the top flitch of high-grade ore bodies crush consistently at this rate.

The maximum crusher throughput was 6% higher equating to approximately an additional 1000t per day.

Vibration Analysis
Geo-technical data appeared to show that the electronic blast trace was more uniform (allowing for an extra row in the electronic blast resulting in a longer trace).

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TECHNOLOGY APPLIED

KEY FEATURES COMPARED

High Precision
The accuracy of the electronic detonator is 0.02% over the entire timing range (0 – 20,000ms) compared to NONEL, which is in the order of 2%.

All realised production improvements are a result of this high precision timing.

Safety and Security
A key feature is the ability to check the status of all detonators before firing, allowing the shot-firer to address any problems prior to blasting.

There is no use of surface detonators to complete the hook-up, preventing the possibility of a surface cut-off.

Once the blast is initiated, all detonators become active, firing at their pre-programmed delay times.

Detonators cannot fire unless the system provides a coded signal together with the correct instruction and voltage.

VALUE ADDED

BENEFITS OF USING ELECTRONIC INITIATION

The electronic initiation system outperformed the NONEL shocktube system on all criteria.

Using electronics, while the muckpile swell was similar, heave was more consistent, and less oversize was visible on the surface.

Operators found it dug better than previous blasts and crusher throughput was consistently higher.

Vibration was more consistent across the entire blast.

The trial showed:

- electronic blasts top flitch dig rate (976 bcm/hour) was 16% higher than the NONEL system,
- electronic blasts instantaneous dig rate was 1211 bcm/hour, an improvement of 11%,
- the electronic blasts second flitch dig rate exceeded 1000 bcm/hour and;
- maximum crusher throughput was 6% higher (787tph).

Today, the mine uses the next generation fully programmable electronic detonator system for all blasts, which enables design and implementation of advanced blast designs.

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