

“ Since implementing Minnovare’s Production Optimiser™ technology in 2018, we’ve seen average drilled meters across our Kalgoorlie operations increase significantly.

At just one of our operations alone, we achieved 42,000 additional stoped tonnes, ~8,300oz annually; increasing revenue by AUD\$18M. That’s a significant impact, which has largely been underpinned by this new technology. ”

Thao Nguyen, Senior Mining Engineer
Aeris Resources, Cracow Mine.



NORTHERN STAR: 1-YEAR-ON

Northern Star Resources (NSR); A global gold producer with a portfolio of Tier-1, low-cost/high-grade underground assets in Australia and the United States. NSR implemented Minnovare’s Production Optimiser technology across their Kalgoorlie operations between Mar-Aug 2018. Jeff Brown, Principal - Innovation & Technology, Northern Star Resources, talks us through this case study.



LOCATION: **KALGOORLIE, AUSTRALIA**

YEAR: **2018-2019**

INDUSTRY: **UNDERGROUND MINING**

CLIENT: **NORTHERN STAR RESOURCES**

FOCUS: **LONG-HOLE PRODUCTION DRILLING**

RIG TYPE: **FLOATING ROOM**

SOLUTION: **PRODUCTION OPTIMISER SYSTEM**

COLLABORATION IS KEY

Jeff Brown: “We were first introduced to Minnovare at an Austmine industry event in 2017. Collaboration with METS companies and implementing new innovative technology relevant to our business has been a critical part of our strategy - [that is] to drive efficiencies and productivity that allows us to grow our mines and reduce production costs.

What we’re seeing now with Minnovare is an example of a relationship that fits our strategy and the culmination of a path that started nearly two years ago.

Since implementing the Production Optimiser system between March and August 2018, we’ve seen average drilled meters across our Kalgoorlie operations increase by 32%. That’s a significant impact, which has been underpinned by this new technology. The follow-on from

that increase is an equally significant impact to the productivity, and ultimately profitability, of our operations. It’s a prime example of a concept that quickly adds value to multiple areas - producing a better business outcome.”



Jeff Brown (NSR) and Callum McCracken (Minnovare) at the signing of an official ‘Collaboration Agreement’ in 2018.

THE IMPLEMENTATION

Minnovare implemented the Production Optimiser system at one of NSR's Kalgoorlie operations in March 2018 - running three long hole production rigs. This was followed by a second operation in August 2018, also running three long hole rigs.

The Production Optimiser technology works independently of the rig's on-board systems to deliver greater speed, accuracy and reliability in rig setup - leading to greater drilling accuracy and optimum blasts. The system uses Minnovare's CORE software which digitises drill plans and plods (Digi-Plan/Digi-Plod) for accurate drill-data capture and realtime transfer throughout the mine.

IMPACT ON PEOPLE AND PROCESSES

"Aside from the improved accuracy, the digitisation of what was traditionally a paper-based process delivers an efficiency gain that boosts people's productivity through greater accountability and visibility - it's brought a level of data integrity and QA/QC to our drill and blast operations that simply wasn't there previously. "Added to this, the Minnovare technology integrates with our existing processes on-site; it doesn't require any additional resources to administer, so the people don't change, the process does. The acceptance from both the technical and operator level has been excellent."



SOUTH KALGOORLIE OPERATIONS

"Following the implementation, the new technology immediately impacted our drilling speed - by simplifying the process the driller had to follow in order to drill each hole, accurately. The amount of time spent actually drilling therefore increased - contributing to the increase in average drilled meters and a reduction in average stopecycle-time. Added to that was the improvement in accuracy and consistency of our drilling - which helped us reduce our bridge / stopecycle tonnes ratio by over 50%. That reduction resulted in less re-work and delays, and ultimately an improvement to both the reliability and productivity of the mines.

"Time that would previously have been spent on re-drilling was now allocated to new production. This all equates to additional ounces recovered thanks to accurate holes, and effective blasts."

**FASTER, MORE
ACCURATE
DRILLING**

**= INCREASE
DRILLED METERS,
= OPTIMAL BLASTS
&
= LESS DILUTION
= LESS BRIDGING
= IMPROVED
RECOVERY**

**31% INCREASE
IN DRILLING
PRODUCTIVITY
(CUMULATIVE)**

**7% REDUCTION
IN AVG STOPECYCLE
TIME**

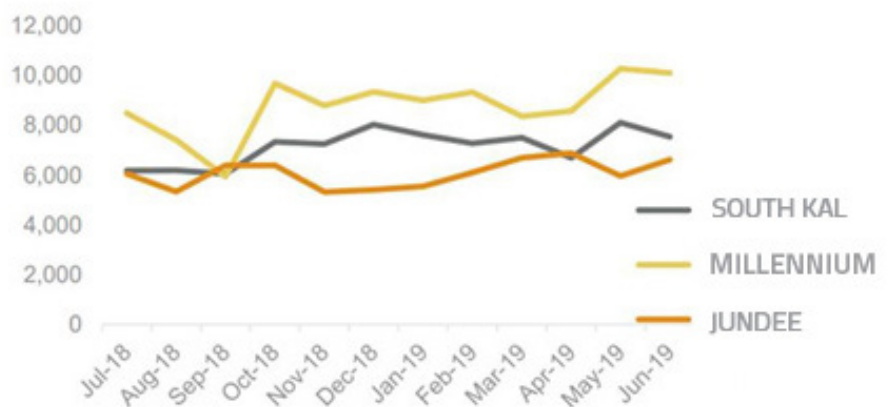
**54% REDUCTION
IN BRIDGED
TONNES**

**42,000 TNS,
8,300 OZ
ADDITIONAL
PRODUCTIVITY**

**ADDITIONAL
AUD\$18M
(USD\$12.2M)
REVENUE**

**PRODUCTION™
OPTIMISER**

DRILLED METERS PER LONG-HOLE RIG

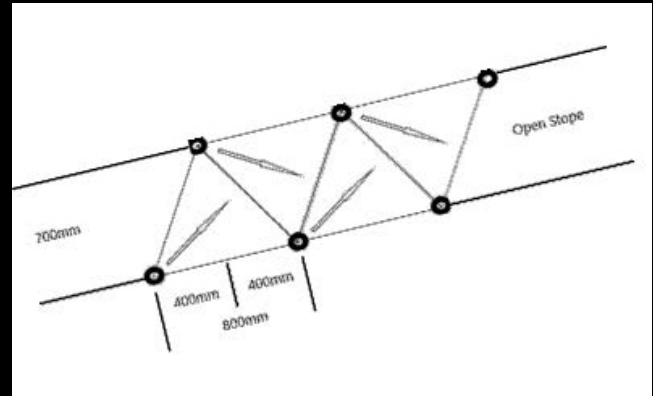


Production drilling productivity results taken from NSR's annual investor event, showing the impact of the Production Optimiser at two of their sites (South Kal, Millennium).

MILLENNIUM OPERATIONS

"At our Millennium operations the technology has arguably made an even bigger impact. We increased drilled meters by 33% - increasing average drill meters towards 10,000m per rig, per month.

"What's also noteworthy is that at Millennium, where ore veins can be particularly narrow, we've been able to reduce our average stoping width by 0.5m using a 'Zipper' pattern - which you can only do if you have great confidence in your drilling accuracy. As a result we've removed 80,000tns of waste dilution from the process."



**NOW AVERAGING
10,000 METERS
PER RIG / MONTH**

**33% INCREASE
IN DRILLING
PRODUCTIVITY
(CUMULATIVE)**

**'ZIPPER' PATTERN
REDUCED AVG
STOPE WIDTH
BY 0.5M**

**REMOVAL OF
~80,000 TNS
WASTE PER YEAR**

**REMOVAL OF DILUTION (WASTE)
FROM HAULAGE & PROCESSING:
= 80,000 TNS HIGH GRADE BROUGHT FWD
= AUD\$20M (USD\$13.6M) OPPORTUNITY**

**INCREASED
PRODUCTIVITY -
A KEY DRIVER
OF ASSET VALUE**

**= REDUCES FIXED
COSTS
= INCREASES NPV
AND FCF**

POPE JOHN (MILLENNIUM) AVG STOPE WIDTH (M)



FUTURE DEVELOPMENTS

"On the back of the success we've achieved with the Production Optimiser system, NSR entered into an official 'Collaboration Project' with Minnovare to help fast-track a number of new product developments currently in the pipeline, that we see as having the potential to make just as big an impact on our operations. That's exciting and promising for us as we look to develop and expand on our assets." **Jeff Brown**

