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Nickel tipped for growth

Prices to reach \$11,500/t by end of 2017: report

CAMERON DRUMMOND

A REPORT by London-based research group Capital Economics projects nickel prices to reach \$11,500/t by the end of the year and continue strongly in 2018, despite current supply uncertainty.

In February 2016, nickel prices fell to a 13-year low of \$US7725/t, before bouncing back to more than \$US11,700/t by mid November after the Philippines – the world's biggest nickel exporter – halted production at 41 of its nickel mines following an environmental audit.

While final results of the audit were due this month, with the halt expected to be lifted soon after, supply from the Philippines may still be constrained.

The report estimated that about 50 per cent of the Philippines mining capacity could be closed, leading to a global nickel supply shortfall.

"However, there are other sources of supply, notably from New Caledonia, that are chomping at the bit to take market share," the report stated.

"In late December, the New Caledonia government approved requests from nickel miners to export over 2 million additional tonnes of ore to China."

Russian miner Norilsk Nickel – one of the world's largest producers – also said it would increase output of its main metals from Russian mines this year.

The company said it would produce between 206,000t and 211,000t of nickel from its own Russian ore feed, up from 196,664t last year.

The nickel price fell again 20 per cent to trade at a six-month low at the end of January after Indonesia's announcement to partially lift its ban on exports to allow up to 5.2 million tonnes (mt) of nickel into the global market this year.



Sudbury nickel smelting operations, Canada.
Image: Glencore.

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Yancoal to purchase Rio Coal & Allied

ELIZABETH FABRI

CHINESE-owned Yancoal Australia has entered a binding agreement with Rio Tinto to purchase its wholly-owned subsidiary Coal & Allied Industries for \$US2.45 billion.

Subject to regulatory Government and shareholder approvals, the deal would see Yancoal acquire a 100 per cent interest in Coal & Allied through an initial \$US1.95bn cash payment at completion; \$500 million in aggregate deferred cash payments; and coal price linked royalty.

Coal & Allied owned and operated multiple, multi-seam open cut mines in the Hunter Valley, with a 67.6 per cent interest in the Hunter Valley Operations mining complex (HVO); 80 per cent interest in the Mt Thorley mine; 55.6 per cent interest in the Warkworth mine; as well as a 36.5 per cent interest in Port Waratah Coal Services coal export terminal.

Yancoal currently operated seven mines in NSW, WA and Queensland, as well as a number of projects at feasibility stages, infrastructure holdings, and a suite of exploration assets.

The deal would put Yancoal in the top spot as Australia's largest, pure-play coal producer, with expected ROM coal production of 71mtpa.

"This is a transformative and exciting acquisition for Yancoal shareholders and will form the basis for our future growth and success as Australia's largest pure-play coal company," Yancoal chairman Xiyong Li said.

"Via the acquisition of Coal & Allied's



Mount Thorley Warkworth in the Hunter Valley was one of the mines that would be sold.

Image: Rio Tinto.

high-quality asset portfolio, we will be delivering substantial cash flows to the company, quality coal products and long-term relationships with end-users in key global markets.

"The substantial cash flows from Coal & Allied's assets, combined with

the anticipated synergies and proposed equity raising will materially strengthen Yancoal's balance sheet."



Rio Tinto chief executive Jean-Sébastien Jacques said the sale was consistent with the miner's strategy of reshaping its portfolio to ensure the most effective use of

capital.

"We are confident that Coal & Allied will continue to contribute to the New South Wales economy and the communities of the Hunter Valley under a new owner."

The transaction was estimated to be complete by the third quarter of 2017.





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\$5.6bn Balla Balla progresses

CAMERON DRUMMOND

THE WA government has paved the way for the development of a \$5.6 billion iron ore mine, rail and port facility project in the Pilbara after signing a State agreement with Balla Balla Infrastructure Group (BBIG).

The 23 January agreement relates to the rail and port development, costing an estimated \$3bn, with the remainder to be spent on the mine.

Majority owned by NZ's Todd Corporation, BBIG would build an up to 10 million tonnes per annum iron ore mine on the Pilbara coast between Port Hedland and Karratha, with a 162km-long railway to unlock ore further inland.

The government said Balla Balla would generate 3300 jobs during construction, with a further 910 jobs once operational.

WA development minister Bill Marmion said the project showed that despite some economic headwinds, there was still great interest and investment opportunities in the WA resources sector.

"State Agreements provide certainty for business, resulting in longer-term investment and advantages for the WA economy through jobs and community benefits," Mr Marmion said.

Construction could begin as early as next year; however Todd – owned by one of NZ's wealthiest families – had not secured



The development of Balla Balla would be Todd Corporation's biggest investment in Australia.

Image: Stock.

finance, nor any off take agreements with nearby producers.

Nearby Flinders Mines – which Todd has

a 53.4 per cent interest in – is the most likely miner to partner into the project.

The development of Flinders' Pilbara Iron

Ore Project in the central Pilbara has been stymied due to the lack of transport options of its ore to port.

\$32m makeover for School of Mines

ELIZABETH FABRI

CURTIN University WA School of Mines' accommodation in Kalgoorlie has undergone a \$32 million facelift to encourage more students into the region.

A collaboration between Curtin University and the WA Government, the Agricola facility will provide accommodation for 228 students, with 180 new individual bedrooms and 48 refurbished rooms.

Curtin Vice-Chancellor Professor Deborah Terry said the rebuild and refurbishment was extremely important to Kalgoorlie as it would help attract high-calibre students to the region.

"The existing accommodation – which had been in operation since the 1970s – needed to be significantly upgraded to meet the needs of today's students and to ensure the sustainable future of the Curtin WA School of Mines," Professor Terry said.

"The project has received strong support from the local Kalgoorlie community, which is proud of the role the WA School of Mines has played in the WA mining industry over its 114 year history."



Curtin chancellor Colin Beckett and vice-chancellor Professor Deborah Terry, Deputy Premier Liza Harvey and Member for Kalgoorlie Wendy Duncan at Agricola's relaunch.

The redevelopment was the first phase of the Kalgoorlie Campus and Curtin WA School

of Mines Master Plan, which also involved an additional \$10 million spend over the

last three years to refurbish the Kalgoorlie Campus library, laboratory, and classrooms.



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IN BRIEF

Doray appoints new
Managing Director

GOLD

DORAY Minerals has ended its search for a new managing director, appointing Leigh Junk to the role after Allan Kelly resigned last year.

The move was announced just days after company chairman Peter Lester resigned to focus on other business interests.

Mr Junk assumed the role of interim managing director on 25 November last year and was deemed the most appropriate person to lead Doray, the company said in a statement.

He had served on the board of Doray since 2011 as a non-executive director and had previously held board positions on other WA-based miners such as Donegal Resources, Parmelia Resources, Goldfields Money and Aura Energy.

Port of Newcastle
breaks monthly
expert record

COAL

THE Port of Newcastle reported a new monthly coal export record of 15.9 million tonnes in December, confirming strong demand for NSW coal.

The previous record was 15.8mt in December 2014.

NSW Minerals Council chief executive Stephen Galilee said the record 161 million tonnes of coal exported through the Port for the year indicated a rise in global demand for the State's coal, particularly its high-quality thermal coal from the Hunter Valley.

"Many of our trading partners in Asia are building more and more new technology coal fired power plants so this high level of demand for NSW coal is anticipated to continue for many years to come," Mr Galilee said.

Newcrest guidance
unchanged despite
flat results

GOLD

Newcrest Mining expected to produce between 2.35moz and 2.5moz of gold in FY17, despite posting a low yielding December quarter.

The company produced 614,715oz in Q4 2016, down from 615,498oz in the September quarter, however production was up 2 per cent from its operations after Newcrest sold its 50 per cent stake in the Hidden Valley gold mine in Papua New Guinea.

Copper production rose 6.1 per cent from 23,723t to 25,176t quarter on quarter.

Newcrest said production at its WA Telfer mine was impacted by heavy rainfall in January; however the mine was still on track to meet its FY17 guidance.

New Acland gets approval



New Acland mine.

Image: New Hope Group.

ELIZABETH FABRI

NEW Hope Group's long-awaited New Acland expansion is one step closer to development after receiving Federal Government approval in January.

The New Acland Stage 3 Continuation Project gained Environment Protection and Biodiversity Conservation Act (EPBC) approval but still required State Government Mining Lease, Environment Authority, and Associated Water License approvals before a final investment decision could be made.

New Hope Group managing director Shane Stephen said the approvals proved the environmental credentials of the project "stacked up".

"It's positive news for the local community as it provides optimism for the continuity of operations at New Acland and the increased economic activity associated with the construction of the project," Mr Stephen said.

"Our 300 direct local employees and 500 contractors have been anxiously awaiting Federal and State approval of this project for many years.

"Whilst we welcome the Federal EPBC Act approval, timing of State approvals is absolutely critical as the current mining lease is running out of resource and a considerable amount of construction activity is required to enable access to Stage 3 coal."

Queensland Resources Council chief executive Ian Macfarlane said the news was

a welcome relief for the State after years of delays.

"The Federal Government has stepped up to help create up to 260 construction jobs and ongoing direct employment of up to 435 jobs and indirectly 2300, worth about \$12 billion in economic benefits over the life of the project," Mr Macfarlane said.

"This project has been scrutinised by both State and Federal governments, and has held up under the scrutiny of experts to meet some of the highest environmental standards in the world.

"We now call on the State government to do its part to help New Hope gain the remaining critical approvals before the current resource runs out."

QLD firm wins Rio contract

ELIZABETH FABRI

RIO Tinto has awarded a \$70 million bulk earthworks contract to civil engineering firm QBirt for critical infrastructure works at its Amrun bauxite project in Northern Queensland.

The contract was set to generate up to 150 jobs during construction and support ongoing employment for the existing workforce of 1400 at the nearby Weipa bauxite operations.

"The roads and other infrastructure to be developed by QBirt are essential to the future Amrun operation," Rio Tinto Growth & Innovation group executive Stephen McIntosh said.

"We are very pleased that a Queensland-based business has won this important work ahead of other competitive bidders.

"QBirt not only brings more than 30 years' experience in the industry, but shares our commitment to developing a strong and sustainable safety culture at Amrun."

QBirt was currently completing construction of a tailings facility at Rio

Tinto's Yarwun alumina refinery and has previously been engaged at Weipa.

"We pride ourselves on the relationships we generate and this is mirrored by our ongoing re-engagement with Rio Tinto," QBirt founder and managing director Quentin Birt said.

"After the success of our accelerated construction mine haul road network at Weipa, this new Amrun contract only strengthens our long-term relationship with Rio Tinto."

The news was also welcomed by the State Government.

"This project builds on Rio Tinto's long-standing existing operations in Gladstone and Weipa which have supplied the raw product used to produce 10 per cent of the world's aluminium," Acting State Development minister Bill Byrne said.

"The awarding of this contract continues QBirt's association with Rio Tinto after previously winning the contract for 300,000m3 of embankment and seven kilometres of mine haul roads."

Construction will begin in the first quarter of 2017, and production and shipping were due in the first half of 2019.

A map of Rio Tinto's \$2.6 billion Amrun bauxite project.
Image: Rio Tinto.

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Is there a lithium bubble?

A bullish market focusing on demand, a growing supply side, and technological advancements could spell trouble for a commodity that is seen as a key material for the future of our energy use.

CAMERON DRUMMOND

ONE of the best performing commodities of 2016 was undoubtedly lithium, burgeoned by Tesla Motor's construction of a lithium-ion battery gigafactory in the Nevada desert, which it fired up in the first week of this year.

Tesla, partnering with Japanese electronics company Panasonic, predicts that the factory will be producing 35 gigawatts (GW) of lithium-ion batteries each year by 2018 for use in electric vehicles (EVs) and energy storage systems – double the rest of the world's current production rate.

Lithium has a range of commercial and industrial uses, such as the manufacture of glassware and ceramics; though by far the fastest growing application is for batteries.

Technological advancements in battery-making had seen the spot Chinese lithium price more than triple from \$US6500 per tonne in 2011, to about \$US21,500/t by mid-2016.

Lithium had also been labelled "the new gasoline" by investment house Goldman Sachs, and Macquarie Research estimating lithium demand had exceeded supply during 2016, expecting the trend to continue this year.

China told its automakers back in November that EVs would have to account for 8 per cent of total car production.

In 2016, China produced 351,000 passenger EVs and 156,000 commercial EVs, an 85 per cent increase from the



Image: Tesla.

previous year.

These factors have caused a boom in Australian lithium exploration as mining companies scrambled around the WA outback in an effort to ride the wave of investor interest and demand for the commodity.

In the last two years WA-focused lithium companies such as Pilbara Minerals, Altura Mining, Kidman Resources and Neometals have transformed from penny stocks to mid-tier companies with market valuations near and above \$300m; and by mid-2016 as many as 30 ASX-listed companies had lithium in their sights – about 15 more than by the end of 2014.

However some analysts believe lithium is heading toward over-supply issues before many of these miners get into production.

Deloitte Access Economics director Luke McFadyen said that at a high level, lithium today has all the characteristics of a classic commodity bubble, and isn't as rare as it is made out to be.

"According to the US Geological Survey (USGS), world lithium reserves are about 14 million tonnes, versus an annual production of about 32,500t; implying that, at the current production rate, the reserves of lithium will last 431 years," Mr McFadyen said.

To put this in perspective, the USGS showed that copper had a reserve life of 39 years, zinc 15 years, gold 19 years and iron ore 56 years.

"There are currently 35 Lithium projects under development around the world and total lithium mine capacity should increase by about 70 per cent by

2025," Mr McFadyen said.

"The capacity for mineral conversion could also more than double over the same period due to improvement in processing technology."

Mr McFadyen also believed that although Australia is currently the world's top lithium producer; China, Chile and Argentina all have equal or better resources than Australia and were progressing them at a faster rate.

"The competition from Chinese production is set to become even more significant and is moving faster to market than Australian producers: there are currently five operating projects, two committed projects, three probable projects and two possible projects in China," he said.

"The demand for lithium from Tesla is significant but Elon Musk, Tesla's founder, has been explicit in his desire to source lithium from local USA producers only.

"There are currently five projects underway in Nevada (where Tesla's gigafactory is being built) to supply Tesla with the lithium they need, none will come from Australia.

"WA's economy unfortunately won't be saved by a few small lithium explorers with a half decent resource and a nice presentation in hand."

There seems to be no doubt that lithium will have a growing use for technology in the near future, however it remains to be seen whether Australian miners will be able to take advantage of global demand in time.

First shipment at Mt Cattlin

ELIZABETH FABRI

GALAXY Resources is making progress at its newly recommissioned Mt Cattlin operation, after loading its first lithium concentrate shipment at the project.

On 3 January, Galaxy announced that 10,000 million tonnes was loaded at Esperance Port, WA on the NY Trader 1 vessel bound for China.

Managing director Anthony Tse said the shipment was a major milestone for the company as it ramped up towards its annual production goal of 160,000t in 2017.

"This is an exciting day for Galaxy and for our customers, it marks another major achievement and signals Galaxy's formal transition back to producer status, elevating it into the ranks of global lithium producing companies," Mr Tse said.

"There has been a tremendous amount of hard work with some very long hours put in, under tight and challenging deadlines, to get the operations to the stage where they are at and to allow us to make our first shipment.

"I would like to again thank all of those that have contributed in order for us to be able to achieve this milestone, including the Mt Cattlin project and operations team, the Primero team, as well as all the staff at Galaxy corporate."

Mr Tse said the production ramp up at Mt Cattlin was going well, with plant utilisation now averaging at 72 per cent and increasing, with recoveries sitting at 60 per cent.

Pilgangoora to start construction



Located 120km from Port Hedland, Pilgangoora is one of the biggest new lithium ore (spodumene) deposits in the world. Image: Pilbara Minerals.

ELIZABETH FABRI

PILBARA Mineral's 100 per cent-owned Pilgangoora lithium-tantalum project in WA's north is set to begin commissioning this year following the award of an engineering, procurement and construction (EPC) contract to RCR Tomlinson in January.

With an estimated value of \$138 million and cap of \$148m, the contract would see RCR deliver plant construction in 35 weeks, and plant commissioning

by the December quarter.

The Stage 1 front-end engineering and design ("FEED") phase will begin immediately, coinciding with the procurement of major equipment, with Stage 2 expected to begin in May.

Pilbara Minerals managing director Ken Brinsden said the terms of the contract were "extremely competitive", with RCR appointing Minnovo and Primero as key technical and engineering subcontractors for the works.

"The combined experience of RCR,

Primero and Minnovo has made for a very compelling offering," Mr Brinsden said.

"Primero's experience in building and operating lithium plants, Minnovo's design experience, and the construction capability of RCR ensures Pilbara will be well served.

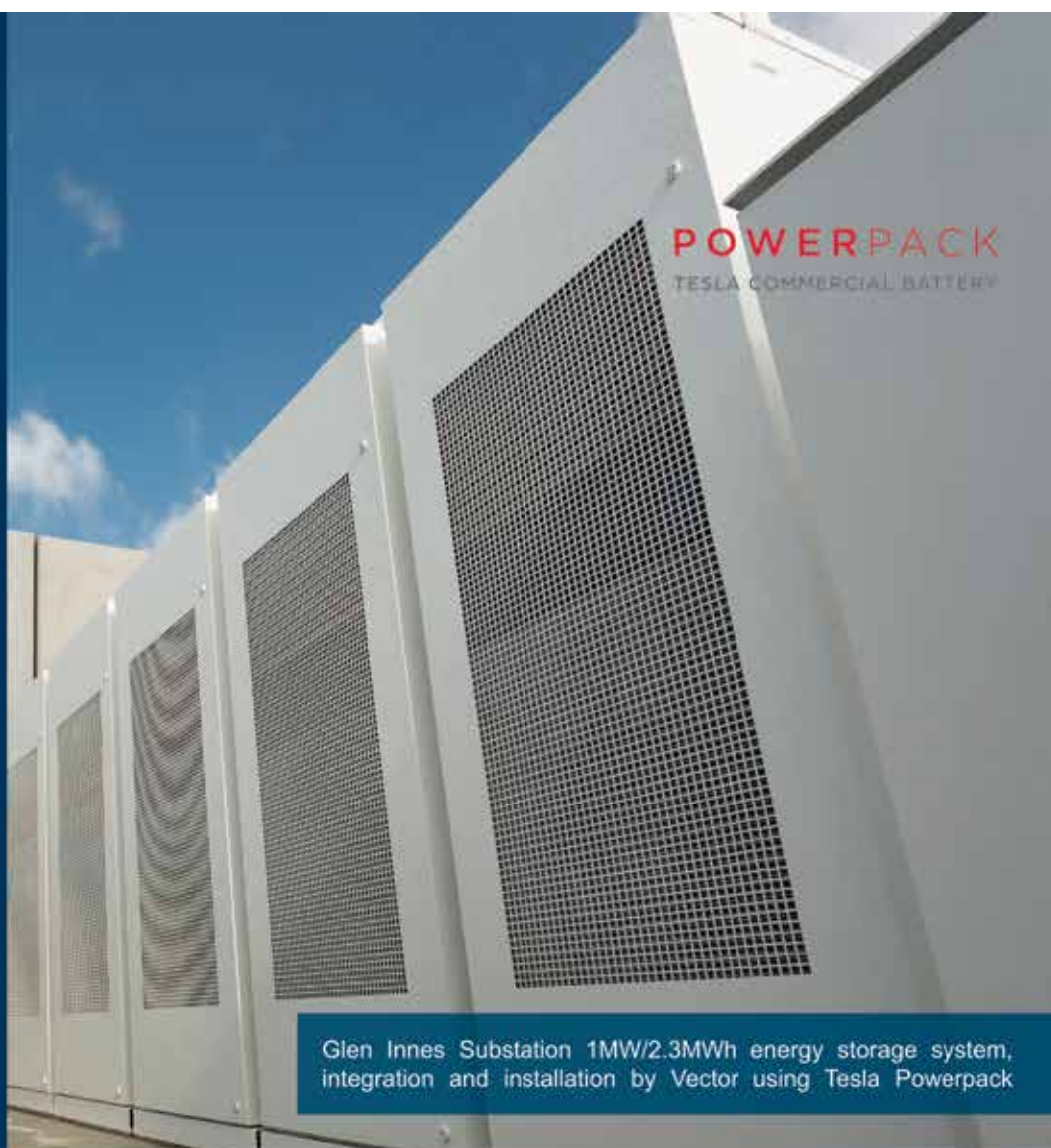
"With projecting funding discussions well advanced and final environmental approvals now underway, Pilbara looks forward to starting the major construction works by the end of this quarter."



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IN BRIEF

US tech giant
acquires MiPlan

ACQUISITION

PERTH-based technology company MiPlan has been bought out by US company Hexagon Mining.

Established in 2010, the locally-owned start-up developed mobile software applications for field data collection, fleet management, production management and reporting, with a proven track record of increasing mine site productivity.

MiPlan managing director and co-founder Robert Daw said the acquisition was a “fantastic outcome” for its clients.

“Hexagon group will contribute to the continued improvement of our existing offerings and provide a great platform for the next generation of solutions that mining businesses need to stay competitive,” he said.

Lithium Australia
advances
recycling plan

RECYCLING

LITHIUM Australia is developing a recycling strategy that will minimise waste and maximise the recovery of technology metals at the end of their product life.

“We see a lot of waste in the mining industry as a consequence of imposing high cutoff grades to lithium deposits,” Lithium Australia managing director Adrian Griffin said.

“This is not sustainable and Lithium Australia is developing the technologies to rectify the situation.

“We see the recycling of batteries in a similar light; legislative changes, on a global basis, are likely to force industry into more responsible recycling programs and Lithium Australia is positioning itself to become part of the solution.”

Express to the
moon

SPACE

OFF-WORLD mining explorer Moon Express has raised \$20 million for its first trip to the moon, scheduled for later this year.

The funds will be put toward launching the company’s MX-1E Lander, which will explore and take photographs of the moon’s surface in an effort to explore lunar mining options.

The Florida-based company has had backing from dot-com billionaire Naveen Jain, who has provided significant financial and moral support for the endeavour.

Moon Express chief executive Bob Richards said the company was looking to raise an additional \$10m as a “contingency” to support future missions.

“This is not a stunt,” he said.

“We’re not putting all our eggs in one basket.”

METS sector receives boost



The Queensland METS sector contributes \$21 billion to the State’s gross revenue.

Image: Queensland State Government.

ELIZABETH FABRI

THE Queensland government has invested \$2.7 million in the State’s Mining Equipment, Technology and Services (METS) sector to increase collaboration between miners, technology companies and researchers.

Minister for State Development Dr Anthony Lynham said the latest funding round supported six actions that would be delivered in conjunction with independent Australian industry growth centre, METS Ignited, to fast track ideas into commercial production.

“These actions are part of the Palaszczuk Government’s \$6 million, four-year commitment to METS Ignited to help facilitate jobs and growth across the State,” Dr Lynham said.

“All of the actions are being piloted in Queensland and offer significant benefits to the State, such as enhancing METS sector clustering in Mackay to encourage local industry collaboration, and piloting an industry accelerator that will be open to Queensland METS companies looking to turn a great innovations into commercial reality.”

Dr Lynham said the State’s METS’ companies were international market

leaders in exploration, mine design and construction, mine safety, minerals processing and rehabilitation.

“The sector’s long record of developing innovative solutions to the challenges faced by Bowen Basin miners has also seen their innovations applied overseas and in other sectors, including agriculture and construction,” he said.

“Much of that innovation has come directly from METS companies based in Paget and the Mackay Region.

“Increasing collaboration between miners, METS companies and researchers is vital to improving our rate and speed of converting great ideas into dollars.”

SBAS positioning tech unlocks potential

ELIZABETH FABRI

A TWO year program testing Satellite Based Augmentation System (SBAS) positioning technology and its application in the mining sector has been launched by the Federal Government.

The \$12 million study would look into instant, accurate and reliable positioning technology that could provide environmental, productivity, safety and efficiency benefits across a cross-section of sectors, including mining.

The research also aimed to improve positioning accuracy in Australia from the current five to 10 centimetres to less than five centimetres.

Federal Resources and Northern Australia minister Matt Canavan said access to more accurate data on the Australian landscape would help unlock potential in underexplored regions.

“This technology has potential uses in a range of sectors, including agriculture and mining, which have always played an important role in our economy, and will also be at the heart of future growth in Northern Australia,” Mr Canavan said.

“Access to this type of technology can help industry and Government make informed decisions about future investments.”

The SBAS test was Australia’s first

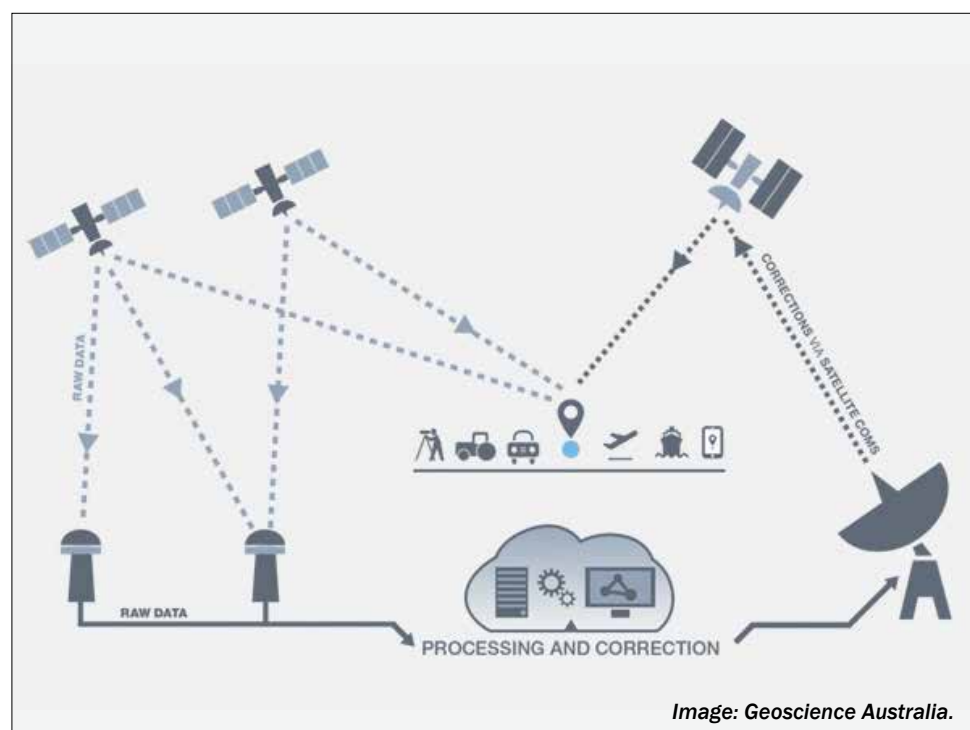


Image: Geoscience Australia.

SBAS systems utilise space-based and ground-based infrastructure to improve the accuracy, integrity and availability of Global Navigation Satellite System signals.

step towards joining world leaders such as the US, Russia and Japan in realising the benefits of improved precise positioning, which had potential to generate more than \$73 billion of value to Australia by 2030.

In early 2018, Geoscience Australia in partnership with the Collaborative Research Centre for Spatial Information (CRCSI) will invite mining and other related organisations to participate in the testing.

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CSIRO to open Silicon Valley office



Image: The CSIRO.

CAMERON DRUMMOND

GOVERNMENT science and research agency CSIRO will be opening an office in the US for the first time, in an effort to promote Australian innovation overseas.

The CSIRO US office will be based in the southern San Francisco Bay Area of Silicon Valley; working closely with American research, industry and business partners to bring Australia's capabilities to the US marketplace.

Foreign Affairs minister Julie Bishop

said the move would capitalise on the CSIRO's already strong relationships with science and industry leaders including NASA, Bayer LLP, Boeing and the Gates Foundation.

"The office opening will support the government's National Innovation and Science Agenda, which is fostering a culture of innovation and entrepreneurship," Ms Bishop said.

"It follows the February 2016 launch of the Government's innovation Landing Pad in San Francisco where our start-ups are already winning contracts."

CSIRO chief executive Dr Larry Marshall said he was excited by the opportunities CSIRO US presents for Australia.

"To accelerate innovation rates in Australia we need to accelerate international engagement, especially in regions where there is a significant opportunity to return value to Australia; from this point of view the US is a no brainer," Dr Marshall said.

"Our focus is firmly on bringing benefit back to Australia and that philosophy will be applied to everything we do in the US."

CSIRO Global general manager Nigel

Warren anticipated CSIRO US would help put Australian breakthroughs at the centre of the world's research and technology frontier.

"CSIRO will support the Australian government and partner with the research sector and business – playing the role of Australia's innovation catalyst on a global scale," Mr Warren said.

Mr Warren said that CSIRO US expected to open its doors in the first half of this year, and was actively seeking involvement from Australian researchers and other collaborators.

Terra Drone launches in QLD

ELIZABETH FABRI

JAPANESE-owned tech company Terra Drone has opened its first regional office in Australia.

The specialist in Light Detection and Ranging (LiDAR) technology delivers unmanned aerial vehicles (UAV) solutions to miners across the world, including improved safety in site scoping and mapping, along with boosted productivity with 3D maps.

Terra Drone chief executive Toru Tokushige said the company was "delighted to establish its first major overseas base in Australia."

Brisbane branch chief Tsuyoshi Honda said the company had chosen Australia for its regional office for its drone-friendly policy framework.

"Modern technology such as UAVs is vital to ensure Australia's resource sector maintains its competitive edge internationally and enhances productivity," Mr Honda said.

Queensland Deputy Premier and Trade and Investment minister Jackie Trad said Terra Drone would be setting up in Brisbane's River City Labs innovation precinct and work alongside local businesses and academics.

Research gets industry backing

ELIZABETH FABRI

FOUR university research projects aimed at enhancing innovation in the resources sector have received \$1.875 million in funding from the Turnbull Government's Linkage Project scheme.

The University of Queensland was the recipient of three of the four grants, which included \$550,000 towards Associate Professor Yongjun Peng's research into more efficient and economical mineral separation and metal extraction with Newcrest Mining, Vega Industries and Sierra Gorda SCM; \$450,000 towards Dr Steven Pratt's project of advancing knowledge of Coal Seam Gas (CSG) water treatment; and \$195,000 towards Professor Peter Hayes and Professor Evgueni Jak's project with BHP Billiton that would provide technical information on the behaviour of different iron ores.

The fourth grant of \$675,000 was presented to the University of Wollongong in NSW, towards its rail track stability project that examined causes of mud pumping and aimed to improve track longevity, boost production and reduce maintenance costs.

Federal Education and Training minister Simon Birmingham said the Linkage Projects scheme was a direct response to the country's "appalling" reputation for industry and higher education research collaboration, of which Australia ranked last out of OECD's 33 participating countries.

"When researchers and businesses come to the Government with strong proposals that will clearly deliver real benefits for



Image: BHP Billiton.

BHP Billiton was one of the miners that would be working with the university research teams.

industry and Australians, we want to be able to green light them as quickly as possible," Mr Birmingham said.

"With the National Innovation and Science Agenda we sped up the processes for approving Linkage Projects that fund collaborations between researchers and businesses and we made changes so that grants could be made year-round so worthy

projects don't need to wait months and months until applications open.

"The Linkage Projects scheme supports our researchers to work with innovators outside the traditional research sector to find solutions to real-world problems and improve the translation of research into broader outcomes for businesses and the community."

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THE AUSTRALIAN MINING REVIEW

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Bright outlook for gold Touted as standout investment opportunity in 2016

SAMANTHA JAMES

MANY junior exploration and mining companies have struggled with volatile and declining commodity prices in recent years, but a new survey claims the light may be seeing for gold prices.

The 2015 Grant Thornton Survey of Mining Industry Executives (SIME) found 60 per cent of mining executives expected gold to be the highest performing commodity in 2016, followed by copper (50 per cent), iron ore (40 per cent) and nickel (30 per cent).

"This will be a welcome ray of hope for a beleaguered sector of young miners given the increasingly challenging conditions that prevail in the sector," Grant Thornton Australia national head of strategy and research Holly Hiles said.

"While there are companies who are exhibiting caution - notably in developing projects - the vast majority of junior miners are being aggressive, with companies continuing to raise funds to finance exploration, which are all taking their toll."

The survey found that exploration was continuing to rise and low cash costs due to ongoing commodity price wars, lack of funding, regulatory challenges, and low commodity prices.

However, there was a growing level of confidence across the broader industry, mainly because miners and service companies, in tandem, were looking for ways to save money.

"To give value in an extended period



The survey found that 50 per cent of junior miners were planning a fund raising within six months and 30 per cent had a cash balance of less than \$500,000.

As a consequence, competition for capital was intense and miners were being exposed, with investment bankers recommending that miners consider raising capital through bank debt facilities, according to the Grant Thornton survey.

(Continued on page 4)



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IN BRIEF

Lucapa acquires Mothae project

AFRICA

PERTH-based Lucapa Diamond Company has inked an agreement with the Government of the Kingdom of Lesotho to acquire a 70 per cent interest in the Mothae Kimberlite Diamond project for \$US9 million.

The acquisition followed a competitive international tender, and would see the miner bring Mothae into production within a year.

"Mothae complements the producing high-value Lulo diamond mine and our highly prospective exploration assets in the advanced Lulo kimberlite project and the earlier stage Brooking and Orapa Area F projects," Lucapa managing director Stephen Wetherall said.

"The acquisition is in keeping with Lucapa's strategy of continued growth as a diamond producer and explorer."

Atlas Copco to split group in 2018

SWEDEN

GLOBAL equipment manufacturer Atlas Copco has announced plans to create a mining focused spin-off company in 2018 to focus on its industrial business.

The new company, with the working title of NewCo, would be made up of Atlas Copco's existing Mining and Rock Excavation and Construction Tools divisions.

Made up of about 12,000 employees, the new entity would have an operating margin of 16 per cent and annual revenues of \$4.2 billion.

The split will be proposed at the company's 2018 annual general meeting.

Vector completes Maniema acquisition

AFRICA

VECTOR Resources has completed its 70 per cent interest acquisition in the Maniema gold project in the Democratic Republic of Congo.

In January, the miner finalised its \$1.65m capital raising, and appointed new chief executive officer Simon Youds to oversee the development of the project and proposed exploration activities.

Vector chairman Gary Castledine said now the acquisition was complete, shareholders held a majority interest in an advanced gold project which included the Kabotshome Gold Prospect and a further four defined gold prospects, within seven exploration licenses.

"We are excited to now be in a position to shortly be actively exploring in the region and to be working with our local partners WBK in making the Maniema Gold Project a success."

Danakali advances Colluli project

ELIZABETH FABRI

WA potash miner Danakali's subsidiary Colluli Mining Share Company (CMSC) has signed an agreement with the Eritrean Ministry of Energy and Mines to progress mining at its world-class Colluli potash project in East Africa.

The agreement provided CMSC— a joint venture between Danakali Limited and the Eritrean National Mining Corporation— exclusive exploitation rights of all mineral resources within the 100sqkm agreement area, a right to apply for and be granted one or more mining licenses, and exclusive land use within the area over the life of the resource.

The Colluli deposit contained an estimate mineral resource of 1.3 billion tonnes of potassium bearing salts; an ore reserve estimate of more than 1.1 billion tonnes; a rock salt mineral resource estimate of more than 300 million tonnes and a kieserite (magnesium sulphate) mineral resource estimate of more than 80 million tonnes.

"This achievement confirms that the Colluli Potash Project is one of the most advanced greenfield SOP developments in the world, with outstanding potential that extends well beyond the scope of the DFS in terms of production volume and products," Danakali managing director Paul Donaldson said.

"This is a very significant milestone for both Danakali and the Colluli Mining Share Company.

"We look forward to the continued advancement of the project to construction and production."

Danakali's announcement was followed

"IT ALSO SUPPORTS OUR BELIEF THAT ERITREA IS AN ATTRACTIVE PLACE FOR MINING INVESTMENTS AT PAR WITH THE BEST EMERGING MARKET PEERS."



Danakali now has the green light to begin mining at its Colluli potash project. Image: Danakali.

by the news it had been awarded seven mining licenses within the Colluli tenements that spanned more than 60sqkm.

Danakali said the licenses would allow the company to mine potassium, sodium, calcium, magnesium salts and bromine from the deposit.

"The award of the agreement and mining licenses is a clear demonstration that business can be done in Eritrea," Mr

Donaldson said.

"We have worked very closely with a number of ministries throughout the approvals process and we are appreciative of both the engagement and support that has been given to the project as it has advanced.

"It also supports our belief that Eritrea is an attractive place for mining investments at par with the best emerging market peers."

Nickel to reach \$11,500/t by end of 2017



CONTINUED FROM PAGE 1

Despite the uncertainty, Capital Economics upbeat forecast was reiterated in the Australian Department of Industry, Innovation and Science's December resources and energy report.

The report stated that global nickel consumption was estimated to have increased 6 per cent in 2016 to just over 2mt, increasing 2.4 per cent and 3.3 per cent in 2017 and 2018 respectively, up to 2.1mt.

In the September 2016 quarter, world nickel consumption increased year-on-year to 500,000t, primarily due to an increased consumption from China which consumed 268,000t.

This was due to Chinese stainless steel production – accounting for about 65 per cent of nickel use – increasing by 15 per cent year-on-year for the quarter, burgeoned by a resurgence of its construction sector and an increase in manufactured goods.

The US – the world's second biggest consumer – also increased nickel consumption 5.7 per cent in the same period.

Nickel is also somewhat tied to lithium, as it is used to create lithium-ion batteries.

Glencore chief executive Ivan Glasenberg said recently that a shift of just 10 per cent of cars to electric vehicles would create the demand for 400,000t of nickel, equating to a 20 per cent rise in global demand.

Image: Glencore.

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THE AUSTRALIAN
MINING REVIEW

SPECIAL FEATURES

BLACKHAM RESOURCES



"BLACKHAM HAS NOW TURNED ITS ATTENTION TO INCREASE ANNUAL PRODUCTION TO BETWEEN 175,000OZ AND 230,000OZ AS A PART OF STAGE 2 EXPANSION STUDIES."

Underground at the Matilda gold project.

Double up in play

With the first stage of its Matilda/Wiluna gold project underway, Blackham Resources is stepping up its Stage 2 development in an effort double gold production to more than 200,000 ounces per annum.

CAMERON DRUMMOND

SINCE purchasing the Matilda and Wiluna gold projects in 2011 and 2014 respectively, Blackham Resources has gone from strength to strength as a gold mine developer-come-producer and breathed life back into the nearly abandoned gold precinct.

The company is the eighth owner of the project area in the last 15 years, located in Australia's largest gold belt stretching from Norseman, through Kalgoorlie, to Wiluna in the Northern Goldfields region of WA.

The belt is divided into the Wiluna and Matilda metamorphic domains in the east and west respectively, and mined via both open pit and underground operations.

History

From 1984 the Wiluna mine consistently produced more than 100,000 ounces of gold per annum (ozpa), and since 1999 has been owned by a number of gold miners including Great Central Mines, Normandy Mining, Newmont, Oxiana and APEX Minerals.

Blackham bought the Matilda domain area through its acquisition of Kimba Resources in 2011.



Blackham is looking to double gold production in the next two years.

APEX acquired the Wiluna tenements from Oxiana (OZ Minerals) for \$29.5 million in 2007, and – battling to lift production and reduce its operating costs – went into liquidation in 2013.

Blackham snapped up Wiluna in January 2014 for \$4.6m – which included

its 1.5mtpa processing plant, 350-bed village and associated infrastructure – as part of its strategy to develop a combined Matilda/Wiluna mining operation.

The project area covers 780 square kilometres and includes gold and nickel rights to more than 50km of strike along

the historical Matilda and Williamson gold mine sequence, as well as the Lake Way, Galaxy, Bulletin and Golden Age open pit and underground deposits.

Its open pits are all within a 20km radius of the Wiluna gold plant with haulage distances for Galaxy, Matilda and Williamson being 15km, 18km and 26km respectively.

Road to production

Since acquisition in 2011, the company had started to develop a mine plan for an eight year, 100,000ozpa open pit and underground mining operation at Matilda/Wiluna, with exploration confirming 4.7 million ounces (moz) of gold resources nearby.

In October 2015 exploration culminated in the release of a preliminary feasibility study (PFS) that determined a mineral inventory of 6mt of ore grading at 2.8 grams per tonne (g/t) for the production of 540,000oz of gold over four years and nine months.

After the PFS results, the company went to financiers and completed a \$38.5m funding facility with Orion Mine Finance, drawing \$13m to undertake a definitive feasibility study (DFS).

(continued on page 18)

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(continued from page 16)

The Wiluna gold processing plant was commissioned in October last year.

The DFS was completed in early 2016 with a mining inventory that increased Matilda's resource to 8.3mt at 2.9 g/t for the production of 668,000oz of gold over a seven year mine life.

Blackham was quick to lock in a gold hedging facility for an initial 20,000oz of gold at \$1704/oz by May 2016 as it progressed mine development.

After mining began in July, and with wet commissioning of the Wiluna processing plant forthcoming, Blackham hedged a further 34,250oz at an average price of \$1774 – more than double the cost of production (C1 costs were \$850/oz at the time).

"With production imminent, the board believes it is prudent to lock in responsible proportions of short to medium term production so that the company can optimally manage its operations and risk exposures in the current volatile price environment," Blackham managing director Bryan Dixon said.

"Being able to lock in close to record high AUD gold prices allows even modest hedge commitments to create a high degree of predictable cash flow at this crucial time in the company's transition

to being a significant gold producer."

First pour from Matilda was achieved within 16 months of financing, and with production underway the mine produced 9240oz for Q4 2016 – 5010oz in the month of December alone – marking the project's ramp up to the Stage 1 production target of 100,000ozpa.

**"SINCE THE MID-1990'S
PREVIOUS OPERATORS
AT THE WILUNA MINE
HAD FOCUSED ON
UNDERGROUND
RESOURCES AND NOT
EXPLORED THE POTENTIAL
OF OPEN PIT CUTBACKS."**

Mines and Petroleum minister Sean L'Estrange said that the reopening of the Matilda gold project marked the rejuvenation of the gold mining industry in the Northern Goldfields region of WA.

"This provides a much-needed stimulus

to the local economy, with the prospect of yielding long-term employment and training opportunities for local residents and strong relationships with local businesses," he said.

Recent Developments

Blackham has now turned its attention to increasing its annual production to between 175,000oz and 230,000oz as a part of Stage 2 expansion studies at the combined Matilda/Wiluna operation.

During Q4 2016 Blackham completed the refurbishment of its 1.7mtpa Wiluna processing plant located in the centre of the project, and announced an increase in total estimated resources at Matilda from 48mt at 3.3 g/t for 5.1moz to 58mt at 3.2 g/t for 6moz.

It also upgraded FY17 guidance for the mine to produce between 64,000oz and 71,000oz of gold; with 25,000oz to be processed by the end of the current quarter.

Since the mid-1990's previous operators at the Wiluna mine had focused on underground resources and not explored the potential of open pit cutbacks.

Last month the company announced a maiden resource estimate at Wiluna's East-West deposit that added 700,000oz to Blackham's portfolio as part of the 25,000 metres of RC and diamond drilling currently being undertaken to investigate open pit potential.

Initial mining studies at Wiluna suggested the scale of the East-West pit had the potential for a 1.5km long, 600m wide "super pit" that could extend 230m deep, with studies at the Happy Jack – Bulletin deposits demonstrating the potential for an additional 1.9km long pit.

"The latest Wiluna extensional drilling has demonstrated the potential to add significant base load open pit mining feed," Mr Dixon said.

"Updated Wiluna open pit resources are likely to compliment the recent drilling success in extending the Bulletin underground mineralisation."

Extension drilling was also undertaken at the Matilda mine along the strike and down dip, with drilling results at the Golden Age underground mine growing its resource by 21 per cent.

Blackham has flagged the Stage 2 expansion to be completed within the next two years.



Wiluna could turn into a 600m wide "super pit".



Extension drilling at the Matilda mine.



The processing plant at the Fosterville gold mine in Victoria.

New look

Record operational performance at Kirkland Lake Gold’s Macassa and Fosterville mines saw the company exceed its 2016 gold production guidance, providing it with a greater opportunity to boost its exploration activities this year.

CAMERON DRUMMOND

THE merger between Canadian miner’s Kirkland Lake Gold (KL Gold) and Newmarket Gold was supported by shareholders, and came after KL Gold shrugged off three joint takeover offers by South Africa’s Gold Fields and Vancouver-based Silver Standard Resources.

KL Gold acquired Newmarket Gold in November of 2016 for \$US764 million, gaining a 57 per cent share of the new company, with Newmarket shareholders holding the remaining 43 per cent.

The move came just 10 months after KL Gold acquired Canadian gold miner St Andrew Goldfields for about \$178m in stock, creating an Ontario-focused producer with four mines and two mills.

The new KL Gold consists of seven underground gold mines and five processing mills in Australia and Canada, and is listed on the Toronto Stock Exchange (TSE) with a market capitalisation of \$2.4 billion.

“With a strong operations team in Australia, I am confident in our ability to seamlessly integrate high quality gold production from our Australian operations and leverage intellectual capital to assist all operations to become more efficient with potential opportunities to reduce costs,” KL Gold chief executive Tony Makuch said in a November statement.



Newmarket Gold’s merger with Canadian-based Kirkland Lake Gold created a global mid-tier miner.

Australia
Fosterville

The Fosterville gold mine east of Bendigo, Victoria produced a record 44,406oz in Q4 2016, significantly exceeding the previous record of 37,245oz achieved in Q2 2016.

This result marks a 20 per cent increase

on the 36,967oz produced in Q3 2016 and a 41 per cent increase on the 31,519oz produced in the same period in 2015.

Full year production was a record 151,755oz, exceeding the previous annual record in 2015 of 123,095oz and the previously announced guidance of between 130,000oz and 140,000oz.

Mine production continued to deliver strong performance during the quarter, totalling 168,812t at an average grade of 9.45 g/t, compared to 191,900t at 6.64 g/t in Q3 2016.

Mined tonnes decreased 12 per cent on the previous quarter as the operation focused on optimising extraction at its Lower Phoenix deposit.

Significant investment in diamond drilling also continued, with nine rigs in operation by the end of last year drilling a combination of exploration and resource definition programs.

The focus of activities was predominantly on the Harrier South and Lower Phoenix systems, which both reported multiple high-grade intercepts in November last year.

Stawell

In the December quarter Stawell produced 6971oz for full year production of 32,204oz.

Low-grade oxide stockpiles continued to supplement underground ore resulting in total mill feed of 172,049t at 1.49 g/t.

On 13 December 2016 KL Gold commenced transitioning the Stawell gold mine in Victoria to care and maintenance.

KL Gold’s Australian operations president Darren Hall said between 140 and 150 positions would be made redundant at Stawell, with only 15 to 20 people remaining to provide maintenance, monitor the environment, and continue exploration.



"DESPITE PLACING TWO MINES ON CARE AND MAINTENANCE IN 2016, THE COMPANY WILL MAINTAIN A PRODUCTION BASE OF OVER 500,000OZ OF GOLD IN 2017, FOCUSING ON HIGH QUALITY OUNCES."

The underground mine entrance at Fosterville.

He said the move to suspend operations had been discussed for several years due to declining profitability.

"In 2009 Stawell Gold Mines (SGM) produced more than 86,000oz of gold, compared with just over 32,000oz this year," Mr Hall said.

The company said activities at the mine would focus on exploration programs on the east flank of the Magdala Basalt, which hosts the Aurora B discovery.

Aurora B results to date had confirmed the extension of mineralisation along the Magdala East Basalt flank, particularly within the Hampshire Lode.

More than 2.3moz of gold production at Stawell had come from the west flank of the Magdala mineralisation.

Cosmo

The Cosmo gold mine is located near Pine Creek in the Northern Territory and has operated since 2013.

In the December quarter Cosmo produced 13,307oz of gold, resulting in full year production of 55,765oz.

Fourth quarter production improved, totalling 156,122t at 2.78 g/t, compared with 141,091t at 2.5 g/t in Q3 2016.

Mine performance was improved with changes to the mine production sequence and accessing additional mining areas to provide production flexibility.

Currently there were four diamond drill rigs in operation at Cosmo following up on potential extensions.

Process improvements in the mill continued to focus on quality performance with an overall mill recovery of 94.5 per cent during the quarter.

Canada

KL Gold's Canadian operations, the Macassa, Holt, Taylor and Holloway gold mines in the Lower Abitibi Greenstone belt of north eastern Ontario, have a combined annual gold production rate of between 270,000oz and 290,000oz.

Historical production at the five mines



KL Gold's exploration expenditure could reach \$55m this year.

had produced in excess of 22moz) of gold at an average grade of 15.1 g/t.

The company put its Holloway mine on care and maintenance after assessments due to the project's limited economic viability.

KL Gold said the majority of the workforce would be reassigned to nearby Kirkland Lake operations and would continue to conduct surface exploration drill programs during 2017 west of the Holloway shaft, an area which was historically under explored.

The Macassa mine in Ontario delivered record production for the full year 2016 with 175,167oz produced, reflecting mill throughput of 396,633t of ore, including ore from low grade stockpiles and record run of mine average grade of 16.52 g/t.

It delivered solid operating results during Q4 2016, with record quarter gold production of 52,318oz; a 22 per cent increase on Q3 2016 of 42,866oz.

The increased production reflected a record run of mine average grade of 21.46

g/t and record mill recovery of 97.6 per cent.

KL Gold said development would continue at the lower South Mine as well as at the main decline to further increase production.

Production and Outlook

In December last year KL Gold announced a 2016 production guidance of between 500,000oz and 525,000oz inclusive of its recent Newmarket gold acquisitions.

Full year results were released on 11 January, and reported gold production of 542,751oz – well above guidance – highlighted KL Gold as a new mid-tier gold producer.

"Both the Canadian and Australian operations exceeded 2016 consolidated guidance, [and] our pro forma operating results indicate a solid year, largely driven by our low cost, high grade, cornerstone gold mines of Fosterville, Macassa and Taylor which accounted for 68 per cent of total 2016 production," Mr Makuch said.

"During the fourth quarter, strong production results were driven by record performance from both the Macassa and Fosterville gold mines, due to increased grade and metallurgical recoveries at both sites.

"Despite placing two mines on care and maintenance in 2016, the company will maintain a production base of over 500,000oz of gold in 2017, focusing on high quality ounces.

"We begin the year with a strong balance sheet and a cash position of approximately \$234m, with a global operating platform from tier one mining jurisdictions."

Mr Makuch said the company was actively conducting extensive exploration, building on high grade results at the Fosterville and Macassa mines.

"We believe our 2017 exploration program of between \$45m and \$55m bodes well for resource growth and mine life extensions across key assets, providing future value for our shareholders."

Long legacy of mine supply



The Elphinstone WR820 underground agitator truck will be used at the Fosterville underground mine near Bendigo.

OVER the course of its 105 year history, shotcrete and concrete specialist Mawsons has grown to be an industry leader in concrete and quarry supply in Northern Victoria and Southern NSW.

As well as a focus on quality and service, Mawsons are always striving for new innovations across the company.

It has just announced the development of a new \$1 million “Innovation Lab” to be located in Echuca, which is expected to be completed

by in the second half of 2017.

Employed with highly skilled engineers and technical laboratory officers, the laboratory will provide regional Victoria with a technical resource for industries ranging from concrete precast, to engineering and construction.

The facility will also enhance Mawsons ability to create innovation within its own product range.

With increasing demand for high quality services and products from the mining and

construction industries, Mawsons is well placed to continue to produce creative solutions for its customers.

Being a regionally-based organisation, Mawsons is a proud supporter of local communities; and continues to sponsor numerous local events including the Victorian Mine Rescue Competition – Rope Rescue Exercise.

With a high priority given to employee wellbeing, Mawsons also sponsored the

IQA Institute of Quarrying - Mental Health Awareness presentation in Bendigo.

Mawsons has more than 10 quarrying sites, 38 concrete plants, mobile hire equipment and a fleet of various concrete, cement and quarrying transport.

The company continues to expand its network and improve performance to contribute to a prosperous and sustainable future for the communities in which it operates.



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All Images: Gold Fields Australia.

A portfolio boost

With a \$350 million joint venture and mine extension on the cards, Gold Fields' has bolstered its already-strong stake in Australia's gold mining sector.

LOUISE BAXTER

IN November 2016, South African gold producer Gold Fields announced a \$350 million 50:50 joint venture with Perth-based miner Gold Road Resources, for the development and operation of the 6.6 million ounce Gruyere gold project in WA – injecting further investment into the Australian gold sector.

Gold Fields currently has eight operating mines in Australia, Ghana, Peru and South Africa, and estimated attributable annual

gold production of 2moz, attributable mineral reserves of about 46moz, and an estimated 102moz of mineral resources.

Australia already accounts for 12 per cent of the company's gold mineral resources (11.3moz) and 7 per cent of its gold mineral reserve base (3.6moz), excluding growth projects.

Gruyere is a large shear hosted porphyry gold deposit, with reserves of 3.5moz and total resources of 6.2moz.

The project comprises the Gruyere deposit and additional resources including Central Bore (700,000 tonnes) and Attila/Alaric (5.3

million tonnes).

Gold Fields will acquire a 50 per cent interest in Gruyere for a total purchase consideration of \$350m payable in cash and a 1.5 per cent royalty on Gold Fields' share of production after total mine production exceeds 2moz, with an approximate value of \$15m.

The Gruyere feasibility study, completed in October 2016, indicated Gruyere's 3.5moz reserve (6.2moz resource) could support average annualised production of 270koz for a 13-year life of mine (LOM). First production from Gruyere is expected at the end of 2018 or

early 2019.

"Australia is a key part of our business and our largest cash generator," Gold Fields chief executive Nick Holland said.

"This deal enhances our portfolio and expands our exposure to a new and emerging goldfield in WA.

"Gruyere will add material reserves and resources, margin and cash flow into what is already a strong region for Gold Fields and which has proven its ability to integrate new operations with ease.

"We are excited about partnering with Gold





Road and are hopeful this is the start of a multi-decade, mutually beneficial relationship and see significant potential synergies in resourcing, intellectual property, procurement and technical skills.

“We believe this acquisition is extremely competitive on a per ounce basis, when compared to similar recent deals, at \$200 (US\$153) per reserve ounce and \$113 (US\$86) per resource ounce.”

Gold Fields has operated in Australia for more than a decade at the St Ives and Agnew gold mines. In 2013, the company acquired the Yilgarn South assets in WA, adding about 400,000 oz of gold to the company’s annual production.

The company employs 2200 Australian staff and contractors.

“GOLD FIELDS HAS A LONG STANDING VISION TO BE A GLOBAL LEADER IN SUSTAINABLE MINING...”

St Ives extension

On 5 January 2017, Gold Fields announced it had kicked off plans to extend its St Ives operations to 2028.

The company lodged an application to the Environmental Protection Authority that would increase its hold in the region from 2061ha to more than 7000ha, including an extra 2000ha of disturbance on Lake Lefroy.

In a statement, Gold Fields said the St Ives’ Beyond 2018 referral was an important part of its plan to safeguard the future of the operations.

“This plan will also see the continuation over the next three to five years of the current investment in exploration of approximately \$38 million per annum,” the company said.

“Gold Fields’ believes that through this investment, St Ives will continue to maintain

a production profile of approximately 350-400,000 ounces per annum.”

St Ives employs about 480 employees and 332 contractors.

Investment in sustainable mining

Mr Holland has a vision for Gold Fields to be “the global leader in sustainable gold mining”.

In June 2016, the company announced a significant achievement in this pursuit, officially opening a gas power plant at its Granny Smith gold mine in Laverton, WA.

The operation is now supplied by “the world’s most efficient high speed reciprocating engine power station of its class, which was designed and delivered by Aggreko”, Gold Fields stated.

“The official opening has marked a significant milestone for the Granny Smith gold mine and a major achievement for Gold Fields as a company which now operates all four of its Western Australian gold mining facilities by using gas-powered generators rather than diesel generators,” Gold Fields executive vice president Richard Weston said.

“Our major investment in the gas-powered technology designed, built and operated by Aggreko, demonstrates our forward-thinking and commitment to finding better ways to excavate and process one of the world’s most precious substances – gold.”

Mr Weston said that in addition to the cost efficiency and reliability benefits of the new gas power station, it would reduce carbon dioxide emissions by 85,845 tonnes during the 10-year contract with Aggreko.

“The Granny Smith Gold Mine is operating greener which makes it eligible for the Australian Emissions Reduction Fund,” Mr Weston said.

He said the investment would also assist in extending the life of the operation.

“Gold Fields and Aggreko have delivered a power station that will supply Granny Smith Gold Mine with safe, affordable and reliable electricity and allow for future expansion,” Mr Weston said.

Talis and St Ives form partnership for growth



Talis distinguishes itself through its extensive local experience, knowledge of government processes, and commitment to achieving project goals.

TALIS has been working in the resources sector since the environment team’s inception in 2014.

For the majority of this time Talis has worked with Gold Fields, which initially engaged the company to undertake investigations and provide key support for the environmental approvals process for the lift of the St Ives Gold Mine tailings storage facility.

The successful completion of this scope led to the development of a close working relationship between Talis and Gold Fields.

Talis’ work has since covered a variety of further approvals, investigations and advisory projects across the St Ives site, including the next phase of the St Ives growth ‘Beyond 2018’.

From Talis’ perspective, the working arrangement with Gold Fields at St Ives exemplifies its approach as a consultancy company.

Talis enjoys the professional relationship it has with St Ives staff, the range of projects it provides assistance with and the trust afforded by the company.

St Ives places a high priority on environmental management and compliance and Talis is proud to play a role in this by assisting to achieve their vision ‘to be the global leader in sustainable gold mining’.

“The professional working relationship between Gold Fields’ St Ives Gold Mine team and Talis has been critical in ensuring the continuity of operations,” St Ives environment superintendent Jarrad Donald said.



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**"Q4 2016 MARKED THE
TWELFTH CONSECUTIVE
QUARTER THAT
RAMELIUS HAD REACHED
OR EXCEEDED ITS
PRODUCTION GUIDANCE."**

All images: Ramelius.

A smooth transition

Ramelius is keeping gold production levels buoyant amidst a transition from completed projects to new development areas this financial year.

CAMERON DRUMMOND

GOLD producer Ramelius Resources had a prosperous 2016 financial year on the back of improved gold sector conditions and increasing profits, while transitioning from completed mining operations to newer developments.

It has enjoyed a staggering rise in its share price from 20 cents at the end of 2015, to more than 60 cents by mid January this year.

The company currently has two gold producing projects, the Mt Magnet and Vivien mining and processing operations in the Murchison and Goldfields regions of WA.

Vivien is an underground mine 15km west of Leinster in the Northern Goldfields region, which the company purchased from Agnew Gold Mining for \$4 million in 2014.

Mined ore is trucked 300km to the company's 1.7 million tonnes per annum (mtpa) Checkers processing facility at Mt Magnet.

Operations at Mt Magnet – near the namesake township – were restarted by Ramelius in 2011 after the company purchased the project from Harmony Gold for \$40m the previous year.

The company also holds exploration tenements in the Tanami desert in the Northern Territory as part of a joint venture (Ramelius 85 per cent) with Tychean Resources.

Steady Production

The Mt Magnet project encompasses the Galaxy, Milky Way and Water Tank Hill



The Vivien open pit.

and Blackmans mining areas, with mining currently concentrated at the Perseverance open pit.

During FY16, the company completed open pit mining at Galaxy's Saturn and Mars deposits.

In four years the Saturn deposit produced 120,748oz of gold, exceeding its ore reserve benchmark of 103,000oz, with Mars – which was completed in October 2015 – also exceeding its ore reserve of 67,000oz to produce 76,680oz during that period.

At Galaxy, Ramelius was in the midst of transitioning its main ore production source from Perseverance – where mining was expected to finish early this year – to the nearby Titan open pit, and had commenced production at the Blackmans development.

Ramelius' managing director Mark Zeptner said production rates at Titan – together with mined ore from Blackmans – would be sufficient to maintain overall gold production levels during the

transition from Perseverance.

"Our current production outlook at Titan is between 30,000oz and 35,000oz and will be able to give us our production target of 135,000oz this financial year," he said.

"Based on ore reserves we are expecting about 16,000oz from the Blackman's pit, which is now at full production, and because of its oxide ore type yielding high grade returns it's a great addition to our gold processing rates."

A third project, Kathleen Valley, finished production in the third quarter of 2016 and was put on care and maintenance.

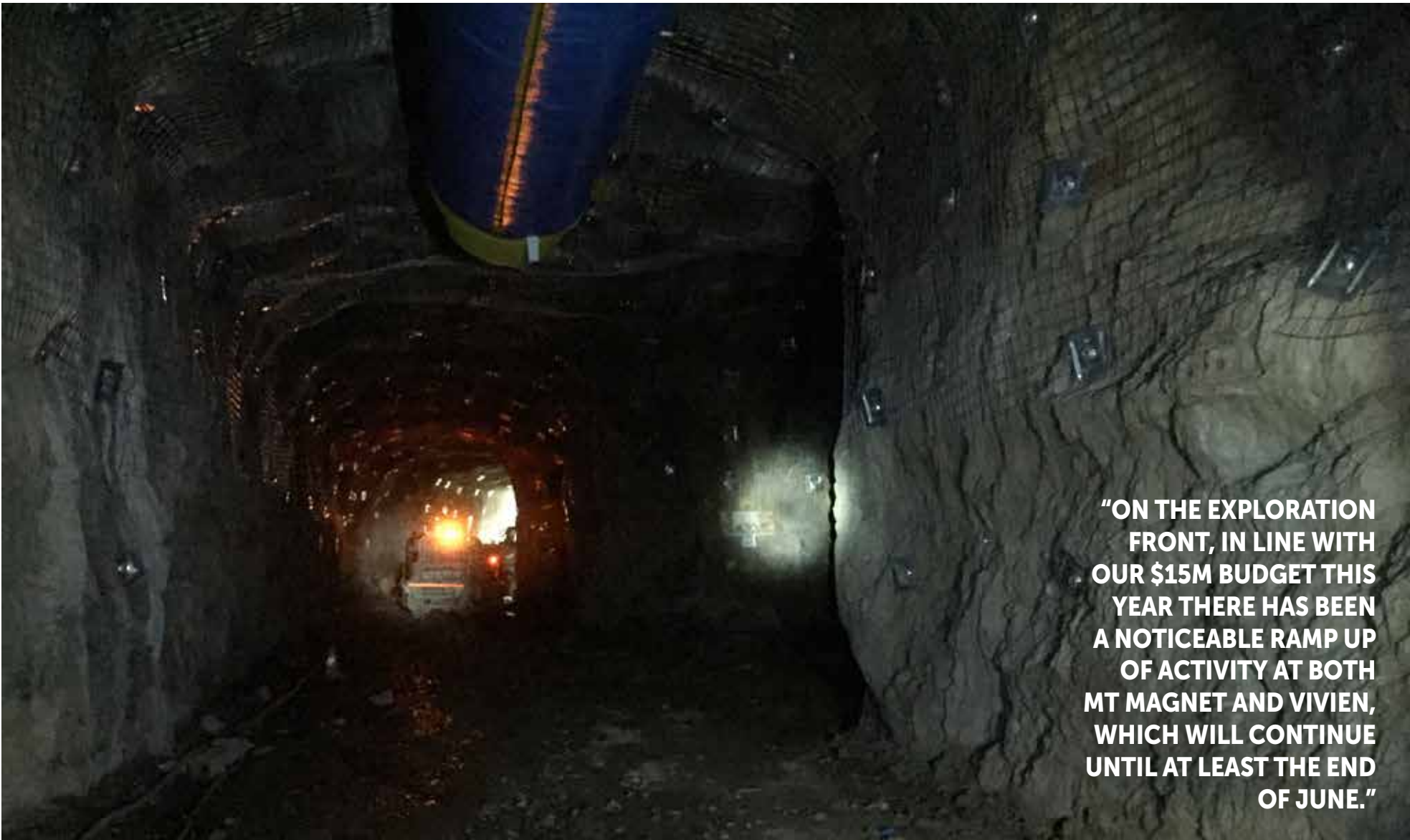
Ramelius jumped on an opportunity to sell off its Kathleen Valley tenements to lithium explorer Liontown Resources (LTR) on 9 December for 25 million fully paid LTR shares, (about \$400,000).

As part of the agreement, Ramelius retained 100 per cent rights to all gold extracted, including an entitlement to \$0.50/t production royalty on any rare pegmatite ore such as lithium, tantalum and other associated metals, as well as 1 per cent of gross sales of produced concentrate.

Financials

FY16 production was 110,839oz at all in sustaining costs of (AISC) \$1157/oz, up 28 per cent from 86,653oz in FY15, mainly due to increased gold extracted at Mt Magnet's Galaxy deposits.

Record gold production of 32,752oz in the June 2016 quarter was surpassed the following quarter with 36,179oz produced across all operations, exceeding the upper



“ON THE EXPLORATION FRONT, IN LINE WITH OUR \$15M BUDGET THIS YEAR THERE HAS BEEN A NOTICEABLE RAMP UP OF ACTIVITY AT BOTH MT MAGNET AND VIVIEN, WHICH WILL CONTINUE UNTIL AT LEAST THE END OF JUNE.”

end of its guidance range of 31-35,000oz at an AISC of \$915/oz.

Ramelius again fell within its guidance range (which remained unchanged from Q3 2016) for the December quarter with a recorded production of 31,367oz, which was flagged to be delivered at a slightly higher cost than AISC guidance of \$1100/oz.

Q4 2016 marked the twelfth consecutive quarter that Ramelius had reached or exceeded its production guidance.

“Effectively three years of achieving production guidance is an excellent performance by the operations team, which has no doubt provided a reliable foundation for the company going forward,” Mr Zeptner said.

A strong financial year for Ramelius saw a 71 per cent increase in profit after tax of \$27.5m in FY16, compared to \$16m in FY15.

Sales revenue also increased, up 33 per cent from \$130.4m in 2015 to \$173.7m in FY16 in which the company generated a cash flow of \$65.5m; up 43 per cent from

the previous financial year.

At 31 December 2016, forward gold sales consisted of 97,009oz of gold at an average price of \$1673/oz over the period to June 2018, with cash on hand rising from \$88.7m at the end of Q3 2016 to \$95m by the end of last year.

Developments

In August 2016, Ramelius took the opportunity to tap investors for \$25m to increase development and exploration across its operations.

During Q4 2016 it upgraded the mineral resource at Mt Magnet’s Stellar and Stellar West deposits to 1.27mt at 1.6g/t for 65,000oz, with the potential to add open pit ore feed to the Milky Way open pit project nearby.

The company also progressed RC and exploration drilling at Mt Magnet’s Shannon, Zeus, Morning Star and Hesperus East deposits.

Ramelius spent \$4m on development during Q4 2016; the Blackman’s open pit

set up (\$300,000) and Water Tank Hill (\$3.7m), as well as an additional \$3.4m worth of exploration.

Work at Water Tank Hill continued with 708 metres of decline rehabilitation during the December quarter, as full production was reached at Blackmans upon the completion of open pit set-up works.

“Ramelius has successfully completed Kathleen Valley and commenced both Blackmans and Water Tank Hill during the quarter, and we continue the discipline of delivering into our lowest priced forward gold sales as they become due,” Mr Zeptner said.

“On the exploration front, in line with our \$15m budget this year there has been a noticeable ramp up of activity at both Mt Magnet and Vivien, which will continue until at least the end of June.”

Mr Zeptner said that by 2018 Ramelius would be a 150,000ozpa producer and has further developed its five year mine plan through exploration spending.

On the back of an improved quarterly

average gold sale price of \$1661/oz that provided a record \$65.2m in sales revenue during the September quarter, Ramelius decided to bring forward the development of its Milky Way open pit mine (\$15m) and exploration expenditure (\$15m) from 2018 to mid 2017, as part of a total capex of \$50m for FY17.

“We are well positioned to bring forward the development of Milky Way and upgrade reserves at the Vivien deposit,” Mr Zeptner said.

“Our exploration budget is by far the largest we have spent in quite some time, and as a part of that spending will have four drills set up this month to further develop our resources.

“We are also working on a resource and reserve update for Vivien and expect results to be released sometime this quarter.

“We have reliable operations given that we are consistently hitting our guidance, together with a healthy balance sheet that give us a lot of optimism about the company’s future mine plan.”



Blasting at Ramelius’ flagship Mt Magnet mine.



Higher than expected gold production has boosted Ramelius’ share price over the last 12 months.



Regis lifted gold output by 7 per cent to 80,090oz during the December quarter.



An after tax profit of \$111.8m was posted for FY16, up 29 per cent on the previous year.

Expansion for success

Increased cash flow and better than expected gold production has Regis Resources well positioned to continue its aggressive exploration efforts that could unlock higher production potential.

CAMERON DRUMMOND

REGIS Resources is a WA-based gold miner with operations at the Duketon gold project in the north eastern Goldfields region of WA, and the McPhillamys gold project in central west NSW.

Located 130km north of Laverton, Duketon commenced operations in 2010 following the construction of its Moolart Well gold mine which has since produced more than 500,000 ounces (oz) of gold.

In 2012 Regis completed the construction of Duketon's second mine, Garden Well, which has its own standalone mill operating at an average of 5 million tonnes per annum (mtpa).

The third deposit within the Duketon project area, the Rosemont hybrid gold project, was completed in 2013 and includes a crushing and milling circuit at the deposit with ore slurry pumped 9km to Garden Well's processing facility.

Additional leaching and infrastructure upgrades at Garden Well processing plant to 7mtpa were completed in the June quarter of 2014 in order to accommodate increased ore throughput from both deposits.

Duketons mining operations are split into Duketon North (DNO) and Duketon South (DSO), each with its own processing plant.

DNO is comprised of the Moolart Well, Gloster, Dogbolter, Petra and Anchol pits, with ore processed through the Moolart Well plant.

During FY16 DNO production of 76,139oz declined 23 per cent from the previous year at an AISC of \$934/oz, sourced entirely from the Moolart Well open pit.

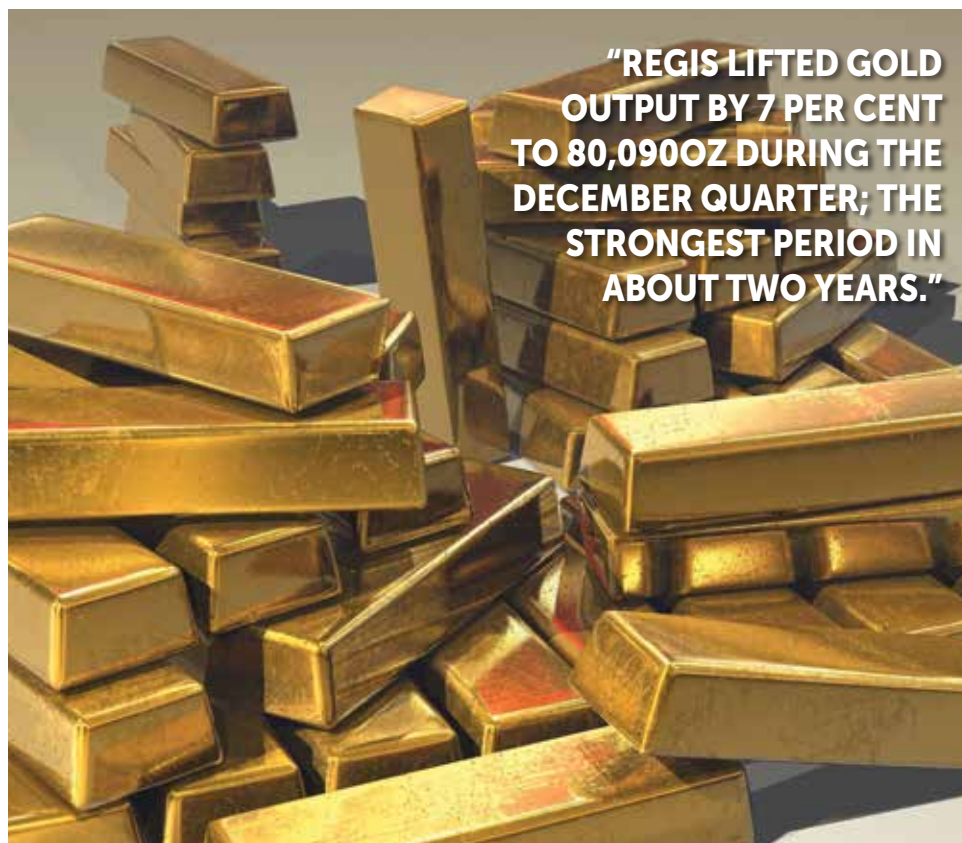
DSO includes the Garden Well, Rosemont, Erlistoun, Baneygo and other satellite projects close to the Garden Well processing plant.

Production benefited from processing upgrades during the year, which led to improved gold recoveries and increased throughput rates.

DSO produced 228,945oz at an AISC of \$924/oz in FY16; above annual production guidance and an 8 per cent increase on the previous year.

Regis said it expected the construction of two additional leaching tanks at the Garden Well processing facility would continue operational improvement at the project.

"Mining at the Erlistoun deposit is expected to commence in the second half of FY17 and would provide higher grade ore feed to be



Regis said it was in a strong financial position to continue exploration efforts at its Duketon project.

processed, displacing lower grade tonnes from the Garden Well open pit," the company said.

Results

Gold production for FY16 was 305,084oz, 2 per cent lower year-on-year due to lower scheduled grade at Moolart Well, but a touch above annual guidance of between 275,000oz and 300,000oz.

Regis reported an after tax profit of \$111.8m for the financial year, up 29 per cent on the previous corresponding period, realised through lower operating costs and an 8 per cent higher delivered gold price.

Operating costs came in below the cost guidance range of between \$950/oz and \$1050/oz, with Regis generating a net operating cash flow of \$204m for FY16; and at the end of the financial year had cash and bullion holdings of \$122.3m with no bank debt.

"The excellent operating results at Duketon have placed the company in a strong financial position," Regis chairman Mark Clark said.

"The industry is experiencing a robust gold

price and strong investor sentiment, but our industry can be cyclical, so we have continued to focus on delivering operational results on a consistent basis as this is within our control."

The company paid an FY16 dividend of 13 cents per share, adding to a total shareholder payout of \$170m since its maiden dividend in 2013.

"With gold production at Duketon forecast to grow over the next three years, the board expects that this commitment to dividends will continue."

2016 exploration

In its FY16 annual report, Regis outlined its aggressive exploration work over the course of the year that focused on growing its resources and reserves base.

In 2015, Regis acquired the Gloster gold tenements for \$1.5 million, 26km west of the Moolart Well plant.

During FY16, Regis completed RC drilling and reported maiden reserves of 226,000oz at Gloster.

Expected to produce 70,000ozpa across three years, mining at Gloster commenced in the September quarter of 2016 with first gold produced just before the end of the year.

RC and diamond drilling at the Baneygo deposit, 12km south of the Rosemont gold mine, added a maiden gold reserve of 136,000oz, which the company planned to develop during FY17.

Exploration works at the Tooheys Well gold prospect 2.5km south of Garden Well continued, producing a maiden mineral resource estimate of 547,000oz by the end of FY16; and nearby at the Russell's Find deposit drilling results had unearthed a gold resource estimate of 81,000oz.

Located 35km east of Orange, NSW, the McPhillamys gold project contained a resource of 2.2moz, making it one of the larger undeveloped open pit gold resources in Australia.

26,000m of infill drilling commenced in the September 2016 quarter aimed at defining resources for pre-feasibility study work. Drilling was ongoing, with a maiden resource estimate expected next quarter.

Recent Results

The miner lifted gold output by 7 per cent to 80,090oz during the December quarter, the strongest period in about two years. AISC was healthy at \$951/oz, below the lower end of FY17 guidance.

Regis said its total first-half FY17 gold production of 154,702oz had put the company on track to exceed FY16 production and reach upper half guidance of between 300,000oz and 330,000oz.

"Cash and bullion increased by \$26.6m for the quarter to \$129.7m after the payment of \$7.7m of pre strip mining and \$2.4m of startup capital at Gloster and Erlistoun, \$2.6m on the Rosemont cutback and \$6.8m on the extensive exploration programs at Duketon and McPhillamys," the company said in a statement.

During the quarter, Regis sold 71,092oz of gold at an average price of \$1719/oz, with a cash flow of \$64.5m; up from \$59.6m from the previous quarter.

Regis expected its gold output rate to be maintained during FY17 as the Gloster and Erlistoun projects in WA came online, and was working toward a target of between 320,000oz and 350,000oz for FY18.

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All images: MMG.

On the upside

Minerals & Metals Group's (MMG) zinc powerhouse Dugald River couldn't enter production at a more convenient time. With a little over a year left on the clock, the project was now more than 40 per cent complete and on track to achieve first production early 2018 amid a global zinc deficit.

ELIZABETH FABRI

LOCATED in Queensland, 85km northeast of Mount Isa and 65km northwest of Cloncurry, Dugald River sits on one of the world's largest undeveloped zinc-lead-silver deposits.

The \$1.4 billion project had been on the drawing board for some time, but wasn't progressed until July 2015 when an updated development plan was approved.

Not wasting any time, MMG began construction in August 2015, and has since been pushing towards its first goal of production in 2018.

In April 2016, the State government granted Dugald River prescribed project status; a red tape reduction that would streamline administrative decisions and accelerate development.

The good news continued in July when MMG entered an amended facility agreement of up to \$US550million.

The anticipated remaining cost of the project to first shipment of concentrate was reduced by up to \$US150 million, from \$US750 million to between \$US600 million and \$US620 million, plus interest.

Dugald River general manager of project delivery Pierre Malan said the cost reduction was a necessity after MMG



Construction is progressing well at MMG's Dugald River.

had sunk a large amount of cash into the project prior to the reapproved plan in 2015.

Mr Malan said the company assessed a number of areas for improvement, including lifting plant capacity to

1.75mtpa.

"We also did work to optimise the underground mine plan, looking at increasing production from underground to match the plant capacity we were going to have," Mr Malan said.

"We also looked at the current market conditions and tried to use the competitive market environment to provide us with the best contractors at the best and most competitive rate.

"That certainly contributed a fair bit, both for the underground as well as the surface construction work, allowing us to come in with a more realistic and affordable overall cost of completing the project compared to 2012."

"WE ARE EXPECTING TO SEE CONTINUED LOCAL PROCUREMENT AND CONTINUED USE OF LOCAL SERVICES AND BUSINESSES FOR THE LIFE OF THE OPERATION."

The company's optimised mine plan supported a 1.7mtpa operation with estimated annual production of 170,000 tonnes of zinc in zinc concentrate, plus by-products including 18,000t of lead and 981,000 oz of silver in concentrate per annum.

(continued on page 30)



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(continued from page 28)

"WE'VE ALWAYS EXPECTED TO SEE A CYCLICAL PRICE MOVEMENT IN SOMETHING LIKE THE ZINC MARKET, AND WE'RE CERTAINLY AT THIS STAGE HOPING AND ANTICIPATING THAT WE WILL BE ON ONE OF THE UPSIDE CYCLES AS RESULT OF THE DEFICIT THAT'S ANTICIPATED."



Workers underground at MMG's Dugald River site.

"This confirms Dugald River's position within the world's top ten zinc mines when operational," MMG stated.

"The mine will operate over an estimated 25 years while the ore body remains open at depth."

Construction on track

At the end of December 2016, Dugald River was more than 40 per cent complete; a significant accomplishment given the project was 28 per cent complete at the end of September.

"We are on schedule with our construction activities as per the plan that we developed at the beginning of 2016," Mr Malan said.

"We are on track and are more than 50 per cent complete on the construction effort on surface."

"We have practically completed the expansion of our accommodation village on site and now have the ability to accommodate an additional 300 rooms with all the facilities that go with that."

"It was quite important because without that we wouldn't have been able to bring on additional people required for the construction effort that really started ramping up a few months ago."

MMG has also completed most of the bulk earth and civil works across the site, including the establishment of various dams, ponds, roads, and subsequent concrete works, and run of mine retaining walls which enable the team to complete the mechanical construction of the primary crusher.

"We've also started with our structural steel installation and that's been progressing quite well to the extent that we've now placed both our primary bore and SAG mills in their final position and also completed our regrind circuit," he said.

"We've done the structural installation



MMG has almost completed the expansion of its accommodation village.

work of our thickeners; we've got a tailings thickener, a zinc thickener and a lead thickener and those have all been placed and construction of those was almost practically complete.

"We've also progressed our mine development ground and we've completed three large surface raise bore shafts."

These are 4.5 metre diameter circular shafts that connect the underground workings with the surface, and are used to ventilate the mine through exhaust fans that are placed on top.

MMG has installed and commissioned three primary surface vent fans on the three raise bore shafts.

"All of those are now in operation which will provide ventilation for the whole mine expansion through the rest of the mine life," he said.

"We've completed in total about 30 per cent of the underground development milestones that we want to achieve or need to achieve in order to progress to commercial production."

2017 developments

The 2017 year will be busy for MMG as it works towards completing the remaining infrastructure needed for first concentrate production.

"We need to complete the construction of the concentrator plant; that's both the mechanical installation and electrical, and then progress with commissioning of the plant," Mr Malan said.

"We also need to continue with our underground development and

start stoping so we will be looking at establishing an ore stockpile on the surface that we can use for testing and commissioning in the second half of 2017.

“It will provide, towards the end of 2017, the initial ore that we will be processing through the process plant in order to start producing concentrate.”

Mr Malan said the team will finish its two switch yards and energise the HV transmission line in April to get the site onto grid power, and later complete the remaining 20 per cent of work on its tailings storage facility.

“We will be recruiting for plant operators in 2017 and also for maintainers to look after our fixed plant infrastructure,” he said.

“At this stage we have got a five-year agreement or contract in place with a mining contractor to do the underground development and therefore we won’t be recruiting for underground mining operators but only for operators or staff to man up the plant and to maintain that.

“Once we are in full operation in early 2018 we’re expecting to have around 350 to 400 total people employed on the mine, and of that about 100 would probably be through the current mining contractor.”

Project prospects

Dugald River production will come at a time when global zinc production is in tight supply.

The shrink in global production was forecast in the wake of numerous of mine closures, including MMG’s very own Century zinc mine in August 2015.

The zinc shortage, however, was set to be in MMG’s favour for its first few years of its operating life.

“Obviously any operation when it starts would like to have higher prices rather than lower metal prices,” Mr Malan said.

“We know the metal market is a cyclical

market that goes up [and down]; you get to full market capacity or you get to a surplus and then it turns around and your high cost operations drop out again.

“We’ve always expected to see a cyclical price movement in something like the zinc market, and we’re certainly at this stage hoping and anticipating that we will be on one of the upside cycles as result of the deficit that’s anticipated.”

Mr Malan said he hoped the zinc shortfall would drive a better price than long term expected prices, and allow the company to get a good return on the initial concentrate with the view on paying back some of its capital earlier rather than later.

“This is a very positive for the value of the project,” he said.

Once operational, at peak production Dugald River would be 170,000t of zinc a year.

The project would also deliver more than 30 years of economic benefits to the surrounding communities through employment, training and revenue contributions.

“Obviously it is early days for this project and our focus has been on the construction effort, and as a result we’ve had to use a combination of both local and interstate contractors to do the work in a financially viable [way],” he said.

“We’ve been able to make use of some local contractors for parts of the work and those benefits would have flown directly back to those contractors, either very locally based in Cloncurry or some in Mount Isa, and some a bit wider in Queensland, including Townsville.

“We are expecting to see continued local procurement and continued use of local services and businesses for the life of the operation and if we can be successful and viable and we can make profits there will be significant tax benefits that will be flowing through to the QLD government.”



Dugald River will provide employment opportunities to the region for more than 30 years.



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The company has a long and proud history, which is reflected through its employees' commitment and long term business relationships.

It is through these that NSS has developed partnerships for the prosperity of its clients and the community.

An example of one of these relationships is the recent seven year contract awarded to NSS by MMG.

This contract is for the provision of port logistics and stevedoring services relating to MMG's Dugald River mine export mineral concentrates.

NSS was selected on its experience and capability, commitment to safety and the environment, superior assets and infrastructure, record for delivering superior productivity, and highly competitive price.

With a reputation as one of the world's top mid-tier miners, MMG's selection of NSS as its port logistics and stevedoring service provider evidences NSS's progressive approach to service delivery.

Placing sustainability and the environment at the forefront of its service offering, while not compromising on productivity or competitive pricing, NSS raises the bar for bulk materials handling now and into the future.



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Minnovo delivers at Dugald River

ENGINEERING firm Minnovo is proud to play an important role in the development of MMG's Dugald River lead-zinc project near Cloncurry in North West QLD.

As a mineral processing focused multi-discipline engineering organisation with experience across the globe, the company provides a full suite of services to the resources sector.

These include metallurgical test work program development and management, metallurgical and engineering investigations, feasibility studies to DFS level, Front End Engineering Designs (FEED) and complete detailed engineering design, through to full EPC/EPCM project delivery of mineral processing facilities and associated infrastructure.

At Dugald River, Minnovo was initially engaged to assist MMG in an optimisation phase to identify capital and operating cost savings.

Following project approval to proceed, and a competitive tendering process, Minnovo was awarded the contract to provide detailed engineering design services for the process plant and several of the associated non-process



A design of MMG's Dugald River processing plant.

infrastructure facilities.

For both the process plant and associated non process infrastructure, Minnovo has worked closely with MMG's project team to identify and implement optimal design solutions for the project.

In addition to the engineering design scope, Minnovo is providing ongoing support services to MMG and its construction contractors during the project implementation phase.

The company's philosophy is to

ensure its clients have access to the highest quality project teams and direct involvement from Minnovo's management group during project delivery, as is the case with its current involvement with MMG.



We provide complete detailed engineering design through to full EPC/EPCM project delivery of mineral processing facilities and associated infrastructure.

FULL SUITE OF SERVICES:

- Metallurgical Test Work
- Metallurgical and Engineering Investigations
- Feasibility Studies (to DFS level)
- Front End Engineering Designs (FEED)
- Detailed Engineering
- Complete EPC/EPCM Project Delivery Solutions

Our team has delivered on projects across Australia - North/South America - Africa - Europe - Asia

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We have experience and expertise covering a broad range of mineral commodities including Base Metals, Precious Metals, Iron Ore and various other industrial minerals.

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- Leaching
- Dense Media Separation
- Filtration
- Pyro/Roasting

**"MINING EMPLOYMENT
AND ROYALTY FIGURES
HAVE BEEN INCREASING
OVER THE PAST YEAR
[AND] WITH COMMODITY
PRICES NOW
RECOVERING, WE SEE A
BRIGHT FUTURE AHEAD
FOR THE INDUSTRY."**



Glencore's McArthur River mine is one of the world's largest providers of zinc in bulk concentrate form.

Image: Glencore.

Opportunities for growth

Famed for its red earth and desert landscapes, the Northern Territory is arguably Australia's most 'under-explored' mining region with only a handful of major mines operating across the 1,346,200sqkm expanse. But with government backing and major projects in the pipeline, things are looking up for the country's top end.

ELIZABETH FABRI

THE Northern Territory, also known as the 'Red Centre', contains a wealth of minerals, including Australia's largest deposits of uranium, zinc-lead, bauxite, gold, phosphate and manganese.

In 2015/16 the territory produced \$3.05 billion worth of minerals, of which gold accounted for 29 per cent and manganese 27 per cent of the total value.

Employment was on the rise, with 6528 people directly engaged in the Northern Territory's mining sector in November 2016; a 19 per cent increase from the 5508 people employed in 2015.

But, despite healthy figures, the Territory has taken a hit from lower commodity prices which have forced a string of mines into care and maintenance.

"Since 2012, the Territory's mining sector has been impacted by the same factors that have led to a global downturn in the industry, particularly lower commodity prices and a lack of investor confidence in the sector," Northern Territory Primary Industry and Resources minister Kenneth Vowles said.

"This led to the closure of our iron ore mines in 2014, and a significant reduction in exploration activity for most commodities."

However, Mr Vowles said the Territory was still faring better than most jurisdictions, with its five largest mines all



The granite mill on-site at Newmont's Tanami operation.

Image: Newmont.

continuing to operate, and values of mineral production across the Territory remaining near record levels.

"Mining employment and royalty figures have been increasing over the past year [and] with commodity prices now recovering, we see a bright future ahead for the industry," he said.

"The past year has seen a strengthening of our gold and base metals sector, a boom in exploration for lithium, and a pipeline

of new projects progressing towards production.

"In 2015-16, the mining sector accounted for 12.8 per cent of the Territory's Gross State Product (GSP), compared to 6.8 per cent of the national economy.

"Following completion of the Ichthys LNG construction project and the commencement of production, it is likely that mining will again become the single largest industry in the Territory."

Major projects

While not large in quantity, Northern Territory's major mines are making up for their lack of numbers in performance.

"Most of the Territory's mining operations are performing well," Mr Vowles said.

"For example, Newmont's Tanami Operation is now one of Australia's best performing gold mines, and is currently undergoing a \$120 million expansion, with development of a second decline."

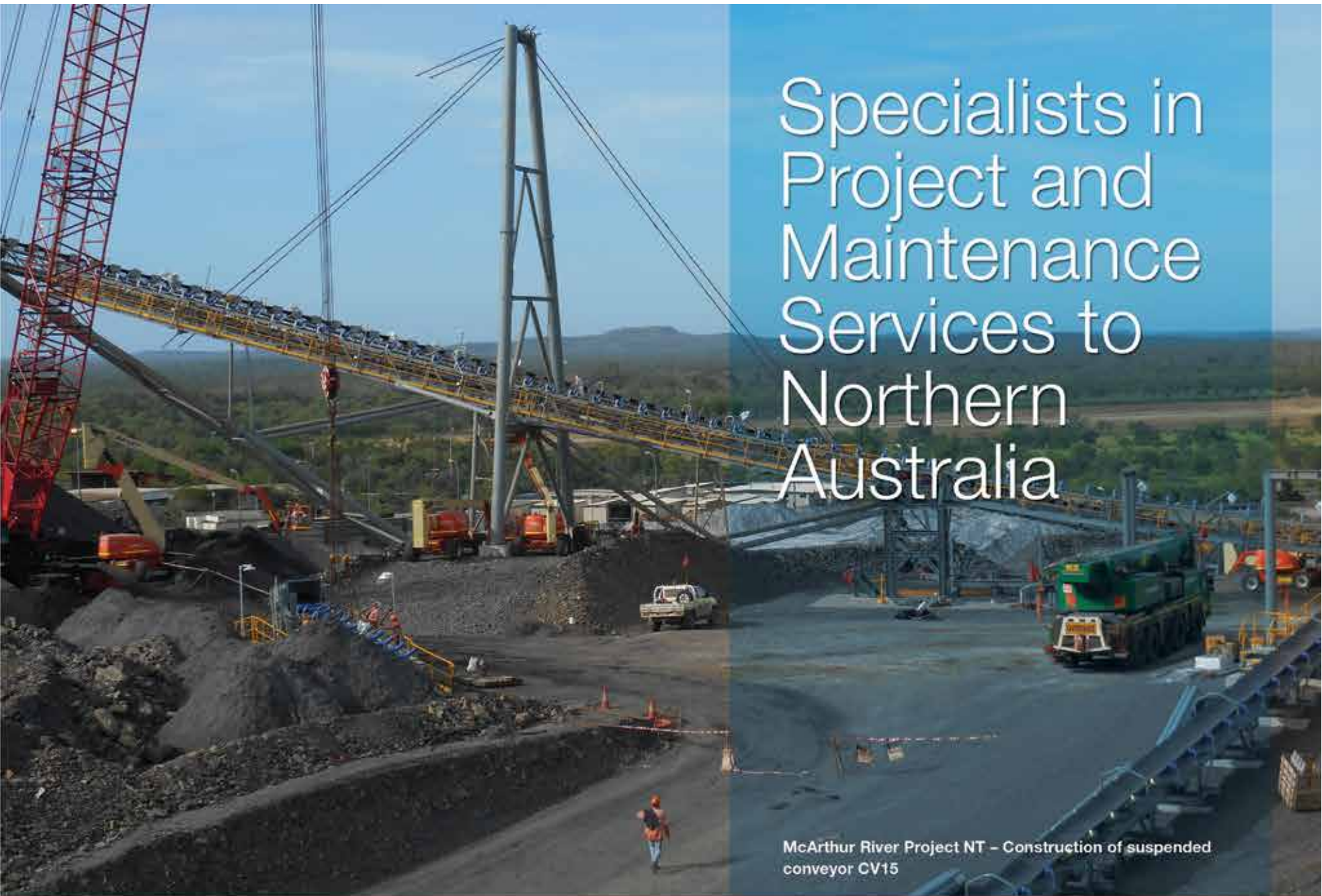
Located 540km northwest of Alice Springs in the remote Tanami desert, the mine has been owned by Newmont Mining since 2012, and operational since 1983.

The current expansion included the construction of a second decline and building incremental capacity in the plant to increase profitable production, add three years of mine life, and serve as a platform for future expansion.

"The project is on budget and schedule to deliver additional production in mid-2017," Newmont Mining stated in its September quarter report.

"The expansion is expected to maintain Tanami's annual gold production of between 425,000 and 475,000 ounces per year at CAS of between \$600 and \$650 per ounce."

South 32's Groote Eylandt Mining Company (GEMCO) manganese mine was also a top performer, recently undergoing an expansion and gaining access to new leases that have the potential to substantially increase mine life.



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"THE PAST YEAR HAS SEEN A STRENGTHENING OF OUR GOLD AND BASE METALS SECTOR, A BOOM IN EXPLORATION FOR LITHIUM, AND A PIPELINE OF NEW PROJECTS PROGRESSING TOWARDS PRODUCTION."



Glencore's McArthur River mine.

Image: Glencore.

The deposit itself accounted for 99 per cent of past manganese ore production and 90 per cent of identified manganese ore resources in the Territory, and was one of the largest and lowest-cost manganese ore producers in the world.

Glencore's McArthur River zinc mine was also on the world-map as one of its largest providers of zinc in bulk concentrate form, with an estimated mine life out to 2038, and Rio Tinto's Gove bauxite mine and Kirkland Lake Gold's Cosmo project were also going strong.

Industry challenges

The Northern Territory still has a long way to go to lose its 'under-explored' tagline.

CommSec's October *State of the States* report stated the Northern Territory was "losing momentum" in terms of exploration; when key resource projects were completed, activity levels would slow unless a lift in investment took place.

In August 2016, the Northern Territory Division of the Minerals Council of Australia *Agenda for Growth* document stated more than \$ 95.7m was spent on Northern Territory exploration in 2014-15 but "more investment was needed to restore exploration to peak levels".

Mr Vowels said there were a number of issues facing the sector, primarily the ongoing uncertainty in global markets and commodity prices, given the reliance of commodity prices on growth in the Chinese economy.

He said the region also faced difficulties in attracting sufficient investment from the market to fund exploration, project feasibility and construction, a lack of transport infrastructure in some areas that impacted project economics, and breaking down international perceptions of Australia as a high-cost jurisdiction.

"The Territory is certainly underexplored, in comparison with the rest of Australia and many parts of the world," he said.

"But we see this as a competitive advantage for the Territory, as this means there are tremendous opportunities for further mineral discoveries.

"We have already seen an increase in the Territory's share of Australian exploration expenditure in recent years, but we will keep working to encourage industry to invest their exploration dollars here in the NT."

Mr Vowels said the main barriers for exploration and investment included a lack of infrastructure in remote areas; lack



GEMCO mine.

Image: South32.

of outcropping (visible at surface) geology and limited historical exploration in many parts of the Territory, making greenfields exploration inherently high-risk; and difficulties for small to mid-size exploration companies to raise funds from the market for greenfields exploration.

"The Territory Government is working to address some of these challenges through programs such as the CORE initiative," he said.

Initiatives for change

The Territory Government's \$23.8m Creating Opportunities for Resource Exploration (CORE) initiative was the most notable initiatives for growth, designed to attract and support investment into the exploration sector, and maximise opportunities.

The four year program was launched in 2014, and has been working towards providing new geoscience datasets to the exploration industry that identify new areas of potential and lower the cost and risk of exploration; supporting and rewarding innovation by industry in greenfields areas through collaborative industry grants for drilling and geophysics; and assisting industry to attract investment from international markets.

"Under the initiative, the NT Geological Survey has substantially upgraded the coverage of the Territory with modern

geophysical data, and undertaken geological studies, 3D modelling and studies of prospectivity to give explorers a much improved understanding of the Territory's geology and resource potential," Mr Vowels said.

"CORE has developed a strategic partnership with the CSIRO Minerals Resources Division, with two CSIRO post-doctoral researchers now embedded in the NT Geological Survey to apply CSIRO technology to better understand the Territory's mineral potential."

He said there has also been a focus on improving accessibility of data and information for the global exploration industry with Geoscience NT (NTGS) making every industry report on exploration since 1901 (23,000 reports) accessible online.

In the most recent Fraser Institute global survey of mining companies, the Territory was ranked fourth in the world for the quality and accessibility of its geological data.

Moving forward, Mr Vowels said the outcomes from CORE were set to increase further.

"Our geological team have worked with Geoscience Australia to design a major new program of geoscience activities in the coming three years to investigate the resource potential of the Barkly region, as a partnership between the Commonwealth's \$100 million *Exploring for the Future*

initiative and the Territory's CORE initiative," he said.

"This is likely to be the most intensive program of new geoscience for exploration ever undertake in the Territory."

Future developments

Despite an investment shortfall, the Northern Territory future looked promising with a number of key mining projects moving towards production in the next three to five years.

"Emmerson Resources is moving to redevelop the Edna Beryl gold resource near Tennant Creek and Australian Abrasive Minerals' garnet sands project is moving into commissioning," the Northern Territory Department of Mines and Energy chief executive Ron Kelly said.

"A number of other projects are proceeding through the environmental impact assessment process, including TNG's Mount Peake vanadium-titanium-iron project, Arafura's Nolans rare earths and phosphate project and Tellus's Chandler salt and storage project.

"Existing gold operations also continue to perform well with Newmont's Callie mine undergoing an expansion and Newmarket's Cosmo project identifying new ore zones."

Feasibility studies were also underway at Verdant Minerals' Ammaroo phosphate project east of Barrow Creek, and KGL Resources' Jervois copper project was also in the pipeline.

"The Territory's resources industry has a bright future," Mr Vowels said.

"There are real opportunities for the Territory to substantially grow and diversify its mining sector, into new commodities such as copper, vanadium, lithium, phosphate and rare earths, as well as strengthening our existing industries in commodities such as gold and zinc.

"Our diverse mix of commodities located so close to the rapidly growing Asian markets suggests that, notwithstanding the inevitable fluctuations of commodity prices, the Territory's mining sector should continue to grow and expand its role in our economy.

"The Territory Government will continue to work with industry to address impediments to exploration and development, and provide a regulatory framework that gives certainty to industry whilst ensuring that the community has confidence in the environmentally and socially sustainable growth of the sector."

Innovative construction and maintenance solutions

CROWHURST Goodline is a privately owned Australian company specialising in the construction, maintenance and operational needs of the mining, marine, energy and construction industries.

The newly formed joint venture company brings together two long established Northern Territory businesses, offering unique and innovative solutions in construction and maintenance support.

Crowhurst Goodline is strategically located within Darwin, Gove and Katherine to meet the demands of metropolitan construction and maintenance, and the broad requirements of servicing regional Northern Territory.

Employing tradespeople of all disciplines, the company has the capacity and experience to complete civil, structural, mechanical, hydraulic, electrical and instrumentation installations. With extensive experience working on mine, port and construction sites throughout Northern Australia, Crowhurst Goodline can additionally provide a single point of contact through all project stages by managing steel fabrication, maximising off-site pre-assembly, and coordinating logistics chains.

Crowhurst Goodline ensures that schedule and quality standards are met with direct consideration of cost-saving benefits for clients.

Further to construction, Crowhurst Goodline can provide innovative maintenance solutions with minimal disruption to operations.

Its shutdown managers ensure close communication with clients to schedule works, mobilise experienced maintenance crews and maximise pre-shut opportunities.

The company culture is driven by an open and honest relationship with clients and



Crowhurst Goodline will operate from five Australian locations.

suppliers and supported by internationally accredited HSE and Quality Management Systems.

Both Goodline and Crowhurst Engineering have held long term commitments to provide opportunities for local and indigenous people in the remote

areas they operate in Australia, including the Northern Territory, Cape York QLD and the Pilbara WA.

This committed pathway is integral in the development and sustainability of local and indigenous people and businesses.

The company is extremely proud of the real results its nationally recognised programs have delivered.

Crowhurst Goodline is committed to the long term prosperity of the Northern Territory and looks forward to meeting the challenge together.

In Situ capability



Machining mill bolt holes at ERA's Ranger mine in the Northern Territory.

ATTransAlign I.S.M., Industrial Transmission Laser Alignment is carried out by six technicians with SKF competency certificates.

Rotating equipment, flat machine beds, line bores and spindle alignment checks can be measured, reported and rectified by adjustment or machining by the same technicians.

TransAlign's 'In Situ Machining' engineers are continually challenged to carry out the "impossible" tasks.

TransAlign has a basic philosophy; if it can be turned, bored, faced, milled or ground the company will build equipment to carry out the task. This equipment's hydraulic powered machining heads utilises laser technology quality control to ensure high standards of accuracy.

In addition to international clients based in Indonesia, Canada and Sweden, TransAlign's client base in the Northern Territory includes ERA, MacArthur River, Newmarket Gold, Newmont Tanami and many OEM and field

service companies involved in oil, gas, mining and power generation.

New services recently added to the company's 'In Situ' capabilities include a Mill Shell Boring System that utilises a rail template to accurately bore larger mill bolt holes.

Even holes with low clearance under the Girth Gear are done accurately.

Large tapered journals, such as Cone Crusher Spider-bearing journals, are now able to be re-furbished on site with pre machining, heating, welding and final accurate tapered boring done with the JTL650; developed to machine tapered internal bores in the 650mm-1150mm range.

In Situ Milling is a core strength service offered with laser control to rectify machine beds, heavy earthmoving axle and strut mounts; in addition to circular milling of slew bearing mounting surfaces from 1400mm-4000mm in diameter.



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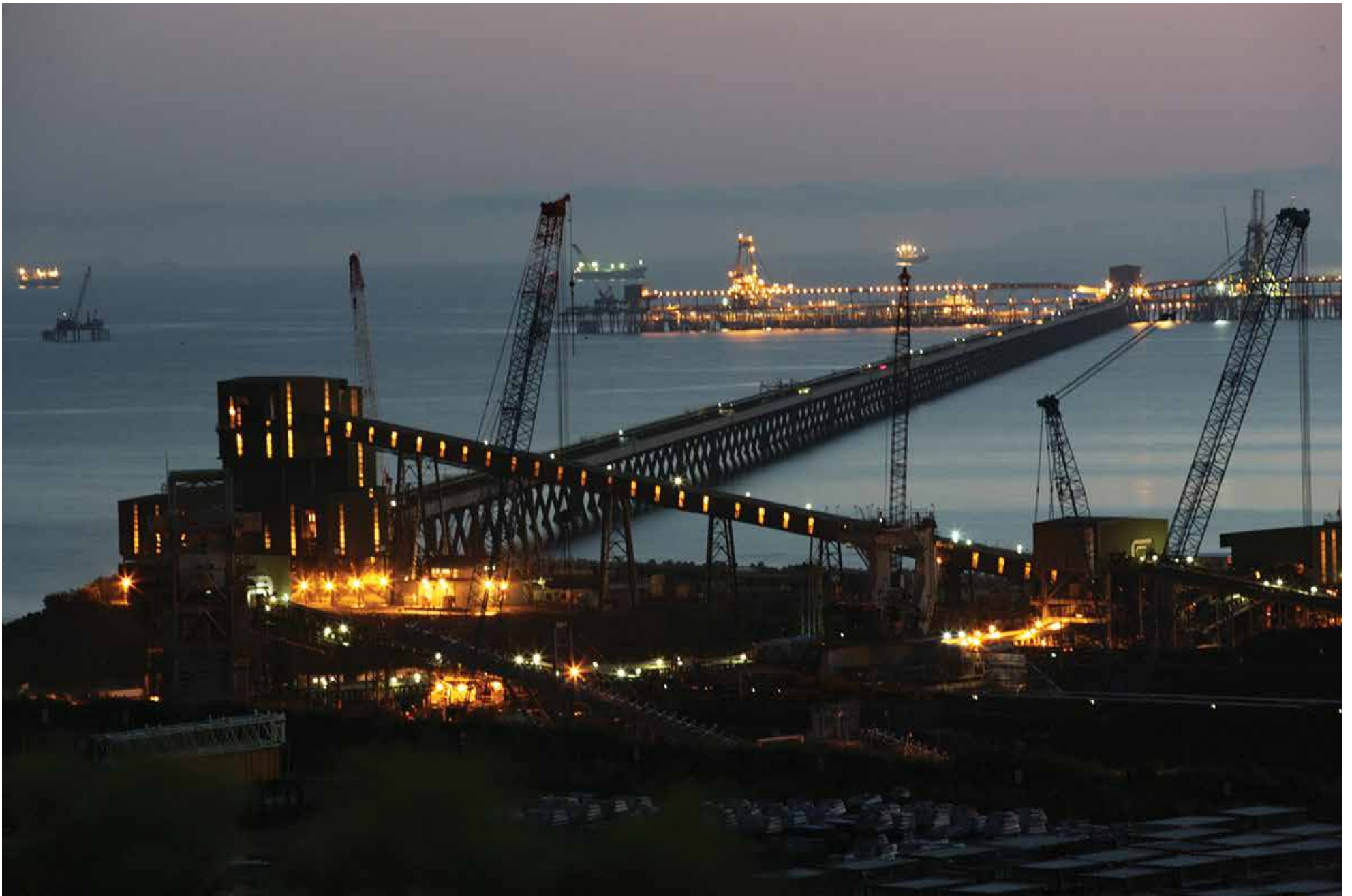
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All images: DBCT.

A unique blend

The Dalrymple Coal Bay Terminal is one of a handful of coal terminals able to blend its coal onsite ready for export. This provides a strategic advantage to mining operations wanting to blend a product that is specific to market demands.

CAMERON DRUMMOND

COMMENCING operation in 1983, the Dalrymple Bay Coal Terminal (DBCT) is leased by the QLD Government to DBCT Management under a 50 year agreement, with rights to extend the lease by a further 49 years.

DBCT Management is the managing entity of the port for Brookfield Infrastructure, which acquired lease-ownership of the terminal in 2010.

It is located at the Port of Hay Point, about 38km south of Mackay in Northern QLD.

DBCT is one of the largest port terminals in Australia, with a throughput capacity of 85 million tonnes per annum (mtpa), and services mining operators in the surrounding Bowen Basin.

The terminal has been exporting coal to about 30 countries for more than 25 years. In 2015, more than 34mt of coal was delivered to the terminal via 2934 trains from the Bowen Basin coal district.

DBCT's predominant export product is metallurgical coal, which includes PCI and coking coal, which accounts for between 82 per cent and 85 per cent of total throughput.

DBCT's throughput for the 2016 financial year was a record 71.5mt, and for the first half of FY17 had so far



An average of 120,000t of coal is loaded into each vessel at the port.

shipped 35.2mt of coal.

The largest importer of coal from the DBCT in FY15 was Japan (14.5mt), followed closely by China (13.5mt) and South Korea (11.6mt).

In FY16, coal exports to China were marginally higher (14mt), while coal to Japan remained the same year-on-year.

In the first nine months of FY16, DBCT was delivered 20.2mt of coal via 1805 trains, slightly than 19.4mt delivered via the same number of trains in corresponding period the previous year.

170 vessels took 17.7mt out of the port in the first nine months of 2015,

compared to 18.1mt shipped with 178 vessels last year, suggesting slightly higher traffic.

Capacity

The DBCT 7X project in 2009 was the latest expansion undertaken at the terminal, which lifted capacity from 54.5mtpa to 85mtpa.

An extensive conveyor network transports the coal either directly to the wharf for loading or to the stockyard for storage.

It achieves this by making use of three rail receipt stations; two of which can receive 5500 tonnes per hour (tph) and a third with an 8100tph capacity.

Four stackers have a combined rate of 15,200tph and are joined by three reclaimers with a combined rate of 14,850tph.

The port also utilises five stacker-reclaimers with various stack rates of between 4250tph and 5500tph, and reclaim rates of between 3700tph and 5300tph.

DBCT has three inloading stations feeding three inloading conveyor systems which deliver coal to the stockyard.

The inloading stations can accept a number of different train configurations and wagon types from any one of three rail haulage operators (Pacific National,



DBCT has a maximum throughput of 85 million tonnes per annum.

Aurizon National and BMA Rail).

The coal wagons are bottom dump type, with the coal falling out of the wagons and into the rail receival pits for transfer via inloading conveyor to the stockyard.

Eight stockpile rows, each about 1.1km in length, cover nearly 67 hectares and can hold at any one time a maximum of 2.3mt of coal.

The average stockpile contains about 20,000t of coal (about two train loads), is 80 metres in length and stacked no higher than 13.2 metres to minimise dust creation.

When a ship is ready to be loaded, the yard machines use a 'bucketwheel' to scoop coal from the stockpiles and place the coal back on the conveyor system at an average rate of up to 4200tph to 5800tph.

The coal is then transported to one of three 'surge bins' that act as buffers between the yard system and the conveying system to the shiploaders, ensuring an even loading rate is sustained.

DBCT has the ability to blend different types of coal from its stockyard, making DBCT unique to most other coal terminals.

Coal is able to be blended from DBCT's stockpiles with two reclaimers required to feed each shiploader.

After the coal is tested to ensure it meets buyer requirements, it is then transported along a 3.8km jetty to the wharf.

The terminal has three outloading systems supporting three shiploaders that can load coal onto cape size vessels across four berths at a combined loading rate of 23,450tph.

DBCT can load coal onto vessels ranging from 40,000 dead weight tonnes (dwt) in size, up to about 220,000dwt.

While the size and cargo of each ship visiting the terminal can vary, it takes about 22 hours to load an average 80,000t onto a vessel.

DBCT is primarily exposed to four



85 per cent of Australia's coal exports are to the Asian market.

classes of vessels: Large Cape Size (140,000-220,000dwt), Capes (100,000-140,000dwt), Panamax and Japmax (65,000-100,000dwt) and Handimax (40,000-65,000dwt).

About 40 per cent of the vessels that come through DBCT are Large Cape Size, followed by Japmax (33 per cent) and Panamax (16 per cent).

Since 2010 the average vessel size has surpassed 100,000dwt, and by 2016 had averaged above 120,000dwt.

To accommodate future demand, DBCT has applications in place to take the nameplate capacity up to a maximum of 136mtpa.

Despite the slowing of global demand growth in the last few years, Access Applications for post 85mtpa capacity at DBCT were still in place, with no indications that a material withdrawal would occur.

"DBCT Management is obliged by the

Port Services Agreement (PSA) and the Access Undertaking (AU) to accommodate the actual and reasonably anticipated future demand for the use of DBCT's Users and access seekers," DBCT stated in its *Master Plan 2016*, released in July last year.

"Accordingly, DBCTM has continued to plan post 85mtpa expansions to take DBCT's nameplate capacity up to a maximum of 136mtpa.

"While an eventual return to demand growth is widely anticipated, the timing of the recovery has proven difficult to forecast.

"In the current environment it seems logical that when demand for expansion does return it will return in a more subdued and measured way, leading to a more incremental expansion requirement than anticipated in previous Master Plans. This Master Plan outlines an incremental expansion pathway for DBCT."



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"IT IS IMPORTANT FOR POLICY MAKERS TO REMEMBER THAT SOME OF THESE PROJECTS... WERE DISCOVERED MANY DECADES AGO WITH HUNDREDS OF MILLIONS OF DOLLARS SPENT TO EXPLORE AND EVALUATE THEM."

Hidden Valley mine is an open pit gold and silver mine in PNG's Morobe province.

Image: Harmony Gold.

PNG prospects stay gold

Historic copper-gold region Papua New Guinea still has bright prospects – it just needs forward-thinking policy and continued investment to see them through.

LOUISE BAXTER

THE small Pacific island nation of Papua New Guinea is a historic producer of copper and gold, an industry that has significantly contributed to the country's economy since the 1970s.

Its wealth of resources – predominantly gold but also copper, nickel and cobalt – has attracted major and junior companies from neighbouring Australia and around the globe, including Newcrest Mining, Barrick Gold and Harmony Gold, which are currently operating in the region.

However, mining in PNG is not without

its challenges.

Illegal mining is rife and requires special consideration and risk management; Barrick Gold stated that it is a "complex and difficult issue to manage and one of the principal challenges of mining at... Papua New Guinea, a country where a relatively low standard of living is evident."

Cultural, environmental and human rights considerations are also imperative for ethical mining in the region – which is reflected in governmental policy deliberation – and companies operating and exploring in PNG must adhere to these guidelines.

(continued on page 44)



"WE NEED GOOD FORWARD-LOOKING POLICIES FROM GOVERNMENT FOR PNG TO REMAIN ATTRACTIVE FOR INVESTORS..."

Newcrest Mining's Lihir mine is located on Aniolum Island, 900km northeast of Port Moresby.

Image: Newcrest Mining.

Experienced service for business growth

EXPERIENCE and back up service are the strengths of Southern Cross Pumps PNG (Southern Cross).

These strengths have ensured exceptional business growth over the 35 years Southern Cross has operated in Papua New Guinea.

Southern Cross supplies quality equipment for the mining sector's water supply requirements.

The company offers a range of mine dewatering pumps, slurry pumps, sewerage pumps, and sewerage treatment plants to suit virtually any application, as well as an extensive range of spare parts.

"We don't just pump clean water – we'll pump any water; we can pump it, store it, clean it up, treat it and turn it into drinking water to meet World Health Organisation standards," Southern Cross PNG branch manager Mark Griffiths said.

Southern Cross pumps range from small domestic house pumps to large rural village systems, as reliable village and town water supplies are essential to all communities.

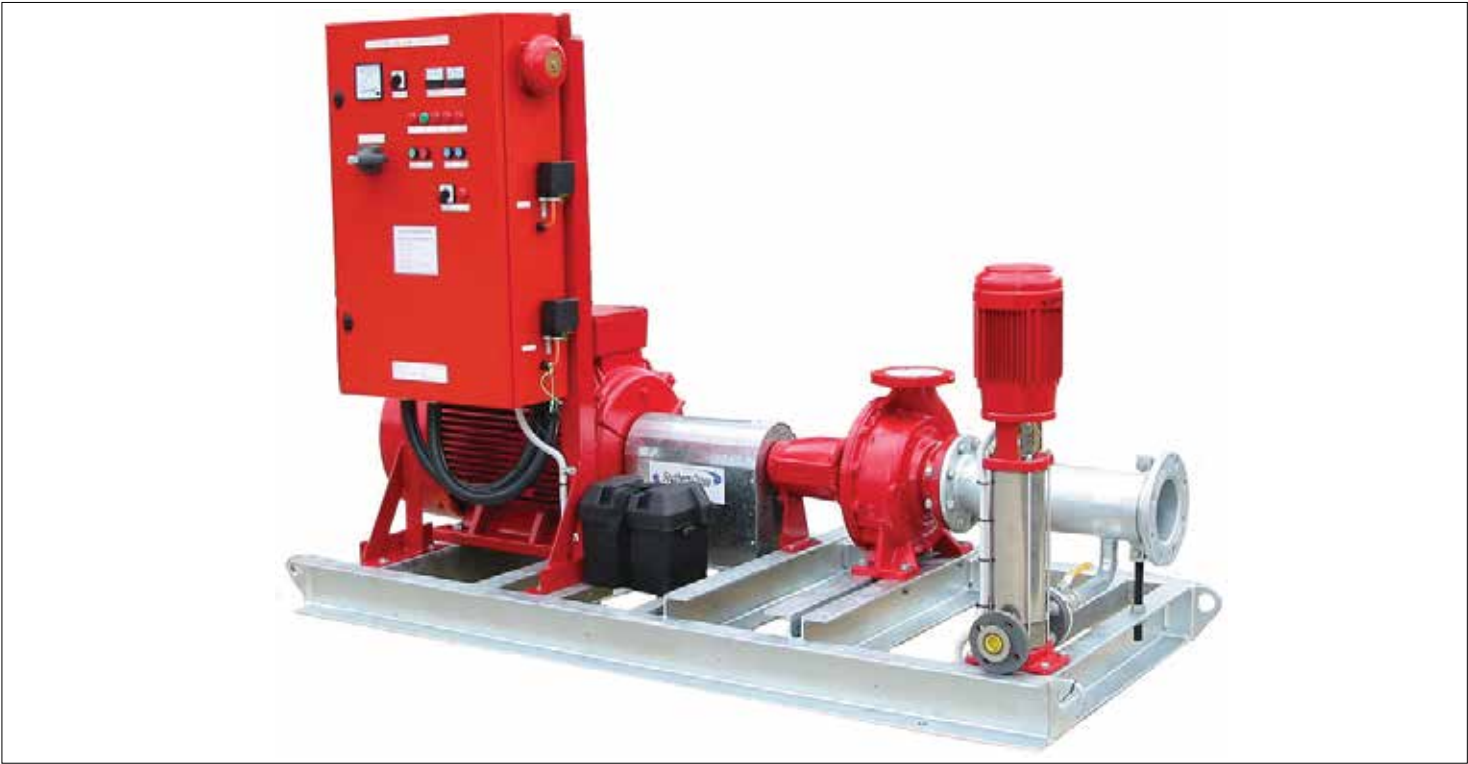
With this in mind, the Southern Cross product range has grown and developed to meet the needs of its client base across PNG.

Southern Cross water pumps cover a wide range of applications for both surface mounted and borehole water supplies.

Reliability and service is also imperative to the resources sector.

With this in mind, Southern Cross Pumps keep a range of pump components and electric motors on hand to offer ultra fast supply of parts or complete units to a range of industries, including mining.

For areas dependent on underground water supply, the company offers a complete



Southern Cross fire pump sets are built to meet Australian standards.

range of reliable, highly efficient bore pumps. These range from line shaft turbine and helical rotor pumps for both electric and diesel operation through to small transfer pumps and heavy duty industrial units.

Driven by quality-first, customer satisfaction and mutual benefit, Southern Cross supplies high end slurry pumps, valves, pipelines and pumping system solutions to its clients.

Multiple series, full sized slurry pumps are available to meet a wide range of requirements;

from diverse corrosion and wear resistant hard metal to elastomer material across a variety of platforms.

Southern Cross, together with Atlas, provides genuine replacement parts with outstanding interchangeability to fit Warman® slurry pumps that are re-engineered and tested in house to provide a superior quality product which significantly reduces operational costs.

A wide variety of construction materials are available; including high chrome iron,

natural rubber, stainless steel, grey iron and ductile iron.

Southern Cross has an extensively stocked warehouse combined with a swift delivery system to ensure a plant is not carrying excess inventory on site, with a rapid response team on hand to meet any emergency requirements.

With its strict quality control system in place and ample experience working with OEM machinery, Southern Cross provides its high-end clients with the reliability and experience they deserve.



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The awarded C Residences 7 on the left, part of the Airways Hotel and Residences property.



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Located alongside Port Moresby's Jacksons International Airport, Residences are leased on both long and short-term leases to oil and gas, medical, aviation and construction related companies management and their families.

Enjoying high demand thanks to Papua New Guinea's recent natural gas resource development, Airways Residences enjoys nearly full occupancy all year round.

The most recent addition to the apartment development is C Residences 7, a luxury development of 12 executive-style two and three-bedroom apartments and a top floor penthouse level apartment that features its own unique interior design.

Each apartment has floor-to-ceiling windows and large balconies overlooking tropical gardens, Bootless Bay and PNG's Owen Stanley Ranges, famous the world over with trekking adventurers.

The adjoining Airways Hotel's international reputation has been built on equally unique interiors, not to mention first-class service and a passionate attention to detail. The Hotel offers finely-appointed rooms, exquisite decor and world-class facilities in an environment that is calm, secure and spacious.

Conveniently close to Port Moresby's Jacksons International Airport, this is an ideal place for accommodation, business meetings, networking and family relaxation.



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It's really so much better here...

(continued from page 40)**Ok Tedi mine.***Image: Ok Tedi Mining.*

This includes ensuring safety and employment for the local workforce and use of local suppliers.

In February 2016, the PNG Chamber of Mines and Petroleum, released a statement about the future prospects and needs for PNG's resources industry.

The Chamber stated that PNG was in a "fortunate" position, as "some major advanced projects are still being considered for development in the next three to five years at a time when many projects worldwide are losing money and many are shutting down."

"In past years, the mining and petroleum sectors have been big contributors to government revenue and have created thousands of jobs, often in remote locations that require the creation of significant infrastructure and provision of better education and health services."

The Chamber executive director Greg Anderson said: "For this reason we need good forward-looking policies from Government for PNG to remain attractive for investors so that the nation's future potential can be realised in a manner that promises improved living standards for people throughout the country."

"Among the advanced projects still under consideration are the multi-billion dollar Papua LNG Project, the Wafi-Golpu and Frieda River copper-gold projects in Morobe and Sandaun respectively.

"It is important for policy makers to remember that some of these projects, such as Frieda River, were discovered many decades ago with hundreds of millions of dollars spent to explore and evaluate them."

Exploration and development

Wafi-Golpu

Joint venture partner Newcrest said Wafi-Golpu is a "world-class mineral province of gold and copper-gold deposits", which has

been explored since the 1970s.

The Wafi-Golpu gold and copper deposits are owned by the Wafi-Golpu Joint Venture (WGJV) – one of three unincorporated joint ventures between subsidiaries of Newcrest (50 per cent) and Harmony Gold (50 per cent) referred to collectively as the Morobe Mining Joint Ventures (MMJV).

The PNG government has the right to purchase, for its pro-rata share of historical costs, up to a 30 per cent equity interest in any mineral discovery at Wafi-Golpu, at any time before the commencement of mining.

It currently includes the Wafi epithermal gold deposit, the Golpu and Nambonga copper-gold porphyry deposits and other substantial exploration targets, located in the Morobe Province of Papua New Guinea (PNG), about 65km southwest of the port city of Lae, PNG's industrial hub and second largest city.

According to Newcrest, the Golpu porphyry deposit is "the largest discovery at Wafi-Golpu to date", hosting a Mineral Resource of 500 million tonnes, estimated to contain 10moz of gold and 4.5mt of copper.

Golpu's current ore reserve estimate is 6.2moz of contained gold and 2.7mt of contained copper.

"Resource definition drilling continues, however Golpu already ranks alongside the highest grade copper porphyry deposits in South East Asia," Newcrest stated.

Frieda River

Frieda River represents one of the largest undeveloped copper-gold deposits in the world. The Horse-Ivaal-Trukai, Ekwai and Koki (HITEK) global Mineral Resource is estimated at more than 2.7 billion tonnes of mineralisation at an average grade of 0.42 per cent copper and 0.23g/t of gold, and contains 13mt of copper and 20moz of gold.

**Hidden Valley open pit.***Image: Harmony Gold.***Simberi mine is in the northern island in the Tabar group.***Image: St Barbara.*

PanAust holds an 80 per cent interest in the project with joint venture partner, Highlands Pacific, holding the remaining 20 per cent.

Upon the grant of a Special Mining Lease, the Government of Papua New Guinea has a right to acquire, at cost, up to a 30 per cent interest in the Frieda River Project which, if exercised in full, would reduce PanAust's holding to 55 per cent and Highlands Pacific to 15 per cent.

In December 2016, an environmental impact statement was lodged for the project.

Existing operations

PNG has a widespread portfolio of operating mines, attracting mineral heavyweights and joint ventures, as well as ambitious junior explorers.

The large projects dominate the market cross-section, including Hidden Valley, Lihir, Porgera, Ramu (nickel and cobalt) and the oldest operation, state-owned copper-gold mine Ok Tedi.

Hidden Valley

In September 2016, Newcrest offloaded its half of the Hidden Valley mine to South African joint venture partner, Harmony Gold, for cash consideration of \$US1.

"Having completed the strategic review of Hidden Valley, Newcrest determined that the best outcome was to exit the operation and focus our attention on safe, profitable growth at our other assets," Newcrest managing director and chief executive Sandeep Biswas said in a statement.

As of 30 June 2016, Hidden Valley had an estimated mineral reserve of 1.4 moz of gold at 1.6 g/t and 27moz of silver at 31 g/t.

The estimated mineral resource includes 4moz of gold at 1.6 g/t and 73Moz of silver at 29 g/t.

"We believe that Hidden Valley has

the potential to contribute approximately 180,000 ounces per year of gold to Harmony's production profile at an all-in sustaining cost of less than \$950 per ounce within the next three years," Harmony Gold chief executive Peter Steenkamp said.

Porgera

The Porgera Joint Venture is an open pit and underground gold mine located at an altitude of 2.2km to 2.7km in the Enga Province of PNG.

Barrick (Niugini) Limited is the manager and 95 per cent owner of the Porgera Joint Venture. Barrick Gold Corporation and Zijin Mining Group each own 50 per cent of Barrick (Niugini) Ltd.

The remaining five per cent interest is held by Mineral Resources Enga and is divided evenly between the Enga Provincial government and local landowners.

As of 2016, Barrick's share of gold production was expected to be between 230,000oz and 250,000oz, at a cost of sales of \$790-\$860 per ounce, and all-in sustaining costs of \$850-\$920 per ounce.

Lihir

The Lihir gold operation is located on Aniolam Island, the largest island in the Lihir Island group, about 900km northeast of Port Moresby.

It is 100 per cent owned by Newcrest subsidiary, LGL.

The Lihir gold operation is located in an inactive volcanic area, which retains geothermal energy.

Since 2003, geothermal energy has been used at Lihir to provide some of the operation's power needs and reduce greenhouse gas emissions.

For the year ended June 2015, Lihir produced 688,714oz of gold.

**Ore at Simberi is sourced from a number of open pits.***Image: St Barbara.*

Pop-up office options for miners



More information can be found at www.pacificpalmsproperty.com.pg.

START-up firms looking for a short term office space in Port Moresby should look no further than the Harbourside West Tower Serviced Offices along Stanley Esplanade, Down Town, Port Moresby.

Pacific Palms Property's professionally styled serviced offices and hot desk spaces can be leased by the hour, day, week, month or year, depending on business requirements.

There are also meeting rooms and a 24 person training room on Level 1 to cater to business needs.

Harbourside West Tower Serviced Offices on Levels 1, 4 and 5 feature a variety of offices, from one, two or three person offices or larger units.

What's more, all rental rates are inclusive of electricity and water charges.

Those looking for a peaceful and quiet place to get some work done for a few hours may also benefit from Pacific Palms Property's hot desk spaces to complete work

in a tranquil environment – free of noise and distractions.

Hot desks are the new modern concept designed to provide a temporary workstation that would suit the needs of a travelling professional or student, and are quickly becoming a trend around the world mainly due to its economical rates and flexibility.

All office units include access to a well equipped shared kitchen, breakout areas, reception services and assistance.

Harbourside West Tower boasts stunning views of the Fairfax Harbour and Central Business District; with paid parking, 24 hour security, access to restaurants, bar, a coffee outlet and an ATM all in the vicinity.

The building is also in close proximity to the CBD, banks and a short drive away to Waterfront shopping centre, making it the most convenient business location in Port Moresby.

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Now you can meet in private and work in world class surroundings at Pacific Palms Property's latest development, Harbourside West Tower Serviced Offices, on the waterfront in downtown Port Moresby.

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Our staff are well trained and ready to assist with efficient administrative support and the offices are supported with quality amenities for your convenience, including a modern kitchen, breakout areas, meeting and training rooms, reception services, security and housekeeping, leaving you free to concentrate on your business.



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**"WE ANTICIPATE
REACHING RAMP UP THIS
YEAR IN THE FIRST HALF."**



Roy Hill is located 340km south east of Port Hedland, WA.

All images: Roy Hill.

Striking the perfect balance

While still in its infancy, Roy Hill mine is shaping up to become one of the country's most valued iron ore operations, recently making national headlines for its hallmark pink truck campaign, string of awards, and dedicated learning centre set to inspire the future generations of miners.

ELIZABETH FABRI

ROY Hill mine's journey from construction to completion and subsequent ramp up has been nothing short of impressive.

After battling a series of red tape obstacles in its early years, once Roy Hill obtained regulatory approvals the race was on to bring the \$10 billion mine into production.

In December 2015, Roy Hill celebrated its first ore shipment, followed by practical completion in May 2016 after Roy Hill Holdings took over the reins from EPC contractor Samsung in February.

Since this time, the Pilbara mine has been ramping up towards its 55 million tonne per annum run rate.

Initial estimates forecast the mine to hit its goal by the end of 2016, but in September Roy Hill pushed back its target to early 2017.

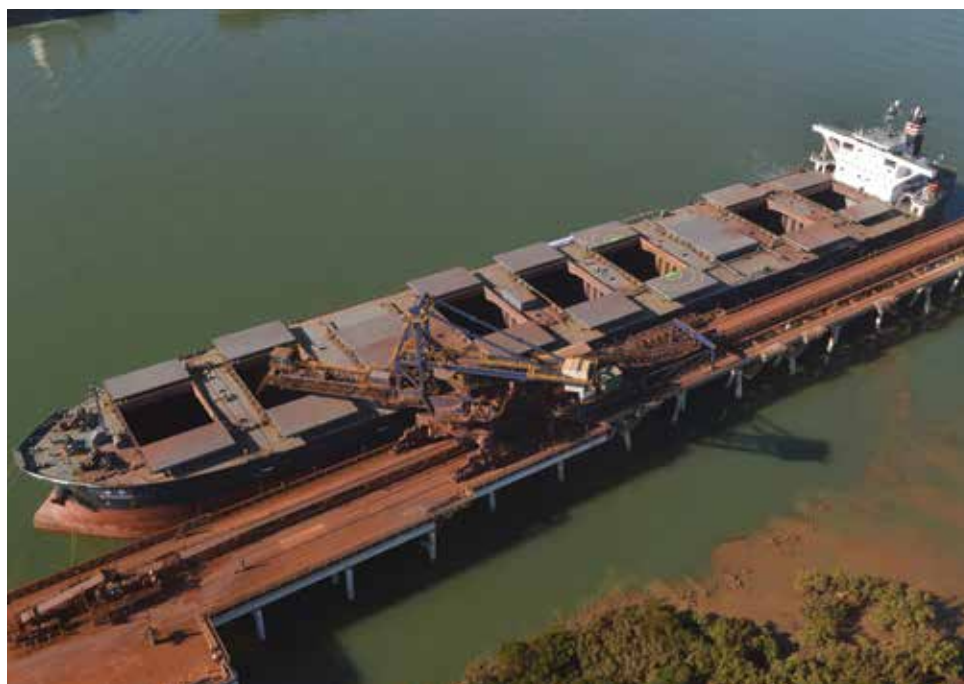
Roy Hill Holdings chief executive Barry Fitzgerald said the company hoped to achieve the run rate in the first half of 2017, attributing the delay to unexpected plant issues.

"Basically we anticipate reaching ramp up this year in the first half," Mr Fitzgerald said.

"There has been a number of plant issues which we are working our way through but we're still happy with our progress."

Mr Fitzgerald said the mine encountered some minor equipment faults in 2016 which was not uncommon to new operations.

"It was really finetuning the plant and making sure we get the reliability out of it, so there was various bits of equipment that might have worn out quicker than expected, or small tweaks to the design, but nothing significant," he said.



Roy Hill's dedicated two berth iron ore facility.

"In the last 12 months, or so, we have shipped 25 million tonnes, so what we're doing is we're slowly ramping up to the capacity.

"We've been doing about two and a half to three [million tonnes a month] most recently but will expect to see that improving up over the next couple of months."

Learning centre launch

In December, Roy Hill Holdings launched ROC-ED; a new interactive learning facility designed to further mining education in WA

high schools.

Based at Roy Hill Holding's corporate headquarters and Remote Operations Centre (ROC) in Perth, the state-of-the-art centre would act as an excursion opportunity for students, aligning with the Year 8 curriculum.

Speaking at the opening, Mr Fitzgerald said the decision to open the centre was to enable students to learn more about Roy Hill's operations in the context of their broader learning in school.

"They will also explore what it takes to build a career in mining and the importance

of the mining industry to the national economy," he said.

Mr Fitzgerald said the centre would also be an avenue for students to explore a career in engineering and other science related fields.

"More importantly the centre will give them an understanding of the variety of jobs that are available, and also make sure we can encourage girls and women to enter the mining industry," he said.

The half-day program would enable students and teachers to observe Roy Hill Holding's real time operations by looking down into its ROC; take part in a number of interactive displays on programming autonomous vehicle models; and learn about investing in the mining industry and economic impacts of not investing, environmental issues, and working with traditional owners.

"There's a variety of those sorts of applications as well the last screen where people can highlight what their interests are and then track it down to find what sorts of careers that they might find in the mining industry," he said.

"This will help them get an appreciation of the diversity of jobs that they might find in the industry and gain their interest.

At the opening the centre, Roy Hill welcomed a visit from students and teachers from Kent Street Senior High School as well as WA education minister Peter Collier.

"We now have got a number of groups to be hosted over 2017," Mr Fitzgerald said.

"We have had strong interest from the schools to come along and certainly the feedback we received from the Kent Street Senior High School was very positive."



Roy Hill has an initial mine life of 17 years.

Employment opportunities

The learning centre launch also coincided with an announcement from Roy Hill Holdings that it would hire 500 workers over the next 18 months.

While the job count was part of the company’s initial workforce allocation, the news instilled a great sense of optimism across the sector, particularly for workers looking for a break into the resources sector.

“The way we have developed the orebody is that our mining activity ramps up from a lower strip ratio very first, and over the next couple of years it ramps up to final steady state numbers,” Mr Fitzgerald said.

“So the additional jobs we have are primarily associated with the mining activities in terms of operators, drill and

blast, surveyors and geology, and then obviously in the maintenance area of those operations in terms of the mining equipment.

“We’re going from our current 1300 strong workforce to probably 1900/2000.”

Mr Fitzgerald said in terms of the recruitment process, the company favoured the values and behaviours of prospective employees over skills and experience.

“We certainly see people who haven’t had a lot of experience in the mining industry but who would appreciate an opportunity, what we call green operators or people new to the industry, and we’re certainly encouraging them to come in if they’ve got the right attitude and right behaviours,” he said.

“We see that we can give them an opportunity to join the industry and bring



The mine loaded its first shipment in December 2015.

their different experiences to the business.

The company has also run a series of assessment centres tailored to traditional owners, aboriginal people, women, and jobseekers new to the industry, where the team gives them an idea of what they might find from fly-in, fly-out work.

“We’ve been quite progressive in trying to reach out to different groups in a positive way to give them a positive experience about understanding what they have,” he said.

Industry recognition

In 2016, Roy Hill mine was the recipient of eight prestigious awards for its environmental work, engineering and project management.

Awards included *Project of the Year* at

the 2016 Project Management Institute Australia for constructing the greenfields project on time and on budget; 2016 *Golden Gecko Certificate of Merit*; 2016 *Railway Technical Society of Australasia Railway Project Award*; 2016 *Australian Mining Prospect Awards Excellence in Environmental Management award*; the 2016 Engineers Australia (WA) *Australian Engineering Excellence awards for Engineering Distinction, Resource Development, and Project Management*; and most recently the Association of Mining and Exploration Companies (AMEC) *Environment Award* in December.

“Obviously winning the awards was a culmination of the recognition of the effort and work the people have done,” Mr Fitzgerald said.



Photo used with permission

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Our team is proud to have helped Roy Hill deliver the project on time, on budget and to the standards required to support its business long into the future.



"WE'RE GOING FROM OUR CURRENT 1300 STRONG WORKFORCE TO PROBABLY 1900/2000."

"It's certainly really pleasing and I think it's probably more pleasing for all the people involved."

"The fact that there's been a variety of awards that we have got means a whole group of people across different disciplines have been recognised."

Mr Fitzgerald said from an environmental perspective the awards recognised the company's efforts in effectively managing and minimising environmental impact during construction.

"In particular it was about the Port facility where we had a major conveyor which was extending onland across mangroves to where the wharf was," he said.

"Mangroves in Port Hedland is a very sensitive area and we managed to minimise the footprint by developing a specific construction technique which reduces footprint on mangroves much below what we had approved, so I think

that was a very positive issue and I think the recognition was in fact that you could do good engineering and still be very environmentally sensitive and also be cost effective in the way we did it."

The company has also been praised for its ongoing "Pink Trucks for Breast Cancer Awareness" campaign at its mine site.

Launched in May 2016, the initiative first saw the arrival of four pink trucks to raise awareness for breast cancer and highlight opportunities for women in mining.

On 28 November, Roy Hill welcomed nine additional pink trucks on site, increasing the number up to 12.

"I am extremely proud of the way staff across all of our operations have rallied behind Mrs Rinehart's Pink Truck initiative and have gone above and beyond to raise funds for this extremely important cause," Mr Fitzgerald said.

"Roy Hill has one of the highest percentages of female employees in the

iron ore and West Australian mining industry, a statistic that we are extremely proud of."

Embracing technology

Over the next 12 months, Roy Hill has set its sights high across all facets of business from production, through to community initiatives and advancing technologies and innovations.

"The key focus that I see for 2017 is to ramp up and move into a steady state operation, which will allow us to get on with business and then provide a platform for us to continue to work on cost-effectiveness, cost reduction and productivity," Mr Fitzgerald said.

"This will also provide us with an opportunity to continue working through implementing the various technology opportunities that we see."

Mr Fitzgerald said the mine has

employed a number of technologies since its inception, including trialling a robotic refueller for trucks; remote dozers; cameras on diggers; and the use of drones for surveying and environmental purposes.

"We've gone to analytics; and we're working closely with vendors and research organisations, and we're looking at various wearables and other systems for monitoring fatigue," he said.

Being a new company, Mr Fitzgerald said Roy Hill was trying to strike the perfect balance between achieving its ramp up, and learning how to drive its business reliably and consistently by maintaining cost competitiveness.

"It is important that whilst there is relief from the forecast downward trend in iron ore, all the economic and market forecasts are still predicted to reduce, so we have to drive our costs lower and technology is the way to do that," he said.





Pushing forward

On the back of a tough year for production, Middlemount Coal has its eyes on the future as it continues to advance plans for a north east extension.

ELIZABETH FABRI

PEABODY Energy and Yancoal Australia’s incorporated joint venture Middlemount Mine has been producing semi-hard coking coal and medium-volatile pulverized coal injection (PCI) coal since November 2011.

With JORC compliant measured and indicated resources and proved and probable ROM reserves amounting to 123mt and 96mt respectively, and an initial mine life of 24 years, the open cut mine in Queensland’s Bowen Basin has significant potential.

While 2015 was a step forward for production with a 10 per cent increase on the year prior, Middlemount Coal’s results took a step back in 2016.

“Production at the Middlemount joint venture was down 15 percent year-on-year, attributable to recent wet weather interruptions to open cut activity during the reporting period,” Yancoal stated in its September quarterly report.

The company’s March and June reports also mirrored this result, listing weather disruptions as the primary reason for a slump.

In July, further obstacles were faced when the Federal Government knocked back Middlemount’s plans for a north east extension, declaring the company’s referral as a “controlled action” due to possible impacts on the community and the environment.

Currently, ROM coal produced at the mine is washed at a 5.3mtpa capacity onsite facility, and beneficiation is performed in a 700t per hour single stage, two product coal handling and preparation plant.

Coal is then transported by rail to the Dalrymple Bay Coal Terminal and Abbot Point Port for export, with marketing undertaken by Yancoal on behalf of the joint venture.

Production updates

At the end of June 2016, Yancoal remained optimistic about Middlemount’s production levels despite reporting a four per cent dip, and nine per cent slump in the previous quarter.

“Strong production rates and consistent



All images: Middlemount Coal.

throughput at the Middlemount joint venture (Yancoal 49.9997 per cent ownership), offset wet weather impacts experienced at the start of the reporting period, with yield improvements and operational efficiencies securing ROM coal production of 2.6mt (2015 2.7mt) and saleable coal production of 2.0mt (2015 2.1mt),” Yancoal stated in its preliminary half-year report.

“Middlemount production outlook for the year ahead remains positive, with expectations of 4.1-4.2mt of saleable coal.”

In the September quarter production levels dipped 15 per cent from the 2015 corresponding period, with December quarter results still yet to be released.

Mining services continued to be carried out by NRW Holdings’ wholly owned subsidiary Action Drill & Blast, which had provided contracting services at the mine since July 2011.

In February 2015 Middlemount Coal awarded Action Drill & Blast a three-year, \$330 million extension to the contract to provide ongoing maintenance services for the fleet that comprised two 550t excavators,

four 350t excavators and one 190t excavator; 17 220t dump trucks, nine 190t dump trucks and six 140t rigid dump trucks; one D11 dozer and five D10 dozers; three water carts; and two 16M graders.

In June 2016, the contract was extended further so Action Drill & Blast would provide its services out to 2020.

Extension plan

Middlemount Coal has been working towards obtaining approval for an extension to the north-east of its project for years.

In June 2012, the Middlemount Coal Mine EA was amended to approve the expansion of open cut mining operations within Mining Leases (ML) 70379 and 70417 (Stage 2), which was further amended in October 2014.

The proposed expansion would extend the currently approved East Dump beyond part of the eastern extent of ML 70417 using the same overburden emplacement methodology employed at the mine.

“The extension will alleviate the ‘saw tooth’ layout of the currently approved

dump design which will in-turn improve the efficiency of the mine plan and reduce the area of the dump slope that requires rehabilitation,” Middlemount Coal stated.

“The existing dump design would reduce the length of the external dump slope by approximately 10 per cent.

“The rehabilitation of dump slopes (or batters) is typically the most difficult component of dump rehabilitation.

“Decreasing the area of slope that is required to be rehabilitated would decrease rehabilitation costs.”

In May 2016, Middlemount Coal lodged a referral with the Department of Environment and Energy for the extension within ML 700014.

In the report, Middlemount stated it anticipated construction and operational activities associated with the extension to begin “as soon as practicable” after necessary approvals and licenses had been obtained.

On 7 July, the Government declared the extension a controlled action due to likely impacts on communities and listed threatened species; koalas, squatter pigeons and south-eastern long-eared bats.

In response, Middlemount submitted an EPBC Act Preliminary Assessment Documentation report in November, in which it proposed mitigation measures to reduce impacts along with an Offset Management Plan/Vegetation Management Plan draft.

“A biodiversity offset package addressing the potential significant impact on the Squatter Pigeon (southern) has also been proposed by MCPL,” Middlemount stated in the report.

“In addition, the proposed offset area would provide suitable habitat resources for the Koala and South-eastern Long-eared Bat.

“The biodiversity offset package has been developed in accordance with the Commonwealth EPBC Act Environmental Offsets Policy (and the EPBC Act Offsets Assessment Guide) via a land-based offset which would compensate for the loss of approximately 181 hectares of potential habitat for the Squatter Pigeon (southern), Koala and South-eastern Long-eared Bat.”

Since providing the supplementary information, Middlemount Coal was now awaiting final approval from the department.

Improving cast blasting at Middlemount

AN initiative to improve cast blasting outcomes at the Middlemount coal mine in Queensland contributed to increased mine production and cost efficiencies by freeing up a whole digger fleet for more productive work.

Integrated drill and blast contractor Action Drill & Blast (ADB), which has been responsible for managing all production drilling and blasting activities at Middlemount since 2011, investigated means to improve the mine's cast-doze-dig process in conjunction with mine owner Middlemount Coal Pty Ltd and engineering consultants.

The improvement program focused on implementing tools and methods that would deliver reliable and efficient results for the best value, rather than simply using more explosives.

A key opportunity identified was the application of electronic initiation systems.

The technology is particularly well suited to cast blasting projects where creating the muck pile profile to suit the digging fleet or eliminating the need to dig it all together, is just as important as the primary objective of fragmenting the rock.

Before launching the initiative, cast blasting at Middlemount was achieving cast to the final position of under 20 percent, versus an optimum outcome of over 33 per cent of material to the final position.

Following the trial period, cast percentage increased significantly, which freed up a whole digger fleet for other production activities.

The application of electronic initiation systems at Middlemount has also provided



With one of the largest, modern drill fleets in Australia, ADB offers integrated, end-to-end drilling and blasting services.

other benefits, including improved vibration control as the pit moved towards a major water pipeline serving a regional town.

Because of the accuracy of the system's timing function, the explosive energy

releases at the exact time it is set to, with no unplanned spikes.

With this capability, the ADB team at Middlemount successfully fired within 100m of the pipeline with no damage caused.

ADB celebrated another performance result in July when it hit a safety milestone after reaching 2000 days LTI-free at the project – a testament to the success of its best practice safety system, ActionSAFE.

ADB remains LTI-free at Middlemount.

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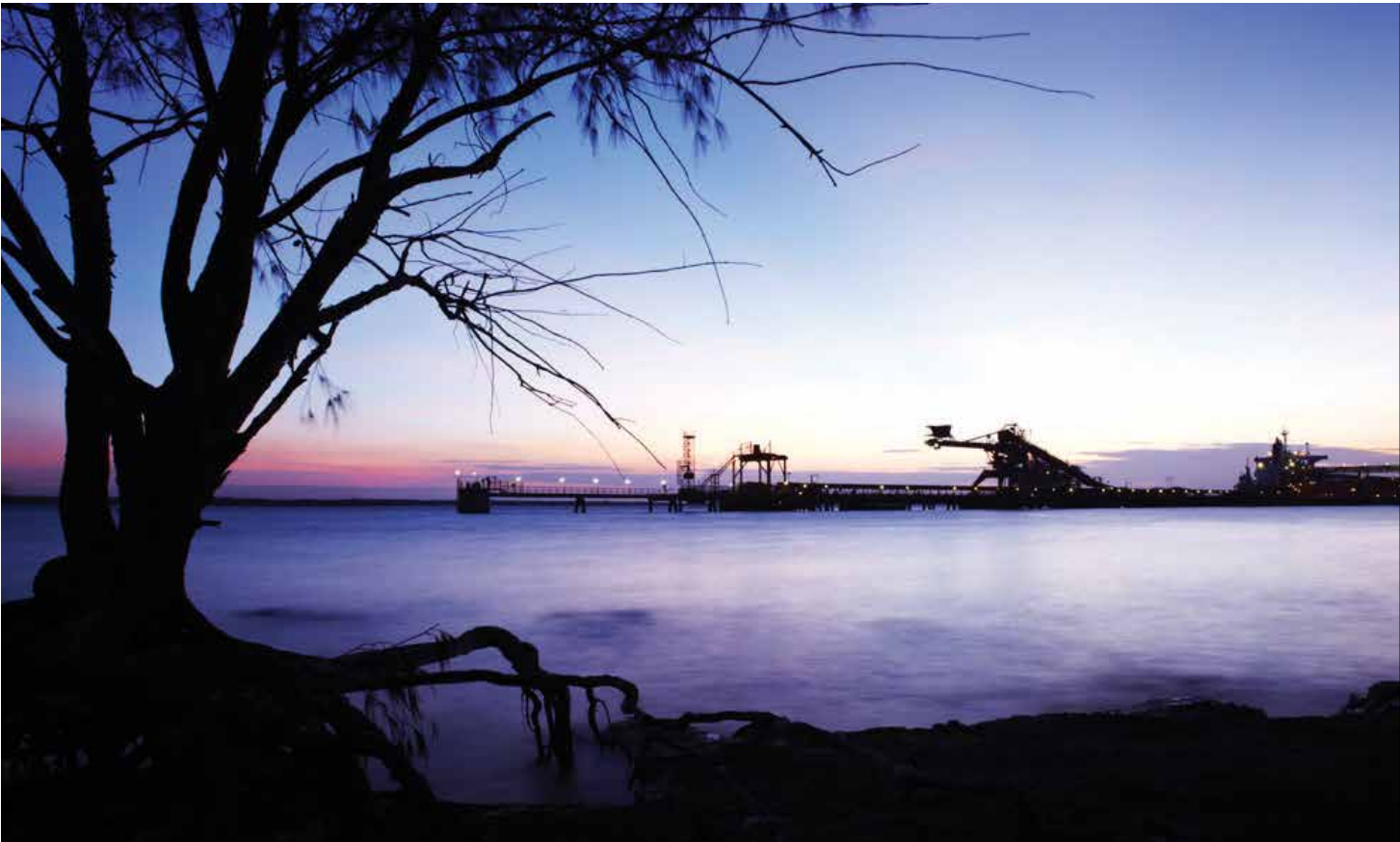
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\$1.3bn a year will be added to the QLD economy once Amrun is up and running. All images: Rio Tinto.

Life extension

Another 40 years of mine life at Rio Tinto’s Weipa bauxite operations will provide an ongoing range of employment opportunities for communities in the remote far North Queensland region.

CAMERON DRUMMOND

THE development of Rio Tinto’s \$2.6 billion Amrun bauxite expansion project near Weipa in the Western Cape York region of far north QLD continues to gather pace.

Rio has mined bauxite at Weipa for more than 50 years, and almost a decade ago began to investigate the possibility of building a new mine on part of its existing lease to the south as current reserves were gradually depleted.

Weipa currently consists of two continuous mining operations, East Weipa and Andoom, which includes two beneficiation plants, 19km of ore transport rail, two stockpiles and two ship loaders.

The new development will eventually replace the existing East Weipa mine centre and develop bauxite reserves south of the Weipa Peninsula toward Aurukun, extending mine life by about 40 years at a production rate of 22.8 million tonnes per annum (mtpa), with an option to boost production to 50mtpa.

The project includes the construction of a range of infrastructure including a processing plant and port near Boyd Bay; as well as a dam, tailings storage facility, roads and a ferry terminal on the nearby Hey River to transport workers from Weipa to the mine.

Construction is planned to take three years, and at its peak would employ about 1100 people.

QLD Natural Resources and Mines minister Dr Anthony Lynndham said the government had worked closely with Rio to create jobs and strengthen the state’s economy.

“The independent Coordinator-General declared the Amrun project a significant project (now coordinated project) more than eight years ago,” Dr Lynham said.

“The Coordinator-General continues to work closely with Rio to progress this important project for the region, the local community and the state’s economy overall.”



The beneficiation plant at East Weipa.

First bauxite from the mine is scheduled to be delivered by 2019, and is tipped to contribute \$1.3bn annually to the QLD economy.

Progress

Rio said Amrun was advancing to scheduled completion in both engineering and construction, with all major contracts committed as planned.

The 40km main access road was completed in December 2016, with the river terminals expected to be operational this quarter.

Site establishment was also progressing with the construction of its 470-bed accommodation village.

Rio said it was committed to providing access to opportunities for local and Indigenous businesses and community members to benefit from the project.

“It is the project’s intention to ensure that any Indigenous training initiatives undertaken are not just for the sake of

training, rather developed as a pathway toward meaningful employment,” the company said in a statement.

Increased bauxite mining once Amrun ramps up would also secure future employment of about 2000 people at the Yarwun and QLD aluminium refineries near Gladstone.

As part of Amrun’s ramp up, Rio awarded a number of key contracts for the development of the mega-bauxite project in December last year.

WA-based marine services provider Baghwan Marine was awarded a contract for the supply of personnel, vessels, plant and equipment; with a significant number of the contractor’s workforce consisting of Indigenous employees from the region.

Indigenous Coxwain traineeships would be handed out, whereby trainees completed a two year program consisting of four weeks pre season training, 20 months on-the-job training and four weeks post sea training.

“We will be supplying a variety of tugs, barges, multi-cats and crew transfer vessels to Amrun which is a huge win for us not only in terms of fleet utilisation, but also in providing two years of ongoing work security to some of our amazing crews,” Bhagwan managing director, Loui Kannikoski said.

“Creating new work opportunities for some of the local community is also very satisfying for us.”

“INCREASED BAUXITE MINING ONCE AMRUN RAMPS UP WOULD ALSO SECURE FUTURE EMPLOYMENT OF ABOUT 2000 PEOPLE AT THE YARWUN AND QLD ALUMINIUM REFINERIES NEAR GLADSTONE.”

Another WA-based firm, Civmec, was awarded two significant contracts totalling \$160m to develop the processing facility at Amrun.

The larger of the contracts was for the construction of the processing facility – including a bauxite beneficiation plant and associated water, electrical and lighting systems – as well as 11,800 tonnes (t) of steel and precast concrete.

The second contract – awarded by Sandvik – included the part supply, fabrication, surface treatment, mechanical and electrical install and the modularisation of a stacker, reclaimer and shiploader for bauxite material handling.

Last month, Rio awarded a \$70m bulk earthworks contract to QLD-based civil engineering firm QBirt to develop Amrun mine infrastructure.



Employment opportunities in Far North QLD have been given a boost by the Amrun project.

It included about 40km of sealed access roads and the haul road network, and would generate up to 150 jobs to support an existing workforce of 1400 people at Weipa's bauxite operations.

QBirt was also tasked to develop the mine stockpile zone, tailings and separation ponds, as well as other critical site infrastructure.

Rio Tinto Growth & Innovation group executive Stephen McIntosh said the roads and other infrastructure to be developed by QBirt are essential to the future Amrun operation.

"QBirt not only brings more than 30 years' experience in the industry, but shares our commitment to developing a strong and sustainable safety culture at Amrun."

QBirt is currently undertaking construction of the tailings facility at Rio Tinto's Yarwun alumina refinery, and had previously completed 300,000sqm of embankment and 7km of mine haul roads at Rio Tinto's Weipa bauxite mine.

"THE COMPANY PRODUCED 3.6MT OF ALUMINIUM IN 2016; A SEVEN PER CENT INCREASE YEAR-ON-YEAR OF WHICH 832,000T (26 PER CENT) WAS ATTRIBUTED TO ITS AUSTRALIAN OPERATIONS."

Production

Bauxite

Annual production records at Rio's two Australian bauxite mines were achieved at Weipa, which benefited from increased plant throughput, and Gove in the Northern Territory which recorded system improvements.



A ship being loaded at Weipa operations with bauxite stockpiles.

In 2016 Weipa produced 29.4mt of bauxite, a 6 per cent rise from 27.6mt the previous year, while Gove showing a 21 per cent year-on-year increase in production from 7.5mt to 9.1mt.

Bauxite production of 47.7mt during 2016 was nine per cent higher than 2015 and above guidance of 47mt.

The company said total production was expected to be between 48mt and 50mt of bauxite, 8.0mt to 8.2mt of alumina, and 3.5mt to 3.7mt of aluminium.

Aluminium

Rio produces aluminium at three smelters across Australia; Bell Bay (Tasmania), Boyne Island (QLD) and Tomago (NSW).

Annual production at Bell Bay was down for 2016 to 182,000t compared with 191,000t the previous year; whereas Boyne Island and Tomago posted slight increases for a combined annual output of 650,000t, up 7000t from 2015.

The company produced 3.6mt of aluminium

in 2016, a seven per cent increase year-on-year, of which 832,000t (26 per cent) was attributed to its Australian operations.

Rio's achieved record annual production at ten of its smelters, most notably at the modernised and expanded Kitimat smelter in Canada, which had ramped up to nameplate capacity since April 2016.

Alumina

Rio's two Australian refineries near Gladstone, QLD, had a combined annual output of 6.3mt last year and accounted for more than 75 per cent of the company's global tally – a marked increase over the 5.8mt of alumina produced in 2015.

This was due to an 11 per cent rise in annual production at the Yarwun alumina refinery, which had an output of 3.2mt; while Rio's share of nearby Queensland Alumina's production remained level at 3.1mt year-on-year.



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INDUSTRY PROFILES

COMPANIES GEARING UP

Durable Australian-made goods improve safety

TOWNSVILLE-based company Beehive Vinyl Products has provided an extensive range of custom-made vinyl, shade cloth, canvas and industrial textile manufactured goods since its establishment in 1978.

Beehive's products and services cover a large range of sectors – from heavy industry, transport, agriculture, mining and local infrastructure to promotional defence and specialised industrial applications.

The Australian owned-and-operated company is well known for its patented Beehive tool bags – the preferred choice of many leading national and international companies and individual trade workers and technicians.

It has a strong Australian client base as well as many global clients at locations such as South Africa, Mongolia, Africa, the UK, Canada, Indonesia, Papua New Guinea and New Zealand.

Beehive has designed and manufactured tool bags for more than 18 years, using high-quality Australian-made vinyl materials to ensure they are safe, comfortable and built to last.

By manufacturing its products in house, Beehive ensures its products maintain a superior quality.

All Beehive tool bags consist of a high density polyethylene base; UV and chemical resistant thread; ergonomic anti-slip cushioned shoulder pad; UV-resistant seatbelt webbing, and quality workmanship – to ensure that tools are safely contained and protected.

The vinyl also has fire retardant properties, tested to parts 2 & 3 of AS1530 standard, to meet Australian building codes for fire retardant materials.

Clients' safety is paramount for the company, which prides itself on manufacturing quality tool bags that will not rip or tear on site – this is known to



More information can be found at www.beehivevinyl.com.au.

happen with inferior imported products, resulting in tools falling from great heights and potential injury.

Beehive's large range caters to specific trades and tool requirements, with add-ons offered.

Tool bags can also be custom-made to suit specific requirements and tools – whether it is a slight alteration to an existing design, different colours or something completely new.

The size, depth and width of pockets can be adjusted and corporate logos, names, or

promotional printing can be added.

The company can also fabricate detonator bags, tool rolls and pouches, document bags, crib bags, esky bags and portable hard drive bags, IBC pod covers and oil drum covers.

Beehive's range of tool bags can be purchased through a number of its reseller partners including: J Blackwoods, MM Electrical and Merchandising, Haymans Electrical, TLE Electrical, Hagemeyer, L&H, Auslec, Rexel Electrical Supplies, EIW Electrical Industrial Wholesalers,

CNW, Tiger Tek, Integrated Industrial Mining Supplies, CMPS Supply Solutions, TEAK Industrial Supplies, Sullivans Hardware and Cows Parts.

New resellers are welcome to contact the company.

Beehive also custom fabricates a large range of other products shade sails, dam liners, tarps, machinery and equipment covers, equipment bags, dust curtains, industrial upholstery, to secondary containment liners and many others products.

A blueprint for wealth generation

THE mining industry has experienced a slowdown for the past couple of years, and as wages and jobs become tighter many people in mining have used this period as an opportunity to make sure they are getting ahead financially.

Many people seeking advice from Blueprint Wealth complain that they do not feel like they are making the most of their current income.

They feel as though their time spent in mining earning high wages should have them in a better position than they currently are.

The team at Blueprint Wealth are big believers in not being able to change the past, but learning from it.

"Working in the mining industry can be lucrative and we see many high income earners establish large amounts of investments; these people work hard and don't have a lot of time to spend in this area so they use a company like ours that specialises in building wealth," Blueprint Wealth director David Baruffi said.

Financial planning is about looking at an individuals' current situation, working out what is best for them, then helping that person put that best practice into place.

Every good financial plan needs to be regularly reviewed. Situations change – it



Blueprint Wealth financial advisor Brad Martin presenting at the Kanowna Belle mine site in Kalgoorlie, WA.

could be a person's job, income, house upgrades or having another child. All of these impact the original plan put in place.

Blueprint Wealth can assist people to make the most of their incomes and help them feel like they are getting ahead financially and not just "spinning their wheels".

The company sits down with clients and

puts plans in place to get them on track to maximising their financial position.

Over time, Blueprint Wealth can show people the benefit and reward of sticking to their tailored strategy.

Blueprint Planning Pty Ltd (ABN 78 097 264 554), trading as Blueprint Wealth, is an Authorised Representative and Credit

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This article contains information that is general in nature and does not take into account your objectives, financial situation or needs. Therefore, before making any decision, you should consider the appropriateness of the advice in regards to those matters.

A force for mining

FOUNDED in 1987 in the WA goldfields region, Force Equipment has built its reputation based on performance and service excellence.

The company offers an unwavering commitment to customer service, with quality machinery presented to the highest industry standards.

Force Equipment has developed its capabilities to provide an integrated service nationally for earthmoving equipment hire, sales, and maintenance for mining, construction, and infrastructure projects.

Force Equipment has operations and large workshop facilities in Perth, Kalgoorlie, Port Hedland and Mackay.

With an experienced and professional maintenance team of more than 200 staff and a fleet of 170 heavy earthmoving machines, the company has the resources to deliver trusted solutions to its clients.

Force Equipment is engaged in several mining projects throughout the Goldfields and Pilbara regions of WA.

The primary function is to supply complete, fully maintained mobile mining fleets engaged in all activities; including ore and waste cartage, ROM feed equipment, and rock breaking services.

The projects are supported by Force Equipment's 24-hour maintenance teams which include trades personnel, servicemen, and support staff.

For the past 28 years Force Equipment has carried out maintenance and repairs to its own mining fleet, while also completing service and repairs on client equipment. Heavy equipment maintenance is in the company's DNA.

Along with its expansive range of services, purpose-built workshops and 28 year history of heavy equipment maintenance, Force



Force Equipment has been providing a range of services to the mining industry for more than 30 years.

Equipment offers clients the same cost saving benefits for all maintenance needs – from minor works to full component and machine rebuilds.

Force Equipment has continually been successful with securing service maintenance agreements with major mining companies for supply and repair of heavy earthmoving machinery components, Boiler making services and site labour supply.

All work completed by Force Equipment is backed by warranties equal to, or better than, the major OEM's and is viewed as a highly viable, cost effective alternative for all heavy equipment maintenance.

Force Equipment's continued dedication to maintaining a high quality range of

services for its clients and own machines has seen the company invest in a new Power Test 45X07 Water Brake Engine Dynamometer, capable of applications ranging from 200 HP to 3200 HP.

The dyno is being manufactured at Power Test's US based factory and will be installed and ready for use at Force Equipment's Perth workshop in early 2017.

Once the dyno is up and running Force Equipment will be able to reduce its cost base and waiting times, both of which will result in cost savings to clients.

Force Equipment provides a safe and enjoyable working environment in which its people are challenged to excel.



More information can be found at www.axishire.com.au or by calling (08) 9791 8300.

Re-imagining long-term fleet hire

FORMERLY Brogen Hire, Axis Hire has provided high-quality vehicle hire solutions to the Australian mining, civil and construction industries for the last decade.

In this time, the business has become the foremost family-owned long-term project hire company in Australia, with support from major international organisations.

Axis specialises in customised long-term truck and plant hire.

The foremost priority is offering tailor-made solutions for every project undertaken.

Every client is unique, and providing solutions that are tailored to specific demands helps offer clients the optimisation of time, money and resources.

To achieve this signature level of efficiency, Axis undertakes a thorough yet detailed approach.

That could mean re-imagining work processes and logistics, procuring machinery, or engineering new equipment; whatever it takes to maximise value.

While size is important – the company does have a vast fleet – getting the little things right is most important.

Axis listens carefully and thinks about the whole project, subsequently offering a solution that considers all factors; cost, scalability, maintenance, safety, and features.

The end goal is to offer value that can meaningfully impact and improve a client's business.

Axis takes pride in a thorough understanding of the industries it caters to, and works painstakingly at understanding specific businesses; and this is what sets the company apart from industry peers.

By expediting decision-making, staying approachable, remaining flexible and always valuing attentive customer service, Axis ensures that clients are free to focus on their business.

Axis' experience in the industry spans decades, which gives the company a panoramic understanding of equipment suited to client requirements.

Its fleet is updated with the latest models of thoughtfully-procured equipment, ensuring that clients are offered the best rates for the most advanced vehicles.

Needless to say, every vehicle is spotlessly maintained and serviced – safety and reliability is not negotiable.

Additionally, it is in Axis' repertoire to source the right vehicle make and model best suited to the project, whether it is a coach, truck, bus or a highly-specialised custom-featured vehicle.

Axis is happy to discuss potential projects in detail, and analyse how it can best assist in getting the job done.

Renewable energy solutions for mine sites



Vector Energy has one of the largest energy storage teams in Australia.

VECTOR Energy, part of the Vector group in New Zealand, is bringing its proven track record in the integration of energy storage solutions to the Australian mining industry.

Vector Energy has one of the largest energy storage teams in Australia.

Utilising their knowledge, experience and technology, they can design, install, commission and integrate robust and fit-for-purpose solutions for mining's most stringent applications.

Delivering practical end-to-end solutions for its customers, Vector Energy has a

full service offering including energy storage integration utilising innovative battery technologies, renewable hybrid power systems and microgrids, solar power generation, virtual power stations, performance monitoring and control, and project financing options for approved customers.

Vector Limited is leading the integration of disruptive technologies and has integrated one of the largest energy storage systems in the Southern Hemisphere utilising Tesla Powerpack.

In October 2016, Vector integrated a 1MW/2.3MWh energy storage system on a substation that could help to reduce peak demand, extend the life of the substation and provide supplementary power to improve reliability.

In terms of investment, it also allows Vector Limited to defer large-scale expenditure in conventional infrastructure that may in time become obsolete.

Vector Energy will work with individual clients to understand their businesses' energy needs and offer a tailored solution.

Transition to TETRA radios

THE ability to communicate on worksites is paramount to the safety and productivity of any business; in the world of mining, the necessity for effective communication is even greater.

Operating in the hazardous mining industry requires infrastructure that supports workers safety; a demand that continually evolves the way businesses communicate.

Previously, conventional Factory Mutual (FM) radios had been sufficient in safely connecting workers across sites, however developments in frequency utilisation and digital technology have seen the adoption of TETRA (Terrestrial Trunked Radio) systems across a significant number of Australian mines.

Throughout Oceania, BHP Billiton, Rio Tinto, and Origin Energy have all benefited from the scalability and interoperability that TETRA systems provide.

Workers now have the ability to communicate smarter and quicker due to features like Direct Mode Operation (DMO), Trunked Mode Operation (TMO), extended coverage, emergency calls, and multiple redundancy features that safeguard connections at all times.

As a system designed to handle high traffic volumes, TETRA networks go beyond conventional infrastructure by integrating mobile and data technologies.

With Time Division Multiple Access (TDMA), users benefit from four channels on each frequency and can engage in both point-to-point and point-to-multipoint connections.

This feature enables communication across large groups quickly, securely, and



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more efficiently than ever before.

The range of Intrinsically Safe, ATEX rated TETRA handsets can be found at TR Hirecom, Australia's largest two way radio rental company.

In particular the Motorola Digital Tetra MTP8550Ex, which comes with built-in GPS, 'Man Down' alarm, superior voice clarity, and a sweep of other features ideal for use in hazardous

environments.

More information on how modern communication can improve safety and productivity can be found by contacting TR Hirecom on 1800 222 327.





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Turning night into day

Energy saving is only the beginning

While the energy saving benefits of LED lighting are widely known, new generation LED technology allows WADCO LED fittings to be completely reimagined and redesigned to client needs, giving rise to numerous advantages in addition to energy savings.

Directional lighting

One of the recurring frustrations of HID fittings is uncontrolled spill. New generation LED technology allows WADCO LED fittings to be tailor-engineered with superior cut-off capabilities to focus light on specific areas requiring illumination thereby eliminating unwanted spill and direct glare.

Colour consistency

HID and earlier generation LED fittings are notorious for the significant colour deterioration that occurs as they age. New generation LED technology, on the other hand, ensures WADCO LED fittings deliver consistent crisp clear light during the lifecycle of the fitting.

“Turtle friendly” solutions

Coastal environments are increasingly difficult to illuminate because of growing sensitivity around the impact artificial lighting may have on coastal areas. WADCO LED fittings ensure the correct wavelength of light is delivered in accordance with regulatory requirements.



WADCO LED fittings deliver crisp clear white light in the background.

Reduced maintenance

New generation LED technology delivers significantly improved reliability and longevity compared to HID light sources and earlier generation LED technology. Reputable manufacturers warrant their technology for a minimum of 5 years. WADCO LED fittings correctly installed have a life span of at least 10 years and allow a “set and forget” approach to facilities lighting management.

Auxiliary lighting

WADCO LED fittings can incorporate an inverter and battery unit which provides auxiliary lighting for up to 3 hours in the event of external power loss.

Lighter smaller fittings

New generation LED technology is both much smaller and lighter than traditional HID light sources. Miniaturisation of

technology allows WADCO LED fittings in stainless steel and aluminium to be less in size and weight than their HID counterparts. Reduced size and weight makes installation easier and imposes less fatigue on lighting support infrastructure.

HID Retrofit Options

The lifespan of HID fittings can be extended and improved by replacing the HID light engine with a WADCO LED retrofit kit without having to replace the existing HID fittings.

Coal Ship Loader – A picture is worth a thousand words...

The photograph of a recently commissioned coal ship loader visibly contrasts the crisp clear white light of the WADCO LED fittings on the coal ship loader above in the background with the uncontrolled spill of the HID dock lights in the foreground.

The absence of spill or glare reflects the superior cut-off characteristics of WADCO LED fittings.

In addition, WADCO LED fittings deliver well-defined directional light distribution ensuring uniform illumination. Constructed from 316 stainless steel, WADCO LED fittings offer the owners of the coal ship loader superior performance, guaranteed longevity and the ability to future-proof their investment.

More information on WADCO Lighting can be found by visiting: www.wadco.com.au.

Improving steel casing in underground mines

INSTALLING steel casing for paste fill, service holes and rising mains using conventional welded methods can be time consuming and costly for underground mining projects. Depending on the requirements, it can take days to install and necessitates additional labour and equipment hire such as boilermakers, chairing frames, cranes or Integrated Tool Carriers.

Following a rigorous development process, underground mining specialist PYBAR Mining Services is now offering an improved solution.

“Our specialist drilling division recently received a tender for ITH drilling and installation of steel casing for paste fill application,” PYBAR chief operating officer Brendan Rouse said.

“With the company’s core values of safety, service, respect and results front of mind, the team identified an opportunity to streamline the drilling and installation process by using one drill to conduct the drilling, reaming and casing operations while also improving safety, efficiency and reducing delays associated with craning, suspended loads and hot work in an underground environment.”

The new method, designed in collaboration with steel casing manufacturers and engineers, not only cuts project timeframes; it also reduces the manual handling and logistical issues encountered with the welded method, and completely eliminates hot work.

The ability to lift, rotate and lower the casing mitigates some of the risk associated with the casing hanging up or becoming stuck part way down the bore hole.

The threaded casing system features specially designed joints comprising of external couplings with machined tool joints, specialised installation tooling, and casing hanger.



A typical set up for reaming and casing.

The casing has been engineered to exacting specifications and ensures a consistent pressure rating is maintained throughout the length of the installation.

The method results in flush internal joints, greatly increasing the life expectancy over the butt welded casing method by reducing wear points.

The Cubex Aries ITH drill, a recent

addition to PYBAR’s Drilling Division, was designated as the ideal drill for installing the system.

The drill has recently been used to successfully complete a drill, ream and casing installation project at St Barbara’s Gwalia Mine in Leonora.

A pilot hole was diamond drilled due to the shallow design angle of the hole.

The Aries was then used to ream the hole to 254mm in diameter and install the six inch schedule 80 steel casing in the 82m hole, 24 degrees below horizontal.

The casing was installed in a single shift without incident.

It is estimated that using welded methods, the installation would have taken up to five days.

Doing things the ‘Rightway’



Rightway Industrial are the abrasive blasting specialists.

RIGHTWAY Industrial is a private family owned company that specialises in wet and dry abrasive and captive blasting. The company was formed in 1996 with a focus on supplying plant protection and preventative maintenance services to the building, mining and energy industries. An unconditional commitment to excellence and the ability to provide complete solutions has resulted into one of the most successful industrial businesses in the South West of WA. “We are able to offer wet and dry abrasive blasting services using various blasting mediums,” Rightway Industrial

managing director Andrew Martin said. “For areas that cannot be wet we offer dry blasting and can vary the pressures and sizes of units to cater for all requirements. “We can also convert our range of dry units to wet for areas where dust is prohibited.” Rightway Industrial also provides specialised coatings for adverse abrasion and chemical attack; waterproofing membranes; concrete repair; grouting; and specialised transport services. More information on Rightway Industrial can be found at www.rightwayindustrial.com.au.

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Redox expands warehouse capacity

THE mining industry demands reliability of supply and personal service; that's why Redox has 11 regional sales offices across four countries with more than 50 storage locations.

It doesn't matter if a customer is in Perth, Kuala Lumpur, Los Angeles or Auckland; they can rest assured knowing friendly help is not far away.

Founded in 1965, Redox has enjoyed significant growth and development since its inception, and specialises in providing customers with the widest possible range of quality chemicals, ingredients and raw materials sourced from the world's best manufacturers.

With more than 16,000 container shipments a year, the company has large dangerous goods (DG) storage facilities in place to ensure the smooth movement of stock at all times.

Redox owns and operates its own DG storage facilities in Sydney, Melbourne, Brisbane, Adelaide and Perth; all with varied capacity.

Its Minto site in NSW has a 15,000 pallet capacity, while its Laverton site in Victoria has a 15,000 pallet capacity as well as a bulk storage facility for Soda Ash.

The Richlands site in Queensland has an 8000 pallet capacity, and its Dry Creek site in Adelaide has a 7500 pallet capacity with a Major Hazardous Facility currently being developed.

By March, the company's Bibra Lake site in Perth will have completed extensions bringing its capacity up to 10,000 pallets.

Recent acquisitions over the last few years have included Deltrex, which



In March, Redox will have completed its warehouse extension in Perth.

enabled Redox to offer blending options for its customers in NSW and Victoria.

Both sites can do specific customer

blends, repacks from bulk to various pack sizes, and solid to liquids, and have also added another 5200 pallets to its growing

warehouse base.

More information on Redox can be found at www.redox.com.

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Redox is a leading chemical and ingredients distributor active in more than 1000 specialty and commodity products. We travel the world to source the best quality materials for our customers throughout Australia, New Zealand, Malaysia and the U.S.A

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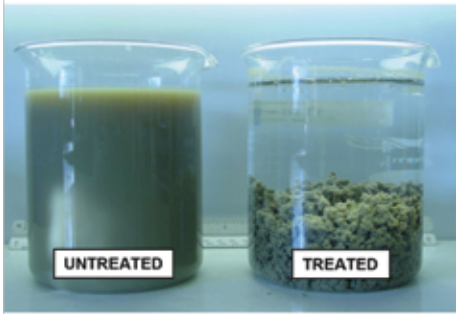
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Clariant increases global footprint



More information can be found at www.clariant.com/mining.

CLARIANT is a leading global specialty chemicals company that supplies chemicals and integrated services to numerous customers in the mining and fertilizer industries around the world.

Based in Muttens near Basel, Switzerland, Clariant's products and services help customers increase yield of ore production, and provide special additives for reliable explosive emulsions at the blasting site and for flotation technologies.

Clariant Mining has many years of experience in modern emulsifier technology

and has proven itself to be a reliable partner for the blasting industry by producing unique, high-quality products and delivering them on time.

The company provides a large range of collectors and frothers that are in service around the world every day.

Clariant's vast experience allows it to tailor solutions that meet individual requirements in processing a wide array of minerals and ores.

Clariant has agreed to acquire Chemical & Mining Services, a provider of specialty chemicals and technical services to mining

industry clients located primarily in Australia.

The company also acquired selected assets from SNF Flomin, a US-based subsidiary of the SNF Group, which manufactures and distributes reagents for the minerals processing industry.

Both acquisitions are aimed at expanding Clariant's geographical footprint and customer base while further improving the portfolio of mining solutions and technical expertise offered to customers around the globe.

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Global reagent supplies

THE December 2015 acquisition of Cytec by Solvay created one of the largest global suppliers of specialty mining reagents.

Solvay's focus has been on the development of intelligent reagents to address the challenges faced by mining operations.

Now, the company's global footprint better positions its mining business to serve international and regional industry players by leveraging the legacy production base.

Solvay is committed to address pressing industry challenges, such as mineral resource depletion and declining ore quality.

As operations shift focus from output to productivity, Solvay has worked to optimise the production processes.

To help process more challenging ores, Solvay offers selective collectors and modifiers to increase recovery.

For example, AERO® XD-5002 and AERO® 5100, together with CYQUEST® modifiers and AERO® depressants, can improve recovery of base metals – mainly copper – and achieve concentrate grade.

Solvay's innovation in the safety and environmental aspects of mineral processing are a source of pride for the company.

Solvay global business director Ricardo



Solvay is global leader for the supply of chemicals to the mining sector.

Capanema said the company continues to introduce products with refined safety profiles.

“Our AERO® 7260 HFP depressant family is used in the Cu/Mo separation process, and replaces approximately half of

the NaSH consumption in some customers' operations,” he said.

“This leads to lower treatment costs and reduces employees' exposure to the risks of handling NaSH.”

As approachable experts in optimising

reagent performance, Solvay works hand-in-hand with its customers to understand their mineralogy, design, and process requirements; while developing sustainable solutions designed to meet customers' needs now and in the future.

Cytec + Solvay: Together, Delivering More Future.

For over a century, our focus has been on the development of intelligent chemical solutions to address the challenges of global mining operations. Now, as the world's largest supplier of specialty mining reagents, Solvay continues its dedication to delivering measurable results.

As experts in optimizing reagent performance, we keep your mineralogy, design, and process requirements in the foreground while developing sustainable solutions for the future.

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Suppress CP20 is ideal for dust suppression at mine sites, roads and tracks.

True blue chemicals

FAMILY owned and operated True Blue Chemicals has been manufacturing and supplying high quality, innovative cleaning and hygiene formulations for the industrial, hospitality and healthcare markets for more than 30 years.

True Blue Chemicals specialises in dust control solutions in liquid and solid blocks, which are ideal for the mining industry, along with a broad range of janitorial and degreasing product solutions.

Uncontrolled dust can result in respiratory disease; reduced visibility leading to increased potential for accidents; and slippage hazards created by deposited dust.

Suppress CP20 is a high-performing liquid dust suppressant ideal for mines, roads and graded tracks.

Developed for use at mine sites, on roads and graded tracks, Suppress CP20 provides excellent versatility.

The key benefit of Suppress CP20 is that the copolymer binds material together to help achieve dust reduction in the air.

The high dilution rates and superior

wetting and binding properties mean Suppress CP20 offers an ideal choice where dust control is vital, delivering longer lasting dust control than water alone.

Suppress SB100 is a solid block dust suppressant effective for use within underground mining environments, with a self metering block that dissolves directly into the water flow.

This highly concentrated dust suppressant block provides benefits of easy storage, efficient transportation and high performance.

True Blue Chemicals also provides heavy duty streak-free vehicle washes for heavy-duty mining equipment, as well as degreasing solutions for removing grease and oils from hard surfaces; which are also ideal for removing alkalines.

Developed to industrial strength, the company's janitorial solutions provide washroom, laundry and skin products perfectly suited to the resources sector.

More information about True Blue Chemicals' comprehensive product range can be found at:

www.truebluechemicals.com.au

Odour control in a bucket

ANOTEC Environmental Control's new, portable odour system – affectionately known as 'Odour Control in a Bucket' – is a flexible, robust product ideal for use in mining environments.

Chemical odours at mine sites can be overpowering, creating an unpleasant, hazardous and potentially unproductive working environment.

A key property of the Anotec 0307 formulation is that it modifies the surface

properties of chemical odour components, with the primary action taking place at the chemical odour and Anotec 0307 interface.

Odour Control in a Bucket packages include a reusable bucket, 25 litre drum of Anotec 0307 solution, and a 200 litre reservoir tank.

Clients can benefit from either purchasing outright or hiring these effective units for the duration of projects.

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Bulk material handling made easy

USED world-wide across a number of mining applications, Thor Global's ThorStacker is one of the most inclusive, high-end telescopic conveyors on the market.

Available exclusively in Australia through Lincom Group, the state-of-the-art product has been designed to slew, telescope, luff, and stockpile material in flat concentric rows without pause, all via an easy-to-use onboard Programmable Logic Controller (PLC).

With an ability to constantly generate layers of radial windrow piles, the product presents a host of benefits to the end user, primarily a 30 per cent larger stockpile volume for materials of all sizes and densities, without having to segregate the mix.

Other advantages include stacking capacities scalable up to 2500MTPH; significant fuel cost savings; reduced maintenance for loaders and trucks; and less compacted stockpiles.

"We only produce what we believe to be practical," Thor Global Enterprises president and founder Thor Johannsen said.

"It's easy to make something complicated, but very difficult to make something simple."

Recognised for its benefits, ThorStacker's Australian dealer Lincom Group recently delivered a ThorStacker T190x36 with a length of 57.9m and capacity of 725MTPH, as well as a T150x36 with a length of 45.7m and capacity of 725MTPH to a customer in NSW.

Lincom, a family-owned business, has been a specialty provider of world-class products for the resources and construction industries for more than 20 years, with a team of fully-trained engineers across four offices in Australia.

More information about Thor Global products can be found at www.lincom.com.au.



A high-end telescopic conveyor from Thor Global.

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ContiTech 
The Future in Motion



Completed **early**, on budget and incident free **20 km overland conveyor belt changeout project**

Project Scope The ContiTech West Australian Service Team from Karratha had to set up and execute the replacement of a 20,548 m 1050 mm wide ST2786 9x5 DIN-X SLL overland conveyor belt in the Pilbara for a major iron ore miner.

Key Data • Motive force provided was from the ContiTech belt puller and 100 t belt winder. The belt winder was operating in tension/slave mode behind the belt puller. This combination provided an efficient and controlled means of belt movement and winding. The maximum diameter of the racetrack reels was 6.8 m. • 32 lengths of belt at 650 m were installed and reeled during the replacement work. The belt movement operations were completed continuously over 72 hours with an approximate belt speed of 17 m/min. • The belt flake length was 450 m. • The belt was guided safely and controllably onto the conveyor system from the flake through two ContiTech 90° turning frames. • Lower than expected pulling forces were recorded during the replacement operations. The recorded values indicated a DIN friction factor of around $f=0.010$

Summary An additional, unscheduled conveyor job was also carried out by the team while their specially developed equipment was nearby. This was also completed early and incident free. The client advised they were extremely happy with ContiTech's safety and performance, indicating they would like to continue the working relationship moving forward.

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Dredging Systems' portable dewatering and separation unit can dry material, pumped straight from the dredge, down to 0 microns.

The unit can dewater ponds and dry up to 500 cubic metres of dredged material per hour, and reduces the need for large drying areas as the material can be loaded straight from the dewatering unit onto trucks or stockpiles. The clean water can then be returned to the dam, pond or harbour.

Dredging Systems' other systems involve pumping directly into geotextile dewatering tubes; particularly useful for smaller volumes as required.

These multipurpose amphibious dredges have the ability to pump, excavate or rake and can be used for dredging difficult or structurally complex areas.

The dredges feature a cutter suction pump, which can pump material up to 1km without the need for a booster pump.

Equipped with an excavator bucket, cutter suction head, pile driving attachments and weed rake, the amphibious dredges are highly versatile.

Using multipurpose technology, the amphibious dredges can complete all jobs at sites with the one machine and have low impact on the surrounding environments.

Dredging Systems proudly offers economical, high-quality solutions for restoration work in various water, sludge or liquid environments.



Dredging Systems' fleet of dredges and portable sludge dewatering equipment provides quality solutions to clients across Australia.

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The smartest way to get a new car

BUYING a vehicle, whether new or used, can be a costly exercise with a whole host of add-on expenses, from insurance and maintenance to fuel costs.

An attractive alternative to an ordinary vehicle loan or burden of buying a car outright is a novated lease, a three-way agreement between the employee, employer and leasing provider.

Instead of pouring post-tax dollars into payments, a novated lease is a simple way for an employee to finance and operate their car, and pay for it using deductions from their salary.

While more commonly seen across government departments — primarily schools — novated leases are also accessible to private companies, such as miners and METS.

“A novated lease allows you to offer all the benefits of a company car, without the expenses and hassles to you,” Leasexpress chief executive Randall Wright said.

“With a novated lease you’ll have no upfront capital expenditure for new vehicles and whilst enjoying national fleet discounts on the ongoing maintenance and running costs.

“All of the car’s major running costs are covered from lease finance to comprehensive insurance, registration, fuel, maintenance and roadside assistance.

“And if your employee leaves for any reason you won’t be required to pay their monthly lease costs.”



Image: Bennymarty, Dreamstime.com

A specialist nation-wide novated leasing company, Leasexpress has a track record in providing great value novated leases to companies across the country, with a track record of providing novated leasing to employees of businesses within the mining sector.

Leasexpress has the flexibility to offer novated leases on both new and used cars, has partnered with a national

dealer network, and offers a national fleet discount to the driver on the purchase price and running costs of their car.

Mr Wright said there were many benefits of taking up a novated lease, including a significant improvement in the customer’s financial position through a tax-effective use of their salary.

“The leases also aid companies in attracting and retaining their valuable

staff by adding to employees’ overall benefits and allowing employees to save on tax.

“The administrative burden is minimised through our account management services where all reports are customised and taken care of.”

More information on Leasexpress services can be found at www.leasexpress.com.au or by calling 1300 36 36 30.

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Autonomous assistance for site vehicles

FOR the past 30 years, Pempek Systems Australia has designed and manufactured industrial control system technologies for the underground mining sector.

The company maintains a proud history of technological advancement and contributions that have elevated both machinery manufacturers and coal mines alike into safer, more productive work environments across the globe.

The ultimate goal has always been 'zero harm'; to that end, the Pempek engineering boffins concluded long ago this could only be achieved with semi-autonomous or, where practical, autonomous solutions.

Pempek has continued to invest heavily in product research and development for underground mining, pursuant to the 'Made in Australia' ideal.

Recent achievements in semi-autonomous drill and bolting solutions are operating successfully around the country. More recently, smart SIL rated hydraulic valve banks have entered operation together with SIL rated variable frequency drives.

These modular bolt-in or bolt-on solutions have continued to promote expansion into autonomous operation, providing a safer work environment.

Pempek recently developed a mining ready Advanced Driver Assistance Solution (ADAS) for shuttle cars, code named 'Ranger'.

Comprised of 3D sensory technology drawn from the automotive sector – coupled with a newly designed SIL2 rated controller – ‘Ranger’ will initially assist the shuttle car driver with active collision avoidance while still offering a pathway to mine managed autonomous operation.



Pempek's robotic pick and place electronic assembly line.

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VR incident training

SAFETY critical workplaces demand high quality training as emergency responses need to be automatic and effective; there's no time to waste.

Repetition is the key to rapid and appropriate response, but building response scenarios to practise with is expensive and potentially risky.

Simulation has long been used to support incident management training with a range of tools, from the hypothetical discussion exercise to field (live) exercises, such as those used in mines rescue.

Trainers have recognised that immersion in the problem promotes learning, rehearses response, and reinforces appropriate behaviour.

Simulation-based training is increasingly used to develop the complex knowledge, skills and attitudes needed to manage multifaceted problems, such as a disaster.

It is used to build teamwork and decision making skills in many industries, including health, military, emergency services, government, utilities and financial services.

Virtual Reality (VR) simulations can be used to test the validity of plans, the readiness of facilities and teams, and identify areas for improvement.

They are used to practice procedures, drills, communication and teamwork, as



Training is made easy and fun with the XVR training tool.

well as orientate or reorient personnel to the work environment and conditions.

Advances in virtual reality make scenario-based training a cost-effective and realistic alternative for industrial fire-fighting, rescue and security responses.

'Drag and drop' technologies make it possible for trainers to create learning experiences that are limited only by their imagination.

3D imagery, including Oculus, Vive and

Igloo have created new ways to immerse learners in a virtual scene.

Hybrid solutions – such as a projection wall as a backdrop to using real equipment – can be easily developed.

Control room simulations, with 'virtual' CCTV can improve operators' skills with regular practise based on 'real' visual cues.

VR simulation reduces the cost of training responders by allowing them to rehearse and practice skills, particularly assessment,

reconnaissance and decision-making, without building expensive props.

Similarly, VR allows emergency response teams to practise their communication skills using visual and auditory cues from the virtual environment.

More information on XVR training can be found at:

www.tigertail.com.au/xvr-3d-virtual-reality-training/, and www.discoverxvr.com.



Emergency Response Training brought to life with immersive 3D virtual reality

The XVR is a modular virtual reality training platform for education, training and assessment of Incident Controllers and their teams. The three modules can be used separately or linked together and run concurrently for use in single or multi-agency settings.



ON SCENE

The *On Scene* module provides immersive 3D visualisation of an incident scenario. It enables one or more responders to walk, drive or fly through the simulated reality, making assessments, reports and decisions based on a situation that changes in real-time.

RESOURCE MANAGEMENT

The *Resource Management* module provides training and exercises for incident controllers at an operational and strategic level, emphasising the skills needed to provide high-level decision-making and logistic support to a major incident.

CRISIS MEDIA

The *Crisis Media* module immerses participants in the kind of media barrage that accompanies a major incident, with real-time simulation of online and social media.

The XVR is proudly brought to you by Tigertail Australia

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VR tools play into resources sector

SENTIENT Computing is a WA-based software company that provides interactive training, 3D visualisation, optimisation solutions and process control.

In 2016, the interest and availability of consumer-ready Virtual Reality (VR) systems such as the Oculus Rift and HTC Vive has enabled Sentient to utilise this innovative technology to provide solutions to its existing customer base.

Sentient's clients are seeing the advantage of using VR in 3D environments to improve their comprehension of complex systems, collaboration and enhancing internal communication within the organisation.

For example, a team can observe a person in VR demonstrate how equipment works, highlight the hazards and indicate what tasks need to be accomplished.

The three main areas are generating interest: immersive training, visualising real time data and simulating shutdowns.

VR systems allow operators to safely perform high risk procedures in simulated remote environments.

The fully immersive environment enables the visualisation of outcomes to be accurately communicated when procedures are not followed correctly.

Working at Heights and High Voltage Switching and excellent examples of using VR to safely assess the capabilities of personnel to perform dangerous tasks.

Tracking assets in a stockyard using real time and historical data is a great tool for remote operations, training, and root cause analysis when an event occurs.

The ability to accurately visualise the movement of the stackers and reclaimers



VR has become an important innovation for the mining industry.

during a previous shift that had high production, is an excellent way to communicate best work practices.

Traditionally, shutdowns are communicated with Gantt charts which are time consuming and difficult to understand.

Sentient has created a product Plan It 3D, that imports the project file and enables users to create visual simulations of the critical tasks during the shutdown.

These visual simulations can be used to

significantly improve the efficiency of the shutdown.

For example, they can reduce onboarding time, retain knowledge for the next shut, improve accuracy of vendor quoting, communicate hazards and are an extremely effective aid for toolbox meetings.

Sentient has recently seen a significant increase in the number of companies that have a defined strategy for a "Digital Plant".

The way companies leverage this asset

will have a direct impact on their ability to optimise their operation and VR will be a key part of this journey.

"I believe that the digital plant will play an important role as companies strive to optimise operations, and Sentient is working hard to be a part of that conversation," Sencom managing director Doug Bester said.

"VR's ability to accurately visualise complex operations makes it one of the most important new tools to hit the resources sector."



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UNSW backs VR innovations

UNSW Mining Engineering combines Virtual Reality (VR) experience, the latest VR technology, and a vision for mining industry applications into an attractive package.

The School of Mining Engineering at UNSW Sydney has been involved with developing mining-related VR applications for more than 10 years.

"It continues to be a strong area of growth for us, both in the development of research projects and training products," School of Mining Engineering virtual reality development manager Dr James Tibbett said.

"VR technology and applications are developing rapidly and we are seeing many possible translations into products for the mining sector."

UNSW Mining has developed VR applications for its VR theatre, portable VR headsets like the Samsung Gear VR, and more advanced VR headsets like the popular Oculus Rift.

These applications are varied but include: simulated underground mining environments for situational awareness and hazard identification training; mine planning applications that raise awareness of social and cultural impacts; Big Data visualisation to look for rock mass response patterns; representing animated mineral processing flowsheets; and providing virtual tours of mine sites and features around the operations.

"It is important that VR developments are paired with research into the effectiveness of the platform and applications," Dr Tibbett said.

"We know they are engaging and memorable, but if we could quantify the



Examples of UNSW Mining Engineering VR modules.

effectiveness of VR training and experiences it could have a significant impact on the industry."

A recent VR project was aimed at improving community support for the mining industry and showcasing mining engineering as a viable career option for high school students, using portable VR headsets that can be brought directly into schools.

Users can explore mineral elements required to produce a smartphone and view recorded VR content from mine sites around Australia where these elements are mined.

"The engagement of students is fantastic, the VR experience is reducing the disconnect between modern technology and the resources used to enable it," Dr Tibbett said.

UNSW Mining Engineering is seeking



industry research partners looking to investigate the potential of VR technology in mining and develop innovative products to address their pain points.

If companies are interested in being a part of existing VR research projects or establishing a new VR research/development agenda, they can contact Dr Tibbett at james.tibbett@unsw.edu.au.



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Mining Engineering Virtual Reality Innovations

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VR Experience at UNSW

UNSW Mining Engineering has over 10 years of VR experience, with 20+ mining related VR applications developed. This has led to our capabilities including:

- 360° VR videos and images
- VR headsets and 360° VR theatres
- Simulated virtual mines
- Hazard perception and safety training
- Big Data visualisation and analysis
- Complex flowsheet simulation
- Virtual mine planning tools
- Social licence and mining awareness

Demonstrations available

VR Research and Development Direction

The VR industry is evolving fast and UNSW Mining Engineering is current with new technology and developing uses. Some R&D focuses include:

- Advanced VR interaction devices
- Linked multi-player VR experiences for people across locations/sites
- Artificial intelligence in VR simulation based training experiences
- Live VR mine representations and 'control room' monitoring
- Accelerated employee training and screening

Seeking interested partners



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In 2017 we continue to lead the field in surface engineering technology across a range of industrial applications. We're passionate about innovation, productivity and conservation. We've been excelling at it for 25 years. We've learned a great deal about the tribology of wearing parts and advanced metallurgy. We're tailoring alloys that will dramatically reduce wear in specific situations, rebuilding worn parts to work better than new and creating innovative new components that are superior. And we have the best deposition methods to apply them. This is why we have attained prized strategic partnerships with leading companies and university researchers. Why we enjoy alliances with key industry bodies and cutting edge technology associations. Why we're actively collaborating to develop more 'Living Labs' to further pioneer improved wear resistance methodology. To discuss the possibilities of increasing wear life, refurbishing worn components and reducing costs for any aspect of your business, contact Laserbond.



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Innovation drives cost savings

AN expert in tungsten carbide hardfacing and wear protection, Abrasion Resistant Materials (ARM) has delivered cost savings and reductions to the Australian mining industry for more than 20 years.

Founded on the premise of continuously innovating, ARM strives to maintain the highest standards in wear loss prevention and equipment operator cost reductions through a state-of-the-art product offering, of which many new wear products are patented.

ARM managing director Tim Falkenhagen said many miners benefited from assessing their existing machinery and equipment, and turning to ARM to improve productivity and cost savings across their sites.

“Can you imagine having a fleet of graders and discovering that you are changing all of the cutting edges four or five times more often than you need to?” Mr Falkenhagen said.

“Right now this is happening.”
One of ARM’s standout products includes its new grader edge (ARM60) which lasted for more than 400 hours on 24M graders, even when used in iron ore mines.

“Other examples of when ARM has set the performance benchmark was in the application of our face shovels, where we have achieved 18 months of service without any field maintenance or down time on bucket adaptors,” Mr Falkenhagen said.

“We also recently made a big investment



Abrasion Resistant Materials has installed a new ARM 25T Factory crane.

and installed a new 25T OH crane to broaden our factory capability.

“In addition, we will soon take delivery of our first fully automatic ARM hardfacing machine that uses touch screen controls.

“This new hardfacing unit will provide a

lift in productivity and will also provide a new level of quality control.”

One of ARM’s other innovations was its brand new dozer cutting edge system.

“This new cutting edge option (patented) also comes with a wear life performance and

a cost per hour guarantee,” he said.

“All you have to do to fix your dozer fleet cutting edge costs – is to order the cutting edges from ARM.”

More information on ARM’s portfolio can be found at: www.arm.com.au.

A.R.M.* Hardfaced wear parts

ARM60 24M Grader Edges

24M cutting edge life increased from 40 hrs - to over 400 hrs per set

PATENT PENDING

ARM60 = impact resistance

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David Hodges

Loc8 managing director

Each year new innovations and technologies that enable miners and METS companies to streamline business processes are introduced to the market. **Elizabeth Fabri** spoke to Loc8 managing director **David Hodges** about the company's latest software and what's next for the technology and innovation industry moving forward.

Q. Describe your professional background in the technology and software industry.

I began my working career in the electronics and physical infrastructure space. After completing a Masters in Project Management and working on Nortel, Cisco and Avaya platforms, I joined Ampolex Limited in the oil and gas sector in the '90s.

Since that time, I have focused my efforts around software optimisation and automation in safety, asset management and field service management with rail, emergency management, and professional services organisations in iron ore and coal mining.

Q. You founded Loc8 in 2011; in the last five years what have you enjoyed the most about working in the resources industry?

2011 to 2017 has been an incredible time to work in the resources industry with extraordinary opportunities for individuals and companies like Loc8, coupled with major technology changes and increasing demands for innovative solutions.

I have enjoyed the progressive approach our customers have taken to embrace technology like ours in an industry that is not always quick to shift its approach.

My team at Loc8 has had to adapt and change its approach many times since 2011 to ensure that we have could provide a solution that is intelligent, practical and meets the demands of resource based companies.

The challenge of it all is really the thing I most enjoy.

Q. What does a typical day look like for you?

Running a 40-odd person business is a very dynamic and hands on job.

I have an incredible team around me, many who have been with the business from the earliest days, who are great at their jobs.

My days always include time working with my sales team, talking with customers or potential Loc8 users. It is important to me to understand our customers/users mind sets, comprehend their needs and expectations, and then translate these into functional and efficient features.

I also always make sure that I allocate sufficient time to discuss with my design and development teams the effectiveness of our software, its features and flaws that can be improved.

Moving forward, one of my goals would be to spend more time with my marketing and finance teams to develop some solid communication around our software and introduce it to many more companies that should embrace a technology like ours.

Q. How can Loc8 streamline processes for both small and large mining operations?



Image: Samantha Sagona.

The first thing about Loc8 that is highly appreciated by our users and prospects is its simplicity, ease of use and implementation within a business.

My teams and myself have always agreed on the fact that our system should be straightforward and user friendly to be best able to help businesses to streamline their operations.

The fact that Loc8 is an operational focused platform allows our resources customers to track their assets, streamline their field service processes, and automate reactive maintenance activities effortlessly.

Another aspect of Loc8 that our users highly value is its ability to provide consistent and reliable sets of data continuously across different teams in their businesses.

Being cloud based is extremely important as it enables all users to access this data safely from anywhere at any time. This data is integral to any and all decisions related to field and/or operations within a business. Loc8 also integrates with core financial, planning, reporting and specialist systems, which offers a unique proposition for an asset reliability management.

For both our small and large customers, having all their activities gathered into one single system is a real competitive advantage.

Having Loc8 to streamline and sort out all the administrative and operational tasks allows them to spend more time focusing on strategic elements of their core business. As mentioned earlier on, my teams and I think that streamlining should be a synonym for

simplicity and we strongly believe that Loc8 provides the ease and reliability that our customers need to be competitive.

Q. Are there any new software and innovation solutions that Loc8 is developing?

Progress and innovation are our bywords here at Loc8 therefore we are constantly working toward developing new solid technologies and trailblazing solutions.

Regarding our core application, the innovations are very much feature based. We are working hard with a select group of customers on a highly advanced predictive maintenance and reporting module. We are also in a process of potentially extending our applications with iBeacon, Bluetooth and RFID technologies.

Our largest R&D project for 2017 is to extend our successful Service Supply Chain solution so our customers can extend their Loc8 platform to their suppliers, contractors and partners.

In a few words, the Loc8 Service Supply Chain is the innovative model offers an alternative for small, medium and large service organizations to operate and collaborate. This solution allows real-time operational data to flow into multiple systems without human touch.

Ultimately, automation, bots and robotics are going to play a big part in our immediate future.

Regarding our system in general, some other the innovations are based on user

experience. We are currently in a process of rebuilding and redesigning our application to make it more intuitive, faster and more enjoyable for our users to navigate around.

Making things easy and pleasant for them is a constant challenge that we thoroughly enjoy taking on.

Q. Where do you see the mining technology and innovation industry headed?

I see a real desire in our customers to simplify technology platforms and take on solutions that are targeted, robust and supportable. The most important element for our customers is that these solutions can be fully integrated into a central data warehouse environments and produce valuable reportable information.

The creation of large amounts of reliable operational data is the only way to fully develop predictive models.

The industry wants to maintain the highest safety standards possible, extract maximum value from assets and deploy their staff in a more cost effective and efficient way.

These demands mean both software vendors and miners need to think innovatively and do things better than we have done them before. There will be an increasing focus on automation, robotics and predictive data modelling in the years to come and that will bring challenges and opportunities across all areas of the resources industry.



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