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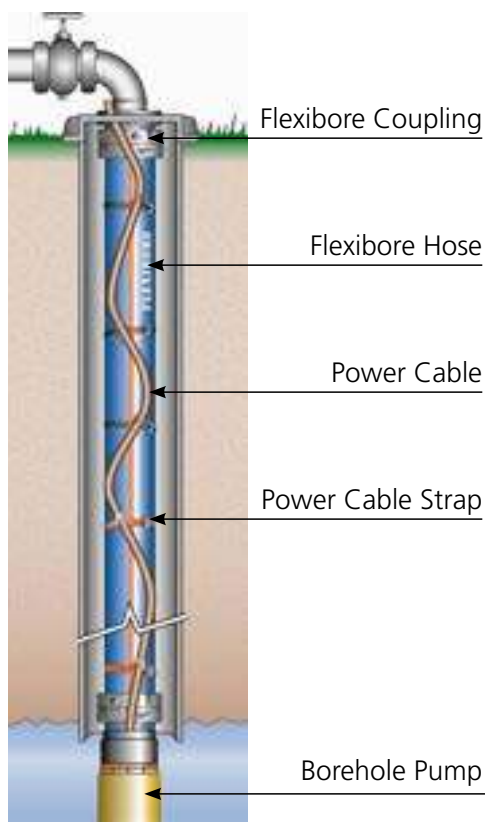
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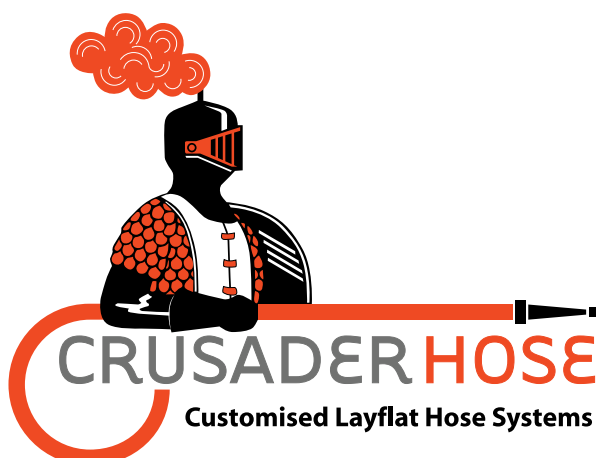
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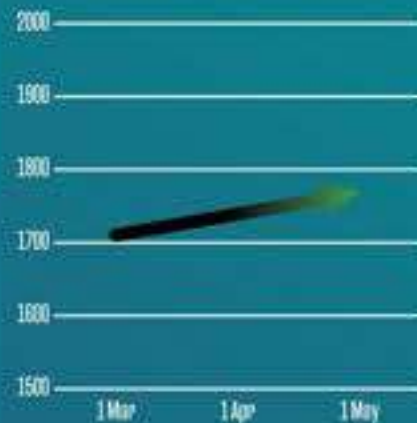
MAJOR COMMODITIES

SNAPSHOT

GOLD

\$US/oz

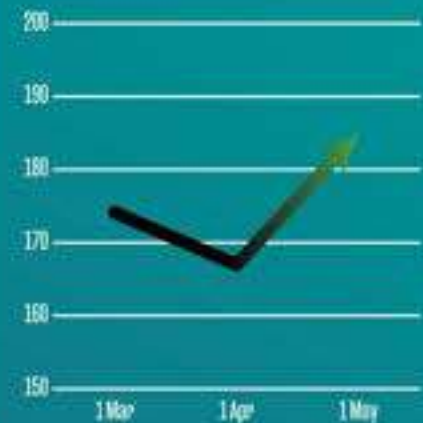
Gold has kept above US\$1700/oz as the price momentum from last year tapers off and the US dollar recovers from its plunge in March 2020.



IRON ORE

\$US/t
62% Fe CFR China

Iron ore prices have soared to 10-year highs, with prices potentially hitting US\$200/t in the middle of 2021.



COPPER

\$US/t
LME Price

Copper prices are a few dollars short of breaking through the US\$10,000/t barrier, steadily rising on the back of the improving world economy from COVID-19 and global transition to low emissions.



COBALT

\$US/t

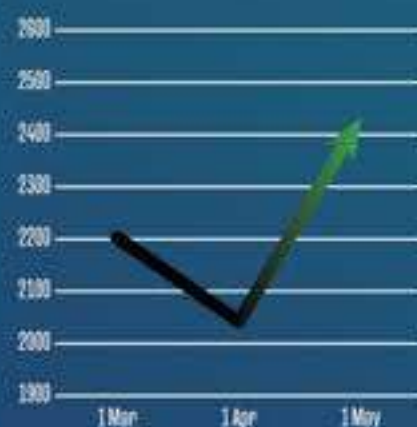
Minor metal cobalt has continued its cool off period, holding steady at just above US\$45,165/t.



ALUMINIUM

\$US/t
LME Price

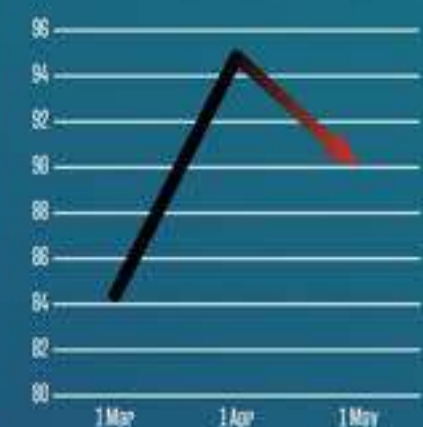
Aluminium continues its upward trajectory, reaching just shy of US\$2500/t, showing growing demand for the metal. China consumes over 40% of the annual global supply of aluminium.



THERMAL COAL

\$US/t

Prices have pulled back to around US\$90/t, with expectations it will trade at around US\$88/t by the end of Q2 CY21.



LEAD

\$US/t
LME Price

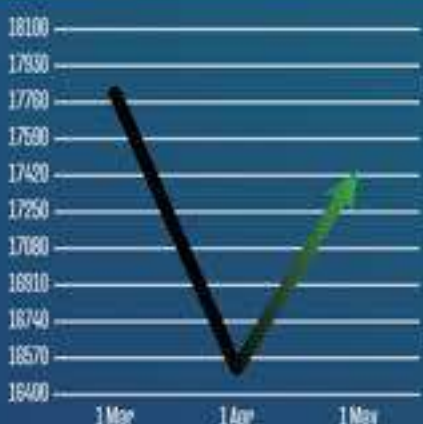
With a total of 80% of lead usage going to battery production, lead prices have jumped to just over US\$2100/t.



NICKEL

\$US/t
LME Price

Rising to a two-month high above US\$17500/t, nickel's use in lithium-ion batteries and electric vehicles are driving confidence in this metal.



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Autonomous Introduction On Track

The Cat 793F haul trucks on site at Newmont Boddington.

Caterpillar® dealer WesTrac is well underway in the delivery of a fleet of autonomous haul trucks to Newmont's Boddington gold mine in WA, with the first commissioned trucks now operating autonomously.

Newmont announced last year an investment of US\$150m to install a new fleet of Cat® 793F autonomous trucks and convert a number of existing units as part of its planned Autonomous Haulage System (AHS) at the mine, located 135km south east of Perth.

The investment in autonomous haulage – the first use of the technology in a gold mining application – is expected to extend the life of the Boddington operation, which is WA's largest gold producing mine.

The order is central to Newmont's AHS project and includes 29 new Cat 793F haul trucks, as well as conversion to autonomous operation of a further seven 793F machines

already operating on site.

Once operational, Newmont Boddington will be the first open pit gold mine in the world with a fully autonomous haul truck fleet.

According to WesTrac General Manager Technology Alister MacPherson, the project aim is to commission all trucks across the new and existing fleet to AHS seamlessly.

"Newmont has acknowledged that the understanding and maturity of AHS in WA is world-leading, and when combined with the extensive experience across the WesTrac team, the company sees the delivery timeline as readily achievable," Mr MacPherson said.

With the mine's proximity to WesTrac's new Technology Training Centre in Collie, about 100km to the south, training of Newmont maintenance and support personnel has commenced.

Newmont has also utilised the Collie facility to introduce the new autonomous operations to its wider team in a safe training environment to assist in developing understanding and enabling adoption of the new operating processes.

Further training covering operation and maintenance of supporting systems is being delivered through the WesTrac Institute in South Guildford.

In addition to commissioning the new and converted haul fleet, the AHS project also includes the installation of supporting systems to around 160 additional assets.

"Those range from Cat 7495HD rope shovels, right down to light vehicles that are used by workers within the mine environment and need to interact with the autonomous fleet," Mr MacPherson said.

Newmont Australia Regional Senior Vice President Alex Bates said enhanced safety

performance and greater productivity were key drivers for the project.

"As well, the project will enable the extension of mine life, supporting ongoing direct and indirect employment opportunities well into the future," he said.

WesTrac Chief Executive Officer Jarvas Croome said safety had been a significant driver for the Newmont project and was a fundamental aspect of the broader mining sector's move to autonomous operations.

"AHS operations have an uncompromised safety record in the mining industry and the rigorous safety controls included as part of the autonomous technology will further improve safety performance for Newmont and its contractors," Mr Croome said.

"WesTrac is excited to be part of the Boddington project and to partner with Caterpillar to deliver this significant milestone for Newmont." **AMR**

Regis Snaps Up Tropicana

IGO is selling its 30% stake in the Tropicana gold mine to Regis Resources so it can focus on commodities that align with its clean energy strategy.

The \$903m deal will allow IGO to focus on battery metals, while Regis will inherit a Tier 1 gold asset and a "world class" joint venture partner in AngloGold Ashanti.

Located 330km northeast of Kalgoorlie in WA, Tropicana is Australia's fifth largest gold mine, producing 463,000oz of gold in the 2019-2020 financial year.

The Tropicana sale proceeds will go toward IGO's investment in its Australian lithium assets including its Tianqi Lithium subsidiary acquired for \$1.4b in December.

IGO announced last September it was carrying out a strategic review of its stake in the Tropicana gold mine that included the option of selling the equity interest.

IGO managing director and chief executive Peter Bradford said Tropicana had been an important part of IGO's history and a key driver of its sustained growth since its discovery in 2005.

"While IGO continues to believe that Tropicana is a high-quality tier 1 gold asset with strong upside potential, it is no longer aligned with our focus on commodities critical to clean energy," he said.

"This transaction, along with the recent investment in Tianqi Lithium assets in Australia, solidifies IGO's position of becoming a globally relevant pure-play



IGO is offloading its stake in Tropicana.

battery minerals producer and developer, uniquely exposed to tier 1 nickel, copper, cobalt and lithium.

"We are extremely pleased with the outcome of the transaction and the assistance of the AngloGold Ashanti teams throughout the sales process. I take this opportunity to acknowledge and thank AngloGold Ashanti for their partnership and support over the last 18 years."

The 30% non-operating interest provides Regis Resources with immediate exposure to high margin cash flows from an asset operated by a "world-class" joint venture partner, according to Regis' ASX announcement.

It also stated the deal diversifies Regis' existing production base with a high quality, low cost, high margin gold asset, which has a mine life of more than ten years.

Regis' Managing Director and CEO Jim Beyer said the acquisition would create substantial value and provide the company with multiple opportunities to deliver growth for shareholders.

"This is a genuinely transformational transaction for Regis and one that delivers on our strategic objectives to grow as a safe, responsible, reliable, long life, low cost gold producer, generating strong financial returns."

Regis Resources has its main gold operations

at its Duketon project in WA's Eastern Goldfields, plus its McPhillamys gold project in western NSW.

The company will increase its production profile to 491,000oz and lower its all-in sustaining cash costs to \$1225/oz.

The deal also increases Regis Resources' reserves to 4.4moz and its resources to 10moz, according to a company presentation.

"Regis is looking forward to working with AngloGold Ashanti, a proven global gold mine operator, to continue delivering a world class operation at Tropicana for many years into the future," Mr Beyer said. **AMR**

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Green Light for Green Port

Gascoyne Gateway is progressing with plans to build Australia's first 'green' deep-water port near Exmouth on WA's north west coast.

The proposed Gascoyne Gateway marine facility, which is expected to set a new benchmark in marine environmental management, is a single jetty port capable of servicing a range of vessels in the Exmouth Gulf, such as navy, cruise ships and private yachts.

The green port would be the first in the country to incorporate environmental regeneration initiatives into its initial planning and operation.

Gascoyne Gateway Managing Director, Michael Edwards, said the company was continually engaging with the local community to get their input into the project.

"We held two community reference group meetings in March to get feedback on specific aspects of the project," he said.

"The Design and Environment group focused on minimising environmental impact and maximising regenerative environmental opportunities in the marine and terrestrial environments."

"The Jobs and Community group addressed another area we know is important to the Exmouth community by helping identify how the jetty could support economic diversification and minimise community impacts throughout construction and into the future."

The construction of the marine facility is expected to create 400 jobs, while 70 full time local positions would be created once the port is in full operation.

Mr Edwards said the facility would be designed to not only protect the marine environment from current risks, but enhance it.

A flora and fauna survey was undertaken in the last week of March, which will be submitted as part of the requirements of the formal environmental impact assessment process.

"Other ports have added green initiatives after they've begun operating, but Gascoyne Gateway will be designed to improve environmental outcomes from the outset," Mr Edwards said.

"This industry-leading commitment makes it the first green and regenerative port in Australia and possibly the world, leaving it better than we found it.

"We believe Gascoyne Gateway will set the benchmark for this type of infrastructure worldwide."

The green port is earmarked for a location 10km south of the town of Exmouth, adjacent to an industrial area and well away from the Ningaloo Marine Park.

Mr Edwards, a naval veteran, has more than 40 years' worldwide experience in both naval and commercial port management and believes the port would regulate the movement of large vessels in the area.

"There is currently little organisation or oversight of the movement of ships and maritime activities in the Exmouth Gulf," he said.

"It's expected that much of the existing traffic within the gulf will use this facility, making it immediately viable and delivering a net environmental benefit as this traffic becomes better regulated.

"The project will also enable marine habitat that has already been damaged by ship's anchors to be gradually restored by significantly reducing anchoring activity within the gulf."

Gascoyne Gateway will co-fund an annual grass seeding program designed to enhance

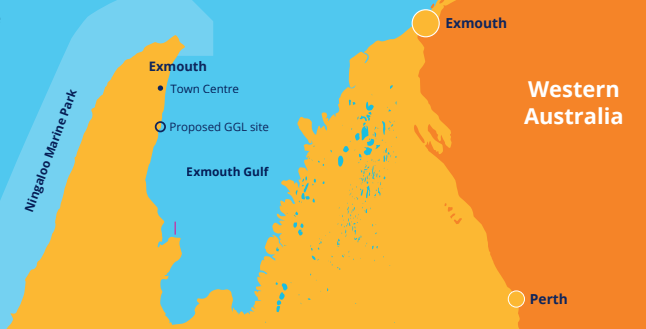


Gascoyne Gateway single jetty deep-water port conceptual design

- 1 Tourist reception area** Welcome area for visitors to Exmouth disembarking tourist vessels, including customs control facility
- 2 Warehousing** Specialised storage facilities for port users, including cold storage
- 3 Access road upgrades** Proposed road upgrades to ensure safe access to site and traffic management
- 4 Cargo area** Designated area for the placement of cargo containers
- 5 Administration building** One or two storey office space for the full-time port employees
- 6 Port access** Road access to the facility will include landscaping, design and signage that is aesthetically in keeping with the current environment
- 7 Jetty structure** Pylon for the first section of the jetty to allow for continued beach access, 4WD underpass and coastal water flow
- 8 Solar farm** Solar panels in place to ensure the port is powered by renewables
- 9 Tugboat pen** Tugboat facility to allow vessels such as tugs and large private yachts to safely berth at the port
- 10 Fuel storage** Fuel storage facility with underground pipe directly to the port
- 11 Desalination** Equipment to produce potable water for port usage and potentially supply the town
- 12 Potential fishing platform** Public access fishing platform for locals to use
- 13 Berths** Up to five berths for vessels at the end of the jetty
- 14 Extended road upgrades** Proposed upgrades to Minilya-Exmouth Rd subject to Federal and State Government funding

Gascoyne Gateway is currently in the concept design phase of the project, which means that no final decisions have been made about the design of the landside or sea structures. However, we understand that residents want to understand what the port may potentially look like so have developed a concept drawing of the proposed port.

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habitat and help address carbon-initiated climate change that currently threatens the marine environment, in particular the Ningaloo Reef.

Mr Edwards said the jetty and port would run on renewable energy, with scalability to contribute to the community's power and water needs.

"We plan to use renewable energy to power

a desalination plant to provide potable water for users of the port and potentially the local community in the future," he said.

Gascoyne Gateway has commissioned comprehensive environmental assessments to meet the requirements of state and federal environmental protection agencies.

AMR



Australian mining has been the backbone of small business during COVID.

Ongoing support by Australian business for regional small businesses during the COVID-19 pandemic and through recovery will be the focus of the next phase of the MCA's There's more to Australian mining campaign launched nationally last month.

The campaign ads filmed in and around Orange, NSW, earlier this year feature a café/general store, family start-up business, wedding reception and accommodation

provider and a smallgoods manufacturer telling their stories of how support from mining provided an important boost after their businesses were hit hard by COVID-19.

The ads feature one of many community support programs funded by MCA member companies to retain local jobs and back local communities during the pandemic.

Every day the minerals industry supports communities from Weipa to the Tanami,

from Bendigo to Port Hedland by providing high value local jobs, essential services, critical infrastructure and support for local businesses. Mining and its related equipment, technology services support 1.1m jobs, many in regional Australia.

Industry is increasingly focused on long-term business partnerships and strategic investments to support local priorities and aspirations whether directly related to operations or across the

broader communities.

The campaign - available on YouTube - will run nationally until September across metropolitan and regional television, radio, print, digital, outdoor, sporting and mobile gaming platforms.

Each story features two versions - a short one (15 seconds) and a long one (30 seconds). AMR



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China Open For Business

by Kate Christian

The trade tensions between Australia and China are temporary and the superpower's infrastructure boom will continue full steam ahead.

That is according to WA's former trade commissioner to China, Stuart Crockett, who sat down with The Australian Mining Review to talk about the huge opportunities that still exist with the world's second biggest economy.

Mr Crockett said the key to a healthy trade and investment relationship with China was to cut out the politics while building better relationships at the personal level through cultural understanding and awareness.

Australian companies also need to do better at showcasing and communicating their strengths in the areas where China is hungry to collaborate, such as innovation, engineering and technology, high level university partnerships and research and development.

Mr Crockett said Australia needed to highlight its superior capabilities when compared to other nations, such as in the mining and energy sectors, which could provide a starting point to repair the relationship with China.

He said significant opportunities still exist with China for off-take, investment and WA Mining Equipment, Technology and Services (METS) companies to collaborate with Chinese organisations working globally on projects such as the Belt and Road Initiative (BRI).

Also known as 'One Belt, One Road', the initiative is a key foreign policy and economic strategy by China to better connect Asia, Europe and Africa along overland and maritime routes.

While the Australian Government has not signed up to the BRI, Mr Crockett said this should not stop Australian mining companies from getting on board.

"There are 200 METS companies in WA active around the world and if they are able to provide a solution or help the economic development of China, then they are super keen to provide the funding and scale," he said.

"We can use the BRI to both economies' advantage.

"Australia has great skill sets to deliver on those sorts of projects that other companies around the world can't."

Door Open To Innovation

Australian mining companies who are innovators in Artificial Intelligence, Augmented Reality and Virtual Reality (AI/AR/VR) have enormous opportunity to commercialise and scale with Chinese organisations, Mr Crockett said.

"Anything to do with AI/AR/VR is a priority for China, which has just committed in its last five-year plan to increase R&D spending...by 7% year on year for the next five years," he said.

"They're chucking tonnes of money at this because they want to be the world's best in that environment and they will do anything to make it happen."

Mr Crockett said opportunities also exist for new energy and research projects in emerging industries such as hydrogen and electric vehicles.



Stuart Crockett is WA's former trade commissioner to China and has taken up a new role with CGM Communications in Perth.

"Universities are super keen to engage at highest level, and the lithium space is only going to grow," he said.

"Steel companies are trying to work out pathways for our universities and the government to collaborate and partner around making better steel."

In its five-year blueprint, China also plans to become a "consumer driven" economy as opposed to an "export driven" economy, which created both challenges and opportunities for Australia.

"It creates opportunities in that they will be looking (to import) more value-added product; anything that is premium, new or innovative," Mr Crockett said.

"We have an advantage because no matter what, we are still perceived as a country that offers premium products.

"It creates challenges because they are scaling up their own industries as well and they are very good at listening to their consumers and diversifying their products within a range.

"So we really need to be smarter, more innovative and we need to be out there pushing what we can offer more and how we push them through the marketplace."

The strategy paved the way for amazing partnerships between the two countries based on their strengths.

"We have got great innovations, especially in mining and energy but we can't scale, we are a country of 25 million people," Mr Crockett said.

"We have the innovation and they have the scaling capabilities, so if it's delivered in the right way there are massive opportunities."

Boom Time

Mr Crockett said he had "no doubt" the trade spat with China "will all be worked out" and that Australia would continue to benefit from the superpower's economic stimulus program.

"I am still very bullish on China, if we take a longer view," he said.

"We all have a right to say what we want, it's just how we deliver the message and how we go about maintaining those relationships.

"By 2035, China wants to build another 32,000km of high-speed rail and another 160 airports in the next 15 years so the (infrastructure boom) is absolutely continuing.

"We can take advantage of that and be a

part of that story with our technology, our skill sets, education providers and obviously iron ore too."

Even when Brazil manages to sort its supply issues, he believed Chinese demand for Australian iron ore would continue "at varying levels", with the free market to determine price and volume.

Chinese investment in Australia fell 60% in 2020, according to the Australian National University's Chinese Investment in Australian Database (CHIA).

"Part of that was driven by COVID-19 and partly by our relationship with China," Mr Crockett said.

"But it was also partly, in my humble opinion, because we haven't been out there showcasing the opportunities that exist in Australia in a defined manner and articulated in a way the Chinese want to hear it.

"That is right through to a Return-On-Investment proposition to how that impacts their position in the supply chain and the entire investment story.

"If we could tell the story better, we would see an increase in investment."

Friendships First

During his time as the Commissioner in the WA Government's Shanghai office between 2017 and 2021, Mr Crockett got to know the Chinese people very well.

"Having lived there for the last three-and-a-half years and being engaged with China for the last 25 years, the Chinese people are fundamentally like us," he said.

"They might look a bit different, they might speak a different language, but on every other level, they are exactly the same."

However, there were ample opportunities for Australia to learn from China on a cultural and business level, which are more closely linked than people may think.

"I always talk about Chinese timelines, for example there is a great saying that you should know someone 1000 days (about three years) before you become true partners," Mr Crockett said.

"For Australian companies, and anyone who wants to do business in China, it is friendship first, business second.

"They always get to looking at the bottom line because they're in business but they fundamentally look at relationships, they look at engagement.

"The biggest thing I take away is their deep desire to build relationships first.

"It's all about cultural understanding and collaboration and working together to leverage each other's skills."

Mr Crockett said this was the key to ensuring an enduring trade relationship with China, rather than focusing on the events that grab headlines in the political sphere.

"I always take it back to a business to business and person to person level," he said.

"Trade and investment is a successful outcome of a continuum, which starts with cultural understanding and education, and that leads to the trade and investment, first smaller amounts and then larger amounts and that needs to go on a continuum back and forth.

"We were lucky in that we received significant trade from China but we didn't do a lot in the relationship building stage and around cultural understanding and cultural awareness.

"So I think we need to go back to the beginning and go on that journey and focus on the people and the things they want to focus on, which is collaboration and innovation.

"The mining and new energy sectors are a key starting point to help us rectify the relationship."

New Role

Mr Crockett has taken up a new role with Perth-based PR specialist CGM Communications, which has launched a new division focusing on trade and investment, with a particular focus on Asia.

He will head the new division, which will help fill a gap in the market to provide help to overseas companies which need assistance navigating the WA market, as well as Australian companies which need advice on launching into Asia.

Mr Crockett commenced as Strategic Counsel, Trade and Investment Communications in CGM's Perth office in March.

CGM Communications founder Daniel Smith said Mr Crockett's arrival would assist the company to leverage its existing market-leading capabilities in community, government and media relations, helping international investors successfully deliver projects that create win-win outcomes for both the proponents and local stakeholders.

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Shattering The Stigma Of Employing Ex-Offenders

MACFORCE founder Anthony MacShane, and Jeff, an ex-inmate and MACFORCE candidate.

In-prison to on-site, how mentoring and mining recruitment is changing the lives of ex-offenders.

A few years ago, Anthony MacShane, founder and director of recruitment company, MACFORCE Australia, heard a talk about a Prisoner Employment Program (PEP) helping offenders consider job prospects post-release.

It flicked a switch of curiosity in Anthony who had a range of experience in the resources and construction industry, working FIFO, managing large projects, and in his new role as the head of a growing recruitment company.

He also had, at times been 'off-track' himself, so he could relate to how most people deserved a second chance.

"This talk was huge for me as I hadn't been exposed to this sector. I enjoy thinking outside the box in everything I do, so I wondered how I could use my experience, the services MACFORCE offered our candidates already, and empathy, to make a huge impact," Anthony said.

"I also considered the skills shortage in Australia's resources industry, and wondered how MACFORCE could play a part in bridging the gap between ex-offenders and these employment opportunities."

Anthony saw being a part of the solution as necessary in reducing recidivism rates, and statistics continue to show how around half of offenders fall back into crime post-release.

The Productivity Commission noted in a

January 2020 report that in 2018-2019, 54.9% of released prisoners returned to corrective services two years post release, which included either prison or community corrections.

Anthony started to consider what prisoners do during their sentences to see how they could potentially be a good fit for the resources industry.

"A lot of us think that while prisoners are serving their sentences they are just sitting in their cell and have a good long time to think about what they've done, but it's far from the case," Anthony said.

"These men and women are picking up skills in prison, and as they reform they're having to work with each other.

"So I was really interested in the PEP program, and how I could help was by lending my knowledge and experience to connect offenders with the mining and resources industry."

Anthony started delivering prison talks, under the MACFORCE Australia brand, and self-funded.

"We were really well received. I was going in telling these men and women what they'd never heard before from any other group; what was possible, exactly where the opportunities were, what the skills were and throwing a bit of motivation in there as well," he said.

"The best thing about the talks has been seeing the prisoners sitting there with their arms folded and at first not at all interested in what I have to say. But after an hour

talking they all line up to tell me their stories.

"The talks gave them a lot to think about. I'd challenge them, I say, don't go being a sook, go back into your room and write your resume; think about what you want to do when you're released and start making efforts towards your career now."

Officialising The Program And Making Connections

Around 18 months into delivering the prison talks, the program began to formalise. This came around the same time Anthony met Jeff, who was incarcerated at the time. Jeff was a career criminal from a family of crime that dated back 100 years.

"This was when we started working closely with guys who'd been institutionalised to help mould our program. This included Jeff, who while serving time had studied and gained a Bachelor of Psychology and Diploma of Social Welfare, and had helped start other reform programs," Anthony said.

"I also started working with a veteran corrections psychologist to help create our program that was unlike any other. We worked on how we could begin engaging with prisoners while they were on the inside so they'd have clear direction on what to do once released. We wanted maximum impact, and to limit the chance of recidivism."

The program is now officialised and runs across two phases. The first, an Information Session, is directed towards prisoners six months before release to cover discussions on job opportunities, hacks, training, industry insider tips, resumes, success stories and an open session for questions.

The second part involves selected prisoners joining a MACFORCE Australia Mentoring Program, where they are positioned as candidates and mentored on their 'road to success', with a major focus being employment on release.

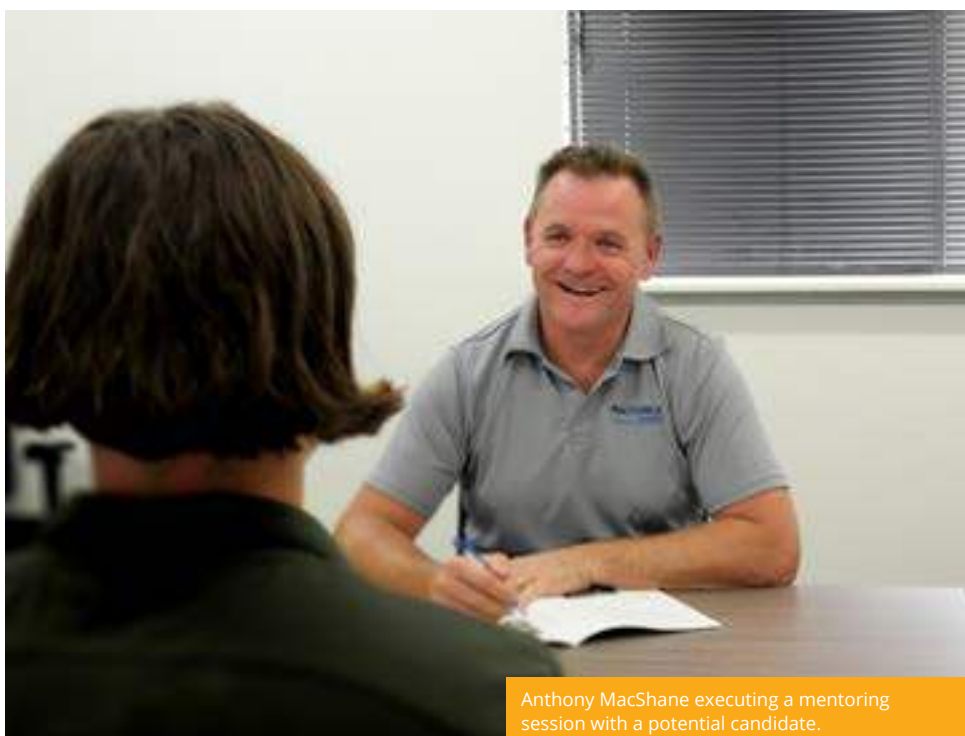
Jeff's situation and how he reformed, made even more challenging coming from intergenerational crime, showed how programs to support recidivism are vital, and can work.

While in prison, Jeff reluctantly attended the seminar with Anthony, and was encouraged by how relatable Anthony and the team were, compared to other talks he'd attended. Having served 15 years in prison, across multiple sentences, Jeff said there were two things that kept him from reoffending; motivation and opportunity.

Jeff aims to encourage other ex-offenders to turn their lives around. He continues to be motivated by those he loves, including his children and grandson, and when it comes to opportunity, employment has been integral.

"It's about motivation and opportunity - if you don't see an opportunity, create it yourself. Go out there and find a place like MACFORCE who are non-judgemental, who have a mentor program where you get the opportunities to go and work but you also get the support from people who know what they're talking about," Jeff said.

Anthony said the more he learned about the prison system, the more he understood how easy it was for prisoners to reoffend, especially if they were, like Jeff, born into crime.



Anthony MacShane executing a mentoring session with a potential candidate.



The core values at MACFORCE Australia.

Anthony MacShane with a mobilisation crew of workers.

"If we can contribute to getting these ex-offenders on track to employment, the benefits are massive to everyone; to society and to the kids of crime. It is such a massive social impact as well as on a personal level; people are turning their lives around and creating a life they hoped for before they committed a crime," Anthony said.

How Employing Ex-Offenders Can Help The Industry

It's no secret Australia is facing a skills shortage across construction and resources, and while many roles are for high-skill levels, like engineers or diesel mechanics, Anthony says there are plenty of roles to fill across varying experience levels.

"This is the perfect time to break the stigma of employing ex-offenders," Anthony said.

"We're in such a lucky country and Aussies want to give people a go, especially once you actually know about these men and women and their story; and the ex-offenders just want a chance to prove themselves."

Anthony also noted that clients MACFORCE works with have been generally receptive of employing ex-offenders.

"In a way, the clients will know more about ex-offenders than they do other candidates because of their explicit criminal record, so there's comfort in understanding their story and the transparency begins from day one," Anthony said.

How MACFORCE Is Making A Difference

Since the program began, MACFORCE has employed more than 40 ex-offenders and mobilised them with clients in WA.

Of these employees, just one candidate has reoffended.

While Anthony is saddened that one candidate didn't find success, he can't help but be excited by the success of the program, already defying the nationwide recidivism rates of 54.9% in two years post-release.

"Over the past three years the impact has been huge - we've delivered our talk to thousands of prisoners, we've interviewed and provided one-on-one guidance to hundreds, and have employed more than 40. Right now, we're employing ex-offenders weekly, with 11 candidates currently in our mentor program," Anthony said.

"We look forward to being able to show the success of our program using a similar measurement timeline of two years (as the Productivity Commission), to be able to show the real impact our program is providing.

"What makes it all worthwhile is the feeling you get when an ex-offender finds their



positive path. You go and do a talk, or you work with someone, and they get a job, and they send you photos of their newborn, or photos of their wedding, or they just write a letter of thanks, or they stay in contact telling you they've now got a bank balance and they've bought a car, or they've moved into a house.

"It's about creating certainty for people, and as humans we need that certainty. So much anxiety stems from not having any money to provide for yourself or family and that's why employment is so important."

Already, MACFORCE has rolled out its program in a number of WA prisons and is looking to formalise partnerships with the WA Government, with feedback acknowledging the importance of connecting prisoners with industry opportunities.

Anthony is passionate about taking the program nationwide to further the impact.

"Imagine if we can roll this out nationwide to prisons in all states. We have huge potential to change the lives of offenders, their families and communities," he said.

The MACFORCE Australia Story

Anthony has always had an entrepreneurial spirit and after being a project manager

on major projects in the resources and construction industry, he wanted to put what he'd learnt into practice, by owning his own business.

"In this industry you either know equipment or people, and I knew people. I've always been empathetic; getting along with people and seeing their needs and enjoying helping them," he said.

"Recruitment was a natural fit; I'd run jobs where I knew what skill sets were required, and I knew how important getting good people on the ground was for companies to get the job done. I also knew I could provide a really personalised service to our clients and candidates."

The company began in 2017 while Anthony was still employed in a FIFO position, with his wife, Richelle helping to get MACFORCE Australia off the ground. But soon enough, he had secured his first clients, meaning he could commit full time.

A year later, Anthony brought family members into the business: his daughter, Tyla, and sons, Egan and Finn, who each lent special skills, before he engaged a team from the field, peers with specific experience in mobilisation and FIFO.

Over the past three or so years, the company has grown rapidly, but what hasn't changed as both MACFORCE Australia's candidate and client base has expanded, is how the company has forged relationships based on its core values of quality, integrity and compassion.

"We care and we're compassionate, and the clients we work with also embody these values. It's an industry that can be brutal, so we need to show that compassion to our candidates and everyone we work with," Anthony said.

"We're a recruitment company with heart and our mission is to change the way people are employed in Australia."

"We're doing that, whether it's by working with ex-offenders or finding someone their next career opportunity, we're all about finding a position that best suits their life stage, and what is going to be the best fit to help them live a better life."

For more information, please visit the MACFORCE Australia website at www.macforce.com.au

Contact MACFORCE Australia at **1300 06 06 41** or email info@macforce.com.au

AMR

IPO for NT Gold-Copper Project

Middle Island Resources will demerge Barkly Operations (Demerger) and ultimately IPO BOPL on the ASX.

BOPL, a wholly owned subsidiary of Middle Island, is the holder of the Barkly copper-gold project in the Northern Territory.

Barkly comprises 12 exploration licences and applications, collectively covering 4411 square kilometres.

The project has Tier 1 iron oxide-copper-gold (IOCG) targets, predicated on extensive government research undertaken by Geoscience Australia and the Northern Territory Geological Survey under the Exploring for the Future (EFTF) initiative.

The IOCG potential extends along the interpreted, fault-bounded East Tennant Ridge and is principally defined by magnetic, gravity and magneto-telluric anomalies beneath the Georgina Basin, between Tennant Creek in the NT and Mt Isa in Queensland.

It is anticipated that Eligible Shareholders of MDI will be entitled to receive free shares in BOPL in the same proportions as their respective holding in Middle Island, as well as priority entitlement to apply for shares in the future Barkly IPO.

The Demerger is advocated because, among other reasons, MDI's Directors believe:

- MDI's market capitalisation is not

according proper value to Barkly

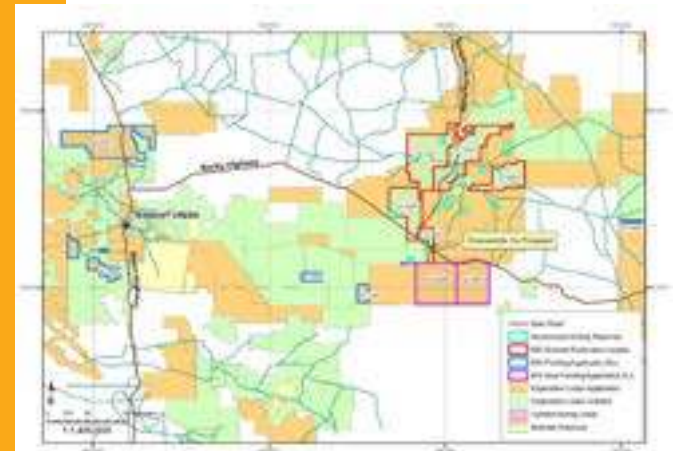
- sentiment for copper, the potential quality and scale of the Barkly copper-gold project and the consequent expected strong interest in BOPL once it is demerged from MDI (market sentiment contingent), give rise to an expectancy that significant value could potentially be liberated for eligible holders
- MDI would be free to focus on optimising shareholder value for its core gold asset at Sandstone
- those shareholders who are invested in MDI for its exclusive gold portfolio, and who have no interest in copper, will not have their shareholding in MDI diluted by the pursuit of active exploration at Barkly, as would be the case if the Barkly Project were to remain in MDI
- certain investors focused on copper-gold, rather than gold only, might well be deterred from investing in MDI due to its exclusive gold focus, whereas those same investors may be eager to invest in BOPL.

Middle Island MD, Rick Yeates, said the demerger of BOPL will provide investors two opportunities to grow value; in Middle Island as a more advanced pure gold exploration and development company, and in BOPL as it commences greenfields exploration of an exciting new copper-gold province. **AMR**



Exposed copper mineralisation at Middle Island's Crosswinds discovery in NT.

Middle Island's Barkly copper-gold project in the NT.



Platina Taps Xanadu Riches

Platina Resources will expand its gold presence in WA after signing a conditional term sheet to acquire the Xanadu Gold Project (Xanadu), located in the Ashburton province in close proximity to the multi-million ounce Mt Olympus gold deposit explored by ASX-listed Kalamazoo Resources.

Platina Managing Director Corey Nolan said Xanadu added critical mass to the company's gold portfolio at a low acquisition cost.

"Xanadu has immense appeal given the number and width of economic grade gold drill intercepts which have never been followed up with a systematic exploration campaign," he said.

"The project has been the subject of a number of mainly shallow drilling programs and a historical gold heap leach operation.

"Our exploration strategy will initially comprise low-cost geophysics and geochemistry to build a deeper knowledge of the geological potential of the project and to define both shallow and deeper targets for drilling."

Mr Nolan said the Xanadu Project secured a large alteration system hosted within sediments and carbonates prospective for intrusion related gold mineralisation, such as the Telfer Gold Mine (Newcrest) and the Hemi discovery (De Grey Mining). He said Xanadu also displayed strong similarities to the Carlin gold deposits in Nevada, USA.

"Whilst we believe there is significant potential to expand upon the known oxide mineralisation, the longer term prize is targeting primary mineralisation within the alteration core of the system which has never been tested by historical drill programs," he said.

Platina believes the project offers significant upside due to:

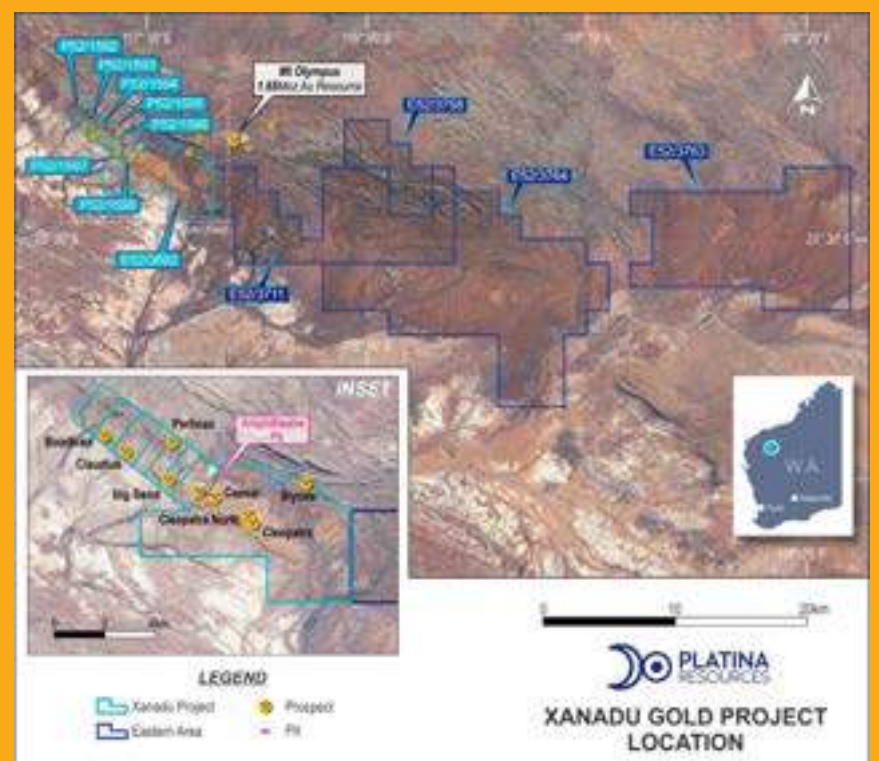
- A favourable regional scale structural setting, with the multi-million ounce Mt Olympus gold deposit situated 7km to the east
- Widespread gold mineralisation identified within a large and intense hydrothermal alteration system which extends for over 10km in strike extent

- The host lithology, the Duck Creek Dolomite, is a highly reactive rock and favourable host to the target intrusion related and Carlin styles of gold mineralisation

- Immediate targets from surface and at depth within the interpreted east plunging alteration system.

Xanadu comprises seven prospecting licences and five exploration licences covering 498km².

Logistics and operations are expected to be low cost with access to the project from the regional mining centre of Paraburdoo 38km to the north. **AMR**





The Arbitration and Mediation Specialist

Paul Menzies has had extensive experience in Work Place matters, including award and agreement negotiations and litigation as well as unfair dismissal and discrimination claims.

Paul has appeared for insured defendants and their insurers, and frequently advises on various aspects of insurance law and liability, both contractual and arising under statute. These appearances have included cases of extent and limits of indemnity, dual insurance and reinsurance.

Paul's professional life at the Bar has seen him appear for Governments in a broad range of areas extending through most aspects of administrative law (including workplace relations), constitutional law, contract and common law generally.

As a result of his relationship with Government cases, Paul has gained considerable insight into the workings of the executive Government and the Public Service and is sensitive to the nuanced approach that is required when appearing either for or against Government.

He has appeared in most administrative and quasi-judicial tribunals including Fair Work Australia, the NSW Industrial Relations Commission and their various predecessors, Administrative Decisions Tribunals, and professional disciplinary bodies.

Paul has also appeared for interested parties and as Counsel Assisting in a broad range of inquiries, including ICAC, significant Coronial Inquests and Royal Commissions.

Arbitrator

Paul is a member of the Chartered Institute of Arbitrators and a councillor of the NSW branch. He is frequently invited to speak at International Conferences, concerning particularly Mediation and International Commercial Arbitration.

Paul accepts instructions as mediator, arbitrator, and advocate in mediations and domestic and international arbitrations in Australia and internationally.

Mediator

Throughout his career, Paul has utilised mediation as an effective mechanism for resolving disputes.

First accredited as mediator in 1995, Paul has since conducted a large number of mediations in relation to a wide range of issues. As an experienced mediator and barrister, Paul is able to quickly identify the key issues in a dispute and facilitate fair and effective outcomes for parties.

Paul accepts instructions as mediator or advocate in mediations both locally, interstate, and internationally.

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Wear Resistance Test For Mines

The mining industry's unrelenting focus on keeping costs down has been a major driver for METS companies to develop new wear resistant materials.

Every few years, there is a new product in the market that is claimed to be 'the best a mine can get.' Is there a way to compare all products, apples with apples, to find the best material for your specific application?

Dr Michael Lum, Materials and Elastomer Development Manager at Weir Minerals Applied Materials Technology Group, and Mark Doyle, Global Product Manager for Linatex® and other products, discuss how materials are tested for wear resistance.

"The industry standard test for rubber materials is ISO 4649, a dry abrasion test," Dr Lum said.

"This method involves a test piece of rubber that is exposed to a specified grade of abrasive sheet attached to a rotating cylindrical drum device. The resultant wear loss can be reported as a relative abrasive resistance index or volume loss."

However, on mine sites wearing materials are often used in wet environments, and Weir specialists recommend that a dry abrasion test should be supplemented with wet abrasion testing.

To get the true picture of how a test piece of rubber will behave outside of the lab, Weir developed a modified version of ISO 4649 for wet abrasion testing, representative of what happens on the mine site.

But really, there is no one single test that can provide a comprehensive reading of the material's wear resistance.

"If you are limiting your testing to a specific test, you will be looking at specific impingement angles, abrasive particles, temperatures, etc., but missing other important variables," he said.

"The same wear material will behave differently in varying conditions, which is why Weir developed additional in-house Wear Testing Program with unique tests such as a Weir® Slurry Jet Erosion test and a Weir® Coriolis test."

"The Weir® Coriolis test for rubber and alloys is representative of what happens inside a mill pump on a mine site," Mr Doyle said.

"It simulates the low angle slurry impingement through a rotational (Coriolis) spinning test which can be used to determine how a material will behave as a hose or tank lining."

The Weir® Slurry Jet Erosion tester sends a jet stream of high-velocity abrasive particles impinging on the material surface at higher angles; this typically would simulate an erosion process affecting various pump parts or a hose bend.

The wear scars are then analysed using a Scanning Electron Microscope (SEM) and surface profilometry to determine the wear mechanism and the tested material's mass loss respectively.

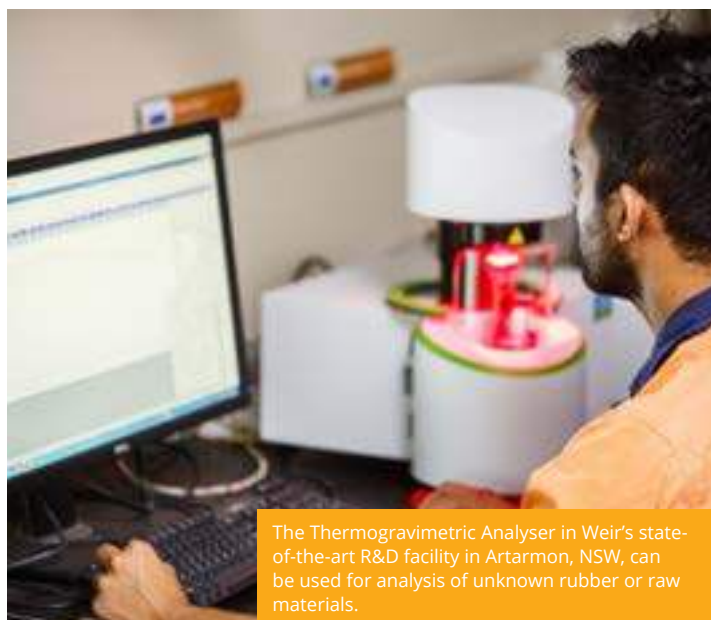
Dr Lum said to get a true comparison of various test pieces, the test temperature can be set at a certain level representative of the desired application, usually around 50-60° C - normal slurry temperature for the majority of mine sites.

"In some mine sites, temperatures can elevate upwards of 100°C, but that is usually

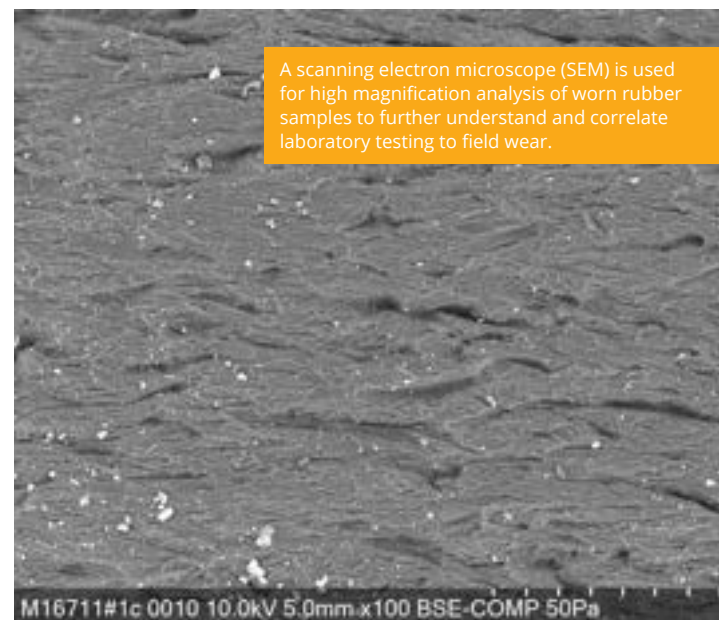


LABORATORY

Linatex® testing lab, 1955.



The Thermogravimetric Analyser in Weir's state-of-the-art R&D facility in Artarmon, NSW, can be used for analysis of unknown rubber or raw materials.



A scanning electron microscope (SEM) is used for high magnification analysis of worn rubber samples to further understand and correlate laboratory testing to field wear.

M16711#1c 0010 10.0kV 5.0mm x100 BSE-COMP 50Pa

associated with acid leaching applications," he said.

Can lab testing give a true picture of the material's behaviour on the mine site?

The lab data definitely gives mining customers confidence, confirming that the OEM has the necessary machines, facilities and knowledge to develop fit-for-purpose products that will last.

"Weir Minerals has four R&D centres in the APAC region for specific product categories, and employs over 100 materials science experts worldwide," Dr Lum said.

"We have advanced market-leading testing equipment, access to international testing and highly analytical tools for in-depth testing to analyse wear.

"We know our mining customers' requirements and have developed a number of in-house tests to analyse wear to address them.

"Our comprehensive lab test knowledge

base for various wear resistant materials in the market goes back for more than 50 years, and with this extensive laboratory knowledge, we are able to give our customers the confidence for trialing and using our materials. But the real test is always how the material behaves in the field."

Mr Doyle said over almost 100 years of Linatex history, many products and companies have come and gone, making various claims of their wear life.

"Linatex premium rubber is still made differently from any other rubber in the market, it is still manufactured in the same way as in 1920s, and it is the only product in the market with almost a century of being tested in the mines - the only test that matters," he said.

He said that Linatex® premium rubber products outperform the competition and deliver the best value in the market.

"Based on our constant testing of new competitor samples and our extensive global library of testing regime going

back many years, we have created a total ownership cost calculator," he said.

"Whenever we compare Linatex with a new product, over their lifetime Linatex products always save our customers money."

As examples, Mr Doyle mentions several recent case studies. In one of them, Linatex® premium rubber delivered US\$110,000 of annual savings to Kansanshi, the biggest copper mine in Africa.

Closer to home, Linatex® premium rubber saved 140 hours of downtime and \$78,000 per annum to KNS nickel processing plant in New Caledonia.

"In order to find the best material for your specific application, you need to consider results from all available wear resistance tests - industry standard tests, in-house lab tests and in-field tests. Compare the data, calculate the total ownership costs of each material in your consideration set, and make an informed decision," he said. **AMR**



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The Beast is a Beauty

One of three Beast SAG mill discharge screens at Cobre Panama's processing complex.

Canadian-based First Quantum Minerals Ltd (FQML) is one of the world's leading copper producers, exporting to customers worldwide.

While its focus is on copper, FQML also produces nickel, gold, magnetite, zinc, and other by-products. The company operates mines in several countries and employs around 20,000 people world-wide.

With its history dating back to the mid-1990s in Africa, the company has steadily grown, largely through project development and acquisition.

In 2010, FQML made four acquisitions, which included Trident/Sentinel in Zambia and Ravensthorpe Nickel in WA.

Following a corporate acquisition in 2013, First Quantum assumed an 80% equity interest in the Panamanian company that holds the Cobre Panama concession. Since then it has increased its interest to 90%.

Spanish for 'Panama Copper', Cobre Panama is one of the largest new copper mines opened globally in the past decade. Located 120km west of Panama City, the production complex Cobre Panama is one of the largest new copper mines opened globally in the past decade, and includes open pit mining, a processing plant, a 300MW power station and an international shipping port.

At full current capacity, the plant can process 85mt per annum of ore to produce more than 300,000t of copper per year along with gold, silver and molybdenum.

Although FQML's head office is in Canada, the company also has offices in the UK, Australia and South Africa. FQML's Australian office has been described as the 'epicentre' of the company's projects capabilities.

FQML has a reputation for being bold, taking calculated risks and doing things a little differently. Over the last few years, the company has commissioned the design of some of the largest mineral process equipment ever made.

In 2017, First Quantum approached Schenck Process regarding the supply of mill discharge screens for Cobre Panama's SAG mills, which are among the biggest in the world. The resulting design was a monster mill discharge screen, that was later dubbed the 'Beast'.

Vice-President for Original Equipment at Schenck Process, Amit Parimoo, said as well as designing a screen that could handle the throughput volume from the mills, it also had to fit within a tight footprint.

"That was the most challenging part for us," he said.

Schenck Process delivered three of these screens to Cobre Panama in 2018 and the processing plant went into commercial production in mid-2019. The same screens were subsequently retrofitted at First Quantum's Sentinel operations in Zambia.

Based within FQML's Projects Group in West Perth, Project Manager Aaron Fields is a professional mechanical engineer with more than 25 years of experience managing mineral processing projects in both Australia and overseas.

Having joined FQML in 2017, Mr Fields became involved in the Cobre Panama development and remains part of the team responsible for the mine's ongoing success. "When First Quantum bought the Cobre Panama mine and restructured the project, it was conceived for a 74mt per annum throughput," he said.

Mid-project, we increased that to 85mtpa by making some changes to the milling and flotation circuits, but there were already elements of the plant that were capable of 100mtpa. We always had the intention to ramp up quickly to 85mtpa and then stretch beyond that to 100mtpa", he said.

"Despite the challenges of COVID, we are currently doing well as we work towards our 85mtpa continuous throughput target. Also, over the last 6-12 months we have scoped some concurrent, complementary projects that should allow us to reach 100mtpa and beyond."

One of these improvement projects involves the installation of a new screening facility between the complex's primary and secondary crushers.

The intention is to minimise fines in the feed to the secondary crushers, freeing up valuable crusher capacity. The installation of a third secondary crusher is also planned. The new screening facility will require three screens each capable of handling up to 8000t per hour of primary crushed ore, with the oversized material feeding the secondary crushers and the undersized material bypassing the crushers and heading directly to the grinding mills.

Based on the positive experience that they had with the supply and performance of their mill discharge screens, FQML once again approached Schenck Process for assistance.

"When we develop a good relationship with a supplier and they prove to be what we would like them to be in terms of technical innovation and support, we tend to go back and work with the same people. This was definitely a factor in our decision to work with Schenck Process on this project," Mr

Fields said.

Responding to FQML's requirements, Schenck Process' Australian based engineering team created a new hybrid design which it says will be the largest multi-slope banana screen ever to be built. The result is a screen that measures 4.3m wide and 9.7m long.

Like Schenck Process' Beast SAG mill screens, the excitation force of the new SLD4397DXX 'mega' screen is delivered by four DF704 exciters mounted on 2 unitary beams. But unlike the Beast, the new screen's drive assembly incorporates a unique twin gearbox arrangement driven via a single motor, ensuring effective exciter phasing.

FQML's Board gave the greenlight to Cobre Panama's improvement project in December 2020. Pleased with Schenck Process' new design, in January FQML awarded the company an order for the three new screens.

These huge machines will be built at Schenck Process' new Jandakot production facility in WA and are expected to be shipped to site by the end of 2021.

"We are really pleased to be chosen to play such an important role in the ongoing success of Cobre Panama. Our purpose-built production facility in Jandakot is equipped with four 40 tonne cranes, allowing our teams to safely handle very large equipment with ease. With a total transport mass of around 89 t, these huge screens will challenge our facility's impressive lifting capability," Mr Parimoo said. **AMR**



Two overland conveyors deliver material from the primary crushers to the secondary crushers.



3D model of the new SLD4397DXX 'mega' screen destined for Cobre Panama's processing plant.

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Light Years Ahead

Light Distance and Ranging (LiDAR) technology is being used to transform measurement in the Australian mining and resources sector.

Around since the 1970s, Airborne LiDAR has evolved to become one of the most efficient, reliable and accurate means of mapping the shape of landscapes and features. Similar to how Radar uses radio and Sonar uses sound, LiDAR uses laser technology to accurately measure distances.

An Australian company uses a potent combination of LiDAR & imagery collected with a fleet of fixed-wing aircraft, intuitive cloud processing platforms and artificial intelligence (AI) algorithms to produce a wide range of mapping and geographic information solutions.

Processing teams with a diverse and well-honed range of skills process massive data volumes at almost unfathomable speeds.

Alex Rixon is the LiDAR Product Manager at Aerometrex, a company at the forefront of Australian – and, indeed, international – Airborne LiDAR surveying and 3D modelling. What sets this organisation apart is not just the way it is using LiDAR and deploying it for a range of applications, but that it is integrating this technology with AI and cloud-based processing to make the data more accessible, usable, and understandable to those who need it.

That includes the mining sector.

Aerometrex LiDAR fleet is made up of four Vulcanair P68C aeroplanes. Each aircraft is fitted with a survey aperture and the latest in

LiDAR and digital photographic technology. In operation, onboard is a pilot as well as a sensor operator who work together to capture required LiDAR and imagery data.

The laser beam emitted from the aircraft starts off smaller than the diameter of a pencil and diverges in a conical shape to the size of a small dinner plate upon reaching objects on the ground.

The LiDAR sensors onboard can emit up to two million points every second!

If that's not impressive enough, each laser pulse can take up to 15 individual measurements through tree canopies to measure the ground underneath!

The laser pulses are resolved as a dense three-dimensional point cloud. Depending on survey needs, this point cloud can be as sparse as 1 to 2 points per square metre or up to densities of more than 200 points per square metre!

Datasets with this high level of fidelity, quality, and accuracy have a wide range of uses in not only mining applications, but many others such as forestry management, and urban planning.

With each aircraft covering up to 150km² of LiDAR survey on a typical day, Aerometrex can capture data and create three-dimensional visual models which detail ground terrain, mine site features, vegetation, infrastructure, etc. Even powerlines and fences in overgrown bushland can be identified.

This level of precision allows for accurate

surveying and analysis in the mining context. With haul roads, safety bunds, windrows and stockpile volumes all able to be accurately appraised and then analysed, mine operators, can access data, which is important in activities such as improving safety, assessing regulatory compliance, planning blasting, productivity reporting and monitoring environmental management and rehabilitation.

With LiDAR datasets, roads within a mine site can be accurately measured to determine the width of the road, the width of each carriageway and the distance between vehicles to ensure minimum requirements were met, while safety bunds can be assessed for compliance to height, width and slope requirements for that site.

Mr Rixon said LiDAR's capabilities were set to further enhance offerings to the mining sector through value-added reporting and data products, all made more efficient by the application of AI and cloud-based platforms. Challenges like transporting data from remote locations to processing offices are being overcome by the use of highspeed cellular broadband technology with data available for processing in the cloud within just hours of being flown.

"The remoteness of a survey location is no longer as great a factor; we can have data uploaded from the field to the cloud and made available to clients very quickly. This is really important for mining clients," Mr Rixon said.

Through the powerful combination of intelligent algorithms and scalable cloud-based computing, three-dimensional

modelling information can be available with extremely fast turnaround timeframes.

"What once took the LiDAR industry weeks to do, Aerometrex can do in just a matter of hours," Mr Rixon said.

LiDAR, being based on emitted laser pulses is also effective at night!

This means data can be collected in locations that may be inaccessible during the daytime. Poor weather, blasting timeframes or difficult airspace can be managed around by capturing data at night.

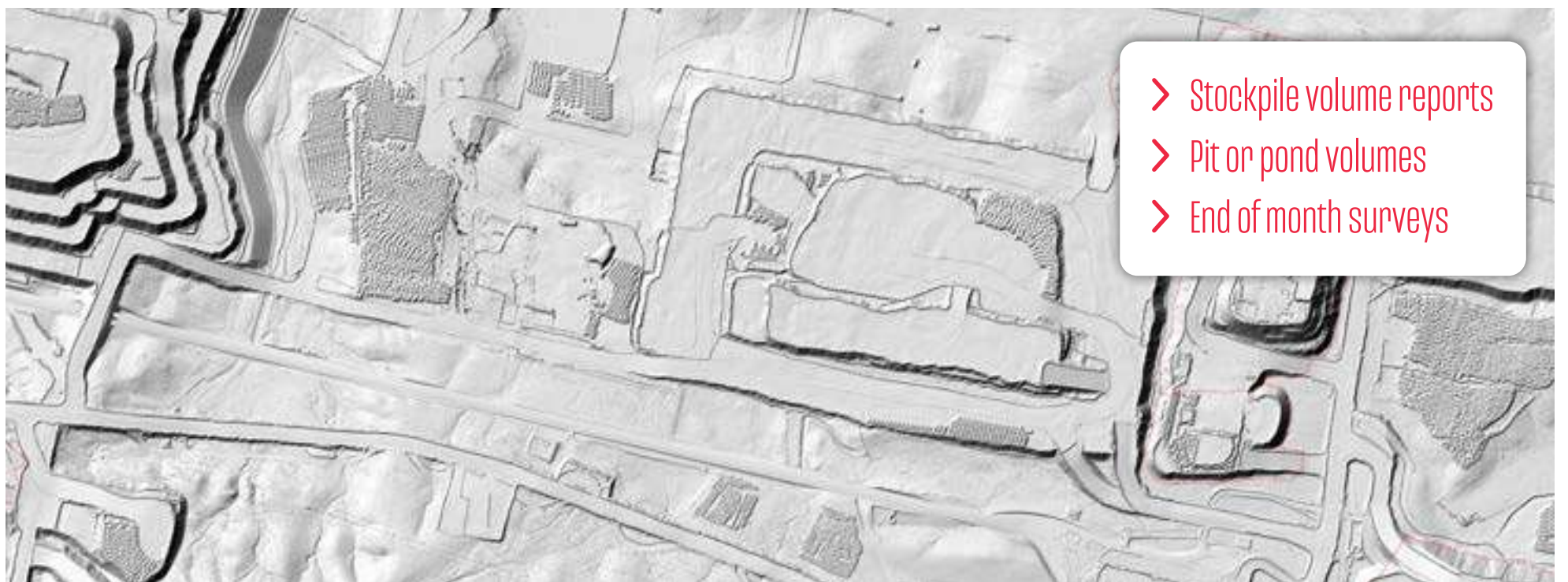
"If we have a clear window of a couple of hours, we can get up there and do what we need to. We don't need daylight," Mr Lidar said.

While fast data turnaround is critical in productivity, safety compliance and incident management, the data can also be used for bigger picture applications.

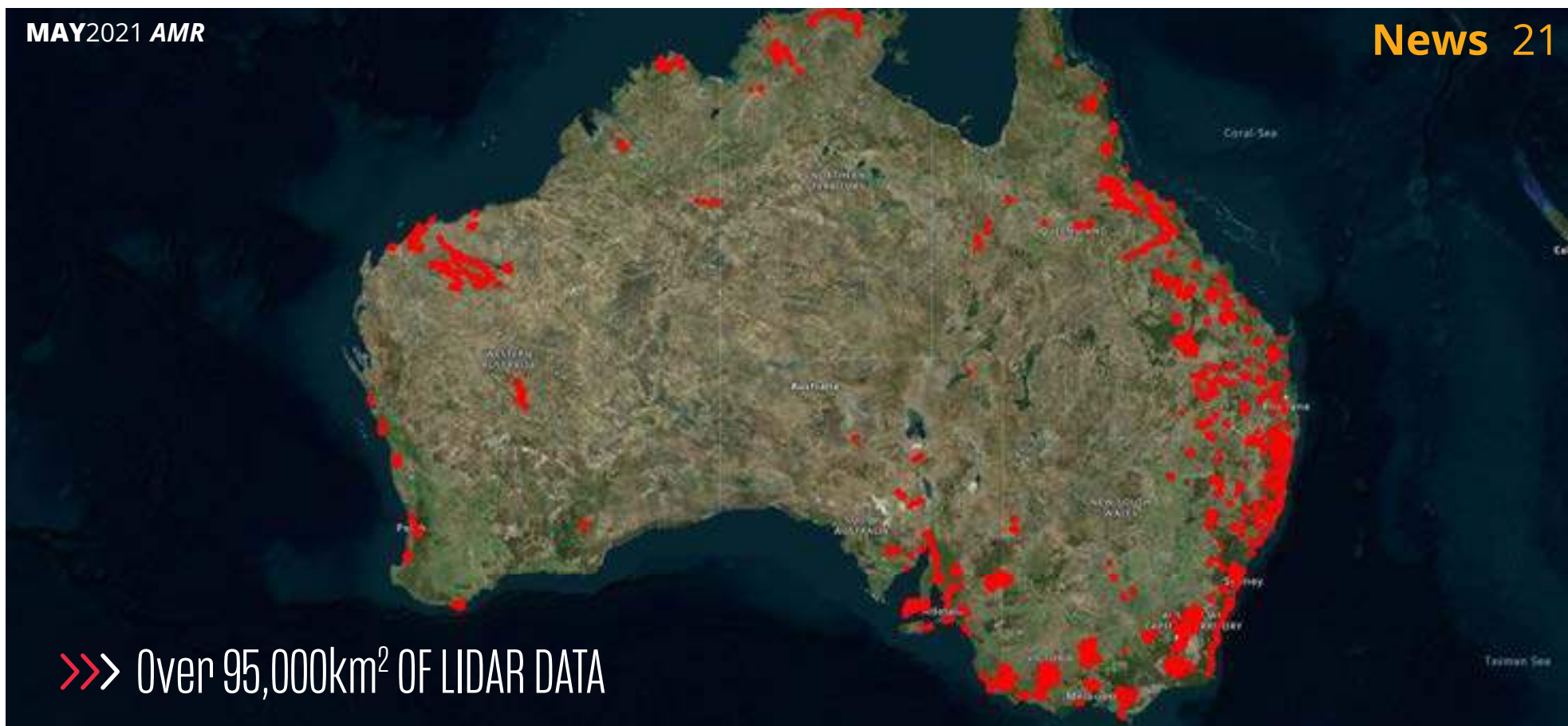
Multiple overlapping surveys can be combined into one large dataset. This makes mapping exceptionally large areas incredibly efficient to capture compared to other survey technologies.

Mr Rixon said that the more than 95,000 square kilometres of LiDAR collected last year is a measure of Aerometrex's impact on this market.

"Our aircraft do not stop – they fly the length and breadth of the country continuously capturing image and LiDAR data for mining, bush fire management, local government, major projects and private



- > Stockpile volume reports
- > Pit or pond volumes
- > End of month surveys



>>> Over 95,000km² OF LIDAR DATA

enterprise," he said.

Aerometrex has more than 40 years of experience, and Mr Rixon has been working with LiDAR technology for more than 20 years - they have seen mapping technology continually evolve to where it is today and believe that the company is well-positioned to lead this industry into the future.

The other aircraft in the Aerometrex fleet are also kept busy, with another Vulcanair P68C, three Cessna 404 Titans, and a Cessna 421 - all of which are used for aerial imagery and can be used for LiDAR as needed.

Since the business started in 1980, Aerometrex has covered more than 3.9m square kms and completed more than 5300 projects - and they have pictures to prove it!

Now, Aerometrex has two offices in Australia - in Adelaide and on the Sunshine Coast - as well as an office in Denver, USA.

As for the future?

Aerometrex applies a combination of technologies to capture detailed data and derive vital decision-making information.

The company has been working towards hosting their diverse datasets on their web-based platform, MetroMap - from LiDAR to 3D mesh models and aerial imagery. This is another key spoke in the Aerometrex wheel - MetroMap is what brings everything together and disseminates it giving customers access to a full suite of spatial data.

Aerometrex is doing some ground-breaking work identifying features such as cars or people, and other elements to be removed from imagery by AI programs to improve the realism of modelling data.

"I think what we are doing, we are doing better than everyone else," Mr Rixon said. "We put a lot of work into our research and development and it has represented quite a lot of value for us."

Federated datasets created from LiDAR, 3D modelling and high-resolution imagery are closing the gap between the virtual and the real world.

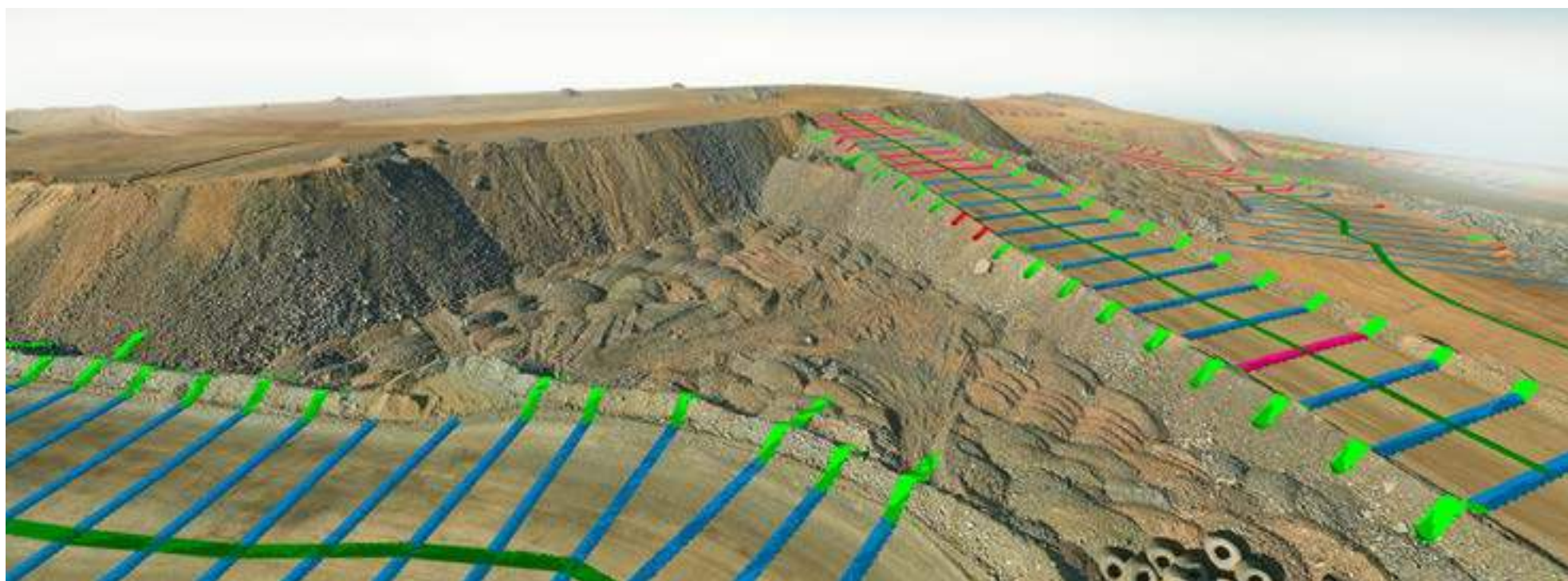
Ultra-realistic virtual environments can be used for decision-making in the same technology being used by game developers

to enable as real and visually appealing an experience as possible for their users. Mr Rixon reckons it is just as much fun to play with data as with video games these days.

"A lot is happening in the space of environmental planning, virtual tourism and even events such as Formula E," he said.

Therein lies the future for Aerometrex. And who would have thought the words gaming, mining, and Formula E virtual racing would be used together in the same story - much less the same sentence.

But that is what the future looks like. And it is in Super High Resolution. **AMR**



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New Life for Earthmover Tyres

Michelin is building its first tyre recycling plant in collaboration with Enviro, a Swedish company that has developed a patented technology to recover carbon black, oil, steel and gas from end-of-life tyres.

Based in Chile's Antofagasta region, the plant will be able to recycle 27,000t of earthmover tyres a year, or nearly 60% of such tyres scrapped every year nationwide.

Work will begin this year, with production scheduled to get underway in 2023.

More than \$30m will be invested in building Michelin's first new-generation end-of-life tyre processing plant.

The new-generation recycling plant will support the circular economy with innovative recycling processes.

Scrap tyres will be collected directly from customer premises, then transported to the plant to be cut up and recycled.

Enviro's technology, which produces new, high-quality reusable materials like carbon black, pyrolysis oil, gas and steel, will enable everything in an end-of-life tyre to be recovered for re-use.

Current plans call for 90% of the recovered materials to be repurposed in a variety of rubber-based products, such as tyres, conveyor belts and anti-vibration products. The remaining 10% will be reused directly by



the plant to generate its own-use heat and power.

This initial recycling plant will enable Michelin to offer a comprehensive recycling solution, from collecting end-of-life tyres to reusing the recovered raw materials in the manufacture of new products.

Michelin's Marketing and Business Development Director for High-Tech Materials, Sander Vermeulen, said the milestone would enable the company to offer customers a new-generation recycling solution, while developing new business for the group.

"We are currently in talks with several Chilean mining customers to sign long-term

contracts," he said.

"By scaling up Enviro's technology, we are offering them a solution that will support their environmental objectives and enables the development of a circular economy."

The future tyre recycling plant is fully aligned with the group's commitment to incorporating an increasing amount of sustainable materials in its tyres, as illustrated by the VISION Concept.

Aware that the speed and nature of innovation in this area require new forms of cooperation, Michelin has positioned itself as a unifying force for developing innovative partnerships across a diverse range of technological disciplines.

This manifestation of the partnership with Enviro follows on from other initiatives and partnerships forged with trailblazers in the area of recycling and sustainable materials.

The underlying goal in the many partnerships and initiatives in which Michelin is participating is to create and develop recycling systems, for end-of-life tyres but also for plastic waste.

Michelin is headquartered in Clermont-Ferrand, France, is present in 170 countries, has more than 127,000 employees and operates 69 tyre production facilities which together produced around 200 million tyres in 2019. **AMR**

Blooming Good Reason

On 65 Roses Day, send your loved ones a rose from the mines, and it will be helping people with Cystic Fibrosis (CF) at the same time.

CF is a rare recessive genetic disorder that causes severe damage to the lungs, digestive system and other organs in the body, and for which there is currently no cure.

On 65 Roses Day, Friday, May 28, you can make a real difference to those living with the disease.

A typical 65 Roses Day sees the streets flooded with red roses being sold by volunteers, but COVID-19 put a stop to that last year and saw the introduction of a virtual rose.

Virtual roses mean every West Aussie, no matter how remote, can access a rose to send to their loved ones.

All virtual roses go into the digital rose garden, which then displays the ongoing support of the WA community for people with CF, their families and carers.

29-year-old Bianca Elford lives with CF. She has worked for Tronox on and off for the last 10 years thanks to flexible and supportive work arrangements.

A typical day for Bianca sees her at the

gym first thing for physical conditioning to help her with weight gain, followed by 30 minutes of nebulised medication and physio exercise.

Bianca endeavours to have a high calorie breakfast where she takes all her morning meds (approximately 10 pills), then it's off to work. Through the day whenever Bianca eats, she has to have more pills. Once home she undertakes a second 30-minute session of nebulisers and physio and then before bed, it's another 20 minutes of nebulised medication.

"65 Roses Day is very important to me as it shows that there are people out there that see and support people with CF and the battles we face every day just to stay healthy," she said.

"I've seen amazing improvements in medication in my lifetime and the research from 65 Roses Day gives me hope that one day there may be a cure, and that children born with CF will have a brighter future and an easier journey than I had growing up."

Send a virtual rose to your loved one and see it bloom in the Virtual Rose Garden – <https://rosegarden.org.au>

For further information contact CFWA on **08 6457 7333**

AMR



Tronox employee Bianca Elford lives with cystic fibrosis.

Eliwana Project on Track



Workers celebrate the completion of the rail track.



When completed, the remote greenfield project will connect the new Eliwana iron ore mine to the existing Fortescue Hamersley Line.

Leading infrastructure and rail company, John Holland, has achieved a major milestone at the Eliwana Mine and Rail Project – successfully laying the final piece of 143km of heavy haul rail track in WA’s Pilbara region.

The track works are part of a \$130m contract with Fortescue Metals Group which will also see an extension to the existing signalling and train control systems and a traffic capacity upgrade to communication infrastructure.

When completed, the remote greenfield project will connect the new Eliwana iron ore mine to the existing Fortescue Hamersley Line.

The John Holland team will now focus on final destressing works for 130km of the

track, siding extension works, final grinding and correction.

Final ballasting and tamping work for about 60km of the track is on schedule, with all remaining track works to be completed by June 2021.

The Signalling and Communication works are well ahead of schedule to be delivered by the end of 2021.

John Holland Rail Delivery Manager, John Ma, said the team had worked hard to ensure the project progressed despite weather and access challenges throughout the course of construction.

“The safe unloading of the last long weld rail off the final rail train on the Eliwana project was a significant moment for us,” he said.

“It’s a huge undertaking - more than 240,000 sleepers were laid as well as 400,000t of ballast dropped with more than 12,000 welds joining the tracks together.

“Working in a remote and often volatile environment has its challenges, but I am proud that the team were able to demonstrate our capability to manage complex logistics and high-production welding facilities while enabling efficient project delivery.

“This remarkable achievement was only possible due to the strong work ethic of all involved and we now focus our attention on delivering the remaining key objectives for the project.”

Remaining track work is scheduled to be completed by late June, while signalling

construction will be complete by the end of August. Testing and integration of the track will be finalised in December.

Located 90km west of Tom Price, the Eliwana mine celebrated the production of its first ore in December 2020.

At full capacity, the mine will produce 30mt per annum.

“It’s no secret that the mining and construction industry is playing a big role in boosting WA’s economy and we are pleased to partner with Fortescue to deliver this world-class iron ore project,” Mr Ma said.

AMR

Peer to Beer



Victoria Bitter has launched Solar Exchange – a new program that enables consumers to trade their excess solar energy for slabs of the beer.

So, whether they want to give the house a clean, play with the team, or just want to go green, their solar panels will be working hard to get them slabs of VB.

The Solar Exchange program allows participants to exchange credit on their power bill – obtained from generating excess solar at home – for VB.

Every \$30 worth of credit can be exchanged for a slab, which is then delivered straight to the door.

Victoria Bitter General Manager Marketing Brian Phan the company “put the Australian sun to work” and started brewing VB with 100% offset solar energy.

“Now we’ve launched this Aussie-first

program to thank those who have made the effort to go solar with some hard-earned VB,” he said.

“The only thing better than drinking the Big Cold Beer in the Aussie sun is earning beer while you do it. Plus it’s a real win-win for beer lovers and the environment.

“There are currently only 500 spots available. While we want to have more people exchanging solar credit for beer down the track, for now any beer lover who wants to participate should sign up quickly at www.vbsolarexchange.com.au.”

The launch of the program follows Asahi Beverages’ acquisition of Carlton & United Breweries last year.

The program is part of Asahi’s ambitious sustainability agenda, which includes commitment to be powered by 100% renewable electricity by 2025.

In 2018 CUB adopted renewable energy as the way forward with the signing of a 12-year Power Purchase Agreement for 74,000 MWh per year of renewable energy from the giant solar farm outside Mildura.

Solar Exchange has been developed in partnership with the 5-star rated energy retailer Diamond Energy, and Power Ledger, a blockchain-powered software platform that enables energy trading. VB will receive the solar credits it obtains under the exchange from Diamond Energy and re-invest them back into the program or towards the business’ broader sustainability goals.

Customers who sign up to the program can track how much beer they’ve earned based on how many solar energy credits they have exchanged with VB, with slabs being delivered each quarter.

Diamond Energy Managing Director Tony Sennitt said the organisation looked forward

to helping Australians get the most out of their solar through the innovative solar exchange program.

Power Ledger Co-Founder and Chairman Jemma Green said the company was a global pioneer of peer-to-peer energy trading.

“In a country that thrives on the beer economy, we are excited to be part of Australia’s first peer-to-beer energy exchange scheme,” she said.

To apply for the program, energy consumers with solar excess, need to switch their electricity retailer to Diamond Energy, and agree to the VB Solar Exchange terms and conditions.

The program is available to residential householders in Victoria, NSW, QLD (Energen customers only) and SA. AMR

THINK • IMPROVE • COMMIT • ACT

Connecting With Business Insurance



Paul Cohalan's extensive background in the mining industry is the major point of difference with Connect Business Insurance.

There are several points of difference with Connect Business Insurance when it comes to providing next-level risk management advice and coverage in the mining industry.

The most important is CBI Director Paul Cohalan's strong and well-rounded background in the industry, with an extensive resume encompassing a wide range of experience from hands-on roles to transport and logistics to managerial positions.

Paul came to WA as a marine technician in the navy and was posted to HMAS Arunta before carrying out ship refit and rebuild works at Henderson near Kwinana.

As the mining boom continued to gather momentum, Paul left the navy and joined HWE Mining in 2007 as a fitter at Koolyanobbing iron ore mine, located 54km north of Southern Cross.

Following that, to further his training relating to specialised mining equipment, he returned to Perth to work as a diesel fitter and to carry out engine rebuilds for Mining Equipment Spares in Malaga.

Over three and a half years he worked his way up to become the workshop manager, which involved manufacturing new mining equipment as a Caterpillar OEM for Tier 1 mining companies.

This broadened his skill base to include an understanding of processes, risks, engineering, product support and achieving efficiencies in manufacturing.

In 2011, when BHP bought out HWE Mining, Paul took up the newly created role of Transport Superintendent at Central Mobile Maintenance in Welshpool.

This involved managing all the heavy haulage moves and relocation of equipment from iron ore sites, as well as planning and management of mobile crane contractors for mobile equipment in iron ore.

With heavy haulage being a high risk and large job, it also involved working in close collaboration with Main Roads on permits relating to oversize loads and ultra-heavy haulage.

Paul was the first one to move a 700 tonne-plus, fully assembled excavator down a publicly gazetted road.

This saved time and money while improving safety outcomes by avoiding the disassembly and reassembly of equipment.

As a result, Paul received two awards from BHP for innovation and thinking outside the box when it came to the transporting of equipment and logistics.

After he achieved everything he could in that role, he wanted to transfer that knowledge to other companies.

In 2014, he was given the opportunity to project manage logistics for the construction of the Roy Hill iron ore mine, which involved huge logistical challenges including 200 metre-long convoys at night to transport heavy equipment to site.

Following that, he became a consultant to a global heavy haulage lift and shift company and subsequently managed a major project for BHP, made possible by the good relationship he had fostered with Main Roads.

A Gap in the Market

Through all of these roles, which involved working in high-risk situations constantly, Paul became heavily involved in crucial discussions around people, workers compensation, insurance and risk management.

By this stage he had built up extensive experience in mining, construction, transport and engineering.

But he noticed that there was a massive gap in the market when it came to adequate insurance for these sectors.

"These are areas where I best understand the risks, so I thought I could bring a lot to the table in terms of genuinely helping businesses with risk mitigation," Paul said.

"So I started Connect Business Insurance in 2016 and since then it has been about having that point of difference, being my background."

Since its inception, CBI has grown 55% year-on-year and out of 35 brokers across WA in its head group, it is number one.

CBI has grown substantially in the last five years in terms of clients, but its biggest asset remains its highly experienced team with Paul at the helm.

Based in Stirling in WA, the team includes Paul's multi-talented assistant, a senior broker, a back-end broker, as well as workers compensation and claims specialists.

"I have brought on board some really key people in the industry," Paul said.

"You can have all the knowledge and passion in the world, but you've got to have the right people in your team."

Understand, build trust and educate

There are many cogs in the machine working in tandem to keep the wheels turning in the Australian mining industry 24/7.

"You've got the mining companies but then you've got all the supporting and different contractors including the drillers, crushers, electricians and those working in engineering and fabrication," Paul said.

"You've got the mining camps, which includes the accommodation providers to the cooks and kitchen hands.

"There's so much involved in mining, it's unbelievable.

"Every time I work with a client, I picture the days when I used to wake up in my donga in the middle of nowhere surrounded by red dirt.

"Whether it's loading a digger onto a trailer or down in the pit working on a truck, I've been in amongst it, I have seen a lot of it for my age and that's what really helps me understand the clients."

Another point of difference with Connect Business Insurance is the importance it places on building a relationship with the client.

"The first thing is to understand what the client does, where they have been and where they are going, which allows us to understand the risks that are unique to them.

"The moment we do that is the moment we build trust with the client, because we really understand their business.

"From there we can talk strategy and risk mitigation to determine the risk profile of a client, and educate the client about where their exposures are so they can focus on growing their business.

"WA is a resource driven state and there are large contracts involved, and a lot of contractual obligations that are pushed down from tier 1 and tier 2 companies on to contractors.

"We help them understand their risk exposures, because if they don't understand it, a simple claim can shut their business down.

"The problem with that is the business is what puts food on their table and a roof over their head."

A recurring problem in the mining industry is contractors are left exposed by policies which don't actually cover mining related work.

"When someone doesn't understand the policy and they are trying to save money, they'll end up trying to get a really cheap policy that they may as well not have in place at all.

"What I see a lot is people go and get a certificate of currency for their liability or workers compensation, just to just prove it for a tender or contract.

"The problem is they expose themselves because the exclusions and the policy wording means you wouldn't be covered on a mine site as a contractor.

"I see it every week and it is what keeps me passionate about trying to help and educate clients all the time.

"The insurance policy is an outcome—it is the risk advice and risk profile of the client that is key."

Paul is always looking for innovative ways to improve the industry and is currently developing a risk profile dashboard that will be unique to the industry.

"The insurance industry is spending all this time on building quoting systems but my dashboard will be based on data to manage risks, which will improve claims management and ultimately lower premiums in the long run."

Not Just a Transaction

The challenge with insurance these days is how reactive and transactional it is.

Business owners jump online to buy an insurance policy as a box ticking exercise

without understanding the risk exposures that are unique to them or thinking about how insurance can help them achieve their goals.

The first thing Paul did when he moved into the insurance space was to devise a core set of values, which centred on developing relationships with clients that allowed them to think, improve, commit and act to achieve their long-term objectives.

"If we are doing those four things, we are not being transactional," Paul said.

"Our vision is we see a world where valued and trusted risk advice inspires business success.

"One of the things I do every time is I sit down with a new client to work out whether they are good fit for us because there is no point in us just trying to get a policy out of them to make money.

"That allows us to have trust both ways because as soon as we have that, they will be more open with us, which will allow me to understand their business so I can actually help them.

"Insurance is not there to use as a balance sheet, it's there to protect people's businesses for the exposures that they cannot accept as a business financially."

Just as building relationships with clients is paramount, it is also crucial to build excellent relationships with the insurers and underwriters.

"When you know what you are talking about and you understand the risks, they do have a better relationship with you.

"It means they are more comfortable, because I have asked the right questions and I have a better chance of getting a good premium with them."

Positive Outlook for Mining

Paul is feeling upbeat about mining and is excited to play an important role in the sector as it continues to prop up the economy through the pandemic, fires and floods.

"We have been lucky because the mining and resources sector has kept the economy moving," Paul said.

"There's been a few blips along the way but it has remained very active because we have been deemed an essential industry.

"Connect Business Insurance has been fortunate because it has carved out a niche not just in mining but also in transport and logistics.

"There are huge risks in this sector and we understand them really well and we are fortunate to have a strong portfolio of transport clients.

"The risks associated with normal transport companies are big enough but when you combine it with mining and resources, the risks are far greater.

"You are talking about huge distances, transporting loads up to 500 tonnes, night-time driving, fatigue and all the systems around safety, education and training."

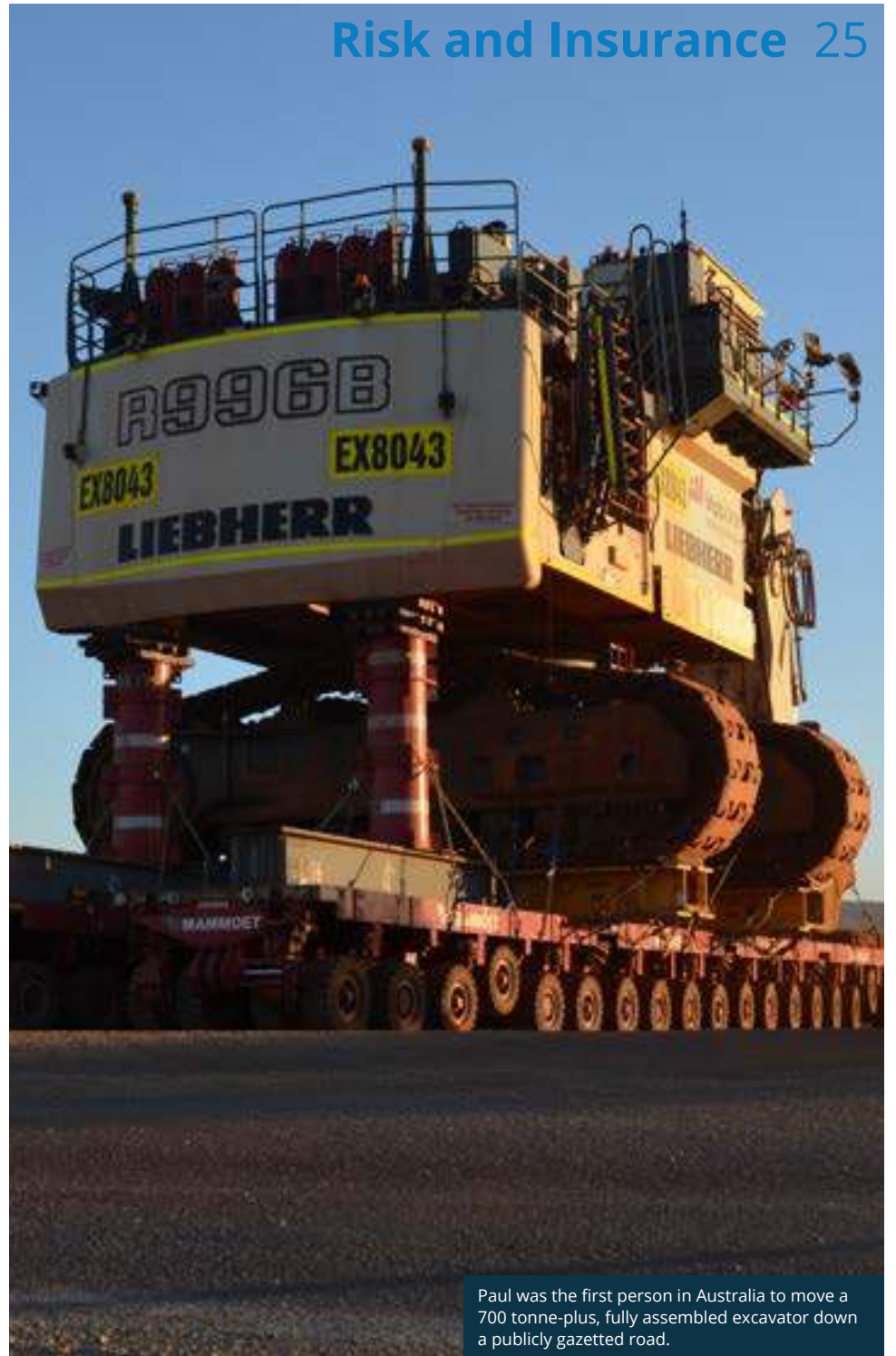
Connect Business Insurance has developed a solid understanding of all the facets of the insurance industry where it relates to mining and can tailor a solution to meet the needs of any business.

Contact Paul Cohalan at Connect Business Insurance on:

Phone: 1300 477 662

Email: insurance@connectbi.com.au

AMR



Paul was the first person in Australia to move a 700 tonne-plus, fully assembled excavator down a publicly gazetted road.

-  mining
-  construction
-  transport
-  engineering



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Copper Fuels Sandfire Success

Backed by a strong operational base and a clear strategy to grow into an international diversified and sustainable mining company, Australian mining and exploration group Sandfire Resources has grown from strength to strength.

Sandfire's business is underpinned by a demonstrated commitment to the highest standards of safety, responsibility and sustainability, which has been recognised through receipt of numerous local, national and international Awards, including Prospectors of the Year; Best Australian Explorer; Developer of the Year; Hard Rock Mine of the Year; and in 2019, the Golden Gecko Award for Environmental Excellence.

Sandfire operates the high-margin DeGrussa Copper-Gold Mine, located 900km north of Perth in WA, which produces high-quality copper-in-concentrate with significant gold credits.

In addition to delivering strong financial returns to shareholders, the cash flows generated from the DeGrussa Operations have been the backbone of a successful exploration and business development program, delivering a global project development pipeline that spans the world's major continental zones: Asia-Pacific (APAC), Europe, Middle-East and Africa (EMEA), and the Americas (AMER).

Sandfire's investment criteria is to seek assets that are:

- Value-accretive
- Capable of delivering production of +30ktpa copper equivalent within five years
- Mine life of more than five years
- Direct cost of production in the bottom half of the global cost curve (C1)
- Have exploration potential
- Within the company's funding capability

DeGrussa Operations

The DeGrussa Operation includes both the DeGrussa and Monty Copper-Gold Mines, two of the Asia-Pacific region's premier, high-grade copper mines.

Starting with an initial two-year open pit mining operation which was completed in April 2013, the DeGrussa Operation is based on long-term underground mining delivering sulphide ore to an on-site 1.5mtpa concentrator.

Construction and development of the project was completed on time and on budget during 2012 at a total cost of about \$400m. DeGrussa's remarkable progress from discovery in April 2009 through resource drill-out, feasibility, financing and construction and development – just over three years from discovery drill-hole to first production – set new benchmarks for the efficient development of resources in WA.

The DeGrussa underground mine plan comprises nearly 40km of lateral development, allowing for the simultaneous extraction of ore from multiple faces, on multiple lenses.

Having four deposits gives Sandfire a strategic advantage from an underground mining perspective – providing production flexibility and enabling it to maintain

consistent ore production of 1.5mtpa through the decline.

In addition to the 1.5mtpa concentrator, other infrastructure and services on site include a Tailings Storage Facility (TSF), power station, paste plant for the underground mine, a sealed airstrip capable of accommodating small jets, a state-of-the-art 400-room mine village, a mobile phone service and fibre optic communications, office buildings, assay laboratory and sealed access roads.

Production from the ultra-high-grade Monty satellite underground mine (discovered in 2015) commenced in 2019, with ore trucked 14km by road to the concentrator for processing.

Ore is then trucked to both Port Hedland and Geraldton for shipping to our global network of customers.

Today, the DeGrussa and Monty mining operations provide employment for a total workforce of about 450 staff and contractors.

Production achieved for FY2020

The DeGrussa Operations achieved total production of 72,238t of contained copper and 42,263oz of contained gold at a cash cost of US\$0.72/lb Cu.

The C1 cost represents the direct cost of production, at site level, per unit of output.

Production Updates

The company produced 16,803t of copper for the March quarter, an increase of 413t on last quarter, while gold production fell 560oz to 9100.

Copper guidance remains at 67,000-70,000t and gold production is expected to meet the guidance range of 36,000-40,000oz.

Sandfire managing director and chief executive Karl Simich said it was an exciting time to be part of the strong copper resurgence.

"The March Quarter has delivered exciting progress for Sandfire on a number of fronts, against the backdrop of continued strength in the copper price and a robust outlook for copper," Mr Simich said.

"In Australia, our DeGrussa Operations delivered another quarter of strong copper and gold production, putting us on track for the upper end of our 2021 financial year guidance band.

"We were able to take full advantage of the healthy copper price environment, with copper hitting a 10-year high of \$US9,550 (\$12,294) per tonne in late February."

Along with the strong production rates, Sandfire was able to achieve a copper recovery rate of 93.3% at its DeGrussa mill.

Sustainability Snapshot

The DeGrussa Solar Farm is the largest integrated off-grid solar and battery storage facility in Australia and reportedly the world. Built in 2016, the facility comprises 34,080 solar photo-voltaic panels and generates about 21GWh per annum for use by the DeGrussa and Monty Copper-Gold Mines

(17-20% of total power requirement).

Since commencement, the solar farm has reduced Sandfire's carbon emissions by 30,789t and offset 11m litres of diesel. This represents a significant environmental saving.

In addition to the environmental benefits, the DeGrussa Solar Farm has provided a blueprint for the adoption of renewable energy at mine sites and remote communities around the world.

The project has been visited by mining companies and government representatives as well as universities and schools, and has been widely showcased as a case study on how to integrate renewable energy at a mine site.

In 2019, Sandfire was awarded the coveted Golden Gecko by the WA Department of Mines, Industry Regulation and Safety for Environmental Excellence in recognition of the Solar Farm.

The Golden Gecko recognises leading practice and innovation in environmental management and the Awards provide an opportunity to share experiences between industry, government and the community.

Mr Simich said the company had maintained its focus on ESG performance during the year.

"A key achievement was refining our sustainability strategy, a move that will further ensure ESG is embedded across all facets of the Organisation," he said.

"Our new sustainability strategy, based on the business plan, incorporates the collective input from our senior leaders and our external stakeholders.

"It reflects a comprehensive, long-term plan that will facilitate our move to an international, multi-asset base and precious metals producer.

"Our sustainability targets have been publically reported since 2016. This demonstrates our commitment to transparency, improves our ability to manage risk, and ensures we continue to improve our ESG performance.

"In 2019, we performed well against our targets to invest in long-term community partnerships, improve female representation and facilitate regional economic development. We will continue to strive in our endeavours to achieve our goals."

Doolgunna Exploration

Sandfire also holds a dominant ground position in the emerging Doolgunna Volcanogenic Massive Sulphide (VMS) province in the Bryah Basin region of Western Australia (WA), which now stands at 7,189km² and includes the company's DeGrussa and Monty copper-gold mining operations.

This landholding includes both 100%-owned tenements, as well as land held under farm-in and Joint Venture agreements.

Since discovering DeGrussa, Sandfire has remained steadfast in its conviction that the Doolgunna region has the potential to yield multiple further high-grade ore discoveries and has invested substantially to build its extensive tenement holding.

The company's geological team, assisted by some of the world's leading independent geological consultants, has confirmed that DeGrussa is a VMS deposit.

It is well-established that this style of mineralisation generally forms in clusters and that VMS fields typically contain many clusters of deposits – often with resources totalling 40-50mt across the field or, in some cases, super-giant fields containing 100-200mt and more.

Much of this stratigraphy is obscured beneath transported alluvium and requires systematic aircore (AC) drilling to test the bedrock geochemistry and identify prospective areas.

Sandfire owns the only operating base metals processing plant in the region (the DeGrussa concentrator), putting the company in an outstanding position to capitalise on new discoveries.

The exploration strategy for the Doolgunna-Bryah Basin region has been developed and enhanced over a number of years as Sandfire progressively refines its understanding of the intricacies of exploration in the district, underpinned by a \$20-\$25m annual exploration budget.

Supporting Shooting Stars

Sandfire has a strong ongoing partnership with Shooting Stars, an initiative of Netball WA and Glass Jar which uses netball as a vehicle to encourage greater engagement and school attendance by young Aboriginal women living in WA's remote communities and regional towns.

Sandfire's support funds the employment of a program co-ordinator based at the Meekatharra District High School (MDHS).

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The DeGrussa solar farm.

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ScafWest has always had the knack for innovation and its systems and processes make a significant difference to their ability

to deliver value for clients.

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Always honouring contracts by doing what has been agreed, safely, on time and within budget, ScafWest can provide a level of agility not possible with larger organisations. And when things don't go to plan, this is where it really excels, adjusting to changing needs or unexpected arisings, finding solutions to minimise or eliminate operational downtime.

ScafWest services include project design and planning, scaffolding hire, transport and scaffolding labour for the full duration of your project or as needed.

While the company thoroughly prepares for every project, unexpected circumstances can arise, so it has developed innovative equipment and efficient processes, to effectively respond to potential challenges.

The ScafWest team are highly skilled experts who are able to plan and design comprehensive solutions, yet also respond to situations as needed. They pride themselves on strong communication and constantly finding ways to improve their systems and processes. With PWC Certifications in Quality, Environmental, OH&SMS, customers can rest assured that they are in good hands with ScafWest.

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Community-minded Coal Mining

The diversified natural resource company Glencore has a global reach, running operations of more than 150 mining and metallurgical sites, offshore oil production assets, farms and agricultural facilities, and employing about 190,000 people, including contractors.

In Australia, the diversification is exemplified by mining commodities such as coal, copper, nickel, zinc and a range of agricultural commodities such as wheat, canola and barley.

Glencore is Australia's largest coal producer with 11 mining complexes across Queensland and NSW, managing the production of thermal and semi-soft metallurgical coal.

Its chief coal producer in the Hunter Valley of NSW is the Mt Owen Complex, which is comprised of Glendell Mine (fully-owned by Glencore), Mt Owen Mine and its 14.5mt per annum capacity Coal Handling and Preparation Plant, which sends product by rail to the port of Newcastle for export.

The integration of these operations enables all sites to use the CHPP and infrastructure at Mt Owen Mine.

Last year the complex made a total contribution of more than \$616m and recorded almost 8.5mt of saleable product.

Glendell

Glendell Mine commenced operations in 2008, with its almost 900 employees and contractors working a 24 x 7 day rotating roster.

The Glendell Open Cut operation includes the Glendell and Bayswater North open cut pits. Glendell Open Cut is an excavator and truck operation targeting the seams of the Whittingham coal measures.

Glendell is currently seeking approval to continue current open cut mining to the north of its existing operations through the Glendell Continued Operations Project, which would provide access to around 135mt of additional coal resources located on land almost completely owned by Glencore.

Once approved, it will extend Glendell Mine's life to 2044 and involve:

- mining the additional coal resources including ongoing use of overburden emplacement areas, predominantly in-pit
- using existing infrastructure, including the complex's coal handling plant and rail loop
- relocating historic Ravensworth

Homestead, realigning the lower section of Yorks Creek and part of Hebden Road.

Comprehensive technical assessments have been completed identifying the potential impacts of the project and recommending measures to minimise and manage potential impacts.

A project determination is expected to be issued in the fourth quarter of this year.

Mt Owen

Mt Owen Operations is 100% owned and managed by Mt Owen Pty Ltd on behalf of Glencore, with the mine running as a truck and excavator operations

The Mt Owen CHPP processes coal from all three mines, with the high quality export thermal and semi-soft coking coals predominantly exported to South-East Asia for domestic power generation and use in steel production.

The world's largest mining services provider, Thiess, is contracted by Glencore to operate Mt Owen Mine, excluding the CHPP and associated infrastructure.

The mine processes up to 8.6Mtpa of ROM, of which 7.8Mtpa is mined by Thiess from the Mt Owen North Pit.

Mt Owen's deposit is complex, comprising multiple seams of coal dipping up to 45o, with mined thickness between 0.4 and 11m. Thiess also mines to a depth of 270m below the surface, with the challenge of minimising truck hours and maintaining 'mass balance' on site to ensure enough dump space for the overburden.

To overcome these complexities, the technical team created 'Dump Planner' software. This allows the mine planning team to run a range of scenarios and develop a mine plan that increases plant hours and scheduling, and achieves mass balance.

In addition, the team has developed industry-leading specialised terrace mining and through-seam blasting techniques, leading to higher reserve recovery.

The Mt Owen contract is Thiess' largest coal mining operation in NSW and under a recent revision worth a extra \$140m, it will mine additional volumes following a renewed "development consent" obtained by Glencore.

As part of the contract, Thiess will provide mine planning, design and execution, drill and blast, overburden removal and coal

mining services until June 2021 – where it will enter into negotiations once more for further extension opportunities.

CIMIC Group Chief Executive Officer Michael Wright said the award reinforces Thiess' long-term commitment to delivering value-add solutions to Glencore at Mt Owen.

CIMIC Group Executive Mining and Mineral Processing and Thiess Managing Director Douglas Thompson said the services group has a proud history at Mt Owen dating back to 1994, when Thiess first built the mine.

Sustainability: Environment and Community Parent company Glencore is committed to engaging with all stakeholders, particularly those in the local community.

Its coal business is committed to being a responsible operator, and in consultation with stakeholders, Glencore aims to return the land to self-sustaining native ecosystems, agricultural use or other suitable purposes and continue to maintain the land long after mining is finished.

For example, both Glendell and Mt Owen mines have a comprehensive Environmental Management System (EMS) in place, which provides a framework for dealing with environmental management issues at the mine, in a systematic way.

It brings together all aspects of environmental management on the mine site and EMS covers the design, development, production, maintenance and rehabilitation of the operation and its infrastructure.

The principal objectives of the EMS are to ensure that the company adopts a continuous improvement approach to environmental management issues at the site and wherever practical and economic, implement best practice environmental management.

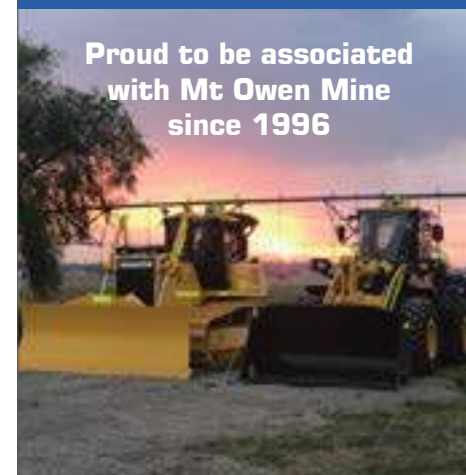
The EMS also serves to ensure that activities at the operations are controlled, such that the company either prevents or minimises any environmental impacts associated with the operation.

Continuous monitoring of meteorological conditions, air quality, water quality, noise levels, blasting operations, flora and fauna and rehabilitation areas is undertaken, which provides the mine with the information required to minimise environmental impacts, and evaluate the effectiveness of the environmental management process and rehabilitation efforts. **AMR**

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Tony More Earthmoving (TME) has been operating in the Singleton area for more than 30 years.

Originally starting off in rural work, TME ventured into the mining industry soon after.

TME managing director Tony Moore says the business has been delivering rehabilitation work at the Ravensworth mine for about 25 years.

"Over the decades, we have been doing our best rehabilitation work, projects and jobs for Glencore, Peabody's Wambo and Whitehaven mines," he said.

"We are a family-owned business and we employ local people."

Mr Moore himself is a local beef cattle farmer, is passionate about the local land around Singleton, NSW, and is a strong

advocate for good rehabilitation work.

"We strive on returning the land back to what it once was to help the environment," he said.

"We like to make sure that vegetation is better than when we first start."

Mr Moore believes his family's commitment to looking after the local minesites have kept them in good stead for continual and repeated work.

A full-range of machinery is on-hand for all types of earthmoving and other jobs within the mining and rural areas, including D6 and D5 dozers, 30t articulated injectable trucks, 30t, 15t and 6t excavators, grader, 105hp tractors, 10t and 5t spreaders, slashers and spray unit.

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Odysseus Investors Invited

Leading nickel producer Western Areas is hoping to lure investors from the EV battery sector for high-grade nickel sulphide from its Odysseus mine development in WA.

The company recently announced an equity raising for \$100m for its Odysseus project and to fund some additional expansion projects.

The project sits within the Cosmos nickel complex, alongside Western Areas' existing Forrestania operation in WA, 28km northwest of BHP's Leinster nickel operations.

Western Areas managing director Dan Lougher said the capital raising would help the company remain on schedule across its developments.

It would allocate \$85m to advance Odysseus' progress towards first production in 2023. The remaining \$15m will be raised to strengthen the company's exploration portfolio including Forrestania, Western Gawler in South Australia and in nickel-gold joint venture projects with Metal Hawk in WA.

"The placement supports the development of the Odysseus underground mine which is progressing well with excellent advance rates being achieved, while also providing funding for Western Areas' exploration portfolio where we hope to make significant progress in 2021," Mr Lougher said.

"With greater balance sheet flexibility, the company will be able to take advantage of opportunities within the portfolio and maximise returns to our shareholders."

Once fully operational, the Odysseus nickel project will use a shaft hoisting system with a throughput of 900,000t per annum to produce a potential 2.1mt.

Odysseus has an annual production target of 14,600t of nickel concentrate and is scheduled to start up in the middle of the 2023 financial year.

The mine has an ore reserve of 8.1mt at 2% nickel for 165,000t and is expected to have a 10-year life at a production rate of 900,000t of ore per year.

Following Western Areas' half year results last February, Mr Lougher said his expectations for the Odysseus project remained very positive in the long-term.

"It is exciting to own the long-life Odysseus project, providing Western Areas a clear nickel mining plan into the 2030's and beyond," he said.

"Early works was being done in parallel with the definitive feasibility study and included dewatering, creating evaporation ponds and doing some work at the camp plus the rehabilitation of the existing decline underground.

"We're now sitting fully rehabbed down to a vertical depth of about 500m below the surface, and have developed a pumps station which will then allow us to continue dewatering from an underground position.

"With greater balance sheet flexibility, the company will be able to take advantage of opportunities within the portfolio to maximise returns to our shareholders."

Not-So-Fickle Nickel

Western Areas is perfectly placed to take advantage of the emerging electric vehicle (EV) market when Odysseus comes online.

Nickel is a sought-after metal for batteries in EVs and power storage systems, with demand forecast to rise substantially in the years ahead as economies shift away from fossil fuels.

EV demand was especially strong in Europe as governments are offering significant incentives to switch to carbon emissions-free EVs.

Western Areas is forecasting global nickel demand for batteries to rise five-fold to 1bt by 2030 from around 200mt in 2020.

"In the current EV market the battery of choice is the lithium ion battery, the name of course doesn't have any nickel in it, but there are several types of battery technology used in cars such as Tesla called a 6:2:2 technology - which is six parts nickel, two parts cobalt and two parts manganese in the cathode of the battery," Mr Lougher said.

"There is also a new technology starting to be utilised in Japan and Korea, and probably China, called a NCM811 battery, which is eight parts nickel.

"So as you can see the quantity of nickel within the battery is increasing because it gives the battery certain positive characteristics in terms of charging capacity and how long the car can drive for, etc."

Mr Lougher said the development of EV batteries is an exciting prospect for nickel miners because it means the demand for nickel sulphide should get stronger.

"The penetration rate of electric vehicles should heat up around 2022-25, so with Odysseus coming into production around that time, Western Areas will be primed to meet a strong demand for nickel products," he said.

"The timing is excellent, plus on reserves alone, Odysseus has a 10-year mine life (not including the AM5 and AM6 deposits).

"There are higher grade parts of Odysseus we haven't been able to bring into the feasibility study but the potential for the project is quite a rare occurrence in the world of nickel sulphide."

With few new deposits being discovered globally, Western Areas considers itself fortunate to have Forrestania and also Cosmos - which was an extremely strong nickel producer for prior owner Glencore.

"We're extremely happy and excited that we've got this new sulphide mine coming online as the market driven demand for the batteries will be in full flight," Mr Lougher said.

Cosmos and Forrestania production hubs Western Areas will also spend between \$15m to \$30m on advancing some production growth at its Cosmos and Forrestania projects, including a mine plan for Forrestania.

The nickel company operates two production hubs in WA, its Forrestania mine and Flying Fox and Spotted Quoll operations, and its Cosmos nickel operation, which includes Odysseus.

Production of high-grade nickel from Forrestania is sold 50:50 to BHP and China's largest nickel cathode producer, the Jinchuan Group.

The company's production guidance for the 2021 FY is for 16,000- 17,000t of nickel concentrate at a cash cost of \$3.75 to \$4.25 per pound.



Odysseus will come into production just as demand for nickel reaches a high.



Western Areas managing director Dan Lougher (left).



Odysseus has an annual production target of 14,600t of nickel concentrate and is scheduled to start up in the middle of the 2023 financial year.

Western Areas is also engaged in joint ventures for exploration in South Australia's Gawler Craton region, and in the Kanowna and Fraser Range areas in WA.

The price of nickel has fallen slightly after touching seven-year highs of nearly \$US20,000/t in late February, but still remains at a healthy level.

Analysts said supply tightness in the nickel market has eased with more deliveries of the base metal to LME warehouses encouraged by higher prices.

Get Back

The bulk of the fresh equity of \$85m is coming from a fully underwritten institutional placement to sophisticated, professional and institutional investors.

Eligible shareholders will also be able to participate in a share purchase plan to raise \$15m, bringing the total proceeds of the equity raising to \$100m.

The share placement has been underwritten

at a floor price of \$2.15 per share.

"The placement supports the development of the Odysseus underground mine which is progressing well with excellent advance rates being achieved while also providing funding for Western Areas' exploration portfolio where we hope to make significant progress in 2021," Mr Lougher said.

Investment bank Goldman Sachs is the sole lead manager, underwriter and book runner for the share placement.

Mr Lougher said while Odysseus was high on the agenda, the company was open to developing any interesting projects of joint ventures that came along.

"All in all we are a strong company, we've got no debt, we've got cash in bank, we've got good investments that will see some cash coming through this year, so we are in a good position to develop new projects," he said. **AMR**



Supporting Western Areas

GRES is proud to support Western Areas Limited in the upgrade and development of the Cosmos Nickel Project.

GR Engineering Services Limited (GRES) is an ASX-listed process design and engineering company providing fixed price EPC and EPCM project delivery services to the mining and minerals processing industries internationally.

GRES is working with Western Areas by providing engineering services, procurement support and potentially future construction work for the upgrade and development of the Cosmos Nickel Project in WA to facilitate the processing of the Odysseus deposit.

The project includes improvement and refurbishment of the Cosmos treatment plant and the upgrade of mine and site

services infrastructure.

GRES has successfully completed feasibility studies, process and engineering designs for the upgrade and looks forward to continuing to assist Western Areas with the Project.

The company has delivered mineral processing, hydrometallurgical facilities and non-process infrastructure to a range of clients, both in Australia and internationally.

GRES has extensive metalliferous and minerals experience including precious metals, base metals, iron ore, lithium, graphite, HPA, SOP and solar salt.

The company is equipped to provide innovative engineering solutions for all types of mining and minerals projects.

The innovative engineering solutions developed by GRES enable clients to confidently move into development with the knowledge that the outcomes from study work will be reproduced in the operation of their projects.

GRES has a presence in the Americas via its wholly owned subsidiary Hanlon Engineering & Associates, Inc. (Hanlon), based in Arizona, USA.

Hanlon is capable of providing the

complete suite of engineering and project management services and is a reputable brand to the minerals industry in the USA's western states.

GRES also has a presence in the hydrocarbons industry via its wholly owned subsidiary, Upstream Production Solutions (Upstream).

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No Shortcuts for Barminco

Barminco is one of the world's largest hard-rock underground mining service providers with a deep capability, comprising of its people, expertise, equipment, systems and processes.

These core strengths have been developed over three decades of operational experience across Australasia, Africa and North America.

Barminco currently employ more than 5000 people at 24 projects in seven countries and its people are renowned for being among the best miners in the world.

In all partnerships, Barminco looks to create enduring value and certainty for its clients and is proud that Western Areas is one of its longest running continuous relationships.

Barminco has operated for more than 15 years at Forrestania, a significant achievement that cannot be understated.

Barminco has also worked with Western Areas for the full life of its current operating mines Spotted Quoll and Flying Fox in WA, providing development, production, paste fill and diamond drilling.

Barminco continues to look for opportunities



A Jumbo travelling to its designated development face at the Western Areas project, Odysseus.

to work with Western Areas to improve efficiencies across these operations with the aim to lower costs and to increase the remaining mine life.

As well as Forrestania, Barminco is proud to be partnering Western Areas at the Cosmos Operation in the construction and development of the Odysseus Mine.

Barminco aims to have the same level of development and production success at Cosmos as it has consistently shown at Forrestania.

The company is pleased that once again Western Areas has trusted Barminco to bring this new operation into production.

While operating at Odysseus, Barminco has transitioned from de-watering and decline rehabilitation to new decline and level development, with more than 10km of rehabilitation and 2.5km of new development being completed since commencing.

Barminco has achieved excellent safety performance with no Lost Time Injuries

during this time.

This is testament to its commitment to safety in line with the Principle: "No Shortcuts".

Barminco's strong partnership with Western Areas is built on honesty and trust, allowing its clients to resolve issues, highlight opportunities, and optimise performance without delay.

Barminco looks forward to being a part of Western Areas' bright future. **AMR**

Certainty comes from knowing we will deliver

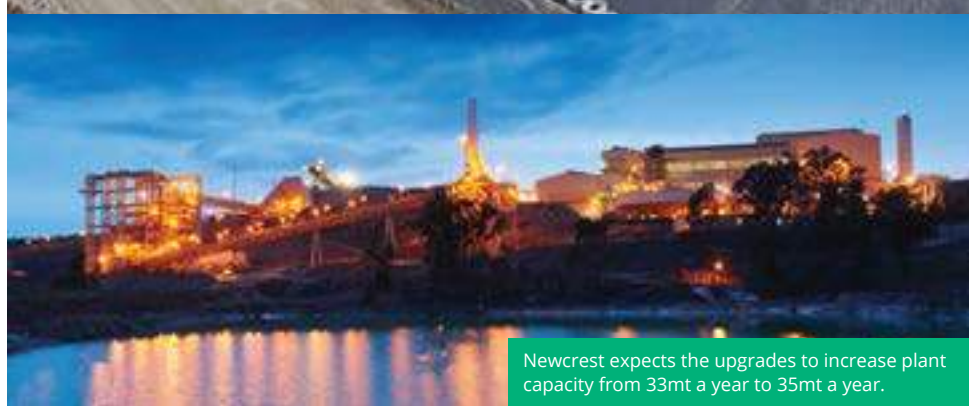
Barminco is one of the world's largest hard-rock underground mining service providers with a deep capability, comprising of our people, our expertise, equipment, systems and processes, developed over three decades of experience in Australasia, Africa and North America.

We are proud to be working alongside Western Areas for over 15 years, consistently delivering exceptional results at Flying Fox, Spotted Quoll and Odysseus.





Cadia Expansion Plans On Track



Newcrest expects the upgrades to increase plant capacity from 33mt a year to 35mt a year.



Cadia is one of the largest, lowest cost, long life gold mines in the world due to the application of Newcrest's industry leading block caving technology.

Despite some bumps along the way, notably guidance revisions due to water shortages, the expansion of the Cadia mine in NSW is progressing well.

The board of Newcrest Mining has approved the second stage two of its 100%-owned Cadia Valley expansion project, which is expected to increase plant capacity and reduce production costs.

One of Australia's largest gold mines, Cadia comprises the Cadia East underground panel cave mine, and the Ridgeway underground mine which is under care and maintenance.

Stage two upgrades include a second coarse ore flotation circuit and equipment upgrades in concentrator two.

Newcrest expects the upgrades to increase plant capacity from 33mt a year to 35mt a year, and improve life of mine gold and copper recoveries by 3.5% and 2.7% respectively.

Newcrest managing director and chief executive Sandeep Biswas said the stage two upgrades, which were estimated to cost \$244m, will enhance the project's market position.

"It is an exciting time at Newcrest as we advance our growth pipeline with both of these projects adding value to our existing large scale, long life operations while we pursue the development of Red Chris and Haverton and exploration opportunities globally," he said.

"Stage two of the Cadia expansion project increases plant capacity, enabling an increase in gold and copper recoveries, an increase in production and a reduction in unit costs.

"Cadia is one of the largest, lowest cost, long life gold mines in the world due to the application of Newcrest's industry leading block caving technology, and this investment helps Cadia maintain this industry leading position."

Cadia produces gold doré from a gravity circuit and gold-rich copper concentrates from a flotation circuit at Cadia.

The gold dore is then refined at the Perth Mint and concentrates are piped to a dewatering plant at nearby Blayney and sent by rail to Port Kembla in NSW for export.

As well, a Cadia Molybdenum Plant Feasibility Study has revealed an estimated capital cost of \$95m, with commissioning of the plant expected in FY22.

The molybdenum plant is expected to deliver an additional revenue stream in the form of a molybdenum concentrate which will be a by-product credit to AISC per ounce. Cadia's all in sustaining costs will reduce by \$US22/oz with stage two completion expected in the 2022 fiscal year.

The first stage had comprised commencement of the next cave development (PC2-3), materials handling system upgrades, associated infrastructure and the initial works to increase in the nameplate capacity of the process plant to 33mtpa - with PC2-3 mine targeting first production in FY23.

The rate of ore mined from Cadia is expected to vary over time according to draw rates, cave maturity and cave interaction as further caves are developed.

Mr Biswas said the expansion plan had been an improvement on the previous 2018 Pre-Feasibility Study.

"It includes an estimated additional 1.8moz of gold production and 67kt of copper production and an estimated \$800m increase in projected free cash flow generation by Cadia over its life," he said.

"The capital investment has an estimated 21.5% rate of return and ensures Cadia remains a Tier One asset for many years to come."

The total amount of capital expenditure associated with the plant expansion in Stage

cells, upgrades to the gold gravity circuit, and the installation of additional coarse ore flotation, the expansion of the floatation circuits and increase grinding and crushing capacity.

Based on the study findings, these improvements are expected to deliver a LOM gold recovery of around 80pc, which is 9pc above the rate articulated in the 2018 PFS.

A 1pc benefit in LOM copper recovery is also expected as a result of changes to the processing circuit, with the LOM average copper recovery expected to hit around 85pc.

An additional 1.8moz of gold and 67kt of copper production is anticipated over the LOM.

"Through continued investment in innovation we continue to discover what is possible," Mr Biswas stated in the company's 2019 annual report.

"For example, we are pursuing the development of autonomous, semi-autonomous and remote mining solutions to reduce exposure of our personnel in hot mining conditions at Lihir and to the underground operations at Cadia and at Telfer.

"We continue to explore and trial technologies for selective processing, mass sensing and sorting at sites.

"We also use advanced analytics and digital technology such as artificial intelligence and virtual reality to increase safety and performance."

Sustainability And Community

Newcrest places a high value on the support and endorsement of its activities by surrounding communities.

Newcrest is a major employer and economic contributor to the local economy.

Cadia works closely with local community groups and government agencies to provide ongoing infrastructure and support in the Orange, Blayney and Cabonne local government areas.

Newcrest undertakes a range of environmental reporting and monitoring activities to ensure that the Cadia maintains a safe environment for employees, operating and developing mines in line with good environmental practices and commitment to local communities. **AMR**

Production And Recovery Improvements

The Stage Two feasibility study had recommended a range of methods to better understand recovery rates at lower grades, including the extended use of Jameson



AWCON are specialists in the underground construction field.



The company also has vast experience in surface civil construction.

Underground Construction Specialists

AWCON is a multi-disciplined company providing industry-leading services in the civil and mining sectors.

The company has vast experience in underground and surface civil construction, with crushers, material handling systems and processing plants.

AWCON's poly division uses state-of-the-art poly welding equipment for major poly pipeline works.

AWCON is also an expert in underground extraction level roadways and has completed various water treatment and council infrastructure works.

The company has successfully completed several projects for Tier 1 companies, including Newcrest Mining's Cadia Valley

Operations near Orange, NSW.

This has included recently completed civil works for the new molybdenum plant—the first processing plant of its kind in Australia.

AWCON has also completed underground road construction and process plant works at Cadia and is currently working on material handling system upgrades as part of stage one of the expansion project.

AWCON managing director Paul Montagliani said the company felt privileged to work at Cadia Valley.

"We are happy to be a part of the Cadia mine considering the huge contribution it makes to the local community and local contractors," he said.

The two other main sites AWCON works on are Oz Minerals Carrapateena in SA and Northparkes Mines in NSW.

AWCON currently has 120 people working across the two states, with offices in NSW and Victoria.

Each team member has been hand-picked for their experience, knowledge and work attitude while the management team has been together right from the start.

AWCON began as Australia Wide Concrete in 1998, providing a range of services to clients in the mining and construction industries.

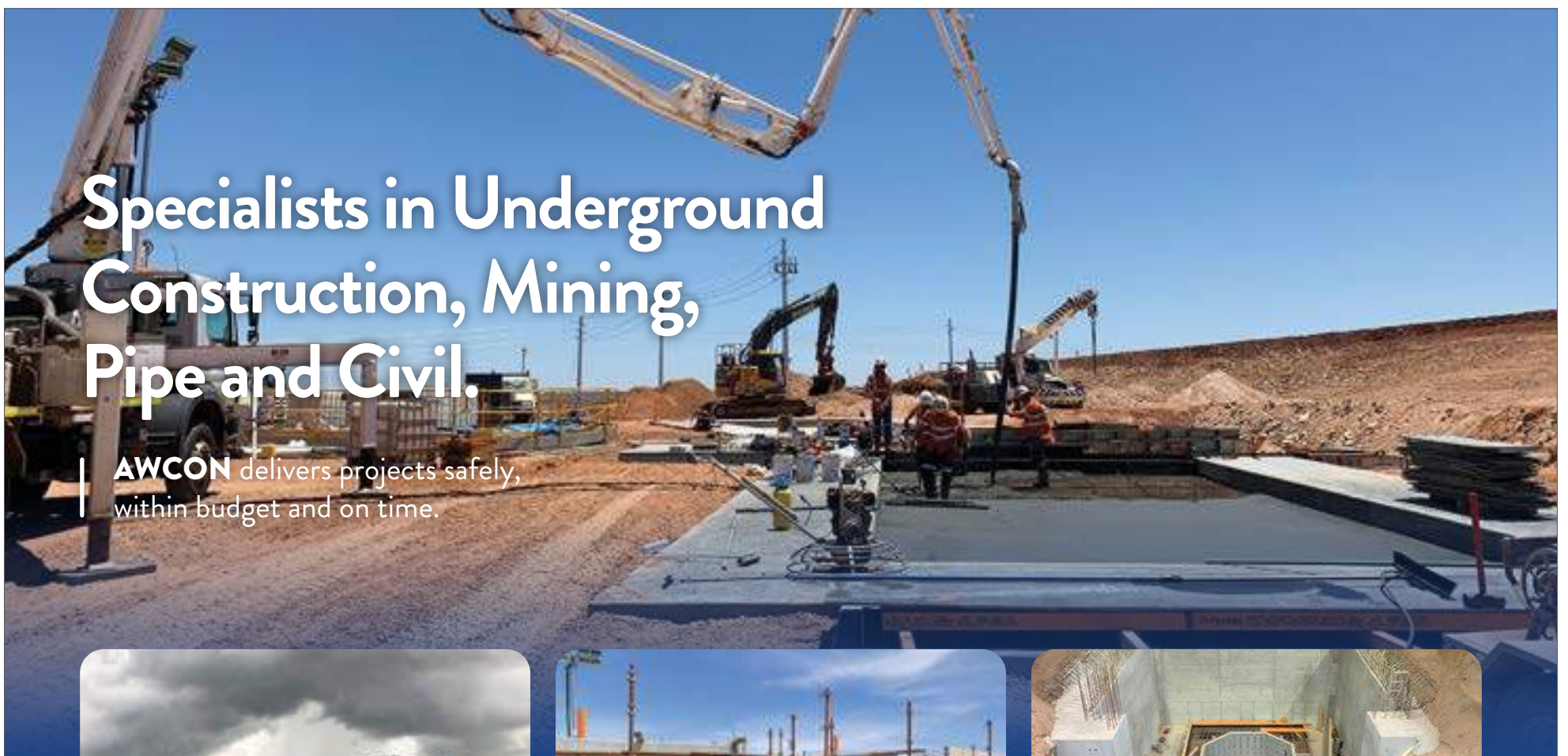
Having established itself as having an outstanding reputation, the company emerged as AWCON in 2014 to reflect the expanding scope of works being carried out.

The company now has a broad range of capabilities in surface and underground construction, mining, pipe and civil.

"We are specialists in the underground construction field and we have vast experience in above ground and underground crushers, processing systems and panel roads," Mr Montagliani said.

"We place a big emphasis on safety, quality and the ability to deliver projects on schedule and within budgets."

The team of skilled construction professionals are subject to continuous training in safety practices, procedural reviews and regular risk assessments to ensure safe work practices. **AMR**



Specialists in Underground Construction, Mining, Pipe and Civil.

AWCON delivers projects safely, within budget and on time.



PIPING



FORMWORK



CONCRETE



Leaders in Conveyor Solutions



Reliable Conveyor Belt offers support across all aspects of conveyors.

Reliable Conveyor Belt is a respected and sought-after conveyor solutions expert that has been improving conveyor reliability and efficiencies for Australian mining operations since 1973.

Working with some of the biggest names and projects in the country, the company offers support across all aspects of conveyors, from conveyor installation, maintenance and management; engineering, drafting and project management; auditing and conveyor reliability packages; to conveyor overhauls

and much more.

Reliable Conveyor Belt is also well known for its full suite of high quality engineered conveyor components including such products as conveyor belt, belt cleaners, idlers and pulleys. All manufactured for heavy industry with hard rock mining.

"We carry more than 3000 metres of belt in stock including belt specs that will meet many of your needs," Reliable Conveyor Belt managing director Geoff Naphthali said.

"With more than 45 years of experience, we know what works and what doesn't in underground applications."

Mr Naphthali said the company's primary focus was always addressing its clients' unique challenges, solutions and requirements.

"With service branches in Newcastle, Muswellbrook, Gunnedah, Mudgee, Parkes, Brisbane, and Lithgow, Reliable takes pride in being readily accessible and providing prompt, 24 hour, seven day service to all

callouts," he said.

"Reliable have built a strong working relationship with Cadia over many years. We have provided reductions in conveyor maintenance costs by implementing process improvements during large shutdowns and major projects."

For more information on Reliable Conveyor Belt and its core service offerings, visit www.reliable.com.au. **AMR**

For comprehensive and efficient conveyor services and components, Reliable Conveyor Belt leads the way.



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Copper Recovery: **>90%**

The HydroFloat® System

The HydroFloat® Separator is designed to recover valuable particles at a coarser size than can be selectively recovered using any other flotation technology.

- Grind coarser at same recovery
- Reduce coarse values lost to tailings
- Increase throughput
- Reduce primary grinding power consumption
- Generate coarser tailings

Benefits of HydroFloat:

Greenfield Projects: Reduce capex, lower power consumption, coarser tailings

Brownfield Projects: Increase production without expanding primary grinding, increase metal recovery

Tailings Re-processing including re-mining historic tails

Applications:

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- Spodumene minerals
- Gold, Silver, Platinum
- Phosphate and Potash minerals
- Heavy mineral sands



HydroFloat CPF™

Coarse Particle Flotation Separator

The HydroFloat® Separator can float base metal, sulphide and industrial mineral particles beyond the 150 micron norm to as much as 850 microns with very high recovery. This offers enormous efficiency gains from off-loading your grinding circuit, producing a coarse tail.

Coarse Particle Flotation... this changes everything.

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- Weekly Mining Report (Carefully researched, real business opportunities)
- Weekly Mines Activity Report (Operational Activity specific to Mine Sites)
- Directory listing on Mine Suppliers Online



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Responsible Resource Extraction

By Eriez® Flotation Global Managing Director Eric Bain Wasmund

Environmental Social and Governance (ESG) considerations are becoming more important for investors, governments and the global citizenry when it comes to resource extraction.

Developing new technology that can improve the efficiency of mining and lower its environmental footprint is a key differentiator for technology providers and operators.

Eriez® Flotation is very sensitive to responsible resource extraction and our vision is to be a world-leader in this area.

This means developing and delivering flotation technology that has significant benefits in terms of reducing environmental footprint and intensity of water and energy use while improving separation efficiency so that more metal can be produced from a smaller resource.

And we have found that the key success factor is collaborating closely with our customers to evaluate and demonstrate our new technology such as the HydroFloat® for coarse particle flotation and the StackCell® for reducing the energy and capital requirements for conventional mechanical flotation.

About eight years ago we began working with base-metal sulfide miners to see how the HydroFloat could be used in their mineral processing flowsheets.

Two applications showed immediate promise.

The first used the HydroFloat to scavenge the final tails of a conventional concentrator plant. We called this the tail scavenging application.

The second used the HydroFloat as an ore sorter, by operating inside the mill circuit to

reduce the grinding intensity and generate a coarse barren tail.

We called this the coarse gangue rejection application.

The tail scavenging application was commercialised by Newcrest at their Cadia Valley Operation in 2018 and is now being developed at a number of other sites. From our experience, the HydroFloat can capture at least 60% of coarse tails. Because a conventional mechanical cell flotation plant is very inefficient in this range, that means a significant amount of the run of mine feed can be diverted from waste, often 4-6%.

This is the business case for the tail scavenging application, in addition to the ability to process more feed because the grind size is increased.

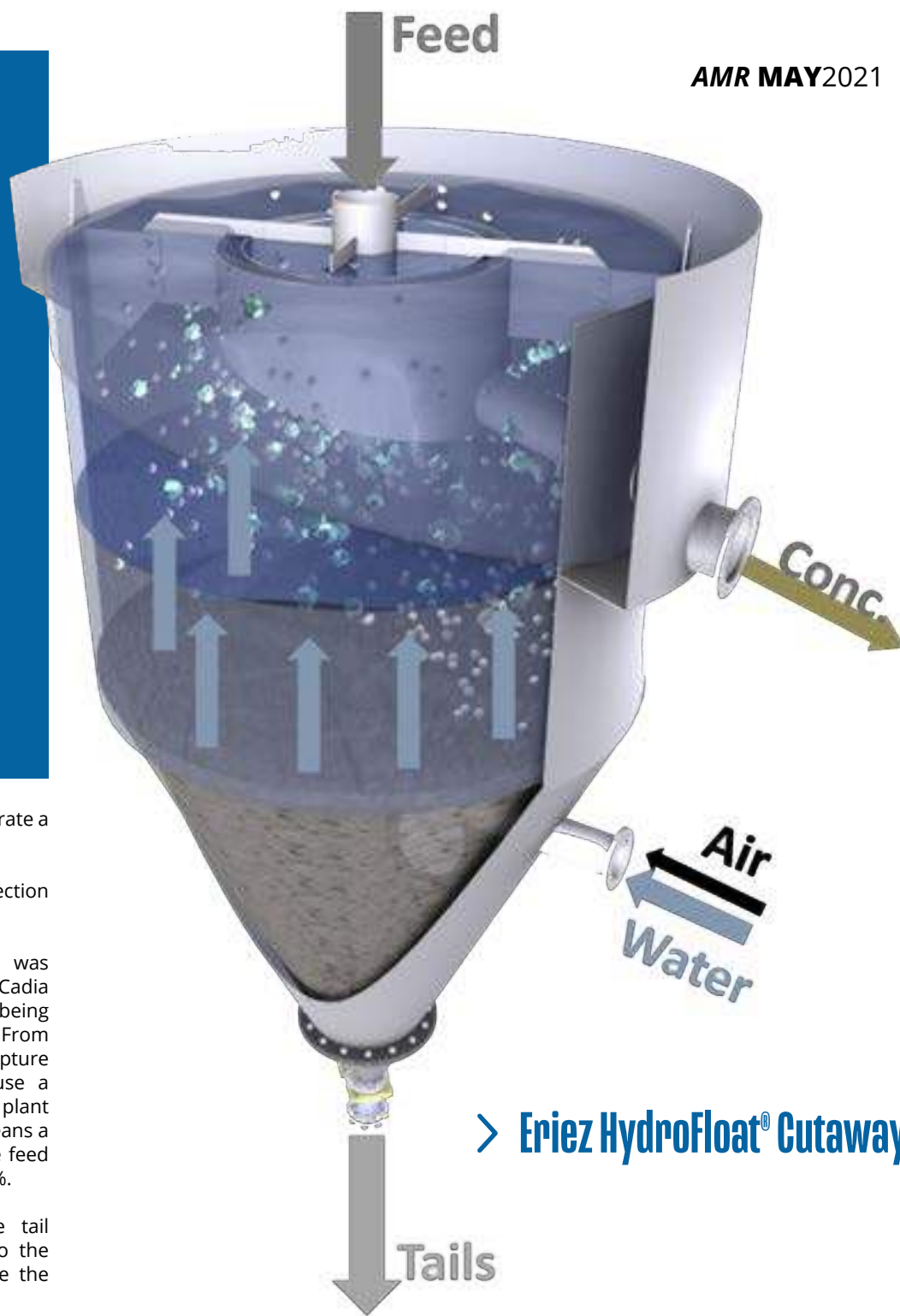
Coarse particle flotation can be added as a brown-field retrofit to any conventional flotation plant in the world.

In fact, Anglo American has announced that they will be adding it on to their greenfield Quellaveco plant so that it will be ready at the start-up.

The coarse gangue rejection application is being demonstrated at commercial scale now. This has the potential to unlock additional green benefits, and it is being studied by multiple mining companies.

One example of this application is shown in the flow-sheet below.

The secondary mill output goes to a two-stage size classification system, shown here as cyclones where the fine stream reports to conventional flotation, the coarse stream reports back to the mill circulating load and the middling stream reports to the HydroFloat.



> Eriez HydroFloat® Cutaway

This allows an increase in the grind size, reduction in power and generation of a coarse and fine tail.

In a recent case-study, we showed the possibility of reducing the energy requirement of the secondary ball mill by 30-50%.

Additionally, about 30% of the total mill feed can be removed from the circuit at a size two to three times coarser than the grinding end-point of conventional flotation.

Finally, the capacity required for conventional flotation could be reduced by 40%.

A paradigm shift

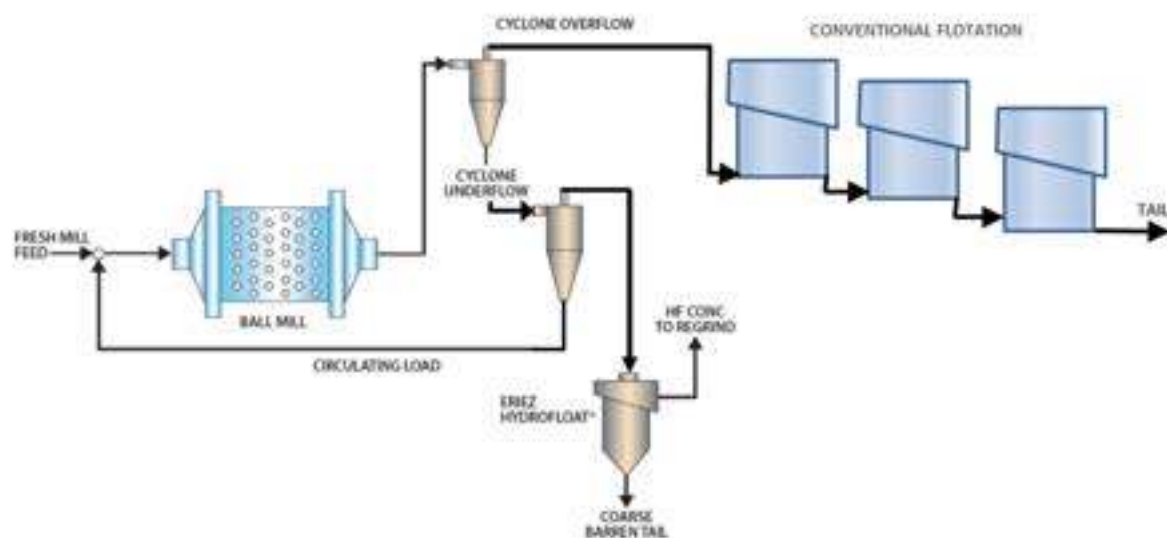
Anglo American has begun examining novel ways to co-deposit the coarse and fine tails that are produced by coarse gangue rejection, and their technology may be able to reduce or eliminate wet storage facilities.

This is extremely important in regions with scarce water supply like Chile, not to mention the risk factors associated with long-term storage of wet tails, that have led to several major disasters over the last decade.

In fact, there are probably other flow-sheets and processes that can be developed around the HydroFloat, now that tail scavenging and coarse gangue rejection are becoming mainstream.

Coarse particle flotation using the HydroFloat is a breakthrough technology that allows miners to recover more metal, produce less waste, use less energy and water, and have safer tailings.

Eriez is excited to be involved in this revolution and thankful for our partners who are turning coarse particle flotation into industrial practise and finding ways to create additional synergies and benefits for improving the resource extraction. **AMR**



Coarse Gangue Rejection Application

The coarse gangue rejection application has the potential to unlock additional green benefits, and it is being studied by multiple mining companies.

Syncline On The Incline

Rio Tinto approved the \$1b investment in the mine in November 2019 to sustain production capacity of its iron ore business in the Pilbara.

Construction of Rio Tinto's Western Turner Syncline Phase 2 (WTS2) expansion is moving ahead at a furious pace.

And it's been a boost for local WA and Pilbara Aboriginal businesses.

To date, more than 85% of spending on the project – which commenced in 2020 – has been awarded to the businesses, directly through Rio Tinto or principal contractor Mondium.

Rio Tinto has to date awarded contracts valued at more than \$500m to support this latest development of its Greater Tom Price Operations.

At peak construction, development will support a workforce of over 1000 people with the majority employed by WA businesses, including Guma Warnii, Monadelphous, Mondium, Kerman Contracting, Whittens, North West Mining & Civil, MACA Civil, Linkforce and Aerison.

Rio Tinto approved the \$1b investment in the mine in November 2019 to sustain production capacity of its iron ore business in the Pilbara.

Most of the technology and equipment needed to build the Western Turner proposal will be manufactured in the state, creating more jobs for local workers.

The investment allows for the mining of existing and new deposits at WTS2 and includes construction of a new crusher and a 13km conveyor, which will help lower greenhouse gas emissions from the mine by 3.5% compared to road haulage.

First production from the new deposits at WTS2 is expected in the second half of 2021. Premier Mark McGowan said the Pilbara region was the engine room of the nation.

"Thanks to WA's strong management of the

pandemic, we can expect more job-creating projects to come online in the coming years," he said.

"Rio Tinto has been embedded in the Tom Price community for decades and have made a significant contribution to the town. I congratulate Rio Tinto for its commitment to this important project.

"This project will ensure Tom Price has a bright future and my government is committed to ensuring mining communities have first class services to support local families."

Rio Tinto Iron Ore managing director of Pilbara Mines, Matthew Holcz, said the company's commitment to Tom Price and regional communities remains as strong as ever.

"Tom Price is the birthplace of WA's iron ore industry and more than 50 years later this investment in the Western Turner Syncline Phase 2 expansion will underpin the viability of this proud town for decades to come," he said.

"We are proud the vast majority of contracts we have awarded to date have been to Western Australian businesses, including Pilbara Aboriginal businesses.

"This investment demonstrates our commitment to spending with local businesses, buying locally and supporting our communities through the creation of jobs."

Rio Tinto Iron Ore currently employs more than 50% of workers living in Tom Price and this latest development will extend employment opportunities into the future.

Geographic Details

Western Turner Syncline Phase 2 is located in the Pilbara region of WA, 35km north-west of the Tom Price mine from where its ore is ultimately processed and loaded onto rail.

Rio Tinto's Greater Tom Price production hub includes the Tom Price, Western Turner Syncline Phase 1 and Western Turner Syncline Phase 2 satellite hubs.

Rio Tinto commenced development of Western Turner Syncline Phase 2 in 2014 and expansion plans commenced in 2019.

The investment in the WTS2 mine will help sustain the current workforce at Rio Tinto's Greater Tom Price production hub.

The project is expected to deliver an attractive internal rate of return with a capital intensity of about \$25/t of production capacity.

Rio Tinto was a member of the Premier's steel fabrication roundtable, which was convened to create more opportunities for local steel fabricating businesses on major projects.

Contract Updates

The Georgiou Group has secured the non-process infrastructure contract for the project, which will include the extension of the heavy mobile equipment workshop, construction of a new light mobile equipment workshop and tyre change facility, as well as expansion of ancillary buildings and installation of water infrastructure.

Georgiou CEO Rob Monaci said the team was looking forward to building on its expertise in non-process infrastructure.

"Over the past five years, Georgiou has really solidified their position in the non-process infrastructure space, having successfully delivered a number of NPI projects for Tianqi Lithium and, more recently, Rio Tinto Iron Ore," he said.

"This new project enables us to continue building on our relationship with Rio Tinto as we take on more complex, technically challenging projects in WA's north."

Construction has commenced with an expected completion of October 2021.

Meanwhile, Fenner Dunlop will manufacture and supply 27,854m of steel cord belt and splice kits for the project.

The large racetrack reel will be manufactured by JAF, part of the Fenner Dunlop Australia group of companies, to maximise reel length, reduce splicing on site and installation time.

This follows the \$55m contract awarded to Mondium for all engineering and design as well as procurement and construction works associated with the development of the process plant, overland conveyor and non-process infrastructure.

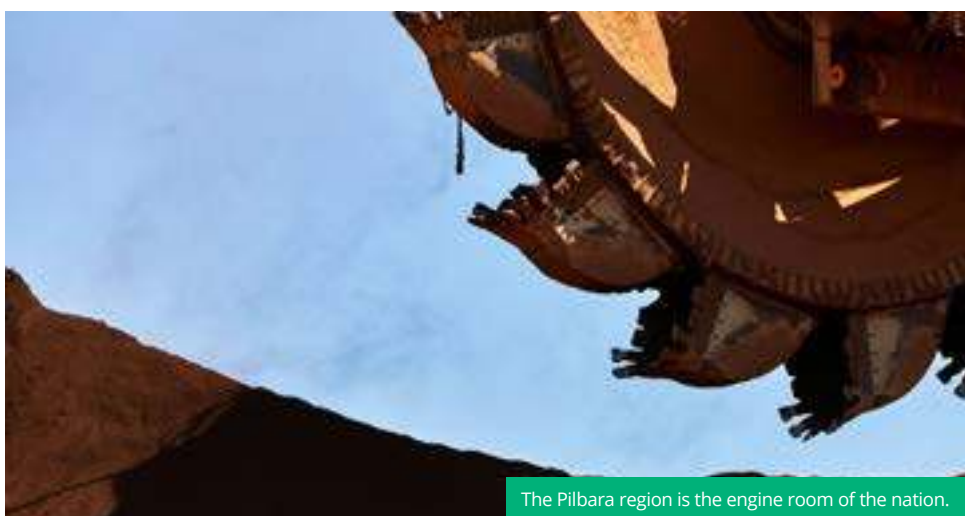
Kerman Constructing will deliver non-process infrastructure facilities and an explosives compound as part of the contract.

In addition, the contract comprises of a fixed plant workshop with amenities and office buildings, a heavy vehicle diesel storage and refuelling facility and two remote facility buildings inclusive of offices, ablutions and crib rooms as well as ammonium nitrate and emulsion storage facility.

"We are excited about the opportunity to working with Mondium at the Western Turner Syncline 2 project and looking forward to building a strong and lasting business relationship with Mondium," Kerman managing director Chris Kerman said.

"This contract award builds on Kerman's previous successful project outcomes in the Pilbara region in particular for Rio Tinto and other major mining companies.

"We are confident that our highly experienced team will deliver the WTS2 project to our client's full satisfaction." **AMR**



The Pilbara region is the engine room of the nation.



Rio Tinto's Greater Tom Price production hub includes the Tom Price, Western Turner Syncline Phase 1 and Western Turner Syncline Phase 2 satellite hubs.

FEATURES



The Complete Screen Specialists

Aury Australia manufactured the vibrating screens for Rio Tinto's Western Turner Syncline Project. The screens were delivered fully assembled and tested directly to the project from Aury's factory.

Aury Australia began in 2010 and has been continuing to grow over the years.

In most recent times Aury Australia has expanded its geographical footprint within Australia with new facilities in Brisbane and Perth along with a new purpose-built facility in Rutherford, NSW. It also has an existing service and sales facility in Mackay, QLD.

The Rutherford (head office) was designed to safely and efficiently assemble and test Aury equipment.

Aury has also recently leased a new facility in Perth designed to manufacture and assemble Aury equipment for the WA mining industry. The Perth factory will be

operational from October 2021 and will be key to supporting WA clients for the future.

Aury also has facilities in South Africa, Mozambique, SE Asia and China.

Aury Australia recently supplied vibrating screens to the Western Turner Syncline Project in WA.

These screens were specifically designed for the iron ore market and are part of Aury's growing footprint within the WA iron ore market. Other installations in the WA market include vibrating screen installations in the Goldfields.

Aury Australia supplies an extensive selection of products including a wide range

of screen media for the mineral processing industry.

The screen media is made both locally and overseas, with a dedicated resource team to support our product.

Aury Australia manufactures a complete range of high-quality vibrating equipment including screens, feeders and centrifuges for the mineral processing industries.

The equipment is designed and manufactured to the highest standards and is ISO9001 accredited.

The company also provides aftermarket support for spare parts and service for vibrating equipment, rotating trommels

and centrifuges. The engineering group has proven research and design capability, backed up by technical expertise from our Australian team, which has extensive experience in this field gained through working with vibrating equipment in the mining industry for many years.

The design engineers have combined traditional vibrating technology with leading edge innovation and design techniques to produce products that are robust, very reliable, efficient, and cost effective.

Visit AuryAustralia.com.au to view the complete range of equipment and services Aury Australia can provide. **AMR**



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World First In Mine Dewatering

Crusader Hose has developed the highest pressure layflat hose for ground water pumping in the world

Power cable is snaked along the Flexibore hose.

Crusader Hose is an innovative Australian manufacturer sitting on the cutting edge of layflat hose technology and has produced a world-first flexible rising main for ultra-deep bores - the Flexibore® 400.

With more than 35 years experience in manufacturing, the Melbourne-based company has a strong connection with the mining, pump and drilling industries.

These relationships have been built up over many years through industry networks, site visits, and trade shows.

Francois Steverlynck, the managing director for 30 years, understands the need mines have for water extraction.

As mines are extending and digging deeper, so too is the need for water transfer systems, which can handle greater pressures at these deeper depths.

A recent breakthrough by the research and development team has been the development of ultra-high-pressure hose for the extraction of bore water.

The 4" Flexibore® 400 series hose is the highest pressure layflat hose in the world for ground water pumping, which boasts a burst pressure of 100 bar or 1000m.

Groundwater now can be safely pumped from 400m below.

"Flexible rising mains such as Flexibore® have been the system of choice for many

Australian mines for in-pit bores due to the simplicity with which the submersible pumps can be retrieved and installed," Mr Steverlynck said.

The typical installation method uses a roller, crane or mechanised spool, as the riser pipe is one continuous length.

This system has proved to be less time-consuming and arduous than using steel or fibreglass pipe.

Crusader Hose knows the iron ore mines in the Pilbara region of WA are a leading powerhouse for the Australian economy.

These mines are at the forefront of best practice in efficiency and safety. Australian mining engineering is highly rated across

the world due to its skilled processing and ore extraction techniques.

Crusader Hose is committed in supporting mining and the Australian economy by investing in technology to design and manufacturer world-best hose systems for both vertical and horizontal dewatering.

"The Flexibore® 400 is a pioneering achievement in the history of our company, which we believe is a world first," Mr Steverlynck said.

"This Australian development will hopefully be keenly adopted by more mining companies, to enable them to keep at the forefront of productivity and profitability."

AMR



Submersible pump being installed into the bore.



160kW pump and power cable on truck.

WesTrac

Whitepaper

UNLOCK THE VALUE IN DIGITAL TRANSFORMATION

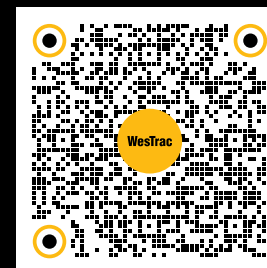
The Australian mining sector is recognised as a global innovator when it comes to mining technology.

As technology evolves and the experience of larger mining operations and equipment providers evolves with it, operators of all sizes are starting to realise the benefits and returns from investment in technology.

In this whitepaper, WesTrac investigates the evolution, scalability and realisation of value in technology for managing mining fleets.

▶ **Scan the QR code for your complimentary download or visit westrac.com.au/miningwhitepaper**

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Water Blaster Safety ...a Serious Subject

This story is contributed by Australian Pump Industries' Chief Engineer, John Hales. John has been working in the development of machinery for the mining and construction markets for decades and has seen massive changes in equipment over that time. One specific area where he and Australian Pump engineers has played a major role is the development of pressure cleaners specifically designed for the mining industry.

The demands for more pressure and efficiency in cleaning has brought with it real challenges in safety and highlighted the need for machines to be improved and operator training upgraded.

Aussie's Class A training course covers both classroom and practical.

Big Job... Big Machine

When Australian Pump first started building high pressure water blasters for commercial use, it was unusual to see machines with more than 3,000 psi capability.

There were ultra high pressure machines already widely used with famous names like Hamelmann, Woma in a very different category in the top end of the market. Those companies produced pumps at up to 50,000psi and sometimes more. This story is not about those machines.

Our focus is on the high pressure blasters used on mine sites every day around the country that are operating 4000 and 5000psi range. They are used for jobs as varied as machine wash-down, or steel preparation as part of ant-corrosion program.

Every mine needs high pressure cleaners and they are considered to be indispensable for a multitude of applications.

Most units being used, based on our surveys, are cold water machines. There is a growing trend to use mobile engine powered steam cleaners for 'in-field' cleaning.

What Miners Want

Australian Pump is one of the few companies in Australia that spends a lot of money on market research. Our recent surveys indicated that over the last decade particularly, Mine Spec machines have evolved and not just suit the requirements of the OH & S regulations, but to be more efficient!

The first Aussie Pump machines built for mines were really just diesel drive versions of their existing Honda petrol drive pressure cleaners. They were 4000 psi machines delivering around 23 litres per minute. They were a breakthrough at the time,

demonstrating clearly that higher pressure and less flow can deliver faster cleaning times! Major water saving was an added benefit.

The company focused on Bertolini "Big Berty" triplex pumps. This Northern Italian manufacturer is a major innovator, producing the first commercially heavy duty 4000 psi pumps for the international market. Australian Pump was quick to put those 4000 psi slow speed gear box drive machines to work with engine drives using a wide range of air cooled diesels. The focus was on machines that would provide the very best in cleaning results but at the same time, generate real efficiencies.

The final evolution of that trend was the company's 500 bar Yanmar water cooled diesel engine "EXTREME" range, delivering 7300psi whack, combined with flows up to 24lpm. We were out to save water but deliver substantial efficiency gains.

As we increased pressure we realised, as did the rest of the industry, that we were making machines that were potentially lethal in the event of operator error or machine malfunction. We set out to re-design the range and started adding safety features that were a first in the industry.

Safer Machines

Analysing the cause of failure and potential injury was the first step. We were the first to fit safety valves to all of our engine drive high pressure water blasters.

We understand that operators are tempted to play with the unloader valve to crank pressures up when they see the gauge pressure drop. Mostly, they don't understand that the fall off in pressure is one of two or three simple issues, most commonly just a larger orifice in the worn

nozzle being used on the operator's gun. Cranking up the pressure, overloads the engine, puts pressure on the pump and is asking for trouble. It's a no-no.

Much the same comment applies to the other uninformed remedy for loss of pressure ie, increasing the engine rpm. To compensate for the pressure spikes induced by this type of "in-field machine modification", we pre-set safety valves on every machine. The safety valve will blow off in the event of a spike of any pressure over and above the operating pressure plus ten percent. This protects the machine and the operator from potential injury and damage to the equipment.

At the same time, we made thermal dump valves an absolute mandatory part of the kit as well to automatically protect the machine from extended by-pass operation.

With machines on extended by-pass, often while the operator is absent, results in the water as it moves through the pump head overheating. The thermal dump valve will dump water at 60°C, normally around half a cup, allowing fresh cold water of that volume to enter the pump head. This keeps the operating temperature to an acceptable level.

We Build 'Em Tough

We also found that mines and quarries wanted machines which were substantially heavier duty in their build. In contrast, the commercial world is generally looking for the most power in a lightweight machine.

The mining industry knows that metal equals cost and most manufacturers want to design cost out of their equipment! We learnt that building 4000 and 5000psi machines in super heavy duty hot dipped galvanised 38mm frames, gave us a real edge over the conventional equipment.

Operators love it!

We wanted something that looked like Caterpillar had designed it, not a bunch of city boys who'd never seen a mine site.

Basic Safety Gear

Apart from building the machines tougher, we decided to standardise on gearbox drive slow speed pumps, normally in the 1450 rpm range. We applied these same pumps for both electric and engine drive machines, with a view to provide longer life for the pump, the heart of the water blaster.

From there, we moved to what we now consider to be essential equipment for tough machine applications. These include emergency-stop, battery isolation, fire extinguisher, double insulated wire and lifting bar. The whole idea was to make engine drive machines as safe as they could be whilst not impairing their efficiency.

The market's acceptance of those diesel powered Mine Spec Aussie blasters in the range up to 500 bar was very rewarding for the engineering team at our 2.5 acre headquarters in Sydney. It's nice to know that the market you have designed the equipment for perceives it to be of value!

Safety Issues with Pressure Cleaners

We're out to protect the operators of machines, not just ours, but all brands and we do that in a number of different ways. First of all, our machines are all equipped with safety valves and thermal dumps, Mine Boss machines are equipped with E-stops, fire extinguishers as well.

We also provide free of charge with every pressure cleaner we build, whether for mines, or tradies or even farmers, a pair of approved safety glasses. We don't want



Aussie's Extreme can come with compatible 500 bar PPE.

Change that hose!



anybody running the risk of eye damage. It's always the first requirements in our Operators Manual and training program.

Change That Hose

Our research also showed that one of the biggest issues with accidents was related to hose blow outs, generally at the point where the high pressure hose is coupled to the butt of the operator's gun. The high pressure hose bursting under pressure at the gun, ie adjacent to the operator's body, can be lethal. The higher the pressure, of course, the more serious the injury.

Most hose blow-outs are generated by insufficient care and attention to daily maintenance programs. We regard daily inspections mandatory! Corroded fittings, badly abraded hoses, sometimes with the wire braid creating an injury hazard just for the operators hands, are to be avoided. Worn out hoses and fittings should be scrapped. They are an operating cost, just like changing the filters on your car.

Training... Aussie Safe Operator

Many high pressure injuries are caused by operator error. The Australian New Zealand Standards Association and Work Cover have done a lot of work on coming up with information and standards to keep operators safe when using pressure cleaners. Standard number AS/NZS4233 breaks the machine category into two areas, Class A and Class B.

Class A machines are those which operate with pumps of up to a capacity of 5600 bar/litres. By that we mean it is the pressure in bar, multiplied by the litres per minute flow. A machine with a combination of 280 bar (4,000 psi) and 23lpm is a Class B machine, ie 6440 bar/litres.

The idea of the Standards was to help protect operators by mandating that Class B machines, operating at over 5600 bar/litres be certified by an RTO (Registered Training Organisation). The problem was that most RTOs are not experts in pressure cleaners and there are very few competent training bodies who are really qualified to carry out this training.

Is a Class A machine less lethal than a Class B machine? The practical answer is used carelessly or poorly maintained, they can be very dangerous. Training is essential and mining companies in many cases have been organising their own operator training for many years. Those old training programs are not necessarily in accordance with the requirements of the Standards.

Our philosophy is that all operators should be trained, whether they are using Class A or Class B machines and to that end, we have developed an excellent non-registered RTO style training program that is available free of charge to anybody who wants it. Our plan there is to keep operators safe, irrespective of what Class A machine they are operating. It relates to all brands within a 5600 bar/litre capacity.

The course covers the fundamentals of the machine function, requirements for safe operation, inspection procedures of equipment and lots more. Having operators understand just the principles of high pressure, the relationship of the nozzle orifice size, and the unloader setting, engine speed, all of which will dictate the performance of the pump. Basic machine maintenance is also covered by the training course.

Class B Difference

When you move into that next level of high pressure machines, above 5600 bar/

litres, operator training is essential under the new Standards. Operators need to be certified by an RTO. Their certification needs to be revalidated every two years. Class B machines need to be operated by two people, one operating the blaster and one standing by the machine to activate the E-stop in the event of a problem.

Machines need to be equipped with high pressure hoses that are individually certified whilst hose restraints are a requirement for Class B machines of all brands and capacities.

Aussie's Class A Expansion

Part of our program was to develop 4000 and 5000 psi machines that were Class A. Our Aussie Ultra and Predator units, a number of which are being used for a wide range of mine and quarry cleaning applications are now available in Mine Spec as Class A. The beauty of the Class A units is **NO OPERATOR CERTIFICATION REQUIRED.**

That doesn't mean the operator shouldn't be trained. That's why we developed the free training course!

Safety... The Human Factor

Our research indicated that often accidents are generated by fatigue. Working long shifts in tough conditions can be a real issue. Even long length high pressure hoses can be a risk factor if the operator is tired and not paying attention.

Shortening the cleaning time is a key focus point for Aussie Pump. We work on development of accessories that will get cleaning done faster, more efficiently and safer. The idea is to use the right combination of accessories, from long length hose reels to turbos or even high pressure grit blast kits. These will get the job done faster and with less stress to the operator.

We know that using a pressure cleaner for hours at a time can be tedious. Getting the job done fast and having the satisfaction of knowing that it is being done quickly, efficiently, and safely is a big gain for the operator's self esteem and morale. That is why we keep developing more user friendly accessories that will cut cleaning times.

For example, our stainless steel drain cleaning Mini Reels can attach to our 4000 and 5000psi Mine Spec pressure cleaners. That means apart from high pressure cleaning, we can also take care of blocked drains or pipework. Drains can be cleared fast with huge time savings using a 5000 psi Class A Aussie machine with a Mini Reel. The kit consists of a stainless steel portable reel and 60m of high pressure drain cleaning hose with nozzle.

Aussie's free training program and our free documentation on explanations on the new Safety Standards is readily available. Aussie Pumps also has free safety stickers for any brand of machine. It's all part of the contribution we make to keeping operators safe, reducing workplace accidents and providing more efficiency for mine operators. That's the Aussie way.

Next month, John Hales will write about the need for high pressure steam, the safety issues involved and the best way of protecting operators, and building efficiency using high pressure steam cleaners either in the workshop or for in-field cleaning.

For more information on

- Class A & B Safety Standards
- Free Operator Safety Training Course
- Free safety stickers for all brands of machines

Contact Aussie Pumps aussiepumps.com.au or distributors throughout Australia. **AMR**

Personalised Service

Bruce Avery started his transport business in 1994 with one Kenworth-W Model truck and a can-do attitude.

Fast forward almost three decades and he now has 65 employees and a large fleet of 45 trucks and 200 pieces of trailing equipment.

Mr Avery has never lost sight of the business' humble beginnings and his original commitment to provide a personalised service to every single client. He even managed to track down that original Kenworth truck, which he plans to restore in recognition of the key role it played in the business' success story.

Bruce Avery Transport is now one of the most respected and experienced transport service providers in the WA and NT region. With depots in Perth, Newman and Darwin, the company can do full supply runs into mine sites covering everything from dangerous goods to construction materials to underground supplies.

Other services to the mining industry include general freight, oversized loads, remote location transport, extendable loads, machinery transport, controlled waste transport, hot shots and a refrigerated tautliner service.

The company is split into four divisions:

1. Mine site runs
2. General freight into Darwin and Newman
3. Transporting construction materials into mine sites in the Pilbara and Goldfields
4. Ammonium nitrate subcontract work for Toll.



Bruce Avery Transport has grown into one of the most respected and experienced transport service providers in the WA and NT region.

With a large and versatile fleet including 42 prime movers, 90 flat top trailers, 17 drop deck trailers, 15 tautliners, 20 extendables, 10 Haulier Subcontractors and 90 dollies to connect into road trains.

The company also recently purchased refrigerated trailers from Vawdrey Australia to cart produce from Perth to Darwin for a large retailer.

"We began as a small company and we are now a medium-sized one, but we still have that same can-do attitude as we did when we started out," Mr Avery said.

"We offer a personalised service but we are well resourced enough to handle

the big contracts.

"We are solutions-focused and we make things happen.

"We are prepared to put the time into training people, we have lots of young people working for us who tend to stay with us long term because of the workplace culture we have.

"It has taken a real team effort to get to where we are today and we couldn't have done it without all the excellent staff we have."

Mr Avery's sons Thomas and Jack also play an integral role in the family business.

Bruce Avery Transport is primarily based in WA and the Northern Territory but it does have alliances with other companies to coordinate projects with its clients Australia-wide.

Routes:

- Once a week service from Perth-Darwin
- Darwin Express for urgent freight needs
- Perth-Goldfields for mine site runs
- Perth-Pilbara: Daily service for bulk and general cartage to mine sites
- Australia wide: Using alliances with other companies and an extensive fleet.

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WHERE OTHERS SEE OBSTACLES, WE SEE AND PROVIDE THE SOLUTIONS

As transport specialists we handle all types of requests and provide a range of options and transport services to the civil, construction and mining industries.

- Dangerous goods transport
- Scheduled general freight services
- Oversized loads
- Remote location transport
- Extendable loads
- Machinery transport
- Controlled waste transport
- Hot shots (available 24/7)
- Security risk substance
- Refrigerated tautliner service

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Newman Depot: 0477 177 280
Operations: 0477 177 280
17 Shovelanna St, Newman 6753

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Thinking Differently

For more than 30 years, Nationwide Towing & Transport has focused on one thing: changing the face of transport in Australia.

Offering towing, transport and heavy haulage services across Australia, Nationwide has built an empire based on providing small business service with big business benefits.

The Australian towing industry has long had a bad image.

Low barriers to entry and fierce competition have led to a reputation for winning work at any cost.

A fractured market means few operators can maintain a fleet large and diverse enough to take on the complex needs of industries like equipment hire, mining and manufacturing.

Nationwide has followed a very different path. It has invested significantly in people, quality, safety, fleet and ICT, which has set the benchmark for the industry.

The business transports more than 35,000 items every month and services a wide range of customers, from one-off transportation or relocation jobs to end-to-end solutions and partnerships with major corporations.

As the company has grown, it has looked beyond towing into machinery transport, heavy haulage, storage and more.

Importantly, Nationwide has always kept its focus on hands-on customer service.

They've become experts at understanding the transport needs of multiple industries and have always been passionate about putting their customers at the centre of their work.

"That's something we've always been good at," said Lennie Jerliu, Head of Business Development.

"Our customers rely on us to get things done for them.

"They need a solution fast, and they often don't have time to try and understand what they need exactly.

"Where others don't have the scale or experience, we really focus on offering a solution."

Anywhere, Nationwide, Anytime - Safely
To deliver this exceptional service, Nationwide is constantly working on training and developing its people.

The entire workforce receives comprehensive training in safety and risk reduction, and drivers, customer service consultants and dispatchers must complete further training before commencing their role.

Teams providing plant and equipment, heavy haulage and specialised services must also complete additional training and development. Ongoing training is provided, and audits are conducted frequently to make sure drivers' skills are maintained.

Understanding the importance of transparency, Nationwide has also worked hard to develop its quality assurance.

It has maintained certification for their quality assurance, safety and environmental management systems for twenty-five years.

Any hazards, incidents or complaints are investigated by dedicated feedback and safety teams who provide information and outcomes to customers throughout.

Equally, any opportunities for improvement are treated with the same dedication to continually adapt and strengthen.

A customer portal provides online booking, live job status and tracking, and flexible reporting and invoicing.

Trucks are fitted with GPS and cameras to easily monitor locations and activities.

Building On Local Knowledge
Nationwide has a lot of experience moving quickly. After more than 20 years of operation in Victoria alone, the company expanded into Queensland, WA and NSW within five years.

According to Nationwide GM Samantha Re, every time the company has gone into a new area, it's because it was invited by a customer.

"When you work the way we do, so different from the rest of the industry, companies notice" she said.

"So when a major organisation in Queensland couldn't find the right transport

provider there, they knocked on our door, and we set up operations in just a few months."

The company decided early that to maintain agility and service quality, it would need a mix of local teams and head office support.

It quickly established a team of experts in the Queensland transport market, supported by their head office.

"Just as we got ourselves set up in Queensland, we had another huge company based in WA approach us about opening shop there," Samantha said.

"We were a bit surprised, but we felt like it was the right time to expand, so we jumped at the chance.

"Then it happened again, this time from a customer in NSW. Now, we've really become a national company, and we are thinking quite differently."

Like with Queensland, each of these expansions has involved mixing local expertise with centralised support from head office.

"It's important to have operations managed by our local team," Samantha said.

"They understand the specific needs of the customers in their area and how the market works. Every state has slightly different regulations and a different mix of industries, so it just makes sense to find people locally who have that experience."

Local teams are supported by national support teams based out of the Melbourne head office.

"This way, we get the best of both worlds," Samantha said.

"We can support local businesses and provide on-the-ground assistance for frontline teams, and at the same time use national systems to build efficiency."

Staying Flexible
Despite this growth, Nationwide has managed to stay just as nimble as its early days. This has been essential for customers, who often need things done well and done fast.

For Nationwide, 24-hour service really

means 24 hours.

It regularly provides equipment swap-overs for mines, where timing is critical.

After-hours availability and a rapid response can be essential for their customers, so it has built a workforce of over 600 representatives and a contractor network across Australia to get it right.

Perhaps the best example of Nationwide's flexibility happened one Christmas Eve.

Most businesses were closed or running skeleton staff, and the plant and equipment team were expecting a quiet few days.

Then, a call came through from a customer who urgently needed to move an item from Sydney from Darwin. The item in question: a 747 Rolls Royce Boeing jet engine.

The team did what they do best and found trucks, drivers, dispatchers and support staff to get this engine on the road and delivered in under two days.

Looking Forward
With material operations in four states, Nationwide is looking to how it can grow the business further.

It is expanding the fleet, adding new vehicles to increase operations and provide more tailored solutions.

In 2020, it won two Australian Business Awards for product innovation for its specialised recovery vehicle.

It is also building on the success of the workforce development, expanding the training model to incorporate a mentoring and development program unique to the transport industry.

Using data collected from training, incidents, skill assessments, and audits, an operator coaching model has been created to reinforce training and embed best practice behaviours.

Above all, Nationwide intends to keep the focus on what really matters to them: its customers.

It has built a reputation based on solving problems with a smile. Whatever comes next, the company plans to remain as agile and as dedicated as ever. **AMR**



Carbon-Neutral Shipping Program

A new class of sustainable container shipping.

Mediterranean Shipping Company (MSC) is the world's first shipping line to offer customers a complete carbon neutral program. For years, MSC has been investing heavily in low-carbon technology to help meet the targets to decarbonise shipping.

Now Australian exporters and importers can share this vision and take responsibility for their emissions by joining the MSC Carbon Neutral Program, created in partnership with South Pole.

The program complements MSC's strategic approach to sustainability and massive investment in reducing emissions and minimising the environmental impact of its fleet.

Partnering with South Pole

Through the partnership with South Pole, the world's leading developer of emission reduction and renewable energy projects, MSC's customers have access to premium climate action projects.

These projects improve lives, livelihoods, and landscapes for communities around the world.

The MSC Carbon Neutral Program supports projects that deliver measurable benefits aligned with the United Nations Sustainable Development Goals.

Accelerate the Transition

The MSC Carbon Neutral Program enables shipping companies to accelerate their

transition to a carbon-neutral supply chain, taking responsibility for their cargo's environmental impact and compensating through an offsetting program.

The emission reduction projects help fight climate change and bring wider sustainable development in local communities, such as poverty reduction, health improvements and access to clean water.

CO₂ Emissions Compensation

The company's team of experts help calculate the emissions generated by the volume of cargo moved.

Users select one of the projects, part of the MSC Carbon Neutral Program, to compensate the unavoidable emissions of

the marine and inland transportation of goods. Companies may decide to offset all cargo shipments processed by MSC or only a few.

South Pole will provide a "Verified Carbon Units Certificate of Retirement" delivered by the Verified Carbon Standard (VCU) Registry, and a climate action certificate attesting the amount of CO₂ compensated by investing in this program.

Further information on the MSC Carbon Neutral Program can be found at www.msc.com/carbon-neutral

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JD Container Logistics provides a full one-stop solution for container transport requirements to importers, exporters and freight forwarders. JD Container Logistics operates out of a state-of-the-art facility based at the Fremantle Port operating a large fleet of:

- **Side Loader Trailers** for the delivery of FCL containers to site.
- **Flat-top trailers** for the delivery and collection of LCL cargo.
- **20' and 40' Flush Back Trailers** utilised for live unloads and drop trailer dock deliveries.
- **40' and 20' Skeleton trailers** utilised for the delivery of FCL containers for either live unloads or drop trailer deliveries.
- **B-Double combinations** for both LCL loads and container combination deliveries.
- **Rigid trucks** for the delivery and collection of LCL cargo up to 8 tonne.
- **DG Cargo** - JD Container Logistics have a number of bulk DG licenced drivers whom are fully trained in the transport of DG cargo.
- **45' Tautliner trailers** utilised for the delivery and collection of sensitive cargo.
- **OOG** - JD Container Logistics fleet contains extendable drop-deck trailers which allows for the safe and compliant movement of OOG cargo, including over width and over height flat rack containers.
- **20' ultra-low drop deck trailers** utilised for the delivery of over height containers.
- **Linehaul Capability** - we can save you time and money by consolidating containers bound for the same destination, including long-haul deliveries to remote mine sites in WA's Pilbara region



With JD Container Logistics utilising the above array of transport equipment and capabilities, we can fully handle all your container and LCL transport requirements including:

- Side Loader Transport.
- FCL Container Transport.
- Refrigerated 'Reefer' container transport.
- LCL cargo transport.
- Drop trailer deliveries.
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JD Container Logistics also offers container storage, bonded warehousing, packing and unpacking, quarantine and project solutions services.



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Improving worker safety with innovative PPE



Working in the mining industry is inherently dangerous, with a high risk of accidental injuries or long-term health and safety complications.

This is especially crucial given that mining accounts for the third highest rate of fatalities of all Australian industries.

Respiratory illnesses and hand injuries are common risks site managers and employers need to protect their workers from. Selecting the right personal protective equipment (PPE) is therefore a critical to element to the hierarchy of control for managing risks in the workplace.

Blackwood, Australia's largest supplier of fit-for-function quality personal protective equipment and safety products, is the exclusive distributor of a new range of disposable respirators and cut resistant gloves designed to protect workers from common hazards in the mining industry.

The new PROSAFE trifold respirators, which are available both with and without valves, are designed to comply with P2 respiratory filter rating -- meaning they can effectively protect users against dust, mist and fumes.

Blackwoods Technical Safety Specialist Jon Martin said the new PROSAFE respirators are designed with maximum user safety and comfort in mind.

"These respirators are designed to comply with AS/NZS 1716:2012. This is the manufacturing standard that helps ensure the masks can effectively prevent users against entry of small particles from the atmosphere," Jon said.

"Additionally, PROSAFE respirators have also been put through a fit testing process, with very positive results. This test actually measures the percentage of particles that can get through the mask after it's been fitted on the face.

"While everyone has different facial features, we still want to ensure that we have a good rate of fit testing when we introduce a new product to the market."

A challenge for any PPE manufacturer is to make a product that's comfortable enough and takes away barriers that stop people from wearing them.

Mr Martin said the new trifold respirators do just that.

"The valved PROSAFE trifold respirators are fitted with one-way filters that allow hot air to escape, so they can be used in hot environments with maximum comfort," he said.

"The trifold design itself is perceived by workers to be a more comfortable option compared to conical and flat-fold masks. So that also helps minimise the likelihood of people not wearing their masks."

The new PROSAFE P2 trifold respirators are equipped with a class of filter recommended for common threats on mine sites including rock, coal and silica dust.

Keeping the hands protected

Hands are crucial to the performance of everyday tasks. An injury causing loss of function, grip, motion or even amputation, can be extremely debilitating to workers.

With wearing appropriate safety gloves reported as reducing the incidence of hand injury by around 60-70%, it is no wonder that Australian legislation takes hand protection seriously.

Employers are required to provide application-specific PPE at no cost to employees - as well as assessing all other WHS options found in the hierarchy of control.

Blackwood's National Category Manager



for Hand Protection, Shane Wood, said the PROSAFE Kyorene cut protection gloves with graphene fibre are the ideal protective gloves where hand injuries are a potential hazard.

"The Kyrene range of gloves uses graphene in the fibre to aid with its comfort and cut resistant properties for the end user," he said.

"This gives workers in the mining industry a product that's comfortable to wear for extended period of time so that they don't need to take the gloves off to do their job."

PROSAFE Kyorene gloves are rated for their cut resistant capabilities based on EN388:2016 standard.

The standard sets a cut rating from A to F, with an A rating representing the lowest level of protection and an F level representing maximum cut and impact protection.

Mr Wood said it's important that gloves with optimum level of cut protection are selected for each application.

"You don't want to use gloves with higher

cut ratings than necessary, because while protection is important, people should also have the dexterity to their job well," he said.

"A Kyorene glove with cutting rate of B or C is probably sufficient for most general applications. An F cutting rate is ideal for people at extreme cut hazards such as sheet metal and glass cutters."

Further, Mr Wood says the PROSAFE Kyorene gloves offer a fair balance when it comes to their price.

Equipped with knowledge around the latest PPE available in the market, he believes employers and site managers will be in a better position to protect workers.

"Most people are oblivious to the latest technology in hand protection, as well as other critical PPE," he said.

"Our job at Blackwoods is to make sure that we understand the customers' requirements properly, so that we can supply them with the right product for the right application."

AMR



A range of PPE products from Blackwoods.

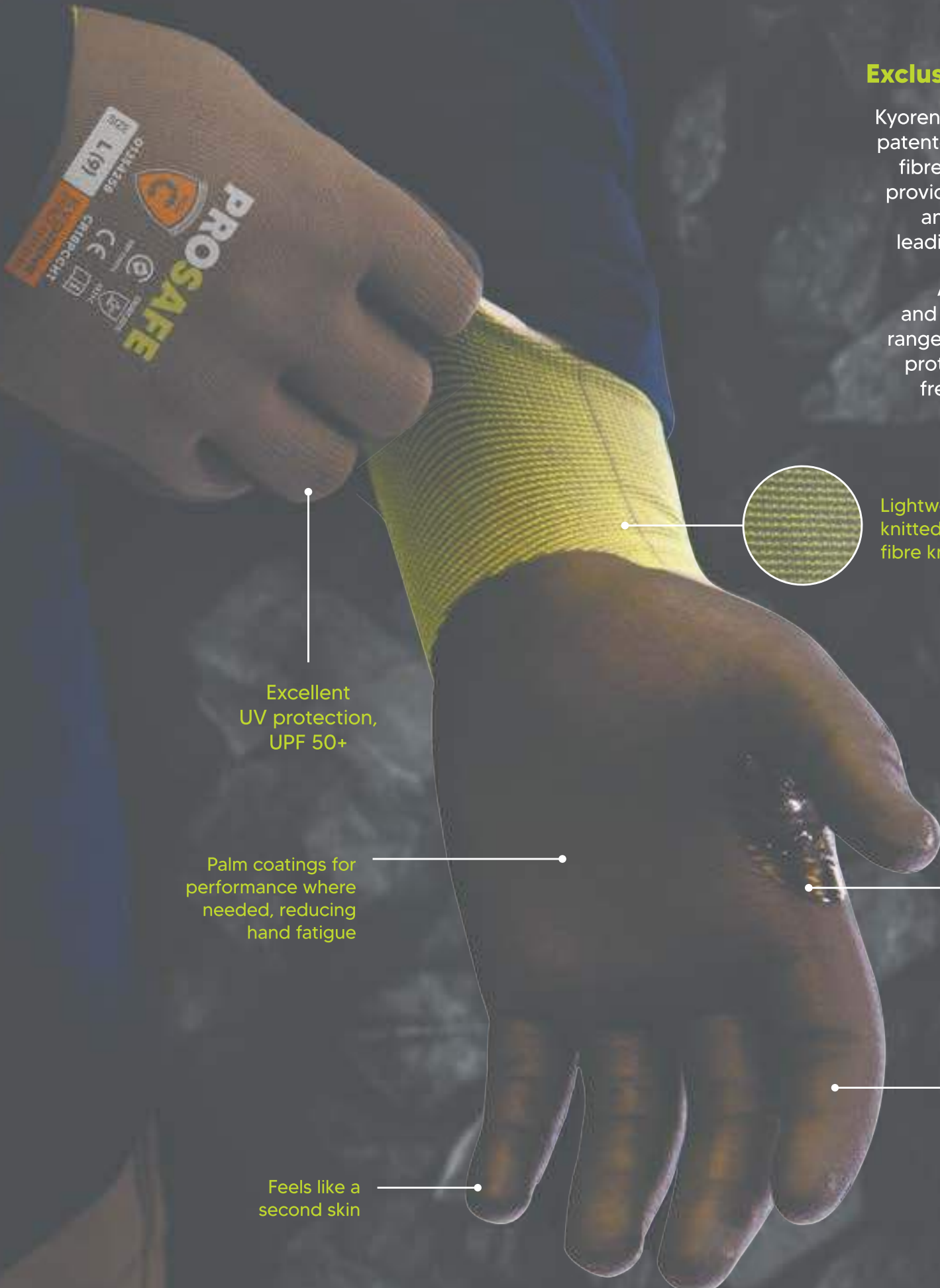


KYORENE

Exclusive to Blackwoods.

Kyorene Graphene gloves use a patented ultra thin cut resistant fibre technology designed to provide a new level of comfort and dexterity with industry leading protection at its core.

Available in various styles and cut ratings to suit a wide range of applications, Kyorene protects the wearer allowing freedom and performance.



Excellent UV protection, UPF 50+

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Hybrid Coating Technology nitrile micro-foam coating for grip

PROSAFE
PROTECTIVE SAFETY

THE COMPLETE KYORENE RANGE



Call To Action

Alarming silicosis report outlines need for better worker protection

A report has found one in three stonemasons had an identified case of silicosis, sparking a call to action from leading respiratory protection manufacturer CleanSpace Technology.

These findings are also likely to have implications for silica-exposed workers in other industry sectors.

The final report of the Victorian Phase 1: Silica associated lung disease health screening research project, which includes the Stonemasons' screening project and the Silica-associated disease registry, has been released with staggering findings.

The report was prepared by Monash University in collaboration with WorkSafe Victoria.

Overall, as of July 2020, 456 workers agreed to take part in the screening project or/and the disease registry.

Among these 456 workers, there are 133 (29%) cases of silicosis identified. Of the 133 workers with a diagnosis, 102 had simple silicosis, and 31 had more severe complicated silicosis.

The median age of workers at the time of assessment was 36 years of age.

The study found that the reported use of respiratory protective equipment (RPE) has increased slightly.

However, many workers reported ceasing RPE use after wet-cutting processes were implemented.

Opening a window/door and ventilation in the ceiling were the most common types of ventilation methods reported, which is unlikely to be effective in removing dust from the worker's breathing zone.

In summary, this research has found a large burden of silica-associated disease in stonemasons working with artificial stone and demonstrated the need for ongoing screening of these workers and further research into the most effective screening methods to be adapted.

CleanSpace CEO Alex Birrell said the report was a "wake-up call" not just to stonemasons but anyone working with crystalline silica.

"I implore all employers to review their current respiratory program to ensure the exposure to silica dust is minimised, and check employee training includes silica-specific information," Dr Birrell said.

Since the release of the report, CleanSpace Technology has ramped up its commitment to educating the industrial sector on the occupational hazards of silica dust.

Key findings

- Of the 324 workers in the stonemasons' screening project, 254 (78%) were referred for further follow-up.
- There were 211 (65%) workers who had clinical abnormalities (abnormal chest x-ray, and/or abnormal lung function, and/or significantly respiratory, other symptoms or signs).
- Of the workers who were referred for further follow-up, 59 (26%) have a current silicosis diagnosis, and 26 (11%) have possible silicosis.



High Protection P3 filtering 99.95% of airborne contaminants.



CleanSpace Respirators are AS/NZS 1716 certified.

Silica dust is harmful when inhaled into a worker's lungs.

It is 100 times smaller than a grain of sand; so small it can be inhaled without knowing. Respirable crystalline silica exposure can cause silicosis, a debilitating and irreversible lung condition that can cut short careers, reduce the quality of life and can lead to death. Respirable crystalline silica is also linked to lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.

Occupational exposure is high for workers in industries including mining and quarrying, constructions, agriculture and stonemasonry.

When looking to protect staff from any airborne contaminants, Powered Air Purifying Respirators (PAPRs) offer high and reliable protection, far exceeding disposable masks. CleanSpace Respirators are positive pressure PAPRs and are a revolution in the area of respiratory protection.

While they provide all the protection of a PAPR, they are free from belts, battery packs and hoses, making them more comfortable and easier to deploy.

Compared to disposable N95 respirators, CleanSpace Respirators offer more protection and are more economical as the cost of replacing disposables stacks up.

With the current COVID-19 crisis, securing a reliable supply has also been an issue. Disposable masks are well-known for causing fogging of eyewear and discomfort, leading to low compliance.

Even when used in hot or humid conditions, CleanSpace respirators provide cool, clean air to the user and eliminate fogging and moisture. CleanSpace respirators are light, easy to put on, reliably safe and comfortable.

These smart powered devices are easily operated using a one-button smart system, recharge in just two hours and have a run-time of eight hours.

These unique features mean more workers wear these respirators for the full shift every time.

CleanSpace meets and exceeds the Silica Dust Exposure Standard.

To guard against silica exposure, State regulators have moved to recommend staff wear respiratory protection using a minimum P2 filter.

CleanSpace respirators meet and exceed these requirements with a P3 filter, and are AS/NZS 1716 and CE Mark certified.

There are four CleanSpace Respirator models depending on the requirements of the industry.

CleanSpace ULTRA is IP rated 66, making it water-tolerant, perfect for stonemasons carrying out wet-cutting.

CleanSpace EX is intrinsically safe, certified for use in potentially explosive environments such as mining.

CleanSpace 2 is suitable in a variety of industrial applications where water tolerance or intrinsic safety is not required. CleanSpace HALO is designed specifically for the Healthcare, Pharmaceutical and Laboratory sectors.

CleanSpace Technology believes employees are an essential part of a business and that the workplace environment must be safe for them.

CleanSpace Technology hosts online presentations to share information on effective risk control, industry best practice and experiences to case studies from people in the industry.

There are upcoming opportunities to join its live sessions to learn more about CleanSpace Respirators and how they can protect you and your workers.

Scan the QR code to reserve your spot.

AMR

Typical silica levels can vary greatly in different materials. Sandstone is almost pure silica at between 70-90%. Granite is around 15-30%. Engineered stones 93%+

Workplace exposure to respirable crystalline silica can occur in many industries such as mining, quarrying, stonemasonry, tunnelling, construction activities and cement and concrete manufacturing.



CleanSpace Technology supports on-going learning, product training, fit-testing and instructions on maintenance and care with attentive customer support.

Contact CleanSpace Technology:

sales@cleanspacetechnology.com

www.cleanspacetechnology.com

The report is available on WorkSafe Victoria's website:

www.worksafe.vic.gov.au/resources/silica-associated-lung-disease-health-screening-research-phase-one-final-report



Safety and Quality First

Founded in WA in 1973, Specialised Welding Australia (SWA) is a steel fabrication and service company.

The TVS division of SWA is a valve servicing business providing turnkey solutions to all valve and flange management problems.

First and foremost is the SWA and TVS commitment to safety and quality.

SWA services a combination of the oil, gas, and mining industries, as well as specialist valves.

The company acknowledges and thanks the past and present employees of SWA for the commitment and dedication that has provided it with the diversification in fabrication and specialist services it offers today.

The SWA mining division has a long history in supporting the Australian mining industry with technical support and fabrication capability.

The team understands the demands of mining companies for continuous operation of their processing plants.

SWA is committed to supporting them with the required resources for plant repairs or replacement, whether the work is required to be undertaken at its Kwinana workshop or the team is required to be mobilised to site.

Refurbishment and overhaul of buckets and heavy mobile equipment, ball mills and in-situ machining, including line boring jobs, are undertaken on a regular basis.

Strong communication and on-going reporting with the client throughout the assignment is a significant strength of SWA's charter.

Its capabilities include heavy structural fabrication, supply of rolled cylinders and cones, gold industry carbon column pressure vessel design and manufacture, fabrication of wear resistant hoppers, chutes and bins in Hardox plate materials and/or dual-plate lined.

With extensive experience with weld overlay, hard facing, erosion and corrosion repair work, SWA is the partner clients need to keep their plant running.

The fabrication capability is complemented by the extensive machining facilities, non-destructive testing, heat treatment and National Association of Testing Authorities (NATA)-approved hydrostatic testing if and when required to provide a one-stop service facility.

The company's clients in the mining industry include QAL, Alcoa, South 32, BHP, FQM, Boddington Gold, Yarra, Gove NT, Murrin Murrin and many more. **AMR**



SWA is a recognised supplier of crushers, tanks, pipe spooling and more.



Providing a quality service for 47 years, SWA offers answers to mining, oil and gas and refineries across Australia.

SWA are recognised quality suppliers of

- Heat Exchangers
- Pressure Vessels
- Tanks and Columns
- Crushers, Grillage, and Chutes
- Pipe spooling (CRA, rubber lined, coated, galvanised)

No job too big or too small.

Our team of motivated and dedicated engineers will find a solution to your supply needs.

SWA offers the ability to solve your problems with a comprehensive range of welding processes and procedures (high Ni, high Cr, high C) and the ability to repair most weld cast and forged pumps, valves and similar equipment.

No more waiting months for a replacement: speak to SWA regarding repair welding of your failed components

Our procedures and QMS are ISO 9000-2015 accredited with NATA testing to ensure the highest levels of safety and quality.

SWA

swaust.com.au

08 6272 8000

Energy Saving Technology Ensures Sustainable Compressed Air Power

Compressed air has been the safest, most convenient and controllable industrial power source for decades.

However, with the cost of energy in Australia and around the world rising at alarming levels, all industry including mining is finding it increasingly difficult to maintain the balance of compressed air output versus energy input cost.

To address what is a serious threat to the continuation of compressed air as a viable power and air supply source for mining, dramatically higher efficiency levels in compressors simply had to be achieved.

One of the world's largest designers and manufacturer of industrial air compressors, the global Kaishan group, has been at the forefront in research and development of ever-evolving technologies in compressor engineering that have achieved energy savings beyond that required to satisfy mining operations around the world.

Kaishan has developed its latest rotary screw machines to integrate with newly developed efficiency technologies that revolutionise the output of compressed air with a highly improved energy in/air output ratio.

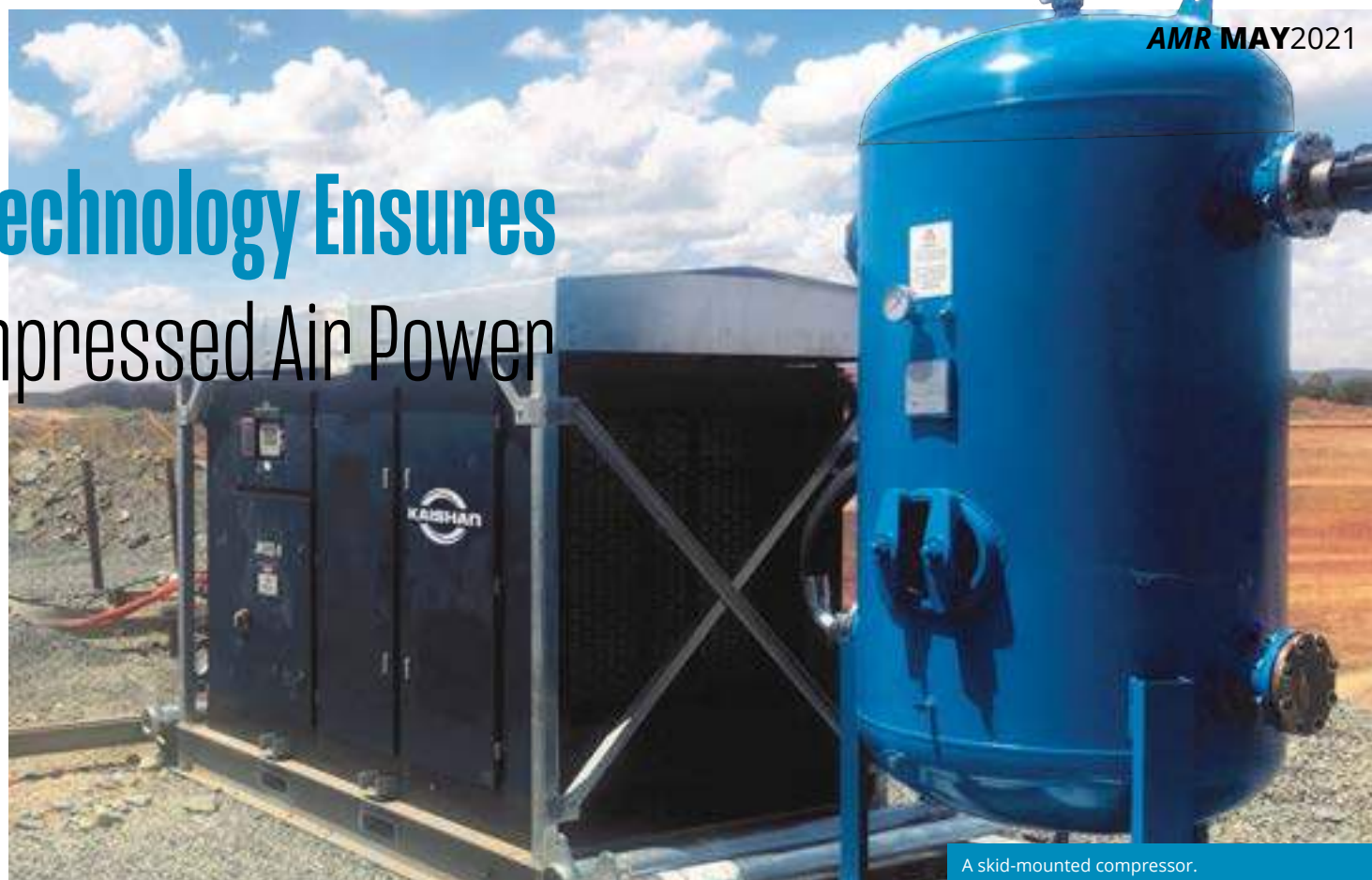
The flagship of the Kaishan models for heavy industry applications is the PMVII range of two stage rotary screw air compressors utilising Permanent Magnet, Variable Frequency (PMVF) technology.

With 'PMVF' when air demand decreases, the machine's output and motor absorbed power declines as well.

After any extended period of zero demand the machine will idle and shut off, saving energy and reducing operating costs.

However, immediately on demand for air, the compressor will automatically restart.

This gives the air compressor the ability to adjust air output ranging from zero to 100% ensuring maximum operational efficiency.



A skid-mounted compressor.

In these times of constantly rising energy costs, environmentally conscious mine operators must look to the world's latest energy saving technologies to remain sustainable now and into the future.

The Kaishan range of advanced air compressors has evolved to be the benchmark in providing sustainable compressed air power at the lowest possible cost.

Custom Compressed Air Systems For Mining Operations

Mining and heavy industrial operations require high output, ruggedly constructed air compressors that are capable of being moved around to different locations both above and underground.

Not a simple task given the size and weight of most large capacity compressors and the fact that they require a stable platform to operate effectively with the lowest possible maintenance requirements.

Kaishan Australia has solved this problem for sites both in Australia and internationally, by integrating the latest compressor technology and engineering into custom designed and built, high strength, fabricated steel skid packages that allow the compressor being safely moved around the site.

The rugged framework also provides protection for the compressor from rock and debris falls while in service impacts.

Specialised compressor filtration systems have also been developed to cope with harsh, dirty and dusty environments.

The combination of this innovative adaption and Kaishan's globally renowned energy efficient technologies which includes PMVF, offers a wide range of industrial single and two stage rotary screw compressors that can be custom-built to suit a range of specialised industry needs.

A number of variations can be offered including high voltage electric motors for underground applications through the KRSP range.

Kaishan also supplies a full range of rotary screw and reciprocating gas compressors to meet a myriad of applications in oil and gas industries.

Clean Air Vital To Mining Industry

The mining industry is particularly susceptible to poor quality air and resulting problems.

Selection and installation of the right dryer and filters to match your system is vital to achieving maximum, sustainable clean air results.

Water, dust and other contaminants in the compressed air supply can cause big problems such as:

- Corrosion to compressed air equipment and pipelines
- Excess wear and tear in compressed air tools
- Water, grit and oil infusion into equipment

- Increased maintenance costs
- Lost productivity

Moisture naturally occurs in the atmosphere and is therefore contained in air induced into air compressors.

Once compressed, this moisture condenses into liquid (water) and flows through compressed air lines and into tools and equipment.

Lubricants used in air compressor can atomise and also form part of the air stream. Other wearing particles such as dirt, dust and pollens, etc, can enter through the compressor air filter, once again causing poor quality of air output.

Eliminating moisture (condensate) and contaminants from your compressed air supply offers great benefits and it's easy to achieve.

Installation of a suitable refrigerated dryer and coalescing filters in the lines immediately after the compressor.

The dryer will remove virtually all liquid condensate and the coalescing filters will remove residual lubricant as well as any wearing particles. Installation is easy and maintenance is minimal.

It is an effective, low-cost insurance that will protect equipment, reduce costs and improve air quality.

Kaishan Australia supplies a wide range of ancillary system components to improve the end air output efficiency and quality.

www.kaishan.com.au

AMR



PMV energy-saving technology.

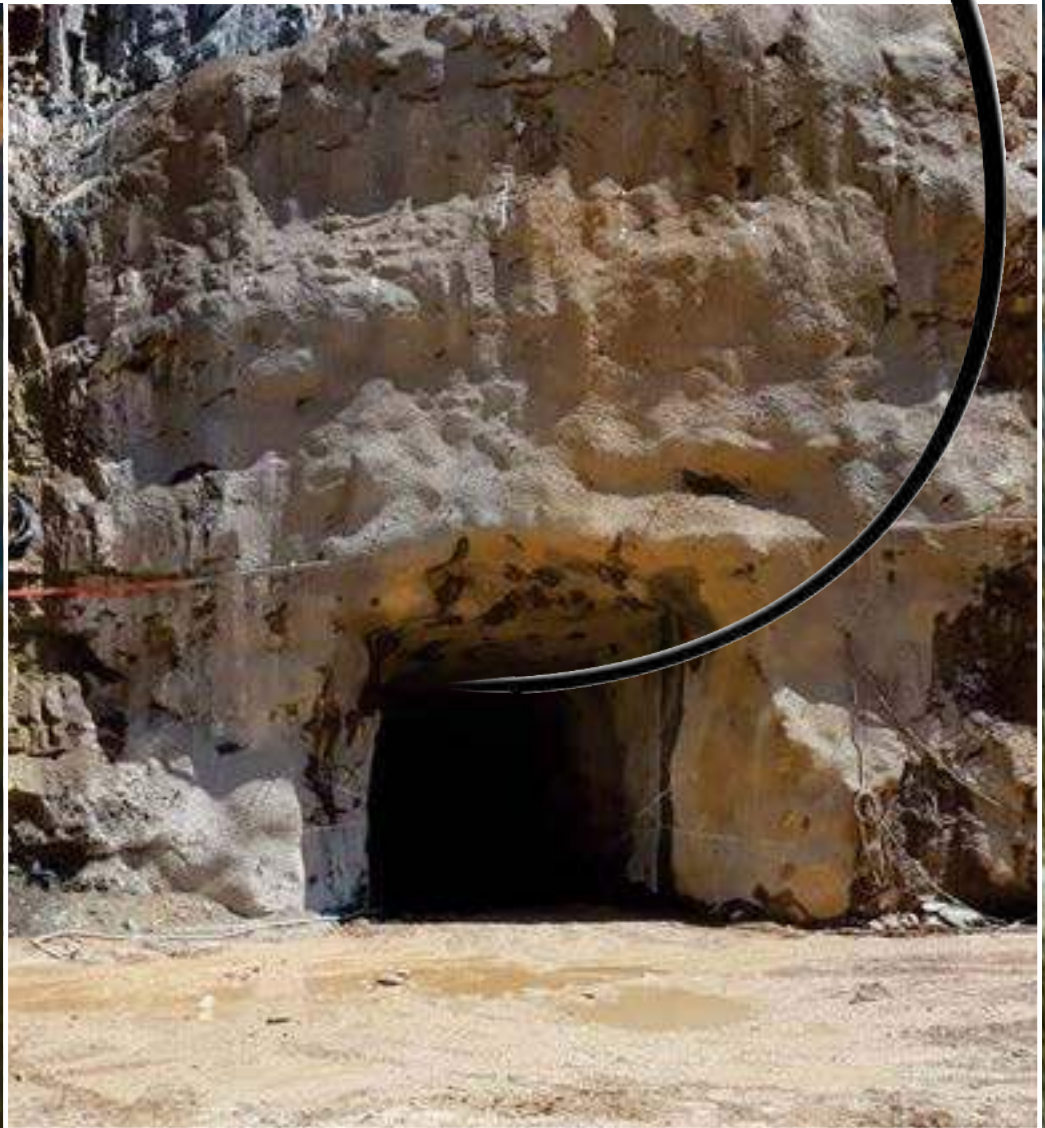


Kaishan high pressure compressors for oil and gas industries.

IT'S ALL ABOUT QUALITY AIR

Compressed air...

where and when you want it!



The harsh, hot and dirty mining environment creates special requirements for the delivery of compressed air for drilling operations, machine power and refuge chambers.

Kaishan Australia have developed specialised, moveable air compressors for mining operations around Australia. Customised design features include boosted filtration capacity, oversize air receivers and mobile skid frames for movement around the mine site. These high performance compressors utilise Kaishan advanced energy saving technology to deliver high quality air, reliably, quietly and efficiently.

Despite the rugged operating conditions, Kaishan Australia maintain their exclusive 'lifetime warranty*' on the airend and extended warranty on the complete unit.

For free advice on your compressed air system **1300 098 901** www.kaishan.com.au



Engineering the Future



*Warranties referred to are subject to conditions



*T&C'S AVAILABLE ON WEBSITE

The Importance of Air Audits

With air compressor equipment at the beating heart of many manufacturing systems, it is essential that they are running at their highest capabilities.

With day-to-day operations more unpredictable than ever, the last thing on-site managers want to encounter is an inefficient mechanical setup.

Less numbers on the ground to oversee your machinery's functionality mean breakdowns and energy wastage are almost inevitable.

With air compressor equipment at the beating heart of many manufacturing systems, it is essential that these are running at their highest capabilities.

Often audits are an afterthought triggered by rising energy bills, but this need not be the case.

Conducted ahead of adjustments or new installs, air audits can not only save you dollars on operational expenditure but also alleviate service headaches in the short and long term.

By choosing Sullair Australia, air audits will be provided to you at your time of need - no matter where you are in the country.

What is a compressed air audit?

As is widely known in the manufacturing industry, compressed air is one of the more inefficient uses of energy; yet it is still a critical cog in the day-to-day running of most industrial operations.

It is therefore essential that your air system is kept running at maximum efficiency so as to avoid wastage (and inflating costs).

One way of making sure this is the case is by conducting regular air audits.

An air audit assesses your machinery's air usage to identify where energy may be being lost.

There could be a number of factors in the mix to cause this wastage to be present including things like air leakages, the condition of different machinery being operated in tandem or even the energy level at which a machine runs during the day, versus at night.

With many aspects to take into account, Sullair's technicians are on hand to conduct an audit for your business at any time which will help reduce energy wastage, enable your machinery to run more efficiently and, as a general rule of thumb, save you money.

Why are air audits important?

Customers come to Sullair looking for air audits for a number of reasons. Often, they have just installed a new machine and their current equipment is struggling to keep up.

In other cases, a customer wants Sullair to assess their whole system retrospectively before installing a new machine, so as to minimise impact on their existing setup.

Others need help identifying the source of a leak that is causing their energy costs to soar.

Whatever the reason, the Sullair team is well-versed in finding the cause of, and solution to, your air system's problems.

How much do air audits cost?

Sullair generally does not charge for an air audit, though it may differ depending on

your setup.

Principally, the cost of an air audit should be insignificant in comparison with the dollars you will save through a proper analysis of your system.

Should a client agree to proceed with the recommendations as per the outcomes of the audit, appropriate costs will then be suggested.

Sullair is dedicated to providing our clients with solutions to fit their needs and air audits are no exception.

How does Sullair conduct an air audit?

Often customers provide details of their problem before arriving on site but at a minimum, all air audits start with a walk-through of the customer's current mechanical setup.

Sometimes the main issue will be clear just from this task, however, a qualified technician will continue to carry out the full audit so nothing is missed.

The technician will then set up the machinery recording equipment which uses a Bluetooth Scadar device to record the machinery's data.

This equipment is left on site for a week, recording the machine's activity and efficiency 24/7 in order to give a clear picture as to where there may be issues.

This means that if a machine is experiencing problems outside of normal working hours, they will be recorded.

A report is then produced with findings that have measured everything from currents to voltage to dollars spent.

This report informs the Sullair team what area of the compressor (or indeed, the whole system) needs attention before recommending a tailored solution for client needs.

Sometimes this solution means the reparation of existing equipment, other times the adjustment of a setup so that older and newer machinery can run side-by-side or indeed, the replacement of machinery altogether.

Once the customer has reviewed the recommendations, they can then decide what action they would like to take - if any.

What are the benefits of an air audit?

- Air audits can help you improve the efficiency of your system, saving money, time and energy.
- An audit can help our customers gain a better understanding of their system and its needs, helping you to make smarter equipment choices moving forward.

Interested in what an air audit can do for your business?

Contact Sullair today on **1300 266 773** or at www.sullair.com.au/products/air-audits

AMR



By choosing Sullair Australia, air audits are provided at any time - and no matter where you are in the country.



Air audits can help you improve the efficiency of your system, saving you money, time and energy.

ENERGY BILLS RISING AND YOU DON'T KNOW WHY?



You may need an air audit.

Whether it's making adjustments to your current system or preparing for a new install, Sullair's experienced team can help save you dollars and time by identifying where your setup may be losing all-important energy.



Contact us today to organise your air audit

Call 1300 266 773 or visit sullair.com.au



Proud to be Australian

Oreflow Australia has built up a reputation as an industry-leading national and international supplier of mineral processing mining equipment.

But the company has never lost focus of its Australian roots, proudly manufacturing and assembling its broad range of screens in WA.

Whether it be a screen for waste processing or a vibrating screen for materials separation, Oreflow can offer a tailored screen solution to achieve the outcomes and aims of any project.

Customised operating parameters ensure accurate sizing and high quantity processing of materials ranging from ores and rock to mineral sands.

The company understands that to get it right when it comes to material size, conforming to a rigid specification relies heavily on using the appropriate screen size.

Different materials have different separation rates, and that is why it is important the correct screen size is used, as it will maximise the efficacy and efficiency of the screen.

Oreflow's innovative and practical range includes static and excited wet and dry screens, portable screening plants and heavy duty Horizontal Linear Motion Screens (HLMS).

Its products are designed to be fit-for-purpose, capable of operating in the harshest conditions and able to be integrated into new or existing plants.

Oreflow founder and technical expert Mel King said the products are widely used in Australia and around the world due to their ease of installation, low maintenance requirements and exceptional performance.

Mr King said the company's strong reputation had paved the way for the company to supply screens, crushers, feeders and belt scrapers to almost every corner of the globe, including Ghana, Tanzania, Burkina Faso, Guyana, Indonesia, United Arab Emirates and Senegal.

Oreflow has the capacity to tackle larger projects while also providing a personalised, customised experience through a small team of experts.

"For us no project is too small and we treat small projects with the same diligence as a larger one," Mr King said.

"We have only one philosophy, which is ensure our clients get the quality products and support that they expect.

"We pride ourselves on dealing with customers' enquiries as soon as possible so we do not interfere with their business."

Oreflow is the Australian master distributor of Brelko Conveyor Products for spillage control, offering a premium range of belt scrapers and skirting systems.

"Brelko has been part of our business for 20 years: they supply excellent products and spend a lot of resources on research and development," Mr King said.

The E905 is a new head pulley belt scraper, which is ideal for when wet and sticky materials are conveyed and is suitable for all types of conveyor belts and metal fastener systems.

Adjustable Brelko torsion twist tensioners allow the scraper to maintain a constant



pressure on the belt while allowing it to deflect away from any obstruction, a significant safety feature.

Specially formulated polymeric blades maximise the life of the scraper while keeping the potential risk of damage to belt repairs, splices and metal fasteners to a minimum.

A V-base blade mounting makes blade changing quick and simple while a streamlined scraper construction prevents material build-up.

The E205 Secondary Belt Scraper is the universal choice for all normal cleaning applications but is not suitable for mounting directly onto the head pulley.

This scraper is used in conjunction with torsion arm mountings to accommodate different belt thicknesses and excessive belt movement. Brelko offers different keyskirt sizes to accommodate different types of spillage.

The Keyskirt Size 2 provides an effective chute sealing system designed to control spillage at conveyor load areas and is suitable for all belt conveyors carrying material with a particle size of less than 75mm.

The patented mounting track system results in simple installation and skirt rubber replacement while self-cleaning grooves trap spillage allowing it to be carried away by the belt.

The Keyskirt Size 3 is designed to cope with spillage of large lump material larger than 150mm.

Features include a robust and abrasion-resistant polyurethane sealing strip and a mounting system for easy strip replacement. Apart from capital equipment, Oreflow offers a wide range of other services including bulk material handling, abrasion control as well as air cannons and magnets.

In 2000, Mr King and partners formed Minspec, a mining equipment manufacturer, and by the mid-2000s the company had formed the beginning of a long running and successful partnership with Brelko.

In 2013 the operations were expanded to form Oreflow, which evolved to encompass and service all areas of mineral processing systems and bulk materials handling from design to installation, maintenance and repair.

The company prides itself on being Australian-owned and never compromising on quality.

"Most of our equipment is manufactured locally which negates any problems with shipping and unnecessary hold ups," Mr King said.

"Our clients are happy with our local supply

as they can inspect them at all stages of the process."

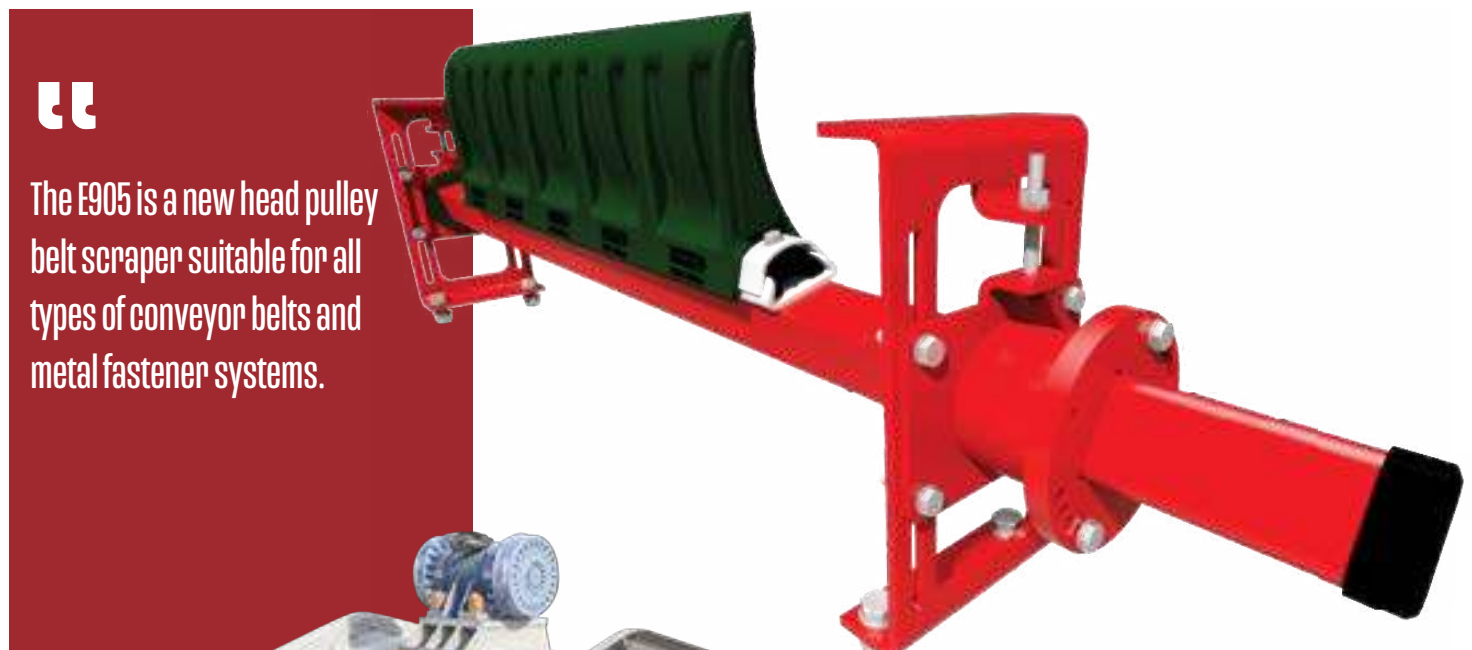
Oreflow now has a business development manager operating out of NSW to help increase the company's presence, provide a point of contact and enable more site visits in the eastern states.

Oreflow prides itself on a rapid response and quick turnaround for design and engineering, manufacturing, feasibility studies, quotations and supplies.

The company offers service and replacements seven days a week with factory-trained Brelko scraper technicians.

It uses 3D modelling for plant design integration as well as simulation software applications to optimise the performance of a new or existing plant.

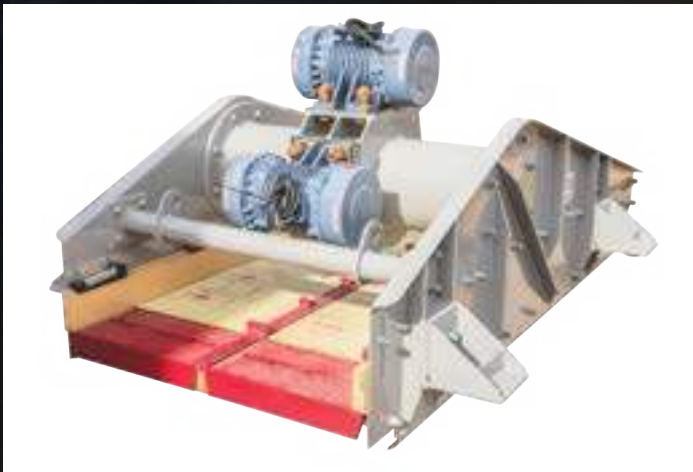
All products and services meet Australian quality, safety and environmental standards while applying industry best practices relating to safety. **AMR**



“The E905 is a new head pulley belt scraper suitable for all types of conveyor belts and metal fastener systems.”



“Oreflow screens are manufactured and assembled in WA.”



ONE OF AUSTRALIA'S LEADING MINING EQUIPMENT SUPPLIERS

CONVEYING FULLY SUPPORTED SOLUTIONS

Oreflow Australia specialise in designing conveyor and bulk material handling solutions capable of operating effectively in even the harshest processing conditions.

As the Australian distributor for Brelko Conveyor Products, Oreflow supplies conveyor systems, chute and hopper skirting solutions, belt cleaning systems, air cannons, and impact beds to Australia and Asia.

We supply quality capital equipment both in Australia and abroad, specialising in bulk materials handling and processing plant design and manufacture.

Our products are designed to be fit for purpose, capable of operating effectively in even the harshest conditions and able to be integrated into new or existing plant.

The Oreflow range includes heavy duty Horizontal Linear Motion Screens (HLMS), excited by under and over Uras out of balance motors and available in single or multiple deck configurations.

Customized operating parameters ensure accurate sizing and high quantity processing of materials ranging from ores and rock to mineral sands.

Our screens are manufactured and fully assembled in Western Australia and are widely used in Australia and around the world due to their ease of installation, low maintenance requirements and exceptional performance.



Scan for website

P +61 (08) 9472 0800
E sales@oreflow.com.au
www.oreflow.com.au



Cost-effective Quality Crushing

Quarry & Mining Manufacture (QMM) designs, fabricates, installs and maintains crushing and screening plant for the mining, quarrying and construction materials sectors.

Offering cost-effective, innovative and practical solutions for plant and equipment in these sectors, QMM incorporates OEM-supplied crushers and screens into clients' requested circuits.

This is followed by the design, fabrication and installation of the remaining balance of plant, including feed bins, conveyors, chutes, equipment base plates, stackers, stairs, handrails and platforms.

QMM chief executive Michael Williams says the company delivers a host of services including new plant concept development, design, fabrication, installation, commissioning, ongoing maintenance support, plant upgrades, shutdowns, maintenance, equipment supply and parts fabrication.

"QMM can provide a range of solutions from full turnkey projects to working closely with the client to incorporate their OEM supplied core equipment into new or existing circuits," he said.



Quarry & Mining Manufacture (QMM) designed, constructed and installed the iron ore crushing plant (secondary and tertiary sections) at the Iron Baron minesite in South Australia.

Mr Williams is a metallurgical engineer with 35 years of experience in the mining, processing and construction materials industries in companies such as BHP steel and iron ore divisions, Adelaide Brighton Cement and Cement Australia.

With offices and operations in Adelaide, Melbourne, Perth, Whyalla and Brisbane, the company operates nationally and is owned and operated by Australians, providing the highest level of services to clients.

QMM's fully-comprehensive preventative maintenance service includes online,

wireless monitoring of asset health, vibration analysis, thermal imaging, and routine inspections along with analysis of downtime and maintenance costs. Further services comprise 3D-design, project estimation, project management and commissioning.

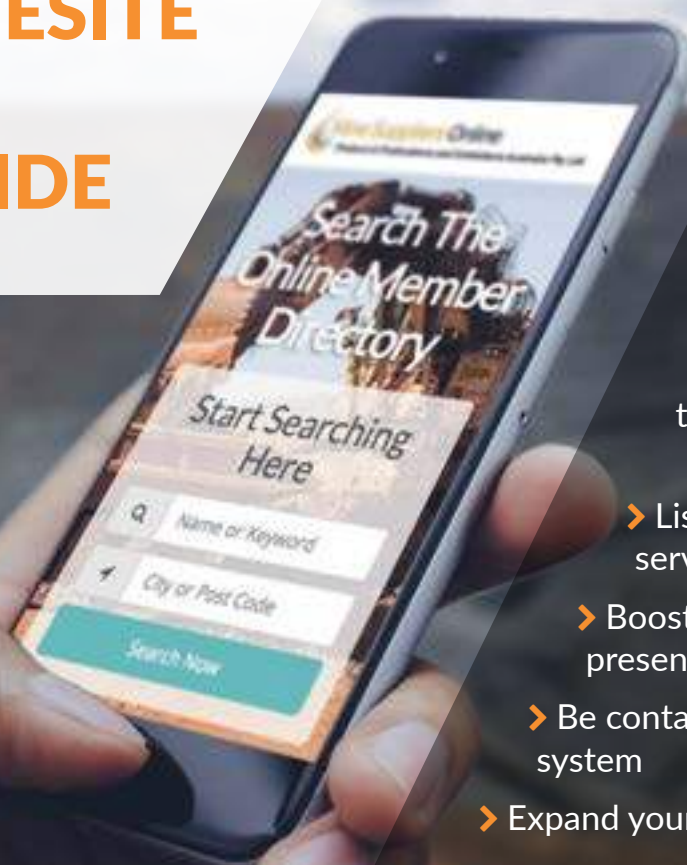
Clients include Cheetham Salt, BHP, Boral, Oz Minerals, Downer, Fulton Hogan, Lucas TCS, Holcim, Hanson, Cement Australia, Adbri, Direct Mix Concrete, Southern Quarries, Resource Co, Centralian Controls, Bis Industries, PGH Bricks and Pavers and ResourceCo/SITA.

QMM is a leading Australian supplier of engineering and maintenance services to the mining and construction materials industries, serving multiple industries including mining, quarries, concrete, cement, asphalt, salt, concrete pre-casting moulds, recycling and materials handling.

The company is part of E&A Limited and its sister companies include ICE Engineering and Construction, Tasman Rope Access, Tasman Power, Heavymech, North West Mining & Civil, AusPress and Fabtech.

AMR

BE AT THE FINGERTIPS OF EVERY MINESITE OPERATOR AUSTRALIA WIDE

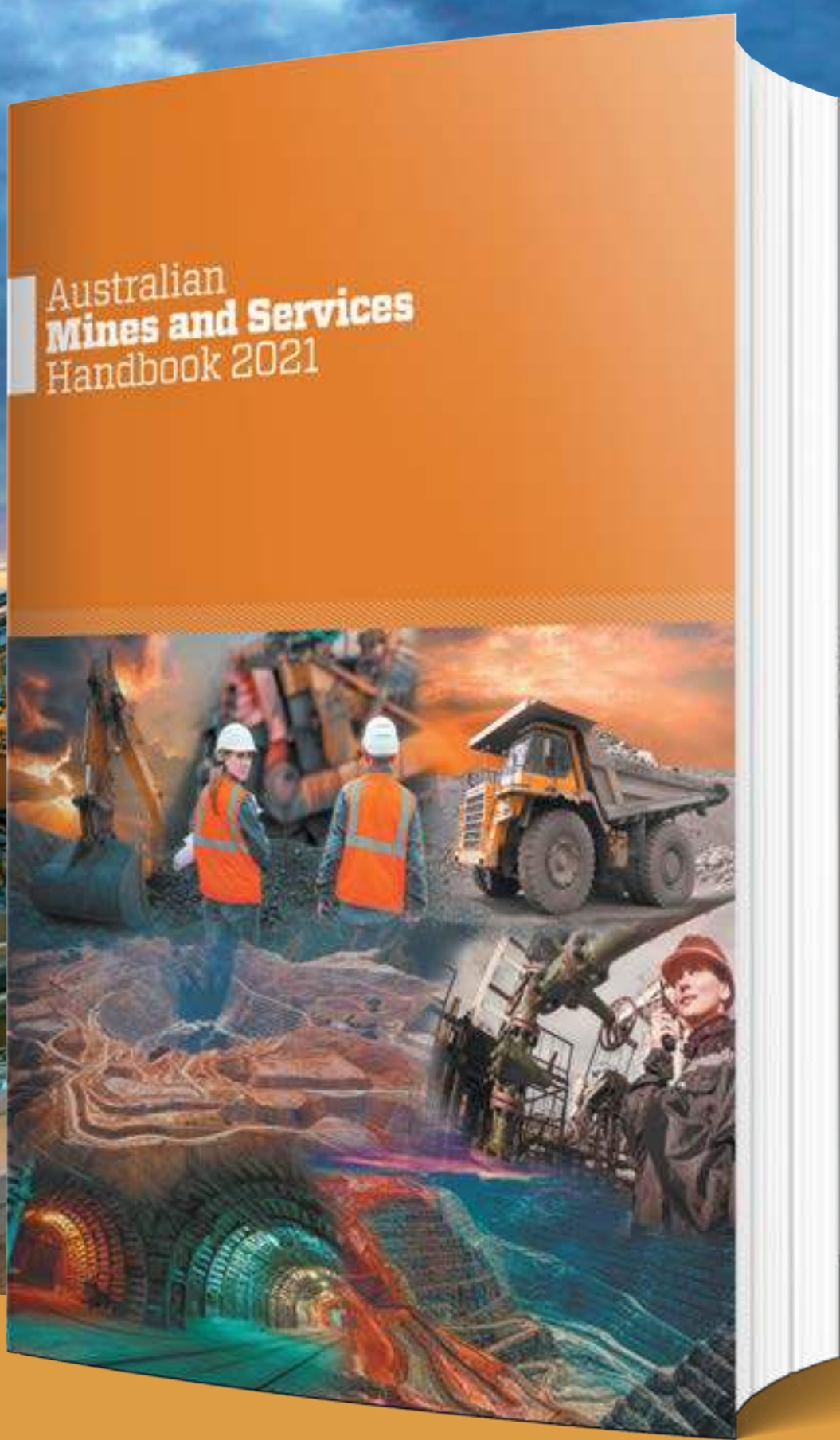


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Digital Mining Signs Specialist

Every day at any mine site, there are a multitude of messages that need to be communicated to employees.

Whether it be safety messages, instructions for the day or notices about upcoming events, there is an endless need for effective and dynamic communication.

There will always be a place for early morning planning meetings but what if the message needs to change throughout the day?

Signpac is a leading manufacturer of LED digital signs, which allow multiple messages to run in a loop—and they can be changed anytime from anywhere.

Running off a 4G network, all that is needed is a computer which can be operated remotely, meaning someone in Perth could be controlling the messaging for a mine site in the Pilbara.

In comparison to static forms of communication like a whiteboard, LED signs creates bold messaging up in lights, making it difficult for workers to walk past without noticing it.

Signpac has been delivering innovative educational, safety and directional signage to schools, churches, clubs, government departments and businesses for more than 25 years.

The company has been delivering LED digital signs and displays for a decade and is now expanding its reach into mine sites with its

dedicated division, Mining Signs.

Signpac general manager Larry Wainstein said the signs had already been tried and tested in the most rugged environments.

“We manufacture our signs specifically for the harsh Australian environment,” he said.

“We have signs in schools and community centres in places like Lightning Ridge and Broken Hill where it is always hot so they have been designed to withstand those conditions.

“The way we manufacture our product is by using the highest quality electronic components so they can stand the test of time and they all come with a five-year warranty.”

Signpac’s popularity has grown through word of mouth, particularly in the education sector, due to the quality of the products it manufactures.

“We work in an environment where everyone is networked, such as the principals of schools who talk favourably about us within their nation-wide networks,” Mr Wainstein said.

“When you manufacture a digital screen, because it is electronic, there are many ways to skin a cat and if you don’t use the highest quality components, it depletes the lifespan of a sign.”

The screens are manufactured to specifications for the Australian market and

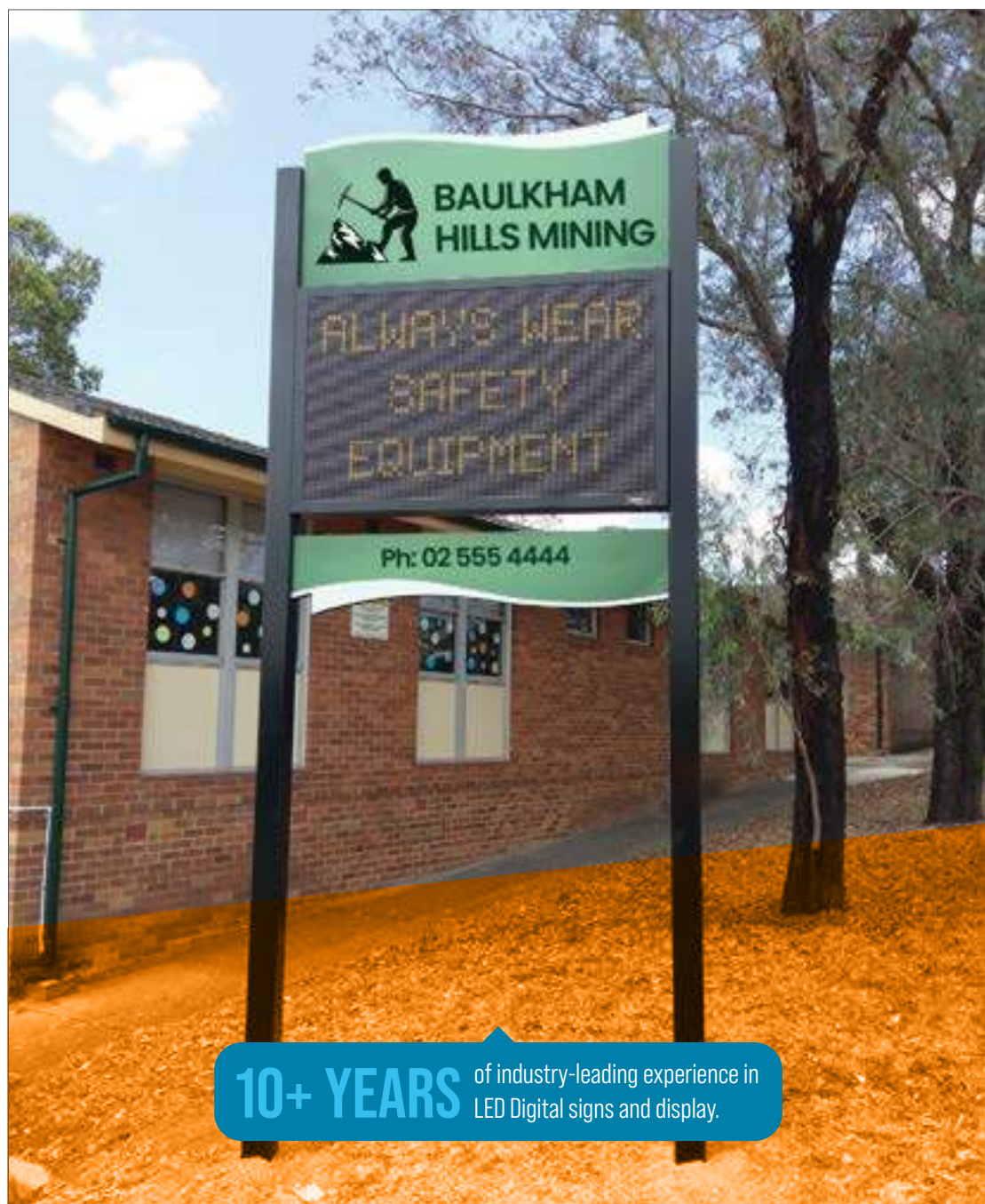


LED digital signs are a gamechanger for mining companies wanting to communicate daily messages to employees.

the frames are made from locally sourced aluminium, with all graphic design work and printing completed in house.

The company has been fielding enquiries from mining companies wanting to place signs outside the mine gates as well as on site.

Signpac can custom make signs for indoor and outdoor to any dimension or requirement and they can also be used to display video, such as safety videos or an instructional video for a new piece of equipment. **AMR**



10+ YEARS of industry-leading experience in LED Digital signs and display.

Australia’s Specialist in Signs

Signpac’s reputation for delivering quality and innovation is now accessible via our dedicated division - *Mining Signs*.

Now, Australia has a specialist sign provider focused on digital signs for the mining industry.

Recognised Australian quality designed and manufactured products, backed by our industry leading service and warranties, you become a customer for life, which provides your company with a dedicated specialist on call.



Call or email now to make an appointment:
1800 1490 940 | sales@signpac.com.au

Billboards on Wheels

The wheels never stop turning in the mining industry and the same goes for the buses transporting workers to and from site around the clock.

As they crisscross the entire country and drive through busy traffic to frequent airports, they are highly visible to other road users.

The moving billboards offer a blank canvass to advertise absolutely any product or service—the sky is the limit—and the target audience is not restricted in the way static advertising is.

Transit advertising reaches an audience as broad as the countless faces one sees on the roads each day, who represent a wider cross section of the community and the full range of ages from the youngest to the oldest in society—who are not all online.

It delivers advertising to the people rather than relying on consumers to find it, and offers a unique dimension to any campaign. The buses represent a golden opportunity for mining companies to achieve two outcomes simultaneously, the most important being the safe transportation of FIFO workers, between the relevant airport and mine site.

It is also a perfect opportunity to convey a message about what the mining company is doing for their local community, whether it be creating jobs, building schools or delivering new infrastructure.

Alternatively, the company could lease the

advertising space to a third party who has a product or service that may appeal to mine workers, managers, supervisors, directors or the purchasing officers who control the flow of products and services into site.

Advertising could relate specifically to mining or could be anything that may catch the eye of an employee coming to the end of a tiring shift—their next holiday for example.

Transport and logistics companies who traverse the continent could also take advantage of the huge blank canvasses on the sides of their trucks.

Colorcorp has 40 years of experience wrapping all kinds of vehicles, including cars, utes, buses, taxis, trains, aeroplanes and even a submarine.

In 2019, Colorcorp turned heads when it wrapped a rideshare submarine as part of Tourism and Events Queensland's unique campaign scUber.

In partnership with rideshare giant Uber, the scUber submarine allowed travellers to explore the Great Barrier Reef at depths of up to 15m, with 180-degree views, without getting wet.

Colorcorp signage specialist Daniel Kimi said it was an "amazing" way of advertising one of Australia's most important natural treasures.

Colorcorp had to apply extra coatings to protect the vinyl on the pontoons as it had never been tested at that depth.

"We had to drop it in the water to see if it

would peel off which obviously it didn't and in fact it stayed the entire course of the campaign," he said.

The moral of the story?

If Colorcorp can wrap a submarine, it can wrap just about anything.

"Apart from wrapping, the company can do display and vehicle signage, regulatory heavy transport signage and fleet transport signage, to name a few," Mr Kimi said.

"The possibilities are endless."

The company has a nationwide presence and no job is too big or small thanks to its in-house capabilities and far reaching partner networks. **AMR**



In 2019, Colorcorp turned heads when it wrapped a rideshare submarine as part of Tourism and Events Queensland's unique campaign scUber.



Take Your Message Everywhere!

Fleetbrand helps you travel loud. We wrap all kinds of vehicles including cars, utes, vans, buses, taxis, trains, trucks... even a submarine! These vehicles are all moving billboards and we've got your brand covered on the road.

The right message can say everything your business does for your local community — building schools, creating jobs and giving back to the local economy. No rollout is too big or too small, thanks to our in-house experience and extensive partner networks. We can help you take your brand everywhere.



Train & Bus Wraps



Truck Wraps



Vehicle Wraps



Directional Signage



Reflective Signage



Nationwide Installation



Safety Signage & Diamond Books

Contact Daniel Kimi on **0410 644 959** or daniel.kimi@colorcorp.com.au

We make your brand **bold, loud** and **everywhere** – Australia-wide!

colorcorp.com.au



Fleetbrand belongs to Colorcorp, a division of the GJI Group

Saving Lives Through Innovation

The Hi-Vis Group has been a leader in the provision of signage and related safety products and services to the mining sector for more than 40 years.

The company is committed to saving lives through the introduction of innovative technologies to solve the innate safety issues surrounding mine sites.

Its product range has been designed and refined over the last 40 years specifically for the heavy-duty environmental conditions on sites across Australia and Asia-Pacific.

Combining world class manufacturing capabilities with leading brands—3M and Avery Dennison—has provided mine sites with quality, highly visible signage that simply OUTPERFORMS and OUTLASTS all market competitors and is guaranteed NOT TO FADE, even in the toughest of environments.

This is extremely important for mine managers and operators as both day and night visibility can be critical to the maintenance of optimal safety on site roads and worksite areas.

Highly visible signage is required to cut through monochromatic mining environments, enabling employees, sub-contractors and site visitors the ability to navigate mine site road systems safely.

Hi-Vis Group has established relationships and vendor numbers with most major mining companies and sites throughout the country, providing innovative and customised solutions to optimise safety throughout a site.

The company's reputation is one of innovation, high quality products and excellent customer service.

Supplying to surface and underground operations, Hi-Vis works closely with major mining companies BHP Billiton, Rio Tinto, Centennial Coal, Glencore, Yancoal, Xstrata, Vale, Anglo American and major consortiums in Australia and overseas.

The company has the experience, knowledge and a team of engineers to assist with unique and specific requirements.

Of particular value to mine operators during scheduled drill and blast operations, has been the LED Blast Boards and flashing TARP indicator signs.

The company has been supplying LED signs for many years, being the original inventors of both the School Zone flashing sign and LED Fire Danger Rating signs deployed across the country.

The company can customise any LED sign to mine-site specific requirements with full screen or part screens available.

All LED signs are completely programmable remotely from a main office or off site for real time updating.

All Hi-Vis Group LED signs can be solar powered with no mains power required and can be manufactured to specific requirements with multiple LED flashing lights and custom printed sign face panels. Cabinetry is vandal proof and IP65 dust and water resistant.

Why Choose Hi-Vis?

- **Experience** – with over 40+ years in the development and provision of mine specific products
- **Warranty** – offering up to 15 years warranty on selected materials
- **Performance** – guaranteed performance under the harshest of conditions
- **Innovation** – constantly striving to design new and better products to optimise site safety

Real Results | Led Technology Saving Lives

Significant investment into technology research and development has resulted in many of our products using LED static or flashing lights to become more highly visible, alerting drivers at greater distances of oncoming vehicles or hazards.

LED truck numbers and greater delineation at intersections with the Hi-Vis range of LED Stop Signs, LED SupaBrite and Vehicle Activated Warning Signs are recording a

significant impact on road user compliance, speed reduction and hazard identification.

All Hi-Vis signs can be solar powered for remote locations, include latest generation radar and number plate recognition where required.

A full analytics dashboard is available via a web interface to report on GPS location (for multiple locations), weather conditions, power usage and battery storage.

Hi-Vis LED signs are fully functional 24/7 in all weather conditions and are operated via Hi-Vis Group developed proprietary software systems.

Full Colour Digital Screens


A range of colour digital screens can also be used either in main guest areas or entry areas utilising full colour video for increased attention and engagement. These screens are fully modular and can be of any shape or size and are perfect for multi-screen control rooms where remote site visibility may be required.

For further information please contact 1300 857 500 or email beseen@hivis.com to reach out with custom requirements.

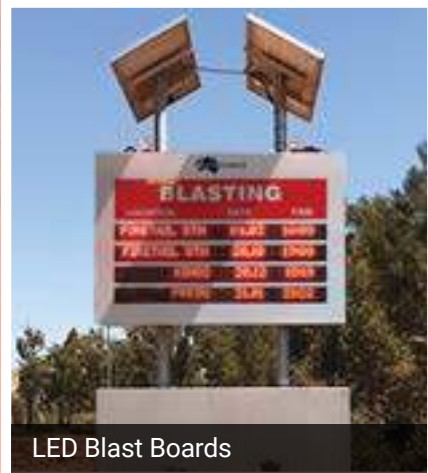
Head to the Resources section of the Hi-Vis website to view all LED and Mining specific brochures, flyers and product updates: www.hivis.com/resources

LED SIGNAGE SPECIALIST


SAVING LIVES THROUGH INNOVATION




Full Screen Messaging




LED Blast Boards



TARP Indicator Boards



LTI Boards



Day/Night Visibility

Everybody should arrive home safely each day

Hi-Vis Group provides a full range of safety products and signage related to both surface and underground environments:

- Haul Road and Intersection Signage
- Vehicle Activated LED signs
- LED Blast Boards and LTI Boards
- Large Format Digital Screens
- Drill and Blast
- Custom Printed Pyramids
- Delineation and Reflective Guide Posts
- Traffic Cones – all colours, over 6 sizes, custom printed
- Wayfinding and Directional Signage
- Vehicle Identification
- Solar Warning Beacons
- Underground Tags and Streamers

AMR

LED Blast Boards and flashing TARP indicator signs have been of particular value to mine operators during scheduled drill and blast operations.



LEADERS IN MINE SITE SAFETY

Mine sites in Australia and Asia Pacific are safer using the Hi-Vis range of innovative and customised safety products.

Vendor numbers for most sites.



> Reflective Tapes



> Reflective Tags



> Custom Sleds



> LED Safety Signs



> Truck ID



> Cones



> Pyramids



> Reflectaline®



> Delineator Poles



> Safety Signs

HI-VIS GROUP

DON'T BE LEFT IN THE DARK.

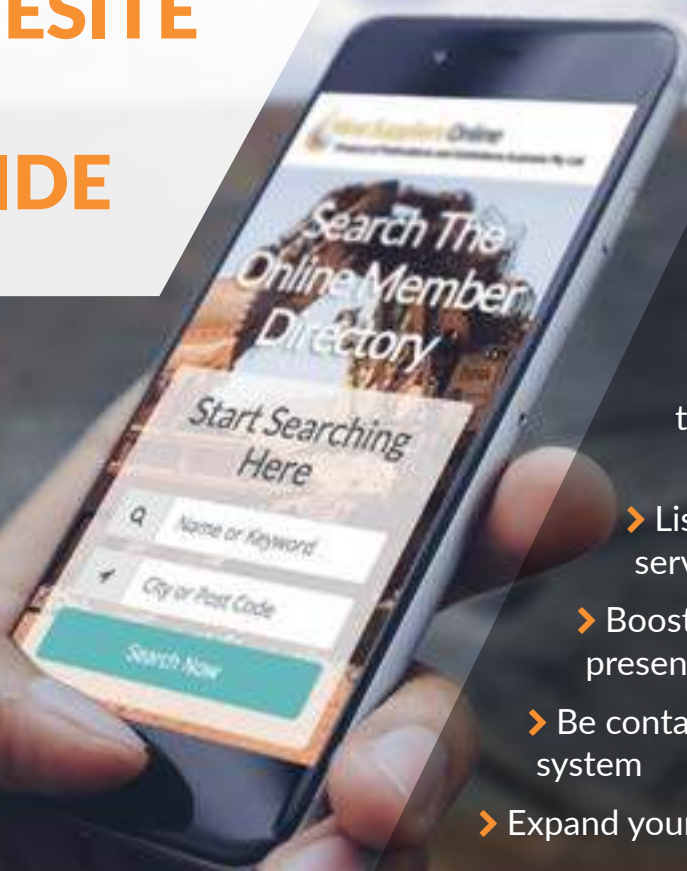
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THE AUSTRALIAN
MINING REVIEW

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- 12 hard copies of The Australian Mining Review (monthly), including The Australian Oil & Gas Review
- Weekly Mining Report (Carefully researched, real business opportunities)
- Weekly Mines Activity Report (Operational Activity specific to Mine Sites)
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Minesite Drilling

Epiroc provide world leading products and services, whether you need a pilot hole in a marble quarry, a core sampling hole, or a blast hole for construction or mining, Epiroc have the drill rig and tools that will suit your needs. Epiroc offer rock drilling machines and other equipment for many applications for example; oil and gas, construction drilling, quarrying, surface mining, underground mining, and exploration drilling.



Dimension Stone Equipment

Epiroc provides world leading products and services for the extraction of marble, granite, limestone and sandstone.



Exploration Drilling Rigs

Designed to help you achieve the highest possible productivity with the lowest possible maintenance costs.



Face Drill Rigs

Epiroc's face drill rigs are built for blasthole drilling in underground mining and tunneling. These drill rigs can be equipped with up to four booms, covering cross sections up to 206m².



Production Drill Rigs

Epiroc's Simba long-hole drill rigs offer a variety of feed lengths, positioning configurations, rock drills and optional automated features for underground production drilling.



Rotary Blasthole Drill Rigs

Epiroc offers the most comprehensive line of rotary blasthole drilling rigs in the industry. With a multitude of configurations to suit your needs.



Surface Drill Rigs

Epiroc has a range of surface drilling equipment within mining, quarrying, construction, civil engineering and the dimension stone industry.

"Smart mining" – safer, leaner and greener operations with semi- or fully automated processes.

As a leading supplier of rock excavation equipment for more than 145 years, we

have gained considerable experience and knowledge of mining techniques that are practiced across the globe.

Today, in addition to providing a broad spectrum of products, from loaders and

trucks, surface drill rigs, face drilling rigs to blast hole drilling rig and production drill rigs. Our team of application specialists also focuses on helping mines to optimize their entire processes with a view to creating a more sustainable future.

Contact us to discuss your Drill Rig solutions

www.epiroc.com/en-au/products/drill-rigs

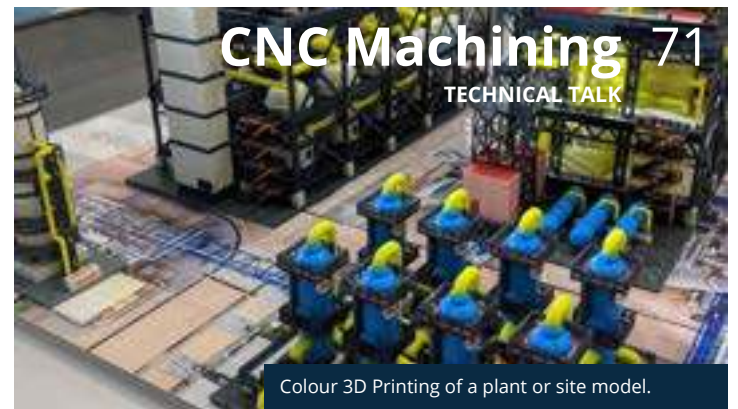
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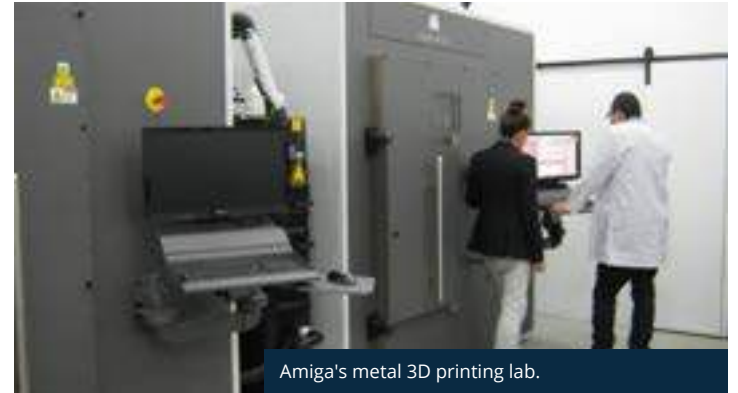


Geared Up For Success

Genat and Wood gearbox driving ebsray pump used in mining.



Colour 3D Printing of a plant or site model.



Amiga's metal 3D printing lab.

Somewhat of an institution in the CNC machining industry, Amiga Engineering™ Pty Ltd was founded in 1988 by two brothers – Michael and Dale Bourchier in East Keilor, Victoria.

Back then the company was primarily an outlet for machining pipe flanges, fittings and special components.

But today, Amiga has grown to become a successful, reliable and reputable engineering company servicing the oil and gas, mining, petrochemical, marine, medicine, defence, aerospace and space industries.

Australian Mining Review spoke to Head of Industrial Gearboxes with Amiga, Dee Bourchier, to find out more about the company and its services.

History

Dee said Amiga Engineering™ moved to its current location, in Tullamarine, in 1995-96.

“More staff were brought to the table, including another Bourchier brother (Guy) for a short time. Over the next few years, the company began to expand through the bringing together of some former employees and customers,” she said.

Amiga later acquired Bradley Technologies, a medical component manufacturer, and in 2009 Amiga acquired Genat and Wood™, one of the last Australian industrial gearbox companies.

“Amiga Engineering™ has been modernising its workshop and intercompany mergers,” Dee said.

“We are now the sole manufacturers of genuine Genat & Wood™ gearboxes, including helical gearboxes, reducers, surface aerators and mixer gearboxes for local and international clients.

“You will find them in almost every refinery, mine site and quarry across Australia: driving pumps, conveyor systems, trommels and much more.

“Amiga also retained the Australian agency for the Italian brands of Varmec, Tramec, Speed Selector and Motomeccanica, which helps provide customers and end-users more versatility for their applications: right angle, bevel helical, worm, planetary and more.

“Amiga Engineering’s survival through the past years has been a direct result of our service and the satisfaction that our customers have appreciated. Quick turnaround, breakdown and emergency situations are part and parcel of our ability to service whenever it is required.”

In recent years Amiga has moved further into innovation by providing additive

manufacturing.

Amiga Engineering has a full suite of industrial-sized metal 3D printers and polymer 3D printers.

“Our company is the largest service bureau in Australia for 3D printing,” Dee said.

“Amiga Engineering™ is also the only one of its kind in Australia that can offer both metal and polymer 3D printing, machining and fabrication, and industrial gearboxes all under the one roof – this is to support our customers and offer an all-in-one location for efficiency and faster turnaround time.

“Amiga has spent a great deal of time and effort upgrading its capacity to produce a full and extensive service to the engineering community.

“Stringent control of delivering a quality product on time is the mainstay of our business.”

Amiga Engineering™ has recently purchased additional machinery for this very purpose.

Gearbox Services

The company is the only company in Australia manufacturing genuine Australian-made industrial gearboxes, the Genat and Wood™ products.

Being a 33+ year-old machine shop, Amiga Engineering boasts complete capabilities of manufacturing/machining specific/custom parts to suit client requirements and applications.

“The quality of our products that we offer is very important to us,” Dee said.

They are accredited to AS9100D for aerospace, space and defence customers and ISO9001 for all other industries, including mining. “We also like to keep the quality of life to a high standard of operation for our customers,” Dee said.

“We endeavour to ensure that the purchased gearbox (whether it be over 30 years old to just recent) is still working to its full potential. “Modern businesses increasingly rely on automated equipment and a failure of that equipment can be a serious problem.

This is why Amiga is the only company with a brand of industrial gearheads that have a five-year warranty.

“It can halt production, inhibit processing capability and reduce productivity and profitability.

“A critical element in a lot of industrial machinery is the gearbox. “Should the gearbox fail, the machine will be rendered inoperable and operations will come to a stop.

“It’s important, therefore, that gearboxes are kept in good order and, should they need overhauling or servicing, they receive attention quickly so that interruptions are kept to a minimum.”

CNC Machining

Computer Numerical Control has very quickly overtaken traditional production methods.

It allows industrial manufacturers to work with more precision and build structures that have greater complexity.

As with many technological advancements, CNC machining has pioneered in the production of medical and defence systems, but now many other industries are opening up to the possibilities it presents.

“We are an accomplished provider of CNC services with five-axis simultaneous capabilities for complex parts in Australia,” Dee said.

“Since our foundation in 1988, we’ve been operating within some of the most challenging industries in the world.

“What started out primarily as a pipe fittings and flange manufacturing company has grown into one of the world’s most diverse manufacturers, with a huge range of manufacturing capabilities.

“Whether you are looking for components for medicine, mining, oil drilling, marine, or military, we have the capability to build you something usable, durable, and affordable.”

Much of the time those who require manufactured parts will buy it from overseas.

Unfortunately, this often results in poor quality work that needs re-doing. Even worse, products will deteriorate quickly and cost time and money.

“Why take the risk of poor quality when you can work with one of the best provider of manufacturing services in Australia?,” Dee said.

Amiga machines can:

- Turn diameters up to 2800mm
- CNC Mill lengths over 4300mm
- Wash grind up to 1200mm in diameter

Even though the company is based in Victoria, it provides CNC Machining Australia-wide, with its services available in Adelaide, Brisbane, Perth, Sydney and Melbourne.

“We also have one of the largest vertical borers left in the country (2800dia x 1800mm high),” Dee said.

3-D Machining

3D Machining is when the tool moves in three directions (the X, Y and Z planes) but stays perpendicular to the machine bed.

The process is perfect for multifaceted and complex shapes because the 3D toolpaths follow the changing surfaces of these organic shapes.

“Amiga Engineering™ has utilised 3D machining for an array of customised parts used in the oil and gas, mining and petrochemical industries for many years” Dee said.

“We are the experts for all 3D machining needs.

“If your part has a complex design, why not try metal 3D printing?

“Amiga is the biggest service bureau in Australia for metal and polymer 3D printing.

“The DMP technology that we use in-house is not just for prototyping, but perfect high quality end-use products.”

The DMP process is just as strong as machining from billet material.

Materials available are 316L Stainless, Titanium Gr23, Alsi10mg Aluminium, H13 Tool Steel, 17-4PH and Inconel718.

Amiga also has available sophisticated 3D printers.

The Mimaki Full Colour 3D printer, for example, has one of the largest print bed sizes available and 15 million colours.

“With a print bed size of 508 x 508 x 305 mm, it is great for production runs or one-off large item builds,” Dee said.

“Colour 3D printing is a perfect idea for architectural models of existing plants looking to upgrade their sites, or for blueprint of future plans.

“Having the model printed in real-life colours can provide clients with a real perspective of how it will look.

“SLS and DLP technologies are also available for polymer parts with a huge range of different materials, from nylon to high temperature, and elastomeric type; we have available some 14 different materials and more under test here at our facility in Australia for the rest of the world.

“When you choose to work with the experts here at Amiga Engineering, you can be entirely confident that you’ll be able to reap the rewards associated with investing in one of the very best colour 3D printing Australia has to offer – and the whole process will be completely seamless and hassle-free.” **AMR**

SOURCE
Amiga Engineering
P 03 9330 0688
E salesgw@amigaeng.com.au
W www.amigaeng.com.au



Newland's high-precision CNC machines are capable of providing multi-axis and multi-tasking machining operations.

High Quality, High Precision



The Newland-manufactured Erebus Mobile Underground Diamond Core Drilling Rig.

Newland Precision Engineering has been delivering valuable, high-quality, precision-engineered products and services to its customers since 1996.

Newland's manufacturing competencies cover engineering design and drafting, precision machining, fabrication, hydraulic and mechanical, complex assembly, heat treatment, blasting, and painting for clients throughout Australia and abroad.

Newland supplies quality Australian-made products to clients in Africa, South East Asia, Asia, South America, North America, Canada and Europe.

The Australian Mining Review interviewed Newland's managing director Peter Newland about how the company has developed a reputation as a leading specialist in the manufacture of machinery for the mining, exploration, mineral processing, oil and gas sectors.

Cutting edge equipment

Newland's well-equipped machine shop consists of 20 high-precision CNC machine tools covering milling, turning, and boring functions capable of performing multi-axis and multi-tasking machining operations.

"Large capacity EDM Wirecut and in-house

ion nitriding further enhance our capabilities," Peter said.

"Our quality control department utilises coordinate measuring machines, laser scanners, and certified thread gauges."

Wealth of experience

Newland's experienced team of engineers and machinists is competent in all aspects of precision machining.

"They can offer excellent service whether you require a one-off prototype or mass production of a thousand items, all fully backed up by our quality management system and quality control department," Peter said.

"The engineering department is also supported by drafting technicians and production staff, which means the team is capable of handling various types of work with accuracy and efficiency using computer-aided design, engineering, and manufacturing software.

"This allows us to deliver complete engineering solutions from concept to finished product.

"Furthermore, our engineers have access to high precision coordinate measuring,

laser scanning, 3D printing, and material analysis equipment to ensure optimised designs are achieved."

Engineering innovation

The Newland-manufactured Erebus Mobile Underground Diamond Core Drilling Rig has been developed with a focus on manufacturing reliable and cost-effective equipment that delivers low operational costs per metre for clients.

The platform consists of a 90kW or 110kW pilot hydraulic drilling system that drives a high speed or high torque rotation unit attached to a 1.8m feed frame.

Standard options provide a 70kN pullback, with the deep hole option delivering 130kN of pullback.

The wireline assembly can be mounted under the feed frame or on the front module of the carrier.

The feed frame assembly is attached to a telescopic boom through two rotary actuators that provide positioning flexibility when setting up the drill rig, and are equipped with an AVD Rod and Inner Tube Handler to enhance the capabilities.

The diesel-driven carrier is available in open or enclosed cabin options, encompassing the driving console, positioning controls, hydraulic drilling module, and drilling controls.

The rear module of the carrier houses the diesel engine, transmission, electrical module, main hydraulic pump, retractable cable reel, and water pump.

Full range of equipment

Newland manufactures a comprehensive range of drilling and mining equipment in addition to stocking quality parts and equipment from its national and global supply partners.

Underground Diamond Core Drilling Rigs, spare parts, components, hydraulic cylinders, replacement parts, drilling consumables, retrieval equipment, wedging equipment, and diamond products are all regularly stocked, ready to support the requirements of valued clients.

Newland also manufactures replacement and spare parts to suit many industry-leading equipment manufacturers.

Its replacement parts are designed to deliver excellent value by using quality raw materials and efficient manufacturing processes at an affordable price.

Some examples include rotation units, rod holders, carriage parts, boom parts, hydraulic cylinders, hoists, stingers, fishing tools, wedging equipment, rod wrenches, core barrels, drilling subs, aluminium work platforms, rod racks, and stillages.

In addition to new parts and components, the company offers equipment rebuilds, refurbishments, and service exchange components to suit Boart Longyear, Epiroc, and Sandvik underground machines.

Newland Precision Engineering is a family owned and operated company, with factories located in Perth and Kalgoorlie in Western Australia. **AMR**

SOURCE
Newland Precision Engineering
P +61 8 9039 8500
E info@newland-pe.com.au
W www.newland-pe.com.au



Newland's well-equipped machine shop consists of 20 high-precision CNC machine tools.



Engineering Productivity

A Precision Engineering company with a strong focus on quality, innovation and service.



Newland supplies high quality, engineered solutions to a range of industries including mining, exploration, mineral processing, oil and gas.

PERTH
15 Pearson Street
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Lighting the Way on Quality

MineMaster 360W Backed by 5-year Warranty.

Ultra Vision Lighting stands as a symbol of excellence for electronics manufacture in Australia.

This drives the product selection, performance criteria and what industries to move into.

Every product produced must reflect the vision and ensure it contributes to the overall goal.

Ultra Vision is currently one of Australia's largest manufacturers of LED lighting products.

Focusing on extreme industries, the range includes driving and work lights for mining, 4WD, marine, heavy construction, and other markets where off-the-shelf products just don't cut it.

Working with independent retailers, wholesalers and distributors and OEMs, Ultra has developed a significant portfolio of high-performance products, with technologies that rival the world's best.

With design capabilities for product housings, optics and electronics, OEM solutions are available from a single source.

Over the past decade, Ultra Vision has established itself as the premier Australian manufacturer of LED lighting products for extreme environments, primarily mining, 4WD and agricultural markets.

Within these markets, excellent performance is required plus the ability to sustain this

performance over a long period in very demanding applications.

Over and over, the company has proven to stay the pace, consistently developing world-leading products that outshine and outlast competitors.

Manufacturing in Australia allows Ultra Vision to respond quickly to the market, ensuring that its products stay relevant and keep up with developments.

With a philosophy of constant improvement, every product is assessed regularly to make sure it is still top of the game.

Keeping up with developments in LEDs, electronics, thermal controls, and manufacturing processes has been the cornerstone of its success over the years.

This means that when you buy an Ultra Vision product you can be confident that it is the highest performer in its category - worldwide!

Dura Vision

The Ultra heavy-duty range of Dura Vision Mine-Spec LED work lamps offers the latest in high powered LED technology, designed for use on heavy duty mining vehicles.

With a compact design, waterproof to IP69 and vibration ratings of 25G RMS, the entire range provides lighting solutions in the most demanding environments.

Electronic thermal management ensures a minimum of 50,000 working hours is

achieved, even when used continuously.

Utilising a patented heavy-duty stainless steel bracket with 145° of adjustment, the Dura Vision work lamps are the most versatile range available.

With the option of either 4000K (warm white) or 5700K (cool white) LEDs, these lamps cater for any application.

The range is also available as a 24V only option to deter theft of lamps on site.

Mine Master

The Mine Master has been designed as an energy efficient alternative for all MH & HPS lamps.

The Mine Master II is housed in the toughest extrusion available on the market and rated to 15.8g/rms and waterproof to IP69.

The lamps are built in Australia and designed to withstand the worst conditions, covered by a five-year warranty.

The Mine Master II has been designed for use on lighting towers, crusher plants, drag lines, heavy machinery and similar applications.

The technology used in the electronic circuitry allows the unit to operate at over 110 lumens/ watt, making it one of the most efficient on the market.

With the options of either 4000K (warm white) or 5700K (cool white) LEDs, the Mine Masters series of lamps provides a solution

for all applications. The use of optics controls the light to a high degree, ensuring that the light produced is directed to where you need it most. Having six options of beam pattern ensures every application is covered.

The manufacturing base has grown significantly and Ultra Vision now carries out in-house electronics production and assembly for all its products.

This makes it versatile to adapt within the market but also ensures it retains total control of the quality and ultimately the performance of the products.

The new purpose-built factory further streamlines processes and facilitates focus on R&D projects.

If you have a specific project, or unsolved lighting issues, call Ultra Vision on 1800 66 55 66 to discuss your requirements or head to the website www.minelights.com.au to view the full range.

The entire range is available throughout Australia from selected dealers including your local Blackwoods store.

Ultra Vision lights are currently used by companies such as BHP Billiton, Rio Tinto, FMG, Newcrest, Glencore, Peabody and Yancoal. **AMR**

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Atom 35



Enforcer



Invader



LIGHTING PRODUCTS

For Heavy Duty, Mining and Industrial Applications

CONV SERIES	EMLUX LED	POSEIDON
<p>Also Emergency</p>  <p>Multi-purpose 40W 40W EM 80W IP66 - IK08 - Class I - LED</p>	 <p>Emergency Bulkhead 3W IP66 - Class I - LED</p>	<p>Arduous Locations</p>  <p>Floodlight 50W 100W 150W 200W 300W IP66 - IK08 - Class I - LED</p>
SST SERIES	SQUARE PRO	TURBO LED
<p>Also Emergency</p>  <p>Bulkhead 40W EM 60W IP66 - IK08 - Class I - LED</p>	<p>Professional</p>  <p>Floodlight 552W 830W 1100W IP66 - IK07 - Class I - LED</p>	<p>Vibration Proof</p>  <p>Floodlight 320W 450W 480W 600W IP66 - IK08 - Class I - LED</p>

*Not Shown - High Bay / Low Bay, Recessed and Special Applications.

Important Selection

Well designed and professional LED lighting solutions for industrial, mine, quarry and other challenging applications offer performance and efficiency that is second to none. With all the benefits that LED are able to provide for end-users it is important to take great care in selecting the right partner to deliver your desired outcome this is where Eye Lighting comes to the fore.

Key considerations include:

- Resistance to vibration (IEC 60068-2-6)
- Ease of maintenance
- IP rating
- Ambient temperature requirements
- Lamp efficacy
- Lamp colour
- Light distribution
- EMC



A NEW GENERATION OF LED LIGHTING TECHNOLOGY

THE PREFERRED CHOICE FOR LED LIGHTING & LIGHT POLE SOLUTIONS

TYPICAL APPLICATIONS

Conveyors, Walkways, Transfer Stations, Road Ways, Stacker/Reclaimers, Stairwells, Tunnels, Container Terminals, High Wash Down Areas, Warehouses & Stores, Heavy Vehicle Workshops, Overhead Cranes, Mobile Machinery, Switch Rooms, Control Rooms, Car Parks.

SEGMENTS

OEM (Original Equipment Manufacturer) Mining, Coal, Metalliferous, Quarries, Concrete Materials Handling, Power Generation, Energy & Utilities, Water, Ports, Wharfs & Waterways, Chemical, Processing & Refineries.



www.phoenixems.com.au
NEWCASTLE | PERTH

Phoenix EMS™ is a leader in the design and manufacture of Industrial, Mining & Hazardous Area LED Lighting + Value-Add Solutions. All products utilise the latest LED technology, Tier 1 drivers & chips and are designed to handle tough environmental conditions. Phoenix EMS range of LED fittings are amongst the highest lumen/watt output across the world and are built robust to handle Australian conditions.

All fittings are designed with optimised electronics and heatsinks to push the light further than conventional fittings, the range is designed

to prevent dust and contamination build up and where environmental degradation can cause premature failure of standard lighting products.

Phoenix EMS products are proven to work in high ambient temperatures, excessive vibration, dust, water, chemical corrosion, salt applications and are installed in major mining & infrastructure applications globally. Phoenix EMS LED Lighting built tough, reliable & proven for Industrial & Mining applications.

Phoenix EMS also manufacture our International recognised brand Ultraswing™

tool-less operation lowering pole technology to complete our packaged solutions, as the only Australian manufacturer of LED Lighting & Poles we have the ability to provide complete end to end product solutions encompassing fully wired LED Lighting and assembled pole & lighting packages.

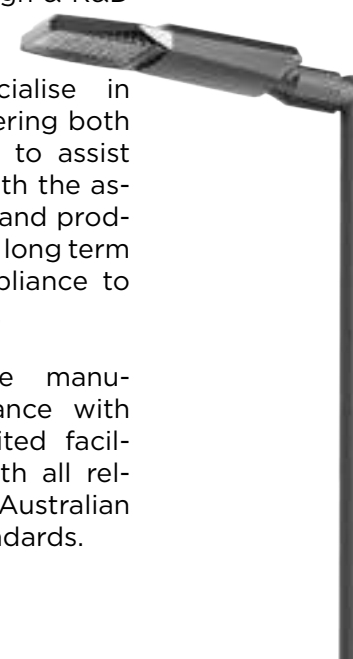
Our manufacturing capability is enhanced by fully resourced engineering, planning, scheduling and purchasing, this allows Phoenix EMS to handle product variations as well as engineer bespoke designs.

Phoenix EMS Engineering

team provide highly qualified Electrical & Lighting Design Engineers with years of experience in product design & R&D activities.

Phoenix EMS specialise in Lighting Design covering both 2D & 3D simulation to assist our valued clients with the assurance the designs and product selection provide long term solutions and compliance to Australian standards.

Our luminaires are manufactured in accordance with ISO9000 in accredited facilities and comply with all relevant mandatory Australian Safety and EMC Standards.



HELPING YOU WORK SAFER AND SMARTER



- LED Conveyor Lights
- LED Bulkheads
- LED Flood Lights
- LED Weatherproof (Aluminium & GRP Housings)
- LED Area Lights
- LED Industrial High & Low Bay
- LED Roadway (Plant Orientated)
- LED Wall Mount
- LED Hazardous Area Lights
- Turnkey Project Packages
- 3D Lighting Design



- Ultraswing Poles
- Instrument Poles
- Plant Poles
- Poles 4M-15 M (Hinged & Fixed)
- Solar Poles & Pods 4M-6M
- Junction Boxes & Isolators
- Turnkey Project Packages

Graphene-enhanced Protective Coatings

Sparc Technologies Limited (ASX: SPN) is a South-Australian based company that is focused on the development of innovative technology solutions using the unique properties of graphene.

Graphene is a two-dimensional form of carbon, with atoms arranged in a sheet which is one atom thick.

It possesses unique and powerful properties such as strength and flexibility that, with the appropriate adaptation, can be imparted on other materials to improve their performance.

Sparc Technologies has licenced graphene-based technologies from the University of Adelaide, a leading institution in the field of graphene research, and is working on commercialising these technologies in large industrial markets.

The protective and marine coatings market is a key area of interest and as a key step in the company's coatings technology development, Sparc Technologies has optimised the process for the inclusion of specific types of graphene compounds into Epoxy coatings.

This has delivered some exciting performance benefits that will provide improvement in the durability and longevity of industrial assets.

As part of a project to develop a range of graphene-based additives for use in high performance anticorrosive coatings, Sparc is conducting ongoing test programs using industry standard methods.

Sparc Technologies employs a cyclic corrosion test program conducted according to ISO 12944-6:2018 Test Regime 2 aimed at assessing the performance of various coating system types in C4 and C5 environments (ISO 9223 high corrosivity and very high corrosivity respectively).

This cyclic test method was previously employed in ISO 20340 (Paints and varnishes — Performance requirements for protective paint systems for offshore and related structures) and is the same method as used in NORSOK M501 prequalification testing for atmospheric and splash zone systems.

It is designed to mimic the severe corrosion stresses that coating systems will endure across a wide range of environments.

The full 26-week test program is designed to assess likely performance of coating systems in severe offshore environments (Cx), however a shorter 10-week cycle can be used to evaluate coating system suitability in C4 and C5.

The method consists of a repeated cycle:

- 72 hours of exposure to alternating four-hour exposures to UVA-340 at 60°C and four-hour exposure to condensing moisture at 50°C. Method A, Cycle 1 of ISO 16474-3:2013
- 72 hours of exposure to 35°C neutral salt spray as per ISO 9277
- 24 hours exposure to freezing at 18°C.

The coating systems used in this testing represent those typically used in industry to protect steel in harsh environments, providing long intervals to major maintenance requirements.

- Very high durability (25+ years) in C4 environments (e.g. industrial areas and coastal areas with moderate salinity, chemical plants, swimming pool facilities, coastal ship and boatyards)
- High durability (15–25 years) in C5 environments (e.g. industrial areas with high humidity and aggressive atmosphere, coastal areas with high salinity, buildings or areas with almost permanent condensation and with high pollution).

Using the ISO 12944 methodology, Sparc has evaluated the performance of a range of experimental graphene-based additives produced using variations of raw material sources, processing methods and addition levels.

Key measures are adhesion and scribe corrosion creep, along with other assessments of coating film degradation.

Scribe corrosion creep gives an indication of the degree of spread of corrosion from areas of damage on steel structures, and is therefore a good indicator of coating

TECHNICAL TALK

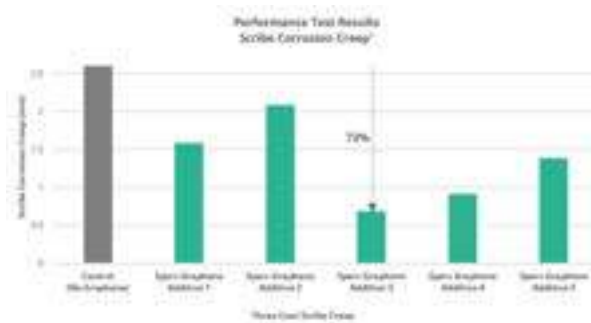
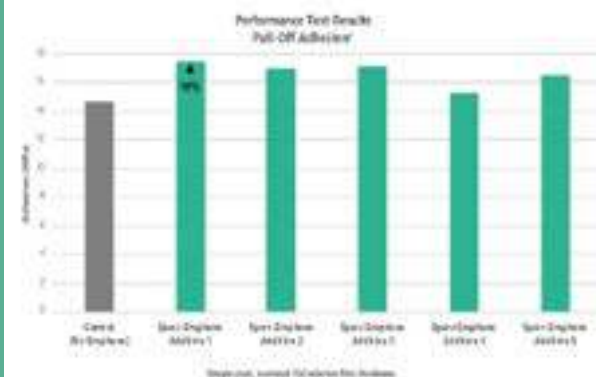


Figure 1: Test results showing anti-corrosion performance of coatings with a Sparc Graphene additive. Lower values demonstrate better performance.

Figure 2: Test results showing adhesion performance of coatings with a Sparc Graphene additive. Higher values demonstrate better performance.



system longevity.

This work has highlighted the performance benefits of graphene additives in general, with a number of the additives generating significant improvement in adhesion and/or scribe creep results at very low addition levels.

As examples, reduction in scribe creep of up to 73% in three coat systems (Figure 1) and improvement in adhesion of up to 19% were observed in single coat systems (Figure 2).

A similar approach has been used to

produce coatings with strong bactericidal activity, leading to potential application in areas where control of biological growth on surfaces is important, such as MIC-resistant coatings for tanks and fouling resistant coatings for ocean going vessels and submerged equipment.

Sparc is continuing research in the coatings area to provide owners with improved options for asset protection. **AMR**

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Test panels in a salt spray cabinet.



Panels after test awaiting assessment.



Measuring Scribe Corrosion Creep.

Tough Coatings Used Around the World



SUPER THERM® reduced flaring on LNG tanks owned by Saudi Arabia's official oil company Saudi Aramco.

NEOtech Coatings Australia offers a range of core coatings solutions that have been individually tried and tested across every continent globally in partnership with the likes of NASA and Chevron.

Working with the U.S. based developer and manufacturer Superior Products International, II Inc. ("SPI"), NEOtech Coatings provides leading innovative insulation and corrosion protection coating solutions with proven success in the oil, gas and mining industries worldwide.

Australian Mining Review spoke to Director of NEOtech Coatings Shane Strudwick and SPI International Sales Manager Arin Shahmoradian about how these coatings are improving energy efficiency, safety and environmental outcomes while saving time and money.

And while these coatings deliver outstanding results on their own, Shane and Arin explain how the main point of difference lies in how the products work together as a system to solve even the most difficult problems in the toughest industrial environments.

SUPER THERM® - blocks 95% of solar heat load

For too many years Australia has relied on traditional forms of insulation like fibreglass that centre on conduction to absorb the heat load from the sun, Shane explains.

Take a standard household roof for example. Air pockets within the insulation work by trapping heat to slow down the heat transfer, but like a bucket of water, heat still penetrates and gradually fills up the roof space.

At night-time, the heat is released into the coolest part of the atmosphere, which is often the house itself.

Air conditioners have to work hard to dispel that heat and twice as much power is needed as soon as the mercury surpasses 38°C.

There have been studies showing air-conditioners become inefficient in any environment about 48°C, a regular occurrence in the Australian mining industry. "And conventional insulation only slows

heat transfer—it does nothing to block the initial heat load or heat absorption," Shane said.

In collaboration with research centres at NASA, ceramics specialist and SPI president Joseph E. Pritchett developed a unique ceramic insulation coating, which blocks 95% of the heat load by keeping out 99% of UV, 92% of visual light, and most importantly, 99.5% of infrared heat.

By blocking the absorption and transfer of solar heat, SUPER THERM® prevents most of the heat from the sun from penetrating into the structure in the first place. It stops heat load.

Whether SUPER THERM® is applied to a household roof, a cooling tower on a mine site, a shipping container or an LNG tank, the concept is the same.

"You can imagine how far reaching the applications of this are in mining, where you have so much equipment above ground which can get up to 80°C," Shane said.

"Take cooling towers for example, where part of the evaporative process is being used to cool down the tower itself, rather than the medium flowing through it.

"SUPER THERM® functions like a gigantic shade tree blocking heat from the sun and preventing the surface from getting nearly as hot as it normally would from direct sunlight.

"If the surface does not absorb solar heat and remains cool, there is less heat transferring to the cooler inside of the structure and that is the benefit of SUPER THERM®."

The energy savings can be enormous, resulting in energy reductions of between 20 to 50% when tested through the Florida Energy Office under the general guidance of the USA Department of Energy in three states.

In La Porte, Texas, the external surface temperature on a shipping container coated with SUPER THERM® was 41°C, or 26°C cooler when compared to the 67°C recorded on a different container of the same size that did not have SUPER THERM® applied.

The conduction-related energy loads were reduced by between 46 and 52% by applying SUPER THERM® as an energy conservation measure.

"The temperature that day was 39°C and that is our go-to line—whatever the ambient temperature is, SUPER THERM® is going to be just two or three degrees above that, which is a characteristic hallmark feature," Shane said.

"And that is just on the outside – it also reduces the temperature and humidity inside the container."

Internal moisture levels were reduced inside the SUPER THERM® container, making it 28.5% dryer.

At the other end of the temperature spectrum in Denver, Colorado, two identical wood building assemblies were painted — one with white paint and the other with SUPER THERM®.

Thermal imaging revealed a 235 BTU per square foot per hour — the amount of heat making it through to the inside — on the white painted structure compared to 80 BTU for the SUPER THERM® coated structure, resulting in 26-30% less energy use.

A similar test applied to a residential home roofing system in Florida resulted in 20-30% energy savings.

The State of Florida Energy Office described SUPER THERM® as "an affordable product that obviously can be instrumental in conserving energy".

A testimonial from the Florida Energy Office stated: "This is the third time we have had pleasure to test SUPER THERM® products, it is rare that a single product will show such repeatable results in three totally different environments...it is a true testament to your energy star rating."

SUPER THERM® saves and protects gas and oil production

Another landmark study was carried out with Saudi Arabia's official oil company Saudi Aramco where its LNG tanks were coated with SUPER THERM® to reduce flaring by 50% in winter and 70% in summer.

Not only did the application of SUPER THERM® result in a cost savings because less gas was being lost, meaning more could be sold.

But it also improved environmental outcomes by reducing LNG boil off, which is when heat affecting the tanks causes some of the gas to evaporate.

The emissions are toxic and the gas industry often comes under fire for being big polluters.

"Now we have a solution and it's as simple as painting these tanks with 250 microns of SUPER THERM®, which is the thickness of a business card," Arin said.

"One of the best parts is they didn't have to shut down the tanks because SUPER THERM® is water based and non-flammable, so they were able to paint it over a live asset.

"Another benefit of a 50% less flaring is a reduction in the chance of a catastrophic safety failure in those valves, which also degrade and have to be inspected.

"So it is a win-win for every department—safety, financial, sustainability and engineering."

Corrosion Protection Paradigm shift

Another core product for NEOtech Coatings is Rust Grip®, a highly innovative encapsulation corrosion coating solution.

A long-term lab and field study by Chevron, published three months ago by the Society of Petroleum Engineers, tested 18 different coatings on drill pipes for eight years.

"Drill pipes are the toughest environment anyone can ever imagine and Rust Grip® was the top performer," Arin said.

"In that paper they highlight the cascading benefits that came from solving the corrosion problem.

"You solve the corrosion problem, that's already millions of dollars in savings and then because you're not having to swap out these drill pipes so often, you're saving millions in logistics.

"Then you're also saving millions on



SUPER THERM® applied to Australian oil fields at Halliburton.



The world's largest casino boat was a great example of the core coatings suite which delivered the best protection against corrosion, heat and biofouling.



Keeping the heat in: HPC® Coating was applied to 470°C steam pipes at a refinery for Gazprom, Russia's largest LPG energy supplier.

inspections and shutdowns and because the pipes aren't rusting and chipping into the well bore, there's no cross-iron contamination, which could be catastrophic and shut down an entire operation for years."

The paper described the use of external coatings as a "paradigm shift" and a "trouble free" solution and significant cost savings through a reduction in pipe repairs and damages, loss of capital assets and rig time due to pipe issues as well fluid and corrosion issues.

"We describe Rust Grip® as not only having superior corrosion protection but it also has incredible abrasion resistance and long term durability, which I think plays very well to the mining community," Arin said.

Rust Grip® works anywhere where there is abrasion and corrosion, including for dump trucks where ore is constantly eating into the interior coating or for conveyors which suffer abrasion from the movement of ore.

It seals virtually any surface including steel, aluminium, concrete, wood, fibreglass, lead-based paints, and is compatible with other coatings.

As long as the surface is dry, there is minimal surface preparation with often only a power washer needed to remove loose material.

It uses a low molecular weight solvent and draws on the humidity from the atmosphere to penetrate deep into the pores of the surface.

As it expands and anchors itself into the pores, it robs water vapor and therefore oxygen from the surface to significantly slow down the electrochemical reaction—a aka corrosion.

Unlike most coatings, Rust Grip® uses aluminium metallics rather than zinc.

"This is what makes it harden like a rock," Arin said.

"You scratch it, bang it, chip it, burn it and Rust Grip® will take it, it is the ultimate tough guy and it can take incredible abuse when it comes to abrasion."

Rather than trying to remove rust, the aluminium allows Rust Grip® to bond and fuse with the existing rust to make the surface even stronger.

Pull test results in field and lab studies have averaged 1200psi over minimally prepared surfaces and in the field over blasted surfaces at 2200psi.

It has also been tested to encapsulate toxic elements such as existing lead-based paints, asbestos and other hazardous materials.

Rust Grip® has proven very successful in the shipping industry and on tankers in the oil and gas industry.

In a nine-month field trial with Abu Dhabi's state-owned LNG carrier, Rust Grip® was applied to the anchor chains, which suffered extensive abrasion.

Unlike many coatings, Rust Grip® was compatible with paint from a different manufacturer, which was applied as a top coat.

"Two years later they came back and all the top coat was gone, the only thing left was the Rust Grip®—even the anchor chains ripping against the metal couldn't peel it off.

"Since then, we have coated eight of their ships in the last four years, the application was completed at sea while the ships were moving.

"So there's no shutdown, and we have cut their dry docking time in half, which has saved them a lot of money."

Rust Grip® was also applied to the three-storey Blue Chip Casino vessel — which was the largest casino boat in the world when it was built in 2005.

The surfaces were power washed and then primed with Rust Grip® with no sandblasting required.

The job was a perfect example of all the surface coatings working even better as a suite.

Managing corrosion underwater

Another innovative coating is Moist Metal Grip — an epoxy coating designed



The application of SUPER THERM® on the exterior of the Nissan Factory in Yokohama, Japan, resulted in a cooler roof as reported by Nissan.

specifically for both wet and damp surfaces.. Moist Metal Grip was applied to the hull under the water line where Rust Grip® was used as a primer.

The waterproof paint for metal surfaces has also shown anti-fouling components, preventing biofouling from clinging firmly to make maintenance much easier.

This also reduces the need to apply toxic paint, which leaves harmful traces of copper in oceans, Shane said.

SUPER THERM® was used as the exterior insulation material with a finishing coat on top of Rust Grip® above the water line, as well as on interiors, followed by a finishing coat of Enamo Grip.

Super tough protection

Enamo Grip is a tough two component polyurethane enamel providing outstanding resistance to water and humidity, stains, chemicals and solvents.

It is often used as a top coat for colour, UV protection and industrial strength to guard against chemical splash and acid rain.

The most popular system is the application of Rust Grip® as the primer followed by SUPER THERM® as the mid coat and topped off with Enamo Grip.

"Stop the rust, stop the heat, stop the colour fade," Shane said.

"The application of these coatings on the casino vessel saved them more than \$2 million on the surface preparation costs and it has never needed another paint job, including below the water line.

"We're not selling paint, we are selling a new way of painting."

Retain the heat, improve efficiency

Many coatings are aimed at keeping the heat out, but in the mining and energy sectors, the aim is often to keep the heat in.

HPC® Coating is a ceramic water-based coating designed to insulate hot pipes, vessels, and surfaces in extreme temperatures up to 600°C.

"Imagine a steam pipe, if it's going 1km

down and it's not insulated, it's lost a large amount of its heat," Shane said.

"In the mining and energy sectors, you often need to protect whatever it is you are putting into the pipe and to get it to the other end at a set temperature."

HPC® Coating replaces jacket insulation, which has major design flaws allowing leakage of moisture into the jacket.

"When moisture gets into jacket insulation it causes accelerated corrosion and to add insult to injury, it degrades the insulation," Shane said.

"It's an absolute epidemic everywhere in the industry and it causes catastrophic damage—plant explosions always come back to corrosion on your insulation."

HPC® Coating is highly unique and was applied directly to 470°C steam pipes in a refinery for Gazprom, Russia's largest LPG energy supplier, with no shutdown required as it is non-flammable and very safe.

By keeping the heat in the pipe, the surface of HPC® Coating remains cool enough to touch with a bare hand.

"HPC® Coating provides three benefits — superior insulation, superior corrosion protection under the insulation and personnel protection," Shane said.

"If someone slips and falls on the surface, they won't get a third-degree burn."

The retention in heat improves efficiency and saves millions in energy costs.

NEOtech Coatings has a range of solutions from corrosion prevention to heat insulation coatings and moisture management to suit any tough mining and energy application.

Other customers who have benefited from the coatings worldwide include Halliburton, Century Drilling, Caltex, Origin Energy, Beverley Uranium Mine and Paladin Energy.

AMR

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Mitsubishi's 'tank terminal' in Japan was coated with SUPER THERM® to stabilise fuel and oil storage.



RUST GRIP® worked its magic at an oil drilling platform in Venezuela.

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NRX Nanoprime's surface preparation technology allows industrial coating applications in areas where it is difficult, cost prohibitive or impossible to perform surface preparation by abrasive grit blasting.

NRX only requires a simple high pressure wash before the product can be sprayed, rolled or brushed onto rusting, clean and painted substrates in the one application. Independent testing has shown very high adhesion results to the substrate whilst also preventing any future under film corrosion.

As a single pack, water based primer, the product is exceptionally easy to apply for a fast and effective solution to rusting steel on any mining site.

- Significant down time reduction
- Chemically reacts for perfect adhesion and top performance
- Quick drying saves valuable time
- Chemically transforms rust via phosphatic process
- Nanofusion prevents under film corrosion for long term protection
- Non-hazardous, No VOC's, environmentally friendly and non-flammable
- No Blasting
- No Heavy Protective Gear
- Suitable surface preparation for many existing compatible top coats

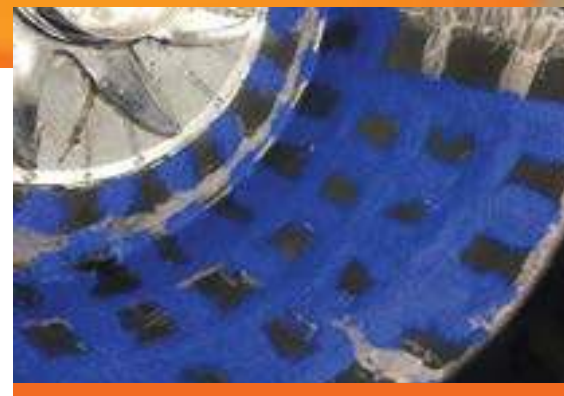
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NRX Nanoprime Introduction Video:



For additional products, safety or technical information please contact Shane Tregear on 0417 676 509 or at shanetregear@rezitech.com.au

LEADERS IN INDUSTRIAL MAINTENANCE



Rezitech Services Pty Ltd offers a wide range of abrasion resistant solutions for the mining industry and other industries where abrasion is a concern.

In these uncertain times more than ever, it is far easier, safer and cost-efficient to repair equipment than is to replace it, which is why you can rely on the Belzona range of repair products.

One such product is Belzona 1818, released in June 2020, which has quickly emerged as the leader for rapid repair solutions. It is a surface-tolerant, abrasion-resistant system ideal for patch repairs on surfaces that are subject to highly erosive and abrasive working environments.

Due to its fast-curing time, damaged equipment can be quickly repaired and returned to service as the product can experience full mechanical loading in as little as two hours post-application.

The system is bright blue and was specifically designed this way to allow for easier post-application inspection and monitoring of the substrate.

Available in 1kg units, Belzona 1818 is an essential part of any emergency maintenance tool kit.

Key benefits:

- Abrasive-resistant material
- Provides long term protection against abrasion
- Simple preparation
- Surface tolerant product designed for simple prep and application out in the field
- Quickly mixed and applied
- Fast curing providing quick turnaround and system start-up
- Allows for 'spur of the moment' jobs to be completed quickly by on-site personnel
- Can be applied and cured underwater
- Ensures minimal downtime for equipment

Contact Us:

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Application Areas:

- Slurry pumps
- Grinding mills
- Screw conveyors
- Chutes and hoppers
- Hydrocyclones
- Wear plates
- Grit pimps
- Agitator shafts, hubs and blades
- Dust extraction pipework

Rezitech has been the sole Australian distributor for the exclusive range of Belzona repair and maintenance products since 1972.

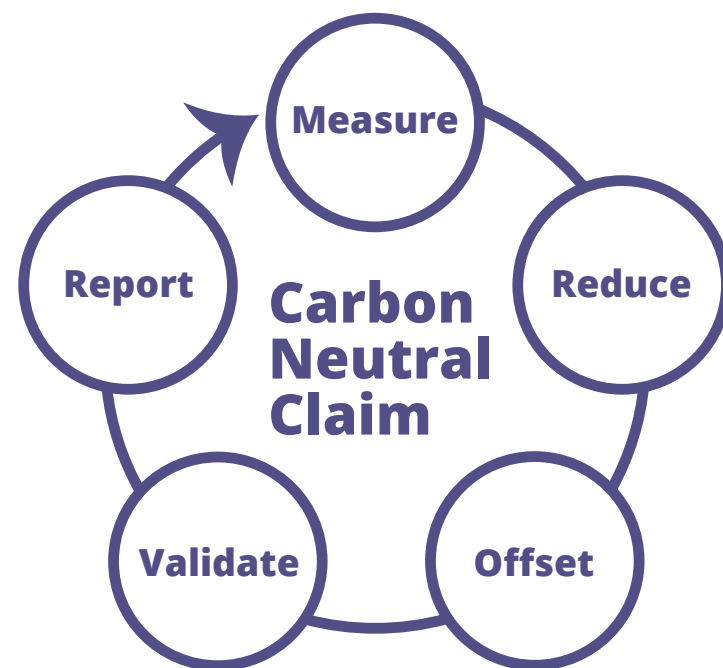
The company provides turnkey maintenance and efficiency solutions along with support from on-site technical consultants who can diagnose problems and offer the appropriate solution.

Rezitech also provides training for applicators and supervisory services for all Belzona applications.



Climate Action In The Value Chain

Traditional Coatings' Journey to Net Zero



The cycle of activities for carbon neutral claims.

The world is calling for governments, businesses and communities to combat the climate crisis.

However, the Australian Government's policy commitments about reducing our Greenhouse Gas emissions has made insufficient progress towards creating the necessary climate-resilient roadmap that will limit our contribution to global warming and its impacts.

Businesses, on the other hand, with their scale, reach, and resources, have a vital role to play in the effort to limit global warming to 1.5°C in line with the Paris Agreement targets.

For organisations – particularly those within the energy and resources sector - to reach ambitious climate targets is to go beyond direct company operations and tackle value chain emissions in their extended scope of responsibility.

In so doing, companies will be able to rapidly respond to internal and external pressures for climate action, and better manage environmental and market risk across complex supply chains.

Carb Zero (a certified Climate Active consultancy) believes that a transition to a

low-carbon economy is growing momentum and that companies that are aligning their strategies with this step-change are opening themselves up to a world of opportunity.

By setting science-based targets, key business benefits include improving the environmental landscape, mitigating anticipated regulatory risks, building a stronger brand, responding to investor pressure, initiating innovation, generating efficiencies and savings, and achieving a competitive advantage.

More and more companies are eyeing net zero emissions by 2050 and aiming for even more ambitious and comprehensive goals. For example, FMG has set a net zero emission target by 2030.

So, how can Tier 1 companies like Monadelphous, AGC, UGL, Downer (and others) and their contract suppliers support the big resource and energy sector companies to align their carbon emission reduction strategies and move toward net zero emissions?

This article outlines the roadmap by which Carb Zero mentored Traditional Coatings through its ambitions to gain carbon neutral accreditation from Climate Active (CA) by June 2022.

The process aims to assist an organisation reach zero carbon emissions, not only from its own operations, but ultimately, through that of its value (or supply) chain as well.

Phased Approach

To reduce value chain emissions, a three-phase process was undertaken.

The first phase entails mapping the upstream and downstream organisations within the value chain.

Phase two entails initiation of pilot projects to demonstrate effective emission reduction strategies while phase three focuses on engaging and collaborating with suppliers.

In the first step to achieve and maintain a valid and credible carbon neutral claim against the CA's Organisation Standard, the responsible entity must:

- Calculate its own Scope 1, 2 and 3 emissions
- Develop and implement an emissions reduction strategy
- Purchase offsets to compensate for remaining emissions
- Arrange independent validation
- Publish a public statement of the carbon neutral claim.

Once calculations have been assessed and reductions put in place, the remaining emissions can be offset by purchasing credits that further reduce an organisation's carbon footprint. Carb Zero has partnered with Ecoprofit, specialising in the procurement and sale of carbon offsets to help organisations achieve net zero emissions.

Once the reporting entity has monitored its own carbon footprint and engaged in effective decarbonisation strategies, assessing the Scope 3 landscape within the value chain is the next big challenging task. By assessing the Scope 3 Landscape an organisation must:

- Define business goals and review accounting principles, identify emissions activities and set the boundary,
- Identify and understand risks and opportunities associated with value chain emissions,
- Identify GHG reduction opportunities, set reduction targets, and track performance,
- Engage value chain partners in GHG management and
- Enhance stakeholder information and corporate reputation through public reporting

Traditional Coatings is a 50%-owned indigenous company with minimum 25 years blast and paint experience for industrial and large-scale commercial projects.

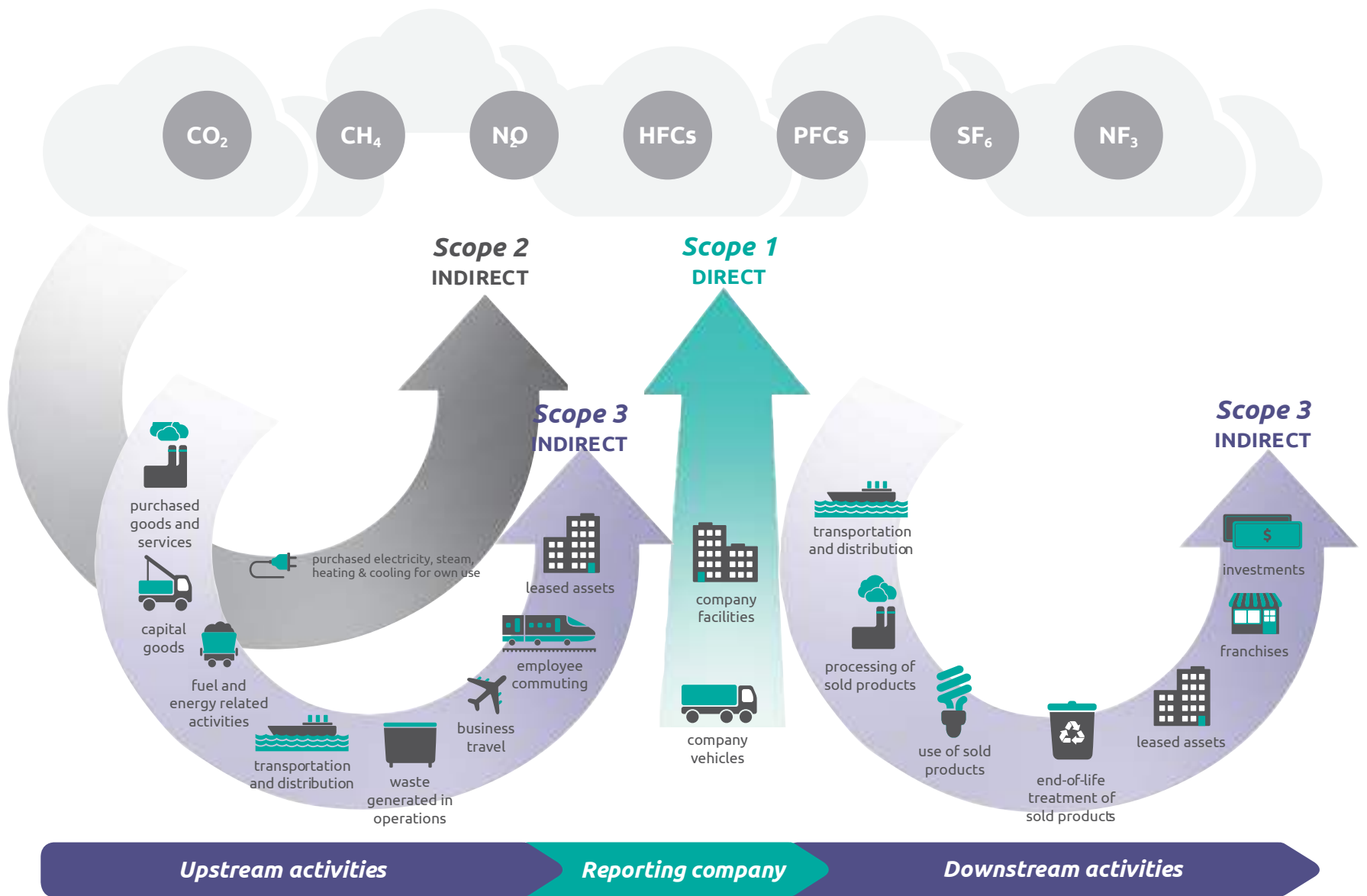
Works encompass preparation and application of protective coatings/paint systems for

- Marine structures
- Major project infrastructures
- Road marking

Offsets are more than just carbon.



Many organisations choose offset units that support co-benefits which align with their organisational values.



Overview of the GHG Protocol scopes and emissions across the value chain.

Companies must identify their most significant greenhouse gas (GHG) reduction capabilities and reduce emissions across their own operations (Scope 1 and 2 as defined by the GHG Protocol) as well as across upstream and downstream value chains (Scope 3 emissions, which overlap with the suppliers' Scope 1 and 2).

To make significant impact on a reporting company's emissions reduction strategies, they need to focus beyond the activities of their Tier 1 suppliers and target the wider value chain.

This becomes difficult for the reporting company to accurately assess the emissions produced within their value chains and is why Traditional Coatings has taken the initiative to become carbon neutral itself; to assist reporting entities engage with their suppliers to set their own science based targets and mitigate the impact

of climate change.

Data Details

One of the most challenging aspects of assessing value chain emissions is the collection and calculation of accurate data. This becomes increasingly difficult to assess because of the shifting landscape for supply of materials, goods and services.

Carb Zero has the capacity to mentor organisations and their value chain operatives design a data management plan which documents the GHG inventory process and provides a means by which organisations can negotiate these hurdles.

In order to accurately make sense of energy consumption and carbon emissions for clients, Carb Zero - in collaboration with Carbon Training International - uses Simble's Simblesense + IoT business energy monitoring platform and its Carbonview

carbon accounting and management platform software.

The business energy platform allows businesses to understand its energy usage and reduce consumption remotely using IoT technology.

Features include circuit level monitoring and control, data analytics, measurement and verification and multi site comparison.

The Carbonview platform is an all-in-one dashboard to track progress towards sustainability targets which meets International Standards of compliance - GHG Protocol, and NGRS - and offers a cost-effective solution for businesses which have to comply with the Australian Govt's compliance framework.

The platform provides businesses with advanced analysis for informed decision

making and transforms energy and resource data into insightful reports and results.

It connects directly with multiple information sources to collect, track and manage energy consumption and carbon emissions across the entire entity.

It provides a single database for all sustainability data in an organisation offering intelligent analytics and allows businesses to identify opportunities to mitigate greenhouse gas emission as well as calculate and report with confidence on their carbon footprint. **AMR**

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Scope 3 carbon emissions reduction process for a sustainable future.

Rhino True Silver Lining

Since 1988 Rhino Linings has been recognised as the World's #1 spray-applied, premium protective lining system for the automotive and industrial vehicle markets. What is not so well known is that Rhino Linings also manufactures premium protective coatings for the mining, marine and defence industries.

Rhino's protective coating systems provide superior solutions for waterproofing, abrasion, impact, corrosion, containment, and chemical attack problems in more than 80 countries around the world.

The range of products can be found throughout the mining landscape, used by companies including BHP, Rio Tinto, Ravenswood Gold, Orica, Newcrest, and Gold Fields to protect their assets.

Australian Mining Review spoke to Rhino Linings General Manager for Australasia, Peter Morgan, about the range of high-grade protective products and solutions that the company manufactures and supplies to the Australasian market.

"We don't just formulate and manufacture superior protective systems within Australia, we also design and manufacture a range of specialised application equipment," he said. "The technical advantages this brings are significant and cannot be matched by competing importers and distributors."

Applicator Expertise

Since the mid-1990s, Rhino Linings Australasia has been formulating and manufacturing superior pure polyureas,

modified polyureas, polyurethanes, polyaspartic and epoxy coatings, primers, and aliphatic topcoat systems.

"Our team of highly trained technicians and sales staff have worked on major projects all over the world and have industry leading experience in the correct use of our application equipment and lining systems," Peter said.

"Our ISO 9001 certified testing laboratory ensures our products remain at the leading edge of technology.

"Rhino's specialised applicators have received in-house training on equipment and application techniques. They understand all aspects of substrate preparation, equipment operation and subsequent application procedures.

"As a result, they are highly experienced in the application of Rhino's industrial protective coatings such as polyurethanes, polyureas and epoxies for primary and secondary containment solutions, tank and bund linings, wastewater treatment plants, potable water reservoirs, roof tops and a vast range of coatings for both internal and external surface applications."

Product Examples

Rhino specialises in a variety of high and low pressure, plural 1:1 and 2:1 mix ratio, polyurea, polyurethane and polyaspartic protective coatings, with unique physical properties and chemical advantages to meet the requirements of virtually any application or substrate.



Rhino's protective coating systems provide superior solutions for waterproofing, abrasion, impact, corrosion, containment, and chemical attack problems

These include:

- Tank and Bund Linings
- Primary and Secondary Containment
- Water and Wastewater Solutions
- Waterproofing Solutions
- CIPP (Cure In-Place Pipe) Trenchless Pipe Repair
- Flooring Solutions

A sample of Rhino Linings Products include:

Rhino PP1195® - Pure Polyurea

Rhino PP1195® is an Australian made two-component, rapid curing, aromatic, elastomeric pure polyurea lining system designed for heavy-duty industrial applications where high performance and rapid turnaround times are critical.

It remains flexible through a wide temperature range and bonds to virtually all substrates of any dimension, including metals, woods, concrete, and fibreglass.

It is typically used in industrial and mining applications where rapid turnaround is critical.

It is also employed in secondary containment as a monolithic, impermeable lining for industrial plants, mining, agriculture, chemical and petrochemical applications, and primary containment in tanks and vessels subject to abrasion and/or substantial substrate movement.

Rhino Extreme® 1150FR (A) - Fire Retardant Pure Polyurea

This is a two-component, flame-retardant, elastomeric, pure polyurea system, an ideal coating for numerous applications that require a flammability rating.

It is typically used in underground mining (anti-static) and in military applications where blast mitigation is needed.

Rhino HiChem® 1170

Rhino HiChem® is a two-component, 100% solids (zero volatile organic compounds, no solvents), exothermic, rapid curing,

elastomeric polyurea based lining system specifically designed for excellent chemical resistance.

Rhino TUFF STUFF®

Rhino TUFF STUFF® is a two-component, 100% solids (zero VOC's, no solvents), exothermic, rapid curing, elastomeric polyurethane lining system.

It features very good slip resistance, excellent weather resistance, and conforms to any shape and size. **AMR**

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SCAN ME

The Resurgence of Polyurea

The use of polyurea has gone through cycles in Australia.

The coating is extremely abrasion-resistant, impact-resistant, chemical-resistant and out-performs rubber and even ceramics in many situations.

However, this has been its downfall.

With increases in popularity, there have been issues with inexperienced applicators, poor products, poor primers (or more specifically poorly matched primers), and even product dumping. These issues have increased with popularity increases and the resulting failures have given the technology a bad name rather than the applicator/product at fault.

And when polyurea fails, it is an expensive exercise to get it off.

According to Shield Crete Services director Nathan Spencer, there is now a resurgence in interest with the changing of the guard at many mines, and the same issues are starting to creep back in.

"We have a number of our customers reporting long-term clients going to alternative applicators/products, only to come back for the next project saying they will never use anyone else due to the issues they encountered," he said.

Nathan listed some ways of addressing the issue:

1. Use an applicator with lots of experience and ask them for references from at least three recent projects (in the last three months) if you are looking at someone new.
2. Use a product that comes with technical experience, knowledge and support. The specification is important.
3. Make sure the primers are specifically tested with the polyurea used. Ideally, use a single supplier system. "We have seen plenty of failures, even with systems from the same supplier where the polyurea peels off the primer," he said.
4. Ensure that the applicator has some form of formal training in polyurea application.
5. Make sure the QA/ITP process is completed. Client oversight can make a big difference here and it avoids any arguments if there are issues.

Shieldpoly Polyureas

Shield Crete Services has a range of polyureas, headlined by the ShieldPoly F15 product that is ideal for most applications, thanks to its unique combination of high tensile strength and high elongation.

"Our polyurea coatings boast fast curing times (~15s for ShieldPoly F15), even at temperatures well below 0°C, as well as insensitivity to humidity," Nathan said.

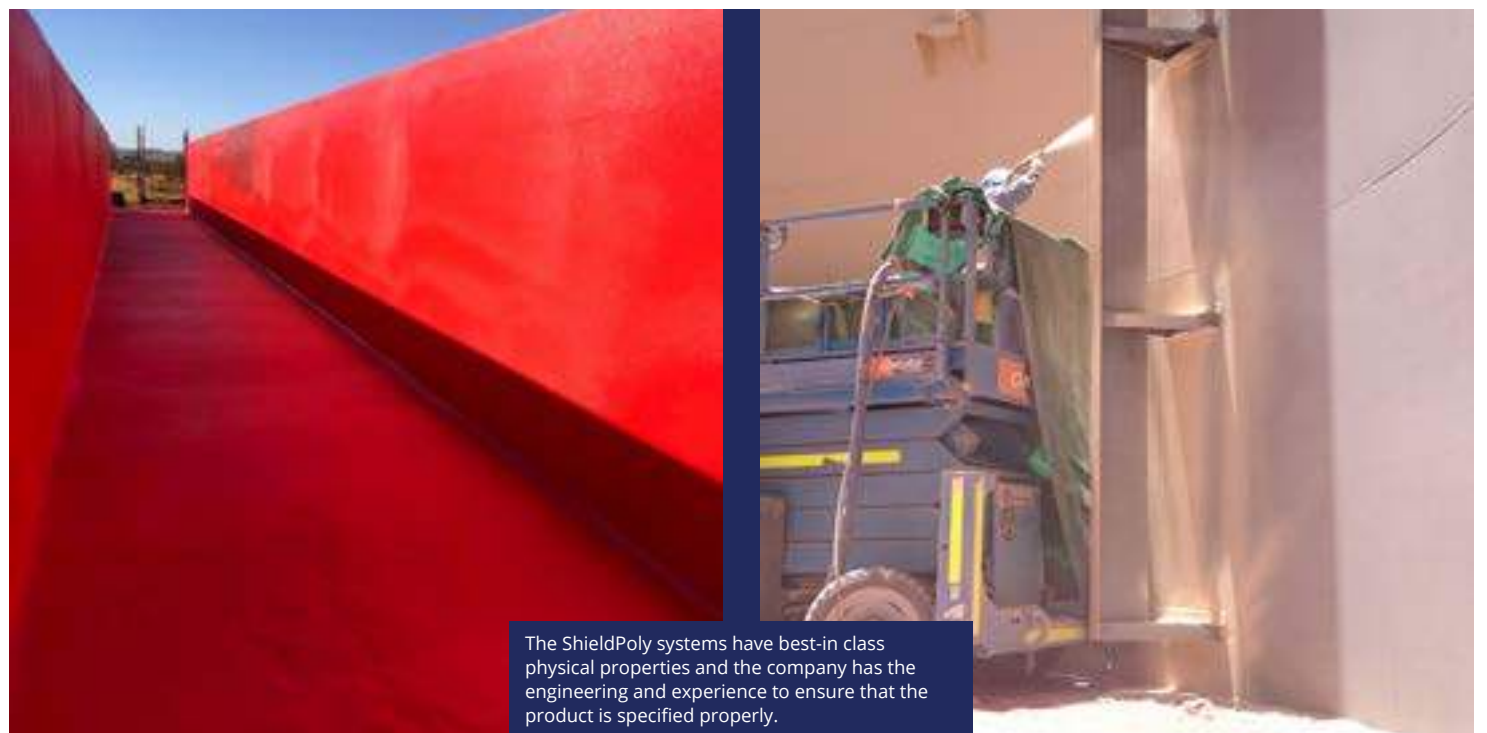
"With exceptional physical properties such as high hardness, flexibility, tear strength, tensile strength, chemical and water resistance, there's sure to be a formulation to suit your requirements.

"Our polyurea is ideal for heavy-duty waterproofing, bund liners, abrasion resistant coatings, containment, conveyor belt repair, waste water treatment liners, pipes, tank liners, tailings pond liners, and a host of other industrial applications.

"They are applicable nearly anywhere to



Shield Crete Services Australia supplies only the highest quality polyurea systems from around the world for application over a range of substrates.



The ShieldPoly systems have best-in class physical properties and the company has the engineering and experience to ensure that the product is specified properly.

protect the vital assets and infrastructure that keep your industry in business.

"Our polyureas do not have any propylene carbonate in the formulation. This is important because if the product gets too hot the propylene carbonate can change to propylene glycol (or polypropylene glycol) which is highly hydrophilic and can cause significant inter-coat and general blistering."

The benefits include:

- Return to service in 1-24hrs.
- Long recoat windows (12-24hrs rather than the typical 2-8hrs).
- Can be walked on in only a few minutes.
- Spans joints and cracks so you won't need to regularly repair/re-point joint sealants.
- High chemical resistance.
- Cost competitive with epoxies and rubber lining.
- Faster project completion and return to service than alternatives
- No harmful VOC's
- Prevent hang-up and carry back of bulk materials.
- Longer lasting than EPDM liners and less leaks.
- Seamless and can handle significant movement and traffic.

Applications include:

- Rail cars
- Pipes
- Tanks
- Poles
- Conveyor belts
- Bund and tailings liners
- Roof sealing
- Asbestos containment in-service
- Transport
- Dump-truck liners
- Semi-trailer liners (wheat, gravel, etc.)
- Heavy-duty flooring
- Commercial waterproofing

- Retaining walls
- Cold storage
- Secondary containment
- Munitions / explosives storage
- Food processing
- Potable water systems
- Waste water
- Screw piling protection
- Driven piling protection
- Boats (particularly hulls and decks)

Specifications

"We have a range of standard specifications available on request," Nathan said.

"We commonly provide detailed specifications for customers and provide assistance for specifiers that are not intimately familiar with how to specify polyureas."

When specifying Polyurea, there are key elements to consider. Not all polyureas are the same.

The performance is highly influenced by the following parameters:

- Tensile strength – High tensile strength improves puncture and tear resistance, and the higher the tensile capacity, the more resistance to particle abrasion and impacts when combined with good elongation.
- Elongation – High elongation is generally better because it allows for higher impact abrasion and resilience against thermal movement. It also helps with particle abrasion resistance when the tensile strength is still high. If bridging control joints and cracks, a bond-breaker can be specified to match the elongation capacity and the expected movement.

- Purity – Generally, the more pure, the better the UV and chemical resistance. Be careful of cheap products because some people claim purity even though they have 10, 20 or even 40% urethane in the formula. Pure means no intentional hydroxyl bonds (no urethane) according to the Polyurea Development Association (PDA).

- Hardness – This isn't hugely important for Polyurea in most situations. Abrasion resistance is better determined by the tensile and elongation balance for particle abrasion, but resistance against scraping abrasion may be improved by higher hardness.

- Taber Abrasion – This measure has been found to not correlate well with any realistic requirement for abrasion resistance of polyurea. We don't normally pay much attention to these values but provide them for reference.

In Summary

"At Shield Crete Services Australia, we supply only the highest quality polyurea systems from around the world for application over a range of substrates (now including rubber and conveyor belts)," Nathan said.

"Our ShieldPoly systems have best-in class physical properties and we have the engineering and experience to ensure that the product is specified properly.

"Not only that, we have one of the best training programs in the world, having trained teams across Africa, America, Canada, Asia, Oceania and Europe." **AMR**

SOURCE
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Condition Monitoring Done Right

When NHP was established in 1968, founder Nigel Peck was determined to create a 100% Australian-owned company focused on providing the best service and highest level of quality products.

From humble beginnings, NHP has expanded to provide electrical engineering excellence to all corners of Australia and New Zealand.

NHP remains committed to embracing new technologies and pushing the boundaries of industry best practice to ensure they provide their customers with the highest quality products and services.

Australian Mining Review spoke with NHP's Product Manager for Drives, Motion and Integrated Condition Monitoring,

Marjan Sprajc, to learn about NHP's integrated solutions, in particular Rockwell Automation's Dynamix™ 1444 Series system and the company's secure technologies that automate production, control power and manage energy across multiple sectors.

The Thought Leaders

With 50 years of electrical and engineering industry excellence and 45 locations across Australia and New Zealand, it's NHP's local people and footprint that help them understand their client's specific project needs, no matter how big or small.

NHP goes to market with over 15,000 stocked items and has an extensive network of global partners, which unlocks a world of expertise, knowledge and experience across electrical and automation products, systems and solutions for clients.

NHP services many major industries from manufacturing, construction and mining to defence, oil and gas and processing plants.

"We understand that the success of a client's project hinges on the ability to choose partners who understand their project's unique requirements and who can offer specialist advice in electrical and automation products, systems and solutions," he said.

"We bring leading experience across a broad landscape of local industries including mining and have the capability to design solutions and service applications both now and into the future."

Integrated Condition Monitoring

NHP provides condition monitoring products which help monitor the performance of mechanical components and support clients with identifying potential failures before they occur.

The replacement of worn equipment, unscheduled downtime and equipment servicing comes at significant cost to an operator, thus it is critical to keep all parts of a system in working order and be made aware of any issues in advance.

NHP offers real-time protection modules, sensors, portable instruments, and surveillance software to help operators maintain the integrity and longevity of their equipment and parts.

"We have a high quality product offering

for clients looking to establish a monitoring system," Marjan said.

"We provide both design and technical support in addition to physical components which may include the physical integrated machine condition monitoring system itself, respective software, protection modules, data collectors and sensors.

"We are proud to be an Australian owned company capable of bringing a world of technology to Australia and our ability to provide a great deal more than products in a box."

Advanced Monitoring Systems

The Dynamix™ 1444 Series Integrated Condition Monitoring system is at the forefront of NHP's condition monitoring products.

The devices are designed to serve the protection and condition monitoring requirements of rotating and reciprocating industrial machinery.

"The Dynamix™ 1444 range delivers high performance and flexibility for machinery protection and condition monitoring," Marjan said.

"The monitoring system integrates machine protection with a standard control system allowing clients to leverage and integrate with existing control monitoring systems to assess equipment health, predict potential issues and help avoid damage to critical machinery.

"The Dynamix™ 1444 system uses Ethernet to integrate machinery health into existing systems which brings unprecedented flexibility to machine instrumentation design and operational efficiency in the plant."

The Dynamix™ 1444 Design

The innovative compact design of the Dynamix™ 1444 device provides a simple solution for equipment monitoring applications and utilises ethernet communication, high performance dual processors whilst maintaining industry recognised certification.

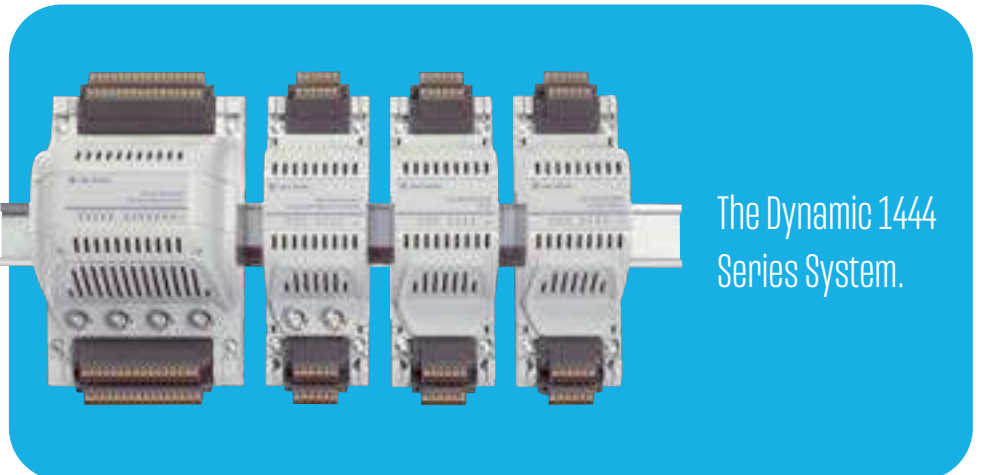
"The compact device can be distributed and fully integrated into Rockwell Automation Integrated Architecture systems and comes with standard assemblies for configuration, input and output," Marjan said.

Not only does the Dynamix™ 1444 Series simplify design applications, it lowers associated engineering, manufacturing and inventory costs with the net effect of reducing and eliminating unplanned maintenance downtime.

Preventive Maintenance Reduces Costs

To protect equipment, the Dynamix™ 1444 system measures and monitors a machine's critical dynamic and position parameters and assures appropriate actions are performed, with the precision, reliability, and performance required by industry and regulatory standards.

For general condition monitoring, the Dynamix™ 1444 system offers unprecedented signal processing and measurement capabilities, allowing clients



The Dynamic 1444 Series System.

the tools necessary to detect and identify the faults and status across all classes of industrial machinery.

"Clients can send information from the system to plant-wide and enterprise-wide databases for storage and trending," Marjan said.

"With this information, clients can take appropriate maintenance action, such as replacing worn-out components before they fail, protecting both production and equipment while reducing maintenance costs.

"The tight coordination between condition monitoring and the control system allows you to leverage existing investments in visualization and information solutions to improve machine builder and end user productivity and lower total cost of ownership."

System Design

"The Dynamix™ 1444 system has a range of modules and terminal bases which accept either spring or screw style removable plug connectors which simplify installation and maintenance and allow selection of the connection method, independent of the selected module and base," Marjan said.

"The Dynamix™ 1444 system comes with a dynamic measurement, tachometer signal conditioner expansion, relay expansion and analogue output expansion modules which must be installed in a terminal base and linked together with ribbon cables.

"The dynamic measurement module is designed for monitoring shaft, casing and pedestal vibration, shaft or rod position, casing expansion and other critical dynamic and position measurements on rotating and reciprocating machinery.

"The tachometer signal conditioner expansion module is a two-channel monitor that converts a signal from common speed

sensing transducers into a once-per-rev TTL class signal suitable for use by up to six dynamic measurement modules.

"The relay expansion module adds relays to the dynamic measurement module, while the analogue output expansion module sends analogue signals that are proportional to measured values provided by the dynamic measurement module."

Tailor-made Product Training

"The system design can sound quite complicated, but at NHP, we encourage our clients to visit the NHP office in their nearest capital city where we can provide a specialist demonstration and training for our range of products," Marjan said.

NHP's renowned events to provide customers with face-to-face product information and training across Australia and New Zealand are now equally complemented by a program of regular technical webinars, which customers can watch at a time and location that suits them.

NHP has also launched an online portal which also allows customers to purchase directly from their company website.

In a Nutshell

NHP is an Australian-owned company focused on providing the best service and highest level of quality products in the electrical industry.

Its innovative attitude and culture is at the heart of the products and services it provides.

For more information, contact NHP to find out how it can support you. **AMR**

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Detect and protect with NHP's SMART Condition Monitoring solutions



With a SMART Motor Control system and the help of our SMART Condition Monitoring products, NHP and Rockwell Automation help you keep your plant floor running by detecting potential mechanical issues before they impact production.

For more information on our real time protection modules, sensors, surveillance software and portable instruments, call NHP today.



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Intelligent Analysis Comes to Pilbara

Techenomics opens up laboratory in Newman



The new lab will deliver an unprecedented level of access to Techenomics' world-class fluid management and condition monitoring services to the Pilbara.

Techenomics International is taking its cutting edge oil and fluid analysis technology to the Pilbara, opening a new laboratory in Newman.

The new lab will deliver an unprecedented level of access to Techenomics' world-class fluid management and condition monitoring services to the mining, transport, marine, power and industrial sectors of the iron ore sector and wider Pilbara client base.

With a consistent trajectory of market growth, Techenomics has already expanded its reach by building several subsidiaries throughout Australia, Indonesia, Singapore, Thailand, Mongolia, Turkey, South Africa and Russia.

And now the company's new facility delivers an unprecedented level of testing and analysis in the Pilbara.

It brings together experience and new ways of thinking, enabling mining companies and OEMs to deliver a more reliable product and service with higher production and less downtime.

Australian Mining Review spoke to Techenomics chief executive officer Chris Adsett about the company and its services.

Analysis and Algorithms

Core to business - and one of the many factors driving the Techenomics foray into the Newman area - is analysis of used oil and other fluids, such as coolants, grease, fuel, and other fluids and lubricants, under a range of conditions.

Techenomics' condition testing extends beyond standard OEM recommendations, and takes into consideration factors of individual site conditions, the nature of material being handled and the machine's use.

Coal has been Techenomics' bread and butter and is at the centre of its business in the Hunter and throughout Indonesia. In Bangkok the business turned its attention to condition testing in a gold mining setting, and then in Mongolia it was a copper-gold mining location.

Now in the Pilbara, iron ore operational

conditions are the focus of attention.

"The company's distribution of liquid tungsten, which is a disulphide nano oil additive used in thermodynamically sophisticated friction reduction, also made the Pilbara lab a strong proposition," Chris said.

"With the COVID-19 pandemic, came the need to sharpen the business' turnaround and service delivery, so a Newman laboratory became a priority, and the benefits were immediate."

Chris said like the company's other labs, the Newman operation would use intuitive Blue Ocean Software to store, manage and analyse the large volumes of data being processed across its network.

He said a sophisticated library of algorithms and conditional variables, which have been developed and built into the platform, enables acutely accurate conditional testing and analysis of oils and other fluids.

This platform will make servicing the Pilbara, from the newly-launched Newman Laboratory, more effective and efficient, especially in a post-COVID setting.

"This data is housed in sets assigned to each client, which means customers can only access their own specific data sets," he said. "This is a platform which can also be fully integrated with a client's IT interface - meaning unabated access to vital data as well as trends, predictions, and anomalies.

"Once collected, the platform stores the data, creates a history and sets trends or predictions - and provides a small but growing set of analytics.

"It is consistent across the whole cloud-based platform - so, wherever the customer, site or the machinery on which the condition testing was done, the data is available on exactly the same cloud-based platform.

At the laboratory in Newman, Kiky Millar, a recent arrival in the mining town from another large mining service centre in Balikpapan, is lab manager.

Kiky relocated with her husband, who has

work in the Pilbara with BHP, and two young children, and brings more than six years previous laboratory experience as well as skills obtained while completing a Bachelor Degree in Chemistry as well as a Masters Degree in Environmental Science.

Assisting Kiki in the new laboratory will be a female chemical engineer, also from Indonesia, as well with Keshini Lokhun, a young science graduate specialising in chemistry, who is also helping Techenomics establish a presence in parts of Africa with her French language skills.

Kiki says women are playing an increasing role in the male-dominated mining industry, including in places like Newman, and particularly in technical and scientific areas. She says that women are now much better accepted and there are more opportunities.

Testing Times

Chris likens the conditional oil and fluid testing and analysis to human pathology testing: just like a pathologist will look beyond the blood, Techenomics analysts look well beyond the oil - and for much the same reasons: to ensure a comprehensive analysis of wear and condition is undertaken.

The testing procedure begins with a sample of oil or fluid being taken.

The samples, usually between 80ml and 100ml, are taken in a standard manner, and when oil is hot. It needs to be indicative of the compartments and be consistent - engine to engine, compartment to compartment, gearbox to gearbox.

Samples are then labelled according to what it is, what the hours are, and any other details, and then the sample kit is dispatched to our lab - either by couriers, hand collected, or post office bag.

The new laboratory in Newman will heavily reduce testing, delivery and analysis time for any samples collected in Western Australia - especially from within the Pilbara region. The reduced time taken to transport samples to the lab means analysis can be completed sooner, customers are provided with the results and action can be taken sooner to resolve issues or prevent further wear or damage to components.

It's at the lab that the AI magic happens.

Testing is undertaken on a scheduled basis. While this is usually consistent for most mobile equipment, there are variables which need to be taken into consideration.

For mobile equipment, Chris maintains there is a vast difference between a coal and a hard rock mine, for instance.

The specific gravity of the material the trucks are carrying - and the diggers are digging - changes, so the volumes change. Simply put: 200t of iron ore are much smaller in volume than 200t of coal.

Again, this presented another opportunity in the opening of the Newman laboratory.

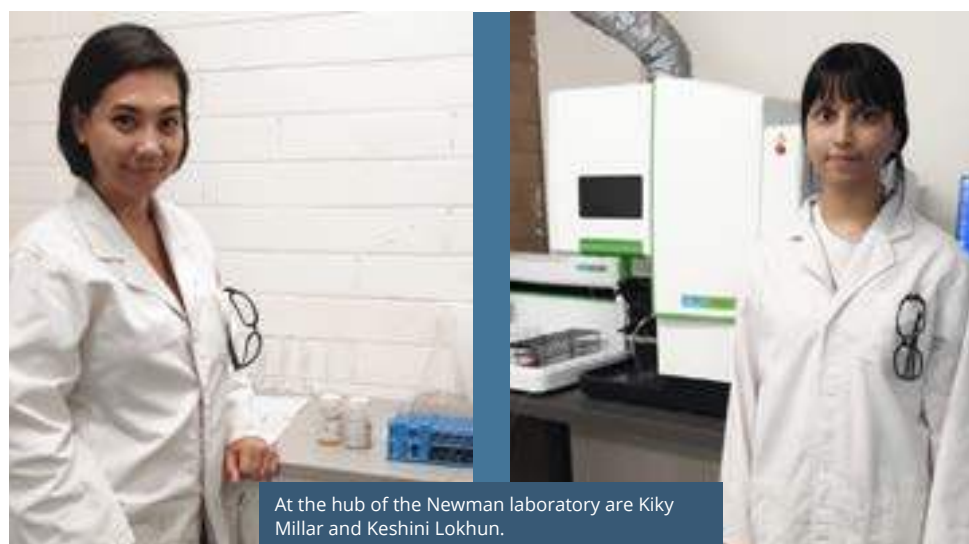
Considering the many variables is vital in identifying potential issues, preventing unscheduled stops and emergency breakdowns and ultimately saving time and money.

"A piece of machinery - for instance a dump truck - might have an engine worth a couple of million dollars so the capital value of that equipment is very high, and the more sophisticated miners want to make sure they achieve the maximum life for the components fluid and everything is running efficiently and in a healthy manner," Chris said.

"The fluid analysis provides data to be collected and then analysed, to enable advice on the health of the equipment to be provided, as well as what may be necessary to ensure long life and make sure no breakdowns occur.

"While some customers seek only the data, so they can make their own decisions - either with or without consideration of OEM / standard recommendations for oil and fluid replacement - others request a full data collect and analysis with provision of reports and recommendations of a way forward.

"Both requirements rely on a fast-as-possible turnaround - especially when an issue has been identified and a reliable efficient diagnosis means limiting lost time and money.



At the hub of the Newman laboratory are Kiky Millar and Keshini Lokhun.



Chris Adsett in the laboratory.



A typical, well-equipped and advanced Techenomics laboratory.

"We tend to have locations that are close to activities so the time in which we can return the information is reduced.

"We saw through COVID how clients throughout the Pilbara would benefit from the lab in Newman and it now enables us to provide a faster and more efficient service to our customers in that area."

The power of platforms such as Blue Ocean means prevention, risk mitigation, downtime reduction and maintenance can be assessed and planned for using reliable, site and condition-specific data.

It also heightens the accuracy with which everything from a particle in oil to the risk of, for example, bearing wear can be identified – and vitally, allow for the consideration of the possible relationship between the two different findings.

About 70% of oil tested is usually of a fine standard. But that remaining 30% is such that it either needs attention or it is an absolutely urgent issue which required immediate intervention.

"The most common element you're going to find is iron," Chris said.

"But that, as well as traces the likes of copper, chrome and aluminium, is generally something which flags issues around wear. "The presence of that can also lead to considering the quality of the lubricant being used in a compartment.

"If viscosity is low due to a fuel leak or a coolant leak oil will lack the capacity to lubricate. When breakdown can start to occur, there will be wear earlier on and this points to the deterioration of a compartment.

"By this stage, failure has started so it is then a case of how you manage the remaining life of that compartment."

It all starts with the oil – if that is okay then the source of the failure needs to be found and signs could be bearings, or rings in the gearbox or big lumps of iron which have been knocked off the teeth. It is a reliable indicator of the health of the overall machine. If a compartment is running

too hot, the oil degrades, and oxidation is evident – this indicates too much friction.

Skillsets

At the helm of the Newman operation is Laboratory Manager Kiky Millar, a chemical engineer who has moved to Newman with her family.

Originally from Indonesia, Kiky has more than six years lab experience and will be driving a team of highly qualified laboratory chemists and chemical engineers.

Chris credits the high level of skill and extensive experience of the team with being able to leverage good outcomes for clients by working with the data and using the algorithm-based platform.

Techenomics is a team which works as a global network as opposed to silos. While each member will employ the years of experience, they have to analyse what they see, and what the data tells them, they base solutions on a bank of knowledge shared across laboratories – and continents!

It's where tech and AI meets and is complemented by what humanness brings to the table.

"We can provide a range of data for everything from a dump truck engine to a transformer in a power station to a rail locomotive," Chris said.

"Some customers rely on us to advise with a report on what to do with oil and what to do with compartment; whereas some others just want the data streamed into their own platform or software.

"We have tried to structure the business so we can make available across the group any skill gained at a particular site or location. We share our knowledge and the skills we learn and we also share our challenges – we avoid working as a silo – and the collective skills and abilities benefits everyone."

It's a team that makes the technology-artificial intelligence-data-human mix work well.

"We have a lot of Masters, the odd PhD across the locations ... we have a few smart

people here – and we have the experience of those people with hands on skills, on the ground with an understanding of the locations and conditions our customers are working in," Chris said.

The blend of youth and age bodes well for the business, especially given the need to navigate successfully through the digital space.

And as for digital, Chris said the platform being cloud based would enable growth and expansion in the organisational sense, but also facilitate continued and growing access for customers as well as growth in the as collective and sets of data.

Predictably, Artificial Intelligence will underpin Techeconomics' intention to remain at the forefront of the industry, finding technology-driven and innovative solutions.

It is also what will enable an investment in research and development – as well as expansion into new products, services and offerings.

Currently underway, and linking existing concepts with new technology, is development of remote, real time condition monitoring.

This brings the magnetic plugs which collect, check and/or filter iron, together with an innovative, remote, and real-time system of monitoring and analysis.

This will provide a tailored system via which issues and risks can be identified – remotely and in real time - and intervention can take place in early stages.

Even in maintenance, this technology would enable a more cost and downtime effective use of oil, while real-time monitoring of compartments and fluids are taking place in the background.

Chris said this will be most beneficial in those cases where oil might be in good condition but it is changed based on an OEM recommendation standard.

This will mean that if the oil is fine, a recommendation on when replacement

should be carried out is given based on specific conditions as opposed to a set number of operational hours or kilometres.

Oil's Well That Ends Well

Whether in Newman or any of the other laboratories across the Techenomics network, the technology being used to test and analyse oils and other fluids - as well as the strategic location of where that testing can be undertaken - is all aimed at minimising downtime and maintenance costs.

Further, each location and set of associated conditions can be accounted for in testing and analysis.

"This is why we call it condition monitoring," Chris said.

"We consider the condition of the oil and other fluids, not just how many hours or kilometres have been done."

This level of analysis – which is already underway to an extent – means tangible savings in time, money and risk.

Most importantly, it is the prevention of unscheduled breakdowns that this will have potentially the greatest impact upon.

This and the careful location of laboratories in locations such as Newman to ensure a more timely and efficient turnaround; along with the liquid tungsten developments and other research, sets organisations such as Techenomics on a trajectory which might have been impossible to plan for 15 years ago when their investment in Blue Ocean software was first made.

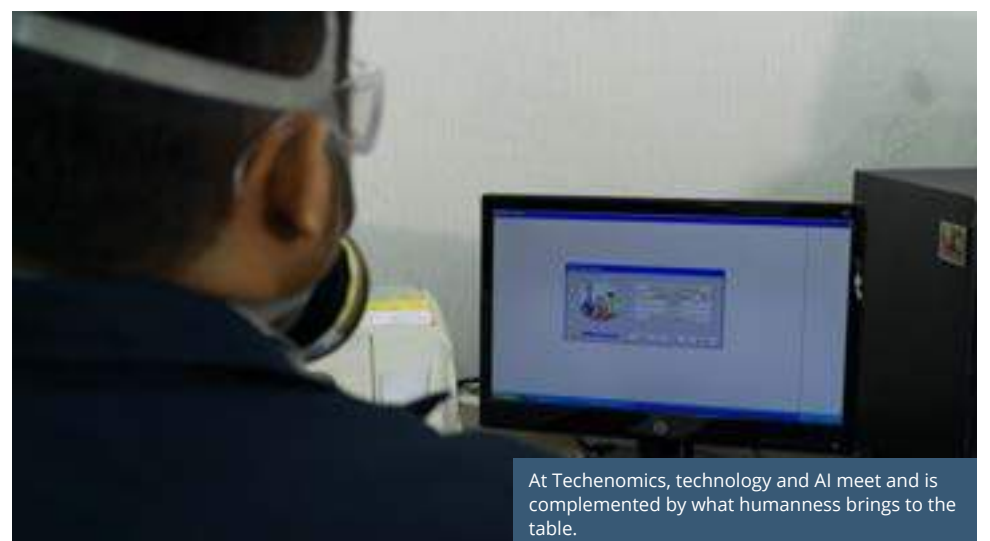
But in this climate, and with AI technology now "marching down the road", as Chris puts it, nothing is off the table.

Not if it means a tailored and condition-specific offering for customers around the world. **AMR**

SOURCE
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Kiky Millar
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Fluid analysis provides data to be collected and then analysed, to enable advice on the health of the equipment to be provided, as well as what may be necessary to ensure long life and make sure no breakdowns occur.



At Techenomics, technology and AI meet and is complemented by what humanness brings to the table.



"SGS have provided excellent service whilst attending to our Transformer oil maintenance and monitoring. Our remote location has never been a problem for SGS who have accommodated our requirements." Simeon, Argyle Diamonds

Ensure Peak Performance

With over 40 labs in Australia, SGS Australia is constantly looking beyond customers' and society's expectations.

Reducing downtime has never been more important with the reliance on machinery stronger than ever.

SGS's Oil Condition Monitoring Services ensures all mining equipment, whether mobile, fixed plant or transformers, operates at peak performance.

As a NATA accredited laboratory, supported by local and global expertly qualified diagnosticians, SGS provides the most comprehensive report and diagnoses of oil and coolant with a clear recommendation.

As equipment is at risk with even minor changes in oil conditions, oil monitoring can prevent downtime and costly repairs.

SGS's lube oil laboratory provides comprehensive trending of results and reports which can be used as foundation to both predictive and proactive maintenance strategies.

The company's field technicians are also able to provide onsite transformer oil sampling and conduct oil filtration as per ASTM procedures.

Routine oil and coolant monitoring ensures:

- Equipment performance and reliability evaluation.
- Major equipment failure avoidance through early detection.
- Budget forecasting by anticipating repairs, downtime, equipment life

and replacements.

- Complete equipment service history.
- Downtime scheduling to suit operation workload.

SGS services clients nationally, backed by global expertise with fast turnaround times starting from 48 hours for OCM and from five days for transformer testing.

Rapid turnaround time is available upon request. All reports are available via an online data base tool for efficient, regular feedback into your maintenance.

SGS is the world's leading inspection, verification, testing and certification company. SGS is recognised as the global

benchmark for quality and integrity.

With more than 89,000 employees, SGS operates a network of over 2600 offices and laboratories around the world.

It is constantly looking beyond customers' and society's expectations in order to deliver market leading services wherever they are needed: working together to make the world a better, safer place. **AMR**

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NATA accredited laboratory No. 2562

WHEN YOU NEED TO BE SURE



Accurate Weighing on the Front Line

COMPULOAD front end loader scales are fast gaining a reputation for accurate weighing in extreme conditions.

Applying the principles behind load cell temperature compensation, WA company Instant Weighing has found a way to better compensate for the temperature changes that scales on the front end loaders experience during 24-hour day operations.

To demonstrate the accuracy, Instant Weighing director Graham Sidney provided comparisons of load weight as provided by a NW customer.

"In this example, the front end loader is parked up while waiting for the next road-train to arrive, as each road-train driver loads themselves," he said.

"The front end loader hydraulic oil therefore cools down.

"Our client obtains the load's weight using the COMPULOAD scale to load their four-trailer road trains to haul ore some 500km to port.

"The second load weight is obtained by the port authority as they both load and survey the ship, and the following comparisons of weights were recorded and reported to us by our client."

In the first shipment, the COMPULOAD scale recorded a total weight of the ore transported as 18,800t.

"The port authority recorded a difference of just 37t. That is an error of just 1/5 of 1%," Mr Sidney said.

In the second shipment, the COMPULOAD scale recorded a total weight of the ore transported as 20,070t.

"The port authority recorded a difference of just 48t. That is an error of just 1/4 of 1%," Graham said.

"COMPULOAD's ability to temperature compensate has saved our customer substantial wear and tear of their equipment and expense while fulfilling their contracts."

The COMPULOAD 6000 scale can be programmed with specific target weights for each individual identified axle group to stop the operator overloading.

The scales also have the optional ability to electronically transmit the loaded weight data back to the office PC provided the front end loader is working within either WIFI, 3G or 4G transmission areas.

SOLAS/AMSA Scale Testing Laws

Mr Sidney said Instant Weighing is also heavily involved in the testing of various existing scales and also supplies new scales that are used to determine the Verified Gross Mass (VGM) of an export sea container for SOLAS/AMSA weighing purposes.

"Only certified test masses can be used during the AMSA testing process. SOLAS/AMSA audits have become very stringent,



and our test procedures and written reports have always passed when the AMSA Inspector has conducted an audit," Mr Sidney said.

The AMSA laws state that the scale used to determine the VGM weight of a container to be transported on water, does not have to be a "trade approved scale" but must be tested as if it was a trade approved scale for that type and capacity scale.

"Trade Approved scale testing is a very complex set of rules. Both the National Measurement Institute (NMI) testing rules must be followed and NMI Regulation 13 certified test masses must be used according to the NMI testing rules," Mr Sidney said.

"Our calibration testing services covers the area of WA, from Esperance to Derby, and Instant Weighing visits these areas at least yearly or as and when required."

Mr Sidney also encouraged users to utilise the Federal Government instant asset write-off provisions.

"Instant Weighing is an Australian owned and operated company. And when the option is available, why not be patriotic and put Australian companies and products at the top of your list?" AMR

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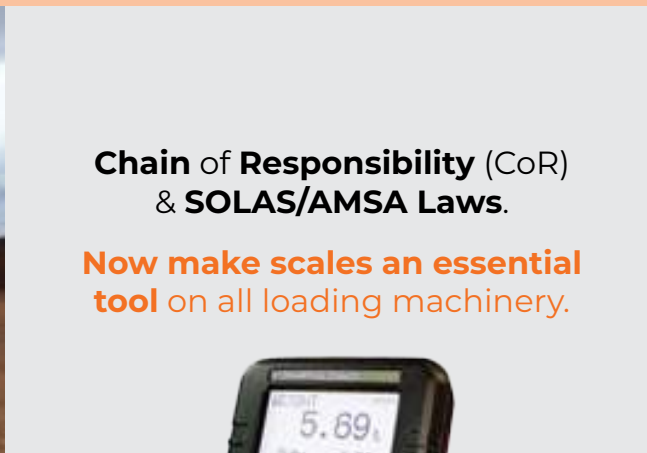
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Virtually the Best

Virtual Reality has become the industry standard for education and training within mining and resources. It's likely you already knew that.

What might come as news to you, is that the global leaders of industrial VR training production are right here in Australia. Perth, to be exact.

As Occupation Health and Safety regulations continue to tighten, and become increasingly complex, VR is the key to maintaining simplicity for mining workforces and operational stability.

Never was this made more apparent than through the swift change brought about by coronavirus. The need for remote training shot up rapidly.

Thankfully VR rose to the challenge and propped up production in the industry, by bridging an isolated workforce with continued training and operations.

Core Benefits of VR in Training

There are three advantageous principles underlying the rise of VR in mining training and education;

- the elimination of risk
- reduction of cost
- an increase in efficacy

The Australian Mining Review spoke with the Technical Director of Viewport XR, Brendan Ragan, about immersive technology and the company's vision for the future of training.

Making a Scene

In 1938, French visionary Antonin Artaud described theatre as "la réalité virtuelle." However, the English term "virtual reality" wasn't popularised until 1987.

It was coined by tech visionary Jaron Lanier, who has been a pioneer in the field of virtual reality, and computers in general.

One could argue that the augmentation of reality has been happening since early humans drew on cave walls. The dawn

form signified real life beings, who were not actually on the cave wall. Though things have come a long way since then.

We are now reaching the crest of the real impact VR will have on our lives and for the purposes of this article, the mining industry. Or, if we're going to get granular, training within the mining and resources industry.

Understanding the importance

Lanier believes:

"If there's any object in human experience that's a precedent for what a computer should be like, it's a musical instrument: a device where you can explore a huge range of possibilities through an interface that connects your mind and your body."

Bearing in mind that we interact with VR through computers, we can draw from this quote that virtual reality is an optimised form of enrichment that computers will bring to our human existence.

Consider Lanier's thought that "information is alienated experience". It follows then, that to effectively absorb information, it should be united with the experience.

Let's take a simple and natural example: a spiky cactus. We know which plants not to touch, as we have all been pricked. This is part of the safety training we do as growing humans.

Well, what do you do when the stakes are much higher, like on a mine site? You can't simply recreate a life threatening disaster to teach someone what to do in such a case.

Increase Efficacy

Efficacy is, more or less, a fancy way to say "efficient". In our context this means many things: more knowledgeable workers, increased production, reduced downtime, among a pile others. Though, how does that come to be? And what does it mean on-site?

It is a well-known truth that training in VR activates a greater portion of our brains than spoken or written content does. One major

contributor for this is the muscle memory learnt, or, the neural pathways formed that optimise the retention of information.

This is a widely understood concept, that the more you do something the better you understand it. In other words; practice makes perfect. VR training empowers your team with the ability to master their craft.

The way we interact with a space has a vast impact on efficient learning. As Tim Massey of Vicon told mining.com;

"You can be in a different scenario just by changing the setting. [It] has emotional impact - which is hugely relevant in building an effective training experience."

In the journal, Multimedia Tools and Applications, David Checa and Andres Bustillo conducted a Review of Immersive Virtual Reality to Enhance Learning and Training. It was found that trainees displayed retention rates of 80% one year after their training.

Why is this significant? Because the one year retention rates for non-immersive learning were only 20%. Virtual reality amplifies retention rates by 400%. Yes, you read that right.

Remote training in VR encompasses entire teams: from ground workers, to supervisors, to managers, to upskill on digital twins of real world plant environments. It enables teams to hone their skills, prior to even stepping foot on site.

The optimisation potential for hiring managers is significant. Forbes confirms that VR technology "will help companies understand their employees' satisfaction, engagement, and empower employees to reach their full potential".

This empowers the workforce through the ability to identify cross operational employee skill sets.

The Viewport team created a VR app to

provide meaningful engagement at a distance, for miners and their families who felt isolated through the coronavirus pandemic. It was an uplifting experience that kept everybody safe.

2020 was tough on everyone, and workers at Rio Tinto's Tom Price Mine were not exempt. As part of the company's meticulous effort to uphold safety standards, Rio Tinto's annual Family Day was another luxury that had to be foregone in 2020.

"We seasoned our high end tech with some lo-fi touches. The user interface (UI) was simple and intuitive - always a top priority at Viewport," Brendan said.

"In this instance it served to create a personable feel to engage people of all ages. "Any item can be created in a virtual world, size is no barrier. Our process creates a visual flow that is intuitive and easy to use, taking the guesswork out of the user experience (UX).

"We made a digital twin of the mine site and recreated it as a cardboard diorama. Then we put this cardboard copy (carbon is so outdated) into a VR app.

"Instead of bringing families to the mine, we put the mine into families' pockets. Now they can take their loved ones everywhere." The Rio Tinto Family Day app gave a closer look at the days of six miners, using 360 video, 3D visualisation, and the personal touch of good old workplace friendships.

Overlaid on a map of the mine site, cartoons of the six miners were used as reference points to the daily activities, in an informative yet entertaining manner.

"We achieved this interactive experience utilising 3D and gaming engine software, utilising the immersive stereoscopic 360 video content for a powerful end result," Brendan said.

Michael Casale, Chief Science Officer of Strivr, explains how businesses can use data



Viewport has created many VR tools for the mining industry.



Virtual reality enables workforces to explore high-risk scenarios and evacuation procedures in digital twins of real world sites.



The Rio Tinto Family Day app gave a closer look at the days of six miners, using 360 video, 3D visualisation, and the personal touch of good old workplace friendships.

learnings from VR software:

“you can make better people decisions that ultimately affect large-scale business objectives at the highest level.”

“We can build in the ability to record every learning session, creating analytics and capturing test scores. Businesses can then leverage these analytics to inform strategic shifts in their training flow,” Brendan said.

Reduced Cost

Virtual reality offers a greater degree of immersion than other training modalities and does so in an extremely cost efficient manner, with year-over-year spend seeing noteworthy reductions, as the workflows and objectives are streamlined.

Viewport created a “Hazard Identification” training platform for a leading petroleum exploration and production company, modelled on one of the largest sites in Karratha using stereoscopic 360 video captures.

It allowed staff from all over the world to train in a real world plant environment, avoiding the danger (and potential expense) of untrained personnel in a live plant.

The simulation recreates unsafe scenarios such as leaks, contamination, high temperatures and trip hazards. These sorts of risks cannot be replicated in real world settings without considerable expense.

Viewport has the mining industry expertise and insight to quickly and efficiently build cost saving VR site inductions that can revolutionise the way a company onboards teams.

As Jaron Lanier said: “Software breaks before it bends, so it demands perfection in a universe that prefers statistics.”

At Viewport, after a piece of software passes the development stage, it goes through rigorous quality assurance. Only then, is it ready for deployment.

Although KPIs within training modules may evolve and need to be altered, the software itself remains robust. This is because when built effectively, training experiences retain the capabilities of customisation.

This means you can add, subtract and alter functionalities of your virtual world, yet the world itself will not be affected. Furthermore, it means that your tactical optimisations will not cost an arm and leg.

The journal Mining, Metallurgy & Exploration asserted the reduced manpower costs with the following:

“the increased engagement can also improve participants’ experiences and maintain higher accuracy, because boredom and disinterest have the potential to confound behavioural results just as severely as poor training or technical errors.”

This is to say that increased engagement gives better results, meaning that users can simply repeat their training infinitely, at no extra cost. Though it is unlikely they would have the need.

VR training content can also be utilised further down the pipeline. It can be put to use after the fact; in ways aside from the obvious; ongoing and future training.

Learning modules can be leveraged via on-demand learning, shareable videos, and consumer engagement. Virtual training experiences attract audiences, plus they are always live and instantly accessible.

The University of Nottingham conducted a study on health and safety training in virtual environments.

It found the tangible benefits to business to be numerous and worthwhile. Broadly researched and undertaken with industrial partners, some of the advantages of VR training over legacy formats were:

“[The] opportunity to conduct OSH induction sessions remotely, reducing the

costs associated with on-site training and with delays while waiting for new starts to be trained.”

The ability to deploy remotely to trainees all over the globe was previously touched upon. When Forbes addressed this, they did so with their sights set on the pay-off remote education could deliver:

“PowerPoint-over-Zoom just does not have the impact necessary to create lasting behavior change.”

The necessities of remote learning preceded the disruptive learn [or work] from home impositions of the pandemic. It has long been the case that managers and their teams needed remote learning solutions to “transcend two dimensions”.

“Let’s use the capability to train on equipment that is logistically inaccessible as a test case,” Brendan said.

“Not only do you need professional supervision, there are hidden costs that accompany already exorbitant travel and accommodation expenses.

“That’s leaving aside the headaches of securing the usage of said equipment. As in the majority of others, usage of VR for training in industrial settings reduces cost and complexity.

“We can sensibly wrap this up by addressing the time and resource vacuums that is site-induction. No one genuinely enjoys them, certainly a business’ bottom line does not.

“VR software that accommodates site and safety training and inductions is an investment that will pay immediate dividends.

Eliminate Risk

When training in hazardous environments and scenarios - for example, authentic blasting experiences - there are significant risks. They typically involve getting workers up to 1000m underground, for monotonous and unengaging formal training.

Virtual reality enables workforces to explore high-risk scenarios and evacuation procedures in digital twins of real world sites. Explosives are expensive and fires are dangerous.

“Let’s address the above blast scenario,” Brendan said.

“You can’t just blow up a whole lot of substances underground repetitively. That would endanger your trainee/s, technicians, and supervisor/s. Constantly subjecting to billowing smoke and flames. Conversely, in a virtual training environment, you can do just that.

“Viewport built a VR training simulation for a leading aluminium producer. We created digital twins of their substations, including relevant tools, equipment and PPE.

“We then integrated these assets with our software development pipeline, and replicated the work process in an immersive world.

“Our team used precise hand tracking technology on the Oculus Quest 2, building multiple options and scenarios for personnel to train on. This allowed Alcoa personnel to train and learn in otherwise hazardous scenarios, before they stepped foot on site.” This pertinent nature of digital twins is highlighted by Forbes:

“Key to the idea of VR-based training are digital twins: exact digital replicas of physical places and things. At their best, these replicas don’t just look like the real world.”

There is strong demand for virtual reality in any industry considered high-risk. This comes as a result of the tactical optimisation of training sequences. VR technology has significantly improved safety and emergency training for the mining industry.

“The main point of interest for training here, is the degree of procedural complexity that tasks can have, once we eliminate the risk,” Brendan said.

94 Virtual Reality Training

TECHNICAL TALK

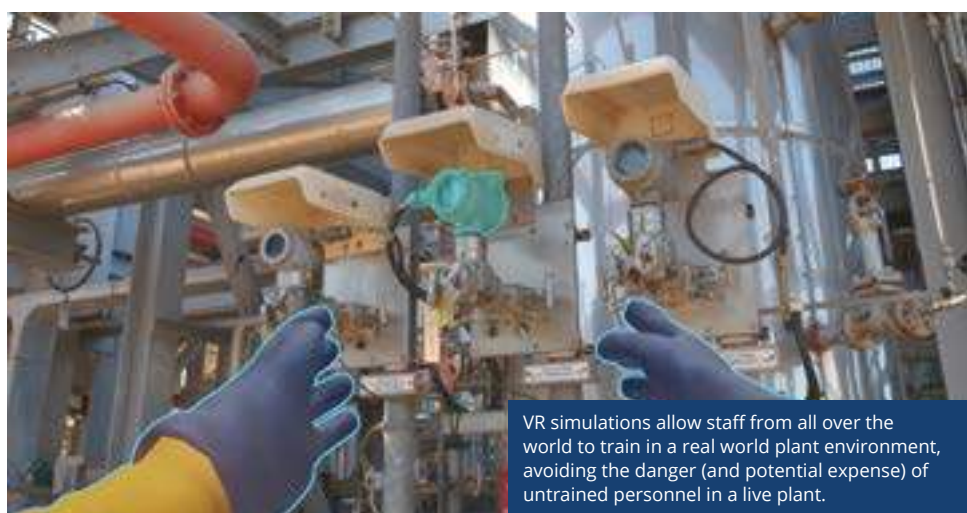


Training in VR activates a greater portion of our brains than spoken or written content does.



AMR MAY2021

With VR, mining maintenance is in the palms of the user's hands.



VR simulations allow staff from all over the world to train in a real world plant environment, avoiding the danger (and potential expense) of untrained personnel in a live plant.



"When done virtually, the training is completely safe and this feeling of safety is what allows trainees to fully concentrate on their learning. The focus this enables is a major contributor to the increased retention rates VR training is known for."

Furthermore, Forbes praised VR's efficiency to facilitate collaborative environments, both remotely, and meaningfully. This means employers can upskill their on-site personnel immediately with remote updates. Even allowing for efficient retraining.

Therefore, if a new piece of operational equipment requires new technical understanding, or safety standards, managers can bring their teams up to speed.

Immersing teams in realistic scenarios, and remotely monitoring their progress. Teams are ready to go as soon as the new equipment is installed or standards implemented.

"Earlier in this article, we addressed the muscle memory, and the usage of digital twins," Brendan said.

"We've yet to touch on the sense of spatial familiarity created by them. This is more to do with worker mindset during a task."

Forbes outlines this notion acknowledging just how realistic these exact digital replicas are:

"Hopefully, even the most tenured employees have never experienced a crisis; with VR, however, employees at all levels can engage in dress rehearsals that prepare them for what crises look like and what their roles and responsibilities will be when responding to them."

This spatial familiarity pays major dividends with reference to productivity and safety. Subsequently, the age old adage of less downtime rings true.

Thankfully, virtual isn't simply for high-

risk industries. Companies all around the globe are using immersive technologies to educate and upskill their staff. While enjoying increased efficiency of training and rises in production.

Future Looking Freedom

It is worthwhile to examine this spotlight on virtual reality's constructive addition brought to the mining industry, with a wider lens.

"One of virtual reality's most liberating, and consequently, important advantages is something we can all agree on. It provides an unbounded space for authentic communication and expression," Brendan said.

Lanier addresses social media platforms, to clarify that mainstream internet is quashing outlets for genuine expression.

"Individual web pages as they first appeared in the early 1990s had the flavour of personhood. MySpace preserved some of that flavour, though a process of regularized formatting had begun. Facebook went further, organising people into multiple-choice identities while Wikipedia seeks to erase point of view entirely. If a church or government were doing these things, it would feel authoritarian, but when technologists are the culprits, we seem hip, fresh, and inventive. People accept ideas presented in technological form that would be abhorrent in any other forms."

One could choose to read the above with the caveat "salt to taste". Lanier offers further context on the topic, by outlining just why virtual reality is so appealing.

"When children are growing up, they face a profound conflict between the internal world of their dreams and imagination, in which everything's possible and fluid, and the practical world in which they have parents, food, and friends, in which they're not alone, and in which they can survive.

So as kids grow up, they have to gradually

de-emphasise this world of imagination and celebration and emphasize the practical world, unless they're willing to be alone in their insanity and completely dependent on others for survival. Of course it's possible to integrate the two, but it's so hard, like walking a tightrope. I think the reason that kids instinctively love computers, and especially love virtual reality, is that it really does present a new solution, a way to make imaginary worlds that we can be together in, just like the real world."

"As readers, we can truthfully appreciate the borderless spaces that virtual reality allows users," Brendan said.

"The ideas of free speech and expression are increasingly challenged in our world.

"While it may not be too close a concern among western society, people are still imprisoned or sentenced to death for singing and dancing in strictly orthodox or extreme nations.

"The technology is a symbol of hope and an outlet of expression that can unite humans around the globe.

"In the realm of training and education, freedom is of utmost importance. The freedom to fail. In learning environments, pupils are often terrified of failing or doing something wrong, meaning that they don't properly take in their task. With the freedom to continuously train and attempt the task, they can achieve outstanding results."

Conclusion

Brendan said that while virtual reality was undoubtedly vitalising industry training, this is only the tip of the iceberg. It will go far beyond learning and hazard awareness.

Viewport has already created sales tools for the mining industry, and we have sights set on the planning and monitoring of mines, even on product development.

"As technologies continue to emerge and enhance our practice, we must embrace the

progress," Brendan said.

"If, while reading this article, you felt a concern that we're going to lose connection to real life, worry not.

"In an interview with the Guardian, Lanier asserted that real life, our world, will always be more important than the virtual ones.

"That priority was always clear to me, virtual worlds can be a part of real life, but this notion that they could be on an equal footing is really abhorrent to me."

"Virtual reality came from humans, so did the technological ideas used to create it. The thought that it is disconnected from who we are, a species, is ungrounded.

"There is so much to come for what the extended realities will bring us. The likelihood is that a majority is not even conceived yet. One thing that is for certain; it's here to stay.

"There is a term applied to the feelings students, trainees, well, everyone gets after a virtual reality learning experience, it's "Positive anchoring".

"Repeated situations and gestures give us sensational reactions. It means that when we practice, we achieve. Our actions result in solutions, and we get a sense of accomplishment.

"It makes our brains happy, so we anchor it positively, and remember it. When compared to learning in a plainly theoretical sense, they are worlds apart." **AMR**

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Great Service For Every Body

CSM leads the way in making it simple, easy, cost-effective and fast for fleet managers across Australia to procure safe and compliant service vehicles.

CSM Service Bodies is a classic Australian success story, having grown from a company of just two people back in 2002, to become a leading supplier of trade service bodies.

The Team at CSM have become specialists in making it simple, easy, cost-effective and fast for fleet managers across Australia to procure safe and compliant service vehicles. They do this by offering a one-stop-shop for everything from service bodies to vehicle accessories.

CSM also offers a national network of certified service centres offering local fitting, warranty repair and maintenance services.

The Australian Mining Review spoke to CSM Service Bodies sales manager Andrew Caton about the range of products, which is fully customisable.

"Once we get beyond a certain number on an order, we can look beyond the standard product range, but it's generally the accessories that we customise rather than body itself, so we add or subtract as required," he said.

"With mine sites, 'a lot of mine sites will run what we call a half open centre, so basically it has a tool box on each side of the tray, but our trays are fully integrated, so it's pretty much all one piece. With that, we'll add shelving, draws and electrical equipment into it, underbody componentry and the like."

Standard stacks up

The company's flagship product, the Full Body service body, utilises CSM's technology and experience to produce a functional,

secure, and aesthetically sound work vehicle solution.

It has been designed for discerning buyers who require reliable top-quality storage and protection for their equipment.

The Full Body includes flush floors for easy and safer loading, lift-up doors on gas struts to provide greater weather protection, and large door openings for increased usable work space. The doors are also recessed for added security and enhanced aesthetic appeal. Additionally, it has unique multi-fit channels for mounting accessories and running them without wiring harnesses.

The integrated roof rails allow for easy accessory mounting and no need for hole drilling on the roof, while its 2mm aluminium construction reduces the weight of the body at the same time as it increases its strength. Every Full Body is 2 Pak primed and paint finished, with colour to match the vehicle.

Heavy duty, ergonomic latching with two point bars adds to the security of the body, while its heavy duty stainless steel piano hinges increase its durability.

The Full Body comes with a three-year or 100,000km warranty with serial number traceability for warranty and spare parts.

As with all of CSM's standard range, the Full Body comes with a huge range of accessories and possible customisations, allowing for the creation of a functional storage solution to suit every requirement. That includes internal drawers, roof racks, underbody draws and more.

The Half Half service body is a canopy that

combines the functionality of a Full Body with the benefit of an open tray area, creating the capacity to transport loose or bulky loads while retaining a functional and secure storage area for tools and equipment.

With many of the same features, accessories and customisations of the Full Body, the Half Half also has an open tray area at the rear for storage of anything including dirty equipment, tools, oil drums and jerry cans.

The Open Centre is just as secure as the previous models, but it comes with the full practicality of an open tray area. Just like the Half Half, it retains the functional, lockable, and protected equipment storage of the Full Body, but it brings with it the capacity to transport bulky items.

Key features include an open tray area in the centre for storage of dirty equipment and tools, and an open centre section for carrying longer items.

The maximum amount of open tray space comes with the Half Open Centre service body, but it too does not sacrifice security in favour of functionality. Instead, it comes with two lockable cabinets in addition to the open tray area and open centre section.

Finally, the Ledge service body is a modified version of CSM's flagship Full Body build that has been adjusted to incorporate a multi-functional ledge at the back of the canopy.

Andrew says each body option comes in a range of formats. "If you look at the Half-Open Centre body, that cabinet length can change in 150mm increments, which gives you more tray if you need," he said.

Accessories For Every Requirement

CSM ensures full functionality for every requirement through its huge range of accessories and customisations.

Gullwing doors comes standard and are known for being strong and lightweight. Recessed into the canopy wall and with reinforced aluminium construction, CSM's service body doors are a veritable barrier to would-be thieves.

The split door is an innovative side door option that sees the door split into two sections with the top folding upwards, and the bottom folding down.

The lower section folds down on chains, laying flush with the service body floor, providing extra work space. The lower door can also fold out of the way when not needed. CSM's bi-fold door is the ideal side door option for enclosed or restricted spaces, as well as roadside work. It is hinged along the middle, allowing it to fold as it opens.

CSM also offers a range of window options, which are available for both sides, and for the front and rear of the canopy.

Window security mesh can be fitted to protect against internal moving objects and increase the security of each canopy. The window mesh is constructed from lightweight aluminium for strength and durability.

Infill panels are an additional accessory designed to improve the canopies' aesthetics, while underbody drawers can be added to provide extra storage space can be accessed from the rear. Each drawer

The Full Body cab includes two gullwing doors and one rear door, LED tail lights, door alerts and buzzer, and internal LED roof lights (EPAC kit).



The Half Open Centre cab includes aluminium Australian-made service Body with large interior capacity, and versatile rear ledge for extra storage options.





The Outback Tray is made of durable aluminium, and includes internal tie-down points, heavy duty headboard, colour-matched paint and LED tail lights.

is secured with two-point latching that can also be integrated with the vehicle's central locking.

Additionally, CSM offers underbody boxes in five different sizes, manufactured from lightweight aluminium and painted to match the service body.

A range of water tanks can be supplied, from small tanks that fit under the canopy before or after the wheels, to larger tanks designed to fit to the underside of the service body in between the chassis rails.

Roof accessories include bars and racks to extend the functionality of the canopy by providing extra storage options.

Rack rollers can be fitted to allow easier access to items that have been stored on the top of the service body. Fitted to the rear of the canopy, they allow tradespeople to slide long or bulky items onto the roof of the service body quickly and easily.

Conduit carriers can also be fitted to racks to provide an easy way to securely store and transport PVC conduit. Ladder accessories include step ladder or extension ladder holders and cable ladder locks.

CSM's range of vents and louvres work to draw hot air out of service bodies while the vehicle is being driven and have been designed to work with CSM's vented cabinet range for the safe transport of gas and fuel. The range includes muller, spinner, pop-up and louvre.

A Look Inside

CSM's huge range of accessories continues on the interior of each service body with

drawers and shelving options including heavy duty aluminium drawers made with rollers and a locking mechanism to secure equipment, and aluminium shelving units that are adjustable and designed to neatly fit parts trays and bins.

Aluminium shelf drawers have been designed as an accessory to CSM's shelving units, fitting into the unit and providing adjustable and configurable parts storage along with the shelves.

The shelving units have also been specifically designed to accommodate plastic micro bins and small parts trays, providing further options for parts storage.

Additional storage space can be added with a roof-hung shelf, parts case cabinets, and light-duty metal drawers.

CSM's range of vented cabinets are approved and certified for gas, fuel, oxygen, or acetylene storage. They are vented through the service body floor and rigged with adjustable straps to secure contents.

Additionally, CSM's service bodies can be fitted out with fridge slides, mesh dividers, vices and vice mounts.

When it comes to electrics, CSM has every requirement covered offering reverse camera and sensor kits, reverse alarms, door alerts, central locking, power inverters, power sockets, and dual battery systems. In terms of lighting, accessories include beacon and mining light bars, high mount LED lights, work lights, and internal lighting.

Other accessories include a range of access steps, grab handles, fire extinguishers,



Some examples of CSM fitouts for emergency service vehicles.

wheel chocks, first aid kits, wheel nut indicators, hi-vis tape, mining flags, and a variety of flooring options.

Cargo restraints include spare wheel holders, gas bottle holders, jerry can holders, and tie down channels and rings.

CSM also offers vehicle option upgrades such as long range fuel tanks, underbody protection and recovery, wheel and tyre upgrades, roll over protections systems, and upgrades to suspension, GVM and brakes.

All In The Design

According to Andrew, CSM is most often called on to design and manufacture bodies for light commercial vehicles but are more than capable of building for specific roles.

"Before we manufacture anything we'll sit down and go through the whole detail of the build," he said. "Design will be involved at an early stage so that they're aware of what we're trying to achieve. Generally, with those sorts of jobs we produce what we call a pre-sales drawing, a rendered image to give our customers an idea of what we're talking about. All of our products are forward-engineered, we don't do any reverse engineering at all."

CSM's expert design process is supported by its investment into a large research and design team, which is committed to getting every detail of each service body right.

When it comes time to build, CSM is well-equipped with a large-scale manufacturing line dedicated to the production of trade service bodies and accessories.

Its production facility has been adopting

lean manufacturing principles for more than a decade, allowing the team to manufacture competitively in Australia.

Its facility has two complete production lines incorporating state-of-the-art machinery and equipment allowing the team to deliver large volume orders to customers nationally and internationally.

About CSM Service Bodies

CSM Service Bodies has been building storage solutions for vehicles since 2012.

Originally established in Warwick in Queensland as Condamine Sheet Metal, it has grown from just two staff members to more than 50.

The team's commitment to providing a combination of function and form has created a distinctive design, which is known around Australia for its innovative versatility and aesthetic quality.

Over time, CSM's products have diversified to meet the changing needs of all tradespeople, technicians, and service-oriented trades.

CSM maintains strategically located service centres across Australia, enabling easy and efficient delivery and fitting nationally. **AMR**

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- ✓ Safety and efficiency, particularly on steep and undulating sites;
- ✓ Zero impact on the site, including the option to sow over existing vegetation for increased diversity and / or vegetation cover on existing areas;
- ✓ Seed handling and processing quality assurance, with the expertise of a seed scientist;
- ✓ Seed treatment and coating technology tailored to your project, to provide:
 - germination succession;
 - germination under favourable moisture conditions;
 - reduced seed loss from predation by insects and other fauna;
 - incorporation of fertilisers and other ameliorants;
- ✓ Conserving our precious native seed resource.

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Drones for Precision Seeding

Traditional ground-based methods of mine site rehabilitation have often involved driving seed-spreading machines over land.

This can take a heavy toll on existing vegetation and soil as well as environmentally sensitive areas and if the coverage needs to be altered in the future, the machines cannot be brought into the area again without causing damage.

Ground-based spreaders will also be inappropriate if the land is hard to access, steep or undulating, which poses safety risks even if the seed were to be applied by hand.

The use of manned aircraft can often be cost-prohibitive and lacking precision which can create expensive problems in the long run.

Sky Land Management has pioneered a new approach to mine site rehabilitation, centering on the use of drones for precision seeding.

The Australian Mining Review spoke to Sky Land Management's managing director Phil Milling about how the company combines the latest drone technology with a holistic approach to land management to provide safer, more targeted, efficient and cost-effective solutions for mining clients.

Zero Impact

The use of unmanned aerial vehicles, commonly known as drones, provides another option when it comes to finding new and improved approaches to mine site rehabilitation.

"It is really about challenging the norms and seeing drones as a different way of seeding that provides multiple benefits," Phil said.

"With traditional methods, once you seed a site, you are best not to drive over it again with machinery because it will damage the existing ground cover.

"We have the option to add more seed to improve cover or species diversity over time if required by flying over the site and having no impact on it."

An issue faced by some clients is they end up having to carry out "thinning" of the vegetation a few years after seeding in areas that have been oversewn.

"They may end up with more germination than expected or dominance of a few species in an area," Phil said.

Sky Land Management takes a different approach because it does not have to complete the seeding in one hit if desired.

"Instead of throwing a lot of seed down and hoping for the best, we can reduce the amount of seed to what we think should be appropriate and improve the process around the seed processing and treatment to give it the best chance of germinating," Phil said.

"Even if down the track, we need to add diversity or increase coverage, or add succession planting we can do that simply with the use of the drone while having zero impact on the site, and it is a lot cheaper than having to go through and thin the area."

It also prevents wastage of native seeds.

Safer and More Efficient

Sky Land Management recently seeded a 16ha minesite in NSW, which had high



Sky Land Management uses drones for precision seeding in minesite rehabilitation.

walls on two sides and was far too steep for ground-based spreaders.

The only other alternative would have been to hand seed, which posed huge safety risks for workers who would have had to walk a couple hundred metres down a steep slope, over uneven ground and carrying up to 15kg of seed at a time.

Cost analysis showed that this would have cost the client approximately double compared with the use of the drones.

Eliminating the need to place personnel either on foot or in machinery on such sites removes a significant risk.

Enhancing precision to the rehabilitation process also aims to reduce costs in the longer term.

"Native seed is an expensive and finite resource, so applying greater precision results in lower costs while conserving a valuable resource," Phil said.

Sky Land Management is fully licenced by the Civil Aviation Safety Authority (CASA).

Holistic Approach

Sky Land Management provides land management solutions that are tailored to the site based on its specific needs.

The company takes a lifecycle approach, which is based on a comprehensive understanding of the end goal, the soil conditions and the seed quality, well before the drones are brought in for the application phase.

A seed scientist oversees a quality assurance process around seed handling, testing, cleaning and treatment.

This determines seed viability and purity

levels, which is used to tailor the right seed mix for a particular site.

"This can involve germination testing and working with the seed scientist to look at the process around how we treat that seed, depending on what the requirements for the site are," Phil said.

"We have got options around different seed coatings so it might hold longer in the landscape.

"For example, it might germinate at a certain moisture, so we have got options to tailor it to get the best result. We can also incorporate fertilisers into the coating so it is directly available to the seed".

"There is a lot of preparation around how the site is presented, and we rely on sound soil testing to look at how we can put seed out in a way that gives it the best chance of surviving."

The team is well qualified to take a holistic approach to mine site rehabilitation.

"We have a background in land management, and one of our consultants specialises in the propagation of native seeds, plus we have the technical expertise of the seed scientist," Phil said.

"We are really looking at the whole picture; you can't just throw seed out there and expect a result."

Phil also has extensive experience in land management, having worked for more than 25 years across all levels of government, mining, agriculture, construction and infrastructure, before establishing Sky Land Management in 2014.

The Application

Sky Land Management uses the latest

drone technology to bring greater precision to seeding rehabilitation areas, reducing waste, costs and environmental impacts.

The latest drone fleet comprises high payload battery powered units—with a take-off weight of 38.5kg.

They are complemented by a revolutionary seeding unit, which provides precision application.

The company remains at the forefront of innovation and is currently doing trial work over a 30ha mine rehabilitation site in NSW to examine different coatings, treatments and application parameters to maximise the potential of native seed.

Tailoring for microrelief areas or different aspects, slopes and/or soil conditions can all be achieved with the precision provided by its fully programmable and autonomous drones.

The drones enable commencement of rehabilitation of areas sooner, in smaller stages rather than having to wait for areas large enough to justify the mobilisation of larger scale equipment such as manned aircraft or ground spreading equipment.

This provides the added environmental benefit of minimising the length of time soil is exposed and therefore subject to erosion and other degradation.

The deployment of the drones can be scaled from small areas using a single drone, through to larger areas using multiple drones flown simultaneously, known as "swarming". **AMR**

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Close-up of coated native seed distribution at mine rehabilitation site. Green = trees; red = shrubs; yellow = grasses and forbs.



The ScOREpion takes automation, high-end design and artificial intelligence to a new level.

Making Technology Work

Automation, artificial intelligence, safety solutions and improved handling are concepts being brought together to create innovative operational realities in the mining sector. Leading the charge in this space is a team of dedicated engineers at Lewis Australia.

For the past 50+ years, the company has developed an impressive worldwide client base and their success has been driven by their commitment to deliver specific solutions. Working closely with their clients, Lewis designs and builds its equipment to suit the operational and environmental requirements and always with operator safety as a priority.

Importantly, these are homegrown solutions! Designed and built in Australia and delivering the highest quality.

Of late, there are three main products which have delivered innovative solutions

to mining companies – all of which have delivered a collective improvement in terms of handling, safety, productivity and quality.

Marcel Geelen is the Sales and Marketing Manager on the Lewis team. He cites these following three products as being game changers in delivering effective improvements in productivity while also improving safety and handling for operators.

Lightening Bolt Ultra Light Weight Tools

As the name suggests, the Lightening Bolt tools have been designed to replace heavy extension tools currently being used for aiding in the removal of Heavy Vehicle wheel nuts.

Traditionally, these tools have been cumbersome to use and are heavy due to the high torques that they must handle.

This results in fatigue and injury for those operating them.

In addressing the problem presented by these heavy tools, Marcel said the Lewis team came up with a solution based around FEA – Finite Element Analysis. That modelling, teamed with "exotic" materials, as Marcel describes them, led to a range of lightweight tools. These tools are safer, easier to handle and attach to the standard guns in the same way as their heavier counterparts.

This meant the team were able to provide extension tools which reduce the weight by around 75%, depending on the torque range. For example, their LB1600, which is used on trucks like the CAT 793 and Komatsu 830E drops the weight from around 32kg to 6kg.

"Once developed, the prototypes were then put through extensive workshop testing to ensure the tools could handle the required

torque," Marcel said. It paid off, with the tools now being used throughout the Pilbara and in the Oil Sands in Canada.

On the receiving end of the greatest benefits of the tool – the improved handling and safety – are the operators on site.

"The operators love it," Marcel said. "They can move the extensions off the workbench and around the Haul Truck wheels with ease."

Due to the lightweight nature of these extensions, they can be used in pits for re-torques, rather than requiring the trucks to come back to the maintenance bays, which minimises downtime and increases production.

Another benefit of being lightweight is that the torque reaction arm can be placed at the nut rather than on the outer rim. This keeps fingers well away from the crush zone.

"It reduces the risk of shoulder and back injuries, fingers being pinched or injured. It also gave the operator more flexibility and control over the movement of the extension," Marcel said.

Marcel said the range of Lightening Bolt tools was virtually endless.

"The range is infinite, because while we have a standard range, we can easily adapt them to suit a new truck or loader," he said.

Mobile Fluid Transfer System

This is a system which delivers a dual benefit for mining companies with an acute focus on safety while enhancing productivity.

Marcel was at the time one of the main project engineers in the development of the Mobile Fluid Transfer System, so this product represents a labour of love.

Blast hole drill rigs require regular filling up with water. For safety reasons, while operators are with in the vicinity of the drill rig, it is locked out. This means the drill is losing drilling time during this refilling procedure. There is the time taken to drag the hose over to the rig, pump the water into it and then drag the hose back, undo all locks and then resume drilling.

This is where Lewis Australia come in.

The robotic Mobile Fluid Transfer System can be fitted to a standard water truck and automatically transfers the water.

Instead of stopping operations, the driver of the water truck remains in the air conditioned cabin, drives up to the rig and starts pumping water.



The Lightening Bolt tools have been designed to replace heavy extension tools currently being widely used the world over for aiding in the removal of heavy vehicle wheel nuts.



The ScOREpion on site.

"These are multimillion-dollar drills, so you want to be able to keep them going to make full use of the asset," Marcel said.

As more and more trucks and drills are becoming autonomous, it is becoming more important to keep operators away from these tasks.

The robot does all the hard work. It scans the surrounds to ensure there are no hazards, and then scans for the filling point on the drill rig. The robot then extends out the water boom, and once connected, the water is pumped.

Aside from the obvious fitting of the robot to the water truck, retrofitting the drill to enable the system's smooth operation is relatively minor, with only a small modification to the filling point.

In the cabin of the truck there is an HMI screen which enables the driver to view the process and see what the robot sees, via a series of cameras mounted to the unit.

The Lewis team have thought about everything, even down to the vibration isolation mounts. The robot base and electronic system are then attached to it. This protects it from the impacts of driving around the rough terrain of a mine site. The

mount itself uses low frequency springs and then inside the electrical cabinet there are extra high frequency vibration mounts, so this enables the full spectrum of vibration to be accounted for.

The robot controllers are mounted inside a secondary box which is dual layered and airconditioned to protect against the dust and heat.

"We have special equipment that can deal with that sort of environment," Marcel said. "It's a cost that no one sees but it will make sure the product lasts and can withstand the harsh conditions it operates under."

Testing for these conditions was conducted in real-world settings, enlisting the site operators as well as gyroscopes and accelerometers for data collection. This would ensure the robot could withstand the vibration, G-Forces, heat and other environmental conditions compatible with what the robot would be subjected to in day-to-day operations.

Now, the system is being recalibrated to explore its application for use in fuel delivery and customers the world over have their eyes fixed on Lewis Australia to see what's next in this space.

ScOREpion: Mobile Blasthole Sampling

This beast of a machine takes automation, high-end design and artificial intelligence to a new level.

Using all three of these concepts to maximum advantage, Lewis Australia has developed a world-leading robot which is retrofitted to an operator-driven truck, and deployed to collect, crush and bag samples from blastholes.

The ScOREpion's two models are mind-blowing bits of gear – and even Marcel is in awe of the capabilities. The Lewis team have other concepts to build on these products.

The machine is a bringing together of reliable traceable sample collection, crushing, bagging, AI-driven scanning, safety measures and precise accuracy.

The current process, which involves operators using a hand-held auger (or sometimes shovels) to collect the ore, is not random and does not provide a true representation of the blast hole cone.

"If you're an operator, doing this all day, every day there is a high risk of shoulder and arm injuries, and exhaustion in the 40° plus conditions," Marcel said.

"On top of that there are numerous tripping hazards near a large hole."

Operators usually only take one sample from each blast hole which does not provide a true representation of the blast hole cone. Rather than taking one sample from each blast hole, the ScOREpion takes a number of randomised samples, puts them through a crusher and splitter and then into a bag. The bag is weighed and labelled with a barcode or RFID tag for accurate tracking and traceability.

"The amount of dirt going back to the lab is the same, but it is now a true representative of the blast hole cone. As it's already been through a crusher, it saves time in the lab as well," Marcel said.

The ScOREpion has an automatic bag collection carousel that can hold up to 24 bags before the operator has to remove them and place in a storage tote on the truck. In terms of accuracy, the ScOREpion collected samples were tested and compared to samples collected using the existing process and a full cone split.

The robot's samples were almost identical to the full cone split sample.

The ScOREpion can use different augers, depending on the type of Ore being sampled. It can even deal with wet samples,

by bypassing the crusher. The auger attachment has a series of sensors on it to enable it to stop and relocate if it hits a rock and the robot can ascertain the depth of the cone it is extracting samples from.

"This prevents the robot from digging below the cone and protects the augers from damage," Marcel said.

"It also operates on a two-metre slide to enable it to move and position itself as needed and provide an extended reach."

Just like the Mobile Fluid Transfer System, the electronic systems are all mounted inside double skinned insulated enclosures which are mounted to the vibration isolation system.

Likewise, the operator completes the task from the safety and comfort of the cabin in the truck. Multiple CCTV cameras relay back to the HMI screen in the cabin so the operator can see what is going on.

Photos of the sample and blast hole cone are kept in a database for tracking and training purposes.

There are a number of safety systems on the ScOREpion, including safety switches in the doors that shut down the robot and crusher if they are opened.

Additional technology and AI included on this machine are the use of smart programming and sensors which can identify any human movement or presence in the vicinity of the robot. With detection, the robot will automatically cease operation.

Understandably, a robot as intelligent and intuitive as the ScOREpion was a project years in the making. Its development grew from a need for consistent sample qualities at the laboratory end of the process.

It was a process in line with Lewis Australia's standard way of operating.

"That is what we do – we are here to deal with issues and find solutions," Marcel said. "We don't have a catalogue as such. We build to meet a customer's specific needs and to their exact specifications."

Marcel added "Lewis Australia's innovative skills lead to the automation of manual processes thought to be too hard." True enough for a company which has built a reputation for "making technology work" for 50+ years. **AMR**

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The ScOREpion takes a number of randomised samples, puts them through a crusher and splitter and then into a bag. The bag is weighed and labelled with a barcode or RFID tag for accurate tracking and traceability.



The robotic Mobile Fluid Transfer System can be fitted to a standard water truck and automatically transfers the water.



Early Detection For Quick Fix

Failure of conveyor systems is a significant problem in the mining industry, causing extended downtime, lost productivity, and increased risk of fire.

The perils of a breakdown make proper detection and maintenance absolutely necessary for even the smallest of components within the conveyor system.

That's where AutoTest's BAMbino conveyor idler bearing monitor is valued highly: it proves that the life of every component can be effectively monitored and that with early detection, maintenance can be carried out without the costs and lost time usually involved in replacing conveyor bearings.

Australian Mining Review spoke to AutoTest managing director David Jenkins about the product.

BAMbino stands for Bearing Acoustic Monitor, and is the world's first portable device that provides accurate, easy and early detection of faulty idler bearings.

It earned an award of excellence in research from the Australian Coal Association, and two Engineering Excellence Awards: the national engineering excellence award for research and development, and the award for innovation.

It is a handheld portable instrument that extracts bearing fault signatures measured from a distance of 0.1m to 3m away from the belt.

A visual and audible alarm provides early notice of bearing damage, allowing forward planning of cost-effective maintenance.

It is a vast improvement on current inspection methods which involve highly subjective assessments without scientific evidence to detect faulty bearings.

According to David the BAMbino came into being after the team was asked to put together a monitoring system on Hammersley's Mt Channar to Paraburdoo conveyor.

"The Paraburdoo conveyor is about 25km long and has more than half a million bearings in it," he said.

Like most systems reliant on bearings, conveyor bearings tend to have a typical bathtub curve, which sees many fail early on.

The rest of the bearings will tend to last between five and 10 years, before they all start to fail again.

Previously, with no way of telling which bearings would be the ones to fail early, it was practically impossible to fix in advance of a system failure.

David said in this instance, the biggest cost of bearings beginning to fail is not the bearings at all, but rather the belt being cut. "It's expensive rubber, but the biggest cost is the loss of production," he said.

"It might cost two or three days of production, which costs hundreds of thousands of dollars in lost time.

"So we wanted to develop a system that could predict an early failure of a bearing, before you can hear or see the failure"

The other issue impacting the Paraburdoo conveyor was its sheer length and the inaccessibility of certain sections, which rendered the traditional method of having an inspector walk down the line impractical.

"We developed a method of acoustically listening to the bearing and then we applied some signal analysis that we had used a lot and worked out a method of grading the bearing into good, bad and ugly," David said.

"The purpose of the device is not to tell you that the bearing is going to fail tomorrow, instead it's about telling you that the bearing will fail in the next few months."

When that has been achieved, the rollers or the conveyor section can be put into a program maintenance schedule, as opposed to having to stop the whole belt to fix the problem as was traditionally done.

Roller sets, typically consisting of three rollers with bearings on either end of each roller, can be removed, repaired, and returned while the belt is still running at a low cost, without the risk of downtime.

However, if a bearing is allowed to fail, it can

cause the whole conveyor system to seize.

"The roller typically stops and the belt will wear that into basically a horizontal knife," David said.

"Ultimately, that will just cut the belt.

"Now it depends on the exact mode of failure, but the alternative is that it ends up as a rotary knife."

All of these problems can be avoided through early detection, now made possible with the BAMbino. The fast and effective handheld tool for predictive maintenance has a simple button operation via tactile membrane keypad with LCD display.

The lightweight device screens out extraneous sources of noise, making it useable in highly reverberant underground tunnels.

BAMbino is reprogrammable for up to 16 belt sections and is easily user-programmable. It also comes with threshold settings, a rechargeable battery and a 12 month warranty.

Most importantly, BAMbino comes with the peace of mind that bearings failures can be detected months in advance and fixed well before it becomes an expensive problem.

Having a Blast

AutoTest has also developed ground-breaking technology in the AutoBlast, which



BAMbino is the world's first portable Bearing Acoustic Monitor that provides accurate, easy and early detection of faulty idler bearings.



The AutoStop Heavy brake performance tester measures average and maximum deceleration, stopping distance, test speed and pedalforce required to stop a heavy vehicle.



The Bambino has a simple button operation via tactile membrane keypad with LCD display, and is lightweight (less than 1kg) yet robust.

AutoBlast is a ground vibration monitoring and logging device.

is a ground vibration monitoring and logging device.

It can be used in various applications such as industrial vibration monitoring, ground transportation traffic vibration monitoring, construction site monitoring, noise, and vibration monitoring in a blasting zone.

It is also useful in the fields of earthquake engineering for monitoring the structures of buildings, bridges, and dams.

Measurement is taken using a packet of velocity sensors, or geophones, and air overpressure level using a microphone, storing the data into a built-in memory storage, which can be downloaded to a computer via Bluetooth.

AutoBlast can be configured to perform a sensor check operation before monitoring starts to ensure the sensors are functioning properly.

Events are automatically recorded when the measurement level of the vibration noise exceeds a threshold value, and alarms can be raised.

These can be auxiliary alarms, such as a light signal or siren, as well as notifications sent by email or SMS using the built-in modem.

Keep Trucking

The team at AutoTest are committed to ensuring every piece of equipment on site is in full working condition.

In addition to the BAMbino and AutoBlast, AutoTest offers a range of other solutions to guard against sudden equipment failure.

For example, AutoTest's AutoStop Heavy brake metre is a decelerometer designed to test service and emergency brakes of heavy and slow-moving vehicles, off-road vehicles and even forklifts used in the transport and mining industries.

The electronic in-vehicle brake-testing device is fully compliant with Transport Authority requirements.

Portable and user friendly, AutoStop Heavy brake performance tester measures average and maximum deceleration, stopping distance, test speed and pedal-force required to stop a heavy vehicle.

Once the vehicle has come to a stop, the brake tester evaluates the brakes' performance and prints the results of the test.

AutoStop Heavy comes with a data logging facility that allows stored tests to be downloaded to a computer for storage and analysis.

It is capable of providing physical evidence of brake performance before and after any vehicle alterations, which mitigates risks.

The AutoStop Heavy's capabilities can be extended through the use of NetBrake, which is a database and brake test reporting

software that assists the mining and heavy vehicle industries in Australia to manage brake test records, as well as brake test standards and calculations for fleets.

Finally, AutoTest's combined AutoGas Five Gas Analyser and AutoSmoke Opacity Meter have been designed as user friendly analysis tools designed to improve how the gas efficiency of a vehicle is measured. Both are distributed throughout Australia and are suitable for both light and heavy vehicles.

Battery operated, they measure the contents of the exhaust gas and assess the efficiency of a vehicles ability to reduce the amount of pollutant gases being released into the atmosphere.

The combined device includes a built-in wireless connection between the AutoGas Five Gas Analyser and AutoSmoke Opacity Meter. Smoke tests can be carried out using a computer connected to the Gas Analyser, which provides easily read, onscreen measurement data.

About AutoTest

AutoTest was founded in the early 1990s as part of VIPAC Engineers and Scientists.

The idea behind its foundation was to commercialise intellectual property developed out of the consulting business, however, AutoTest branched out on its own in 2000 and since then is a truly standalone operation.

It is now an award-winning Australian made and owned manufacturer and distributor of state-of-the-art automotive testing and diagnostic products based in Kensington, Victoria, possessing ISO 9001 Quality Management System accreditation.

AutoTest's products have been designed to provide many years of reliable testing and have been built from durable quality components.

Its products are currently used by garages, workshops, regulatory authorities and service testing stations.

AutoTest supplies directly and through a network of international distributors across Australia and the world.

Its development program ensures the consistent launch of innovative, new products to meet industry demand, from BAMbino to AutoStop and everything in between. **AMR**

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The lightweight device screens out extraneous sources of noise, making it useable in highly reverberant underground tunnels.

Keep Your Cool

The use of cooling towers is widespread on modern mine sites. Their application ranges from the cooling of process liquids in mineral processing to cooling ventilation air and everything in between. In a Niagara Wet Surface Air Cooler, unwanted heat is removed by passing the hot medium through a bundle of tubes, over which flows a constant stream of air and water vapour.

Cooling is achieved by the evaporative effect of the water absorbing heat from the tube's surface as it changes state from a liquid to a gas.

While this might sound as simple as a home evaporative air conditioner, in an industrial application, there are many other factors to consider such as maintaining separation between the medium being cooled and the water/air mix of the cooling circuit, the most efficient design to optimise the cooling effect using minimal energy and fresh water inputs and having the flexibility to create a custom solution to achieve all this for a specific site, with a specific cooling requirement and a limited range of input options (such as water supply).

The Australian Mining Review recently spoke with Alfa Laval's business development manager, Neil Wissemann, about new technologies being introduced in Australia to dramatically improve water, sustainability and cost outcomes in cooling tower requirements for heavy-duty industries such as mining. These technologies have been used internationally and locally over many decades with overwhelming success and are well suited to the Australian environment.

Niagara WSAC®

Established in Australia since 1926, Alfa Laval specialises on three key technologies: heat transfer, separation and fluid handling. All three have great significance for industrial companies and Alfa Laval holds leading global market positions within its fields of technical expertise.

The company acquired New York-based manufacturer Niagara in 2014 and incorporated the company's products in its market leading range of heat recovery and heat transfer technologies.

The Niagara Wet Surface Air Coolers (WSAC®) are efficient closed-loop, evaporative cooling systems designed for heavy-duty industries such as power, mineral processing, refineries, wastewater facilities, oil and gas and petrochemical industries.

Originally designed in the USA, the Niagara system has the ability to cool a broad range of fluids and vapours, including wastewater, effluents, oils, glycols, hydrocarbons, drilling mud, supercritical carbon dioxide, nitrogen, vacuum steam, ammonia, hydrocarbons (propane, ethane, propylene) and refrigerants.

Perhaps one of the Niagara's most environmentally and economically significant benefits is its capacity to utilise low grade and even wastewater as a cooling medium.

Rather than requiring fresh or scheme water for cooling, the WSAC® allows the cooling tower to be designed and engineered to operate with the by-products of RO systems, treated sewage water and even salt water if required.

This represents a significant saving to mining operations who frequently have a shortage of clean water on site and who may even have to pay to have wastewater carted off



The Alfa Laval Niagara Wet Surface Air Coolers (WSAC®) for fluid cooling and vapor condensing are efficient closed-loop, evaporative cooling systems designed for the power, process, wastewater, natural gas, mining and petrochemical industries.

site for proper disposal.

Early Engagement

Alfa Laval emphasises the benefits of its early engagement with proposed cooling tower projects because the Niagara platform allows it to tailor a design that works for a very specific requirement.

The engineers can visit a site, engage with the client, assess the cooling requirements for a given fluid and then engineer a solution that uses the available water on site – however harsh or unconventional it may be – and match that to an energy efficient tower to create a solution that not only works well but offers a very high ROI thanks to associated potential cost savings on site.

Degrees of Separation

Neil says that Alfa Laval's Niagara cooling towers incorporate a physical barrier between the evaporative air and coolant and the process medium being cooled.

"With a standard cooling tower, the large, constructed pieces of equipment that spray water down over the fill or structure, using the evaporative cooling of the surrounding air, however this water and air can contain solids, dust, grime and highly saline fluids," he said.

"Designers will typically design heat exchangers in between the cooling tower and the rest of the plant processes.

"We service a niche application in the closed loop cooling tower or evaporative tower and we integrate heat exchangers with cooling tower structures into one unit, rather than separate units at mine sites."

Available as either small packaged, modular or large field-erected WSAC® systems, the team of project engineers provide custom solutions – from design to commissioning, from tube bundles to electrical controls as well as ancillary components – to maximise performance of a site or plant's cooling requirements throughout the lifecycle of the equipment.

How it works

Hot process medium flows through prime surface tube bundles and this medium is then cooled by the co-current flow of air and spray water on the outside of the tubes.

Recirculating recycled water is pumped up to the spray system which is mounted above the tube bundles and distributes water over

the tubes at a high drenching rate. The high drenching rate is important as it helps to keep the heat transfer surface cleaner for longer.

The unique Alfa Laval wet surface technology used in the Niagara cooler system is based on evaporative cooling, where cool air is drawn down over the tubes by fans.

Spray water flows downward in a co-current direction with the air which sets up a continuous film of water over the tubes.

The heat from the process fluid inside the tubes causes some of the water to evaporate.

The air and water vapour stream makes a 180° turn, removing free water droplets by gravity separation. The vapour is removed by fans.

Unevaporated water is collected in the basin and pumped back to the top of the unit to begin the process again.

As a closed loop system, there is no risk of contaminants entering the process stream. The system also entails no fill, meaning the tube bundles are 100% prime heat transfer surface.

The WSAC® can reach much lower outlet temperatures due to its direct evaporative cooling, compared to a cooling tower-plus-heat exchanger combination.

Its water-consumption is several times lower as the same spray water can be reused up to 10 times. The use of bare tubes, a large spacing between the tubes and the absence of tower fills allow for dirty wastewater to be used as spray water.

The WSAC® can also guarantee significantly lower outlet temperatures the whole year round, even during the hottest summer months, compared to a dry air cooler, while using a much smaller plot-space and having a much lower power consumption.

Benefits

The Alfa Laval Niagara WSAC® combines high efficiency maximum performance, low operating costs, compact size and reliable operation for sustainable alternatives to cooling tower systems and air coolers.

The Australian mining industry now has access to this unprecedented cooling capacity for increased production and

processing output in their heavy-duty industrial applications.

Renowned for their robust design and minimum life cycle and maintenance costs, the benefits of the Alfa Laval Niagara WSAC® in liquid and gas cooling as well as condensing are:

- the coldest possible process outlet temperature
- increased water conservation due to higher concentration cycles
- low quality water can be used as makeup
- compact footprint
- lower parasitic energy (HP)
- competitive installed cost
- minimal maintenance required
- less drift

FlexWater

One of the innovations Alfa Laval developed to keep life cycle cost to a minimum while maximising cooling performance is FlexWater.

This feature allows a WSAC® system to operate on recycled water of low quality such as blowdown water, wastewater or effluent – quality that is much lower than what is required in a standard cooling tower.

The high drenching spray water flow, nozzle design, bare tubes, wide spacing between the tubes and absence of cooling tower fill prevent debris from getting caught, falling through the heat exchanger and collected in a pump screen at the bottom.

This makes it possible to re-use the spray water up to 10 times, sometimes more.

The result is much lower freshwater consumption and lower maintenance costs compared to a cooling tower.

Examples of FlexWater used in the cooling water recirculation include fresh water, sea water, treated effluent, reverse osmosis reject water, brackish water and wastewater. "One big advantage of interest to Australian mine sites is that you can use fairly low quality water sources as the evaporative medium," Neil said.

"Australian mining customers use about 4% of total water consumption in the country, which is relatively significant as most of mine sites are in areas where water availability is very poor.

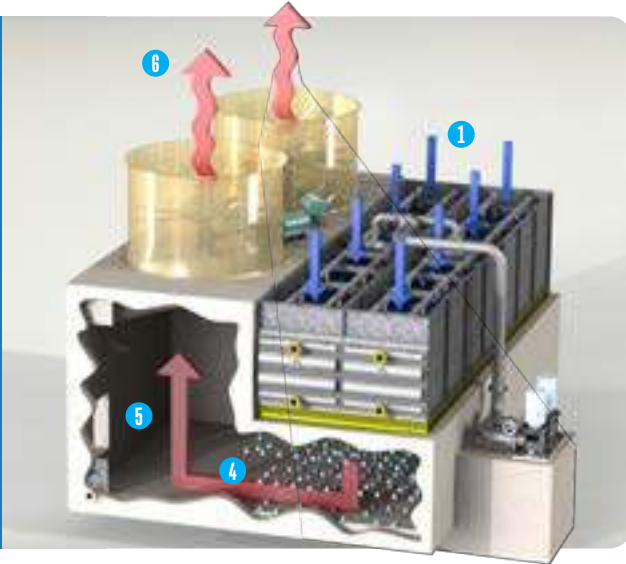
"Mine sites utilise bore water facilities or



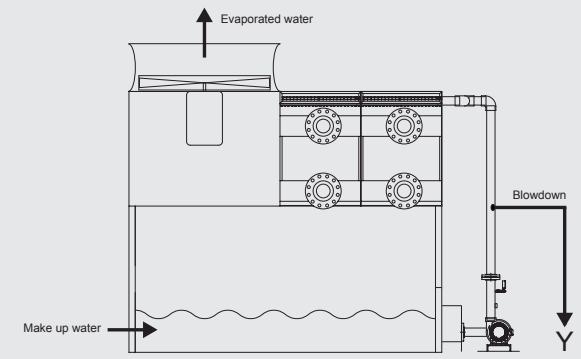
The WSAC® system is tailored to customer specifications for inlet and outlet temperatures, as well as worst case ambient conditions, and come as either small packaged, modular or large field-erected systems.



1. Air is induced downward over tube bundles.
2. Water flows downward along with air.
3. Heat from the process stream is released to the cascading water.
4. Vaporisation transfers heat from cascading water to the air stream.
5. The air stream is forced to turn 180° providing maximum free water removal.
6. Fans discharge air vertically at a high velocity to minimise recirculation.



Water saving benefits: as compared to cooling tower water costs, the WSAC® system provides significant savings in operating expenses.



Cycles of concentration in a WSAC
 Evaporation (GPM) = Heat Load (Btu/hr) ÷ 500000 (same as CT)
 Blowdown = Evaporation / Cycles - 1
 Total makeup = Evaporation + Blowdown

reconstituted water and, very frequently, large reverse osmosis style systems to produce freshwater which they can either use for cooling or offsite usage as well.

“The difference with our system is that you can utilise very poor quality water sources, such as bore water directly into the Niagara system, even reverse osmosis concentrate (the by-product) as the cooling medium.

“We’ve produced systems that can use a variety of cooling mediums, even sea water, and all we did was determine the construction materials to use on the Niagara system itself.”

Efficient cooling – water on tube and no tower fill

Alfa Laval’s efficient and effective cooling in its systems is due to its unique WetSurface technology, which provides maximum cooling efficiency and the lowest possible outlet temperature.

As hot process medium flows through tubes that are sprayed on the outside with water, the heat is rejected through the evaporation of the water on the tube surfaces.

This evaporative cooling process is much more efficient than convective heat transfer taking place in a traditional dry air cooler.

The Alfa Laval Niagara WSAC® can cool the process medium to lower temperatures, has smaller footprint and less power consumption.

Unlike traditional air-cooled heat exchangers, the tube bundles in a WSAC® are sprayed with water resulting in cooling lower than the ambient air temperature.

The system is significantly smaller, has a lower power consumption and lower output temperature than an air cooler.

“The reason why the WSAC® system is different is that it doesn’t have a fill or structure within the system,” Neil said.

“It’s a blank open basin and the heat transfer happens through the tube bundle which is set on top of this structure.

“Water is sprayed over the tube bundle and into a blank basin, which is why the WSAC® system can work with poor quality water as it doesn’t have a fill or timber structure to power up.”

HybridCool

The feature HybridCool in the Alfa Laval Niagara WSAC® combines wet and dry bulb cooling for minimised water consumption.

The system is fully-customisable to requirements and these hybrid systems allow operators to choose operating mode depending on ambient conditions.

Dry mode can be engaged during cooler weather to save water while wet mode can be activated during hotter months to ensure cooling performance.

The WSAC® system can produce the coldest possible process outlet temperature compared to other technologies.

It operates with a single temperature approach to the wet bulb temperature, making it possible to cool the process medium to a lower temperature than what a traditional cooling tower plus heat exchanger combination could do, which has two temperature approaches.

Design air temperature is at 37.7°C for dry bulb and 26.1°C deg for wet bulb.

“You can achieve the lowest possible temperatures back to your plant without requiring any refrigeration just by using the dry/wet bulb temperature of the air in order to achieve the cooling,” Neil said.

Case Study 1: Darling Downs Power Station

Australia’s largest power station, based in Kogan, Western Downs region in Queensland, is capable of generating 630MW of electricity.

The challenge the Darling Downs power station had was to reduce the volume of wastewater transported off-site by truck for treatment or disposal.

Alfa Laval installed the Niagara wet surface air cooler (WSAC®) wastewater evaporator, powered by scavenger heat to significantly reduce water volume with high efficiency.

The scavenger heat source also provided auxiliary cooling.

The creation of this low emissions facility using efficient, eco-friendly technologies and durable construction materials could also be integrated as part of a multi-stage water concentration and filtration process at the power plant.

Designed for use with high TDS water, the facility also uses the heat available on-site, created by an existing generation process, to power the evaporator and drive further efficiency.

The outcome was that the Darling Downs power station reduced water usage by 97% and emitted 50% less greenhouse gas, compared to a coal-fired plant of similar capacity.

It also reduced the requirement for wastewater trucking by 70%, reducing costs and carbon emissions related to truck transportation.

Mr Wissemann says it was cost exorbitant for the Darling Downs power station to truck their waste fluid to Brisbane.

“The installation of the Niagara system allowed the power station to take their effluent waste from site and use it as a cooling medium for some of their auxiliary systems in the power station,” he said.

“The power station therefore reduced their trucking from site down by about 70% which is a really short payback on the WSAC® system.”

The savings from transportation paid for the evaporator in just one year of operation.

Case Study 2: Salt water and extreme environment applications

Industries along the Red Sea in the Middle East such as oil refineries and cement factories use water from this sea for cooling purposes.

There is extensive demand for desalinated water, with at least 18 desalination plants along the Red Sea coast of Saudi Arabia.

A refinery in Saudi Arabia that required water from the Red Sea for its plant cooling needs found the large salt content of the sea water challenging to work with.

Along with limited water resources in the region, the sea water used caused high fouling and corrosion, making it extremely difficult for cooling.

Cooling towers were traditionally used to directly cool the sea water, which was then circulated in an open loop to plant heat exchangers.

Due to the high amounts of salt, the

exchangers would need to be constructed with corrosion-resistant materials, however the issue of fouling would remain an issue, leading to further inefficiencies and additional maintenance.

The Alfa Laval Niagara WSAC® with FlexWater feature, which allows the WSAC® to operate on recycled water of low quality such as blowdown water, helped the refinery achieve a heat rejection of 169,553,000 BTUH and cooling of 24,000 GPM potable water.

Further outcomes were low fouling, low maintenance, all plant heat exchangers able to be low-cost standard material and no thermal pollution back to the sea.

In this application, potable water was cooled inside the tube, providing closed loop cooling to the plant heat exchangers.

The outside of the tubes was drenched with an open sea water loop providing the evaporative latent heat cooling.

Titanium tubes with all prime surface (no fins) minimised fouling, with fiberglass reinforce plastic (FRP) used for tube bundle casings. The sea water was used at 2.2 cycles of concentration.

About Alfa Laval

Swedish headquartered Alfa Laval is a recognised market leader in the technology areas of solid-liquid separation, heat transfer and fluid handling. Alfa Laval has a presence in 100 countries, 16,700 employees and holds 3,700+ patents worldwide.

The company prides itself of a strong local heritage of 95 years in Australia, with a significant local service and support presence including Service Centres in Sydney and Perth and field service engineers based around Australia to service even the most remote mine sites.

Alfa Laval imagines a world in which less is needed to produce even more. Alfa Laval’s innovative technologies are dedicated to improved energy efficiency and heat recovery, better water treatment and reduced emissions. Alfa Laval doesn’t just imagine the world – it builds the world together with its customers and partners.

IWC Plays It Cool

As mining companies dig deeper underground and venture further afield, it is becoming increasingly important to ensure the work environment is adequately cooled.

This not only creates a safer and more productive environment for employees, but also prevents malfunction of equipment.

Industrial Water Cooling (IWC) is a specialist EPC contractor with a specific focus on evaporative cooling systems and cooling towers.

IWC managing director Roger Rusch has provided The Australian Mining Review with an insight into the company's engineered solutions for a diverse range of mining applications, whether it be for the searing outback or hundreds of metres underground.

Its solutions are backed by decades of industry expertise and include bulk air, condenser, slurry, solution and process cooling towers, as well as side stream filters and chemical dosing equipment.

Bulking Up On Safety

IWC is one of the few providers of bulk air cooling solutions on a global scale and has been at the forefront of developing ventilation and cooling system technology in the mining industry for more than 30 years.

Roger said bulk air coolers maintain temperatures at a safe level for workers, safeguarding employee health and consequently improving efficiencies.

"With rock temperatures exceeding 60°C, it is important for mines to install ventilation and cooling systems to safeguard employee health," he said.

"The company can provide a complete solution – including design, supply and construction – for bulk air cooling plants on an engineering, procurement and construction contract basis."

Its offerings include cooling towers, from factory assembled packages to large field-erected towers, as well as heat exchangers and chillers.

"If we can't mine safely, we will not mine"

This is a core operating principle of Gold Fields and is deeply ingrained at its South Deep mine, one of the largest gold mines in South Africa and indeed the world.

In line with this, IWC was called in to construct and erect a custom designed bulk air cooling tower at the mine, which has a mineral reserve of 38m oz—the equivalent



Bulk air coolers improve efficiencies and working conditions in mines.

of close to 100,000 gold bullion bars—and a mine life of 75 years.

The mine is accessed from the surface through two shaft systems.

One is the Twin Shaft Complex, comprising of the 2998m deep main shaft and the 2947m deep vent shaft.

The second is the South Shaft Complex, which is a vertical system comprising three operating shafts to a depth of 2786m.

The forced draught counterflow Bulk Air Cooling tower (BAC) was customised designed for an EPC specialising in mine ventilation and cooling.

The BAC is a two-cell, 9MW unit making use of a low fouling trickle grid fill with a fibre cement clad steel structure erected above a concrete basin.

Golden Partnership

Howden Africa approached IWC to supply package cooling towers at the ROXGOLD gold mine in Burkina Faso, located in the world-class Birimian Gold Province.

In consultation with Howden's engineers, it was concluded that IWC's FM range of cooling towers would be best suited for the condenser circuit of the surface refrigeration plant.

As the mine is exposed to the harsh African sun, it made sense to use the FM cooling towers as they are produced with non-corroding materials to ensure there is no degradation of the tower over time.

This range of towers is also cost effective, easily installed and maintained.

IWC's FM 248 cooling towers were built in two compact halves for easy transportation in shipping containers, which were shipped to the port of Tema in Ghana, and then transported via road to site.

These robust towers were assembled on site by a local mechanical contractor under the supervision of IWC and Howden.

Alongside the cooling tower order, IWC also supplied a four cell, bulk air cooler, specifically designed for this application.

"We are thrilled to be part of this exciting project and to facilitate Roxgold's goal of becoming West Africa's next multi asset producer," Roger said.

Improving efficiency through filtration

Keeping process-water clean is essential to maximising the efficiency and performance of an industrial cooling tower system.

Dirty process water corrodes cooling tower equipment, reduces heat exchange efficiency, drives up energy costs and leads

to unnecessary water wastage.

Furthermore, unclean water can lead to the growth of microbes such as those that cause Legionnaires' disease.

When water is evaporated from cooling towers to dissipate heat, dissolved solids such as calcium, magnesium, chloride and silica are left behind.

If the concentration reaches a level higher than the saturation point of the cooling tower, the solids cause scale to form within the system, which eventually corrodes the process equipment, leading to reduced system efficiency and the need to replace system parts more frequently.

To reduce the build-up of suspended solids, the cooling tower's process water is flushed out (blowdown) and replaced with fresh water, known as make-up water.

In addition to controlled blowdown, the water is sometimes chemically treated to reduce biological growth.

Used alone, these methods can lead to high water wastage and pollution as the treatment chemicals are released into the environment through the evaporative process.

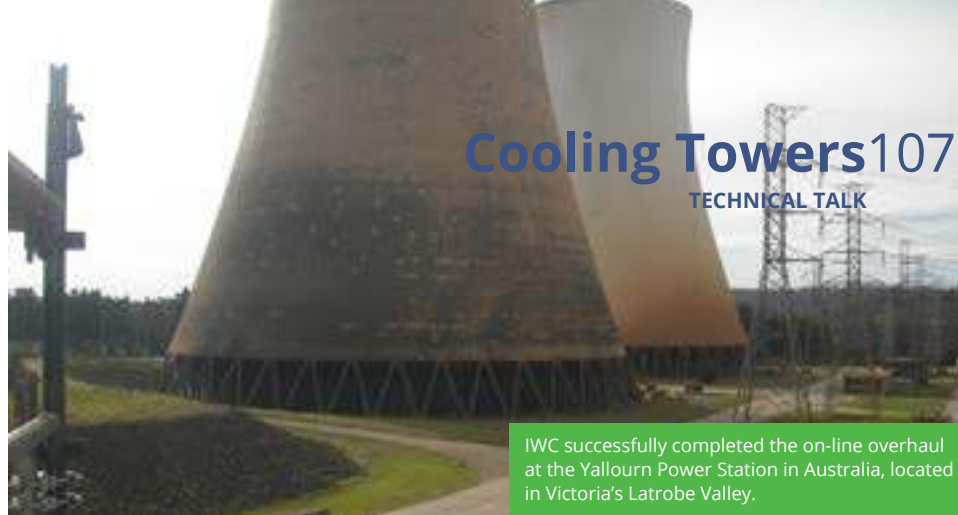
A more effective method to clean a cooling tower's process water is by installing cooling

IWC custom-designed a Bulk Air Cooling (BAC) tower to ensure a safe working environment for staff at the South Deep mine in South Africa.





A compressor cooler supplied to the Gwalia Gold Mine in WA for Gordon Brothers.



IWC successfully completed the on-line overhaul at the Yallourn Power Station in Australia, located in Victoria's Latrobe Valley.

tower water filtration systems, which dramatically reduce suspended solid build-up and cut down on the need for process water to be chemically treated.

"Blowdown is quantified by cycles of concentration, which is the ratio of the concentration of dissolved solids in the blowdown water compared to the make-up water," Roger said.

"It is also approximately equal to the ratio of volume of make-up to blowdown water.

"Using an efficient filtration system combined with filtration technologies such as screen filters and centrifugal separators means cooling tower operators can maximise cycles of concentration, which in turn reduces cooling tower make-up water by 20% and cooling tower blowdown by 50%."

Full flow and side stream filters are two of the most common filtration systems used in cooling towers.

In a full flow system, the filter must be sized in order to handle the system's design recirculation rate and then installed during cooling tower installation, on the discharge side of the pump.

This type of filter continuously cleans all of the recirculating water.

Side stream sand filters are a cheaper alternative to full flow and work by directing water through a bed of graded filter media, usually made up of compounds such as silica, anthracite or garnet.

Side stream filters are often the preferred choice for many cooling systems because they can be installed on an operational cooling tower and they can be cleaned while the cooling system remains online, avoiding the need for downtime.

"A side stream filtration system composed of a rapid sand filter or high-efficiency cartridge filter is particularly useful for cooling systems that are subject to dusty atmospheric conditions," Roger said.

"These systems draw water from the cooling tower's sump tank, filter out sediments, and return the clean water to the tower, which enables the system to operate more efficiently with less water and chemicals."

With the increasing problems of pollution and water shortages, cooling tower operators at mine sites must maximise cycles of concentration, which means more water reuse and, therefore, less make-up and chemical treatment requirements.

"Implementing appropriate filtration systems increases efficiency, reduces downtime, and helps control biological activity," he said.

"Furthermore, it considerably reduces labour costs incurred from frequently draining and cleaning the cooling tower sediments."

Yallourn Power Station upgrade

An efficient natural draught cooling tower is an integral part of any power station.

IWC successfully completed the on-line overhaul at the Yallourn Power Station in Australia, located in Victoria's Latrobe Valley.

The upgrade involved replacing the internals of the No 3 cooling tower, which was 131m high and 95m wide and serviced two generation units.

The thermal performance of the cooling tower was well below that of other towers of similar shell size, due to poor design and failing components.

Both the drift eliminators and the distribution system contained asbestos with significant failures evident on both.

Testing revealed the cooling water flow rate was 15-20% below the original design value. IWC carried out an upgrade which enabled the operation of the two generation units consistently at full load to meet the minimum performance guarantees.

It also involved the removal of all asbestos from the cooling tower, while a new

distribution piping support structure was installed.

IWC designed a fibreglass network of beams to carry the piping as well as an internal walkway system that provides maintenance staff with safe access to each sprayer installed in the cooling tower.

The work had been split into four separable portions to ensure there was no impact on generation output.

The completion of each separable portion consistently yielded an improvement in cooling tower capacity, with the tower exceeding a 100% capacity on completion of the fourth portion.

IWC has completed the on-line refurbishment of 12 natural draught cooling towers to date within the power generation and petrochemical industries and is currently busy with two more.

IWC has a global presence with offices in Australia, South Africa and Africa, and representatives in India and the Netherlands, all offering a range of customised thermal solutions, products and services. **AMR**

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Unparalleled Cooling Solutions

As a specialist EPC contractor within the mining industry, IWC provides numerous unparalleled cooling solutions to customers globally. With clients like Glencore, Newmont, RoxGold and Barrick, we're the obvious choice when it comes to cooling solutions.

Our cooling solutions are widely used in some of the world's biggest and deepest mining operations, and typically include:

- Bulk Air Cooling Towers
- Condenser Cooling Towers
- Slurry & Solution Cooling Towers
- Process Cooling Towers
- Side Stream Filters and Chemical Dosing Equipment



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Tough Dog makes you the toughest in town.

The guys at Tough Dog Suspension (Tough Dog) are passionate about all things 4WD and are committed to investing in the strength and safety of off-road vehicles in the global mining industry.

With mining companies operating in some of the harshest environments on the planet, and vehicle operation featuring as one of the highest risks to operators, mining fleets and vehicles must be specifically designed and engineered to deliver safe performance.

Tough Dog has been “making tracks across the world” since 1984 and has grown rapidly as a result of their commitment to both safety and high quality of their specifically designed and engineered 4WD products.

The Australian Mining Review spoke with Tough Dog’s Fleet and Corporate Manager, Blake Jones, to learn how the company’s Fleet program, Gross Vehicle Mass (GVM) program and tailored suspension packages are supporting mining clients globally.

Tough Dog

As an industry leader in innovative and quality suspension systems for just about every 4WD application, Tough Dog’s products are in high demand across a global distribution network spanning 41 countries including Africa, Russia and the Philippines.

“With 35 years of industry experience and a combined experience of over 100 years, we are able to support global clients in the mining, fleet, government and commercial sectors by providing them with our custom fleet service, gross vehicle mass (GVM) program or tailored suspension packages that can transform a vehicle for any use,” Blake said.

In 2018, Tough Dog took up residence in its new headquarters in Marsden Park, Sydney. Featuring dedicated facilities for Research and Development, Design and Manufacture, and Bulk Production, the new home of Tough Dog marked the beginning of a new chapter in its journey to maintaining their top spot as global leaders in the 4WD industry.

Awarded For Business Excellence

Tough Dog has developed a product to suit just about every possible 4WD application and is proud that each one has been developed on home ground, here in Australia.

“With some of the harshest conditions right here in Australia to test out products, the gear we take to the market, is a cut above the rest,” Blake said.

Tough Dog’s pioneering attitude to R&D has helped it gain industry recognition and lead

the way with several unique products.

“The hard yards and hours perfecting our product range were officially recognised when the Tough Dog 41mm Foam Cell Shock was awarded first place in independent shock absorber testing by Australian 4WD Action Magazine,” Blake said.

“We were also awarded three runner-up positions – the most significant was in the Defence Industry category – and a win in the Western Sydney Awards for Business Excellence (WSABE) in Export category.”

Tough Dog Products

Tough Dog products are specifically designed and engineered to deliver a complete suspension solution, not only for safety and load carrying capability, but for ride quality and handling.

Their suspension kits have been designed to suit a large range of commercial vehicles such as Toyota Hilux, Toyota Landcruiser, Ford Ranger, Isuzu D-Max, Mitsubishi Triton and many other vehicles.

“We offer one of Australia’s largest range of suspension specific products for the fleet and commercial industry which can be tailored exactly to our client’s needs,” Blake said.

Fleet Advantage Program

Tough Dog recently initiated a Fleet Advantage program with a strengthened focus on providing tailored suspension solutions for mining, fleet, government and commercial clients.

“Having had 35 years in the 4WD industry, we identified the global need for better suspension solutions for many of today’s vehicle fleets,” Blake said.

“We initiated our Tough Dog Fleet Advantage program to provide tailored suspension solutions for our clients with market leading three year/unlimited kilometre commercial warranty.”

Tough Dog understands that selecting the right suspension for a 4WD is all about matching the components with both the weight it will be carrying, and the vehicles’ intended use.

“We offer our clients access to an online Build & Buy System, to allow selection and purchase of suspension kits online,” Blake said.

Tough Dog foam cell shock absorber.





Tough Dog strut assembly and upper control arm.

GVM Program

The allowable payload on most modern 4WDs seems great on paper, but this quickly gets eaten up when the vehicles are fitted with bull bars, trays, equipment, and of course passengers.

If a fleet vehicle loaded beyond its factory GVM is involved in an incident, or a component in the vehicle fails as a result of over loading, a business could be exposed to claims of breaches in occupational health and safety legislation or employee negligence.

There is also a strong possibility that the company's insurance protection and vehicle warranty will be void which will result in costly component repair.

Remaining under the manufactures Gross Vehicle Mass (GVM) specifications can seem like a tough task but this is where the Tough Dog GVM program can assist.

Tough Dog provides suspension solutions for owners and managers of vehicles who have a need to carry loads which exceed the manufactures specifications while at the same time meeting practical application and regulatory compliance.

Safety First

Tough Dog puts safety first and undertake rigorous testing on all GVM program vehicles.

"The structural safety of an automobile's suspension is crucial because it plays an important role in the vehicle's safety, stability and handling performance," Blake said.

"We undertake finite element analysis (FEA) to predict the structural performance of our suspension designs and to check the vehicle's factory axles to ensure they can safely operate within the vehicles new GVM."

Brake testing is carried out on all Tough Dog GVM vehicles, both laden and unladen, as well as testing under partial system failure to comply with the Australian Design Rule ADR35/00 which specifies braking requirements under normal and emergency conditions.

Tough Dog also puts the GVM vehicles with ESC fitted through electronic stability control (ESC) testing to ensure that the vehicle's ESC system's response is the same of or better than before.

ESC testing is used by all vehicle manufacturers and major component suppliers around the world to simulate vehicle dynamics for the development and testing of new chassis system components, engines, power trains, drivelines, suspension, and vehicle electronic control systems.

"Safety and regulatory compliance is at the core of our business, we put our products through the same testing programs required by all global vehicle manufacturers," Blake said.

Rigorous Product Design

When it comes to testing, the knowledge acquired in the workshop is just as important as the real-world testing carried out as a part of every Tough Dog suspension product.

Tough Dog use the state-of-the-art Roehrig shock dynamometer to obtain an exact measurement of the forces exerted on the overall system.

"We test our product designs in our workshops for suitability, longevity and heat resistance to give a complete picture of our suspension product's capabilities," Blake said.

"This workshop testing, coupled with real world testing on every road surface, helps us to remain at the cutting edge of 4WD suspension design."

Federally Approved

"Tough Dog Suspension is a recognised Second Stage Manufacturer (SSM) which allows us to develop and federally certify vehicle components and increase a vehicle's GVM," Blake said.

"We can maximise our client's allowable vehicle payload without risking its roadworthiness.

"Each GVM vehicle is extensively tested to ensure legislated compliance is maintained."

Tailored Suspension Packages

Tough Dog offers coil springs, leaf springs and complete strut assemblies.

"In most vehicles, we offer multiple shock and spring options to fine tune every aspect of a particular suspension package as well as a range of other specialised and optional accessories," Blake said.

"The Return To Centre and the 'SV' adjustable



Tough Dog meeting Mine Spec demand.

steering damper are two great examples of the results of Tough Dog's unique thinking when it comes to making the best off road suspension system available.

"The Tough Dog coil springs are Australian made from German X5K spring steel: our coils can be designed with less material while maintaining superior ride quality and load carrying characteristics.

"The result is a lighter, tougher coil that can handle just about anything you can throw at it. Our spring retains its original memory even after heavy loading.

"Not only is our light, tough coil design manufactured using computer-controlled systems, it is also designed for armoured vehicle applications."

Tough Dog also offers leaf springs manufactured from flat bar steel with diamond cut ends which are truly progressive.

"The military wraps and rolled eyes are formed, before the springs are heated to around 1000°C in a gas forge, and hot cambered to the required specifications," Blake said.

"Each leaf of the spring is individually coated

in primer and then coated in high grade sealer enamel."

Complete Strut Assemblies

Assembling a strut unit prior to fitment to a vehicle is the most crucial part of any suspension fit out, and incorrect assembly can lead to premature suspension failure.

"Tough Dog offer their complete range of struts in complete assembly variants at no extra cost as part of their GVM package," Blake said.

The Toughest in Town

Setting up a 4WD suspension system isn't all about the added gains on the tape measure. Setting up a vehicle's suspension can be a mine-field of pitfalls, misinformation and wrong turns.

When it comes to kitting out a vehicle for the toughest environment on the planet, it certainly pays to speak to Tough Dog to find out how they can make you the toughest in town. **AMR**

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Tough Dog products undergo rigorous testing.



Shock Treatment

TJM's high end after-market suspension products are tailored specifically for rough outback and mining conditions.

You cannot argue with physics.

That is the simple but effective principle driving research and development into better load management and handling in light vehicles used in and around mine sites.

James Renou, of TJM 4X4 Equipped, is at the forefront of this space and works with a team of industry-leading engineers spearheading that company's rapid development of high-end after-market suspension products tailored specifically for rough outback and mining conditions.

Speaking to Australian Mining Review, he said that whether it's general aftermarket suspension or GVM (gross vehicle mass) upgrades, the deployment of tailored suspension gear all comes back to the simple premise of equipping a vehicle with the means of handling loads under the conditions it will be operating.

It's physics.

Beyond General OEM Suspension

General OEM suspension, which meets the needs of about the 50th percentile of its market is, for the most part, catering to a fairly wide variation in usage.

Going beyond that, TJM is looking to a market with different needs: needs which are based on load carrying and vehicle usage.

In doing so, the first point which needs to be addressed is that of vehicle weight and the loading a customer will typically want to be able to support.

Then there is consideration of the accessories – how much does that weigh, and what does that mean in terms of weight over the axle.

It's from here that shock absorbers able to deal with these conditions can be developed. James said in dealing with the spring rates associated with these factors, ride height, performance levels, fade, damping capacity, temperature, internal pressure and spring travel were all factors which needed to be considered.

In ride height, TJM generally worked to a 50mm increase.

That, in concert with an increase of 15-20% in shock absorber diameter, contributed to increased performance levels of the equipment when off-road in the outback as well as when towing and load carrying.

"That 15-20% increase is a big deal. It is this which dictates all the geometry and dimensions as well as the piston rod size – which all lends to strength and durability," James said.

"Generally, with an increase in piston diameter comes a reduction in internal pressure. That then leads to a durability improvement.

"When you have lower internal pressures, you have seal life improvements and operating temperature is reduced. Then comes fade resistance. So, in terms of like-for-like input, the amount of time in operation, before reaching the peak temperature that shocks will start to fade out at, is improved."

Of course, there are several factors which can contribute to fade. A reduced amount of oil and surface area is also fundamental, so as that goes up that performance increases. It's about a holistic approach to resisting the suspension motion.

The other focal point, James said, is increase in piston diameter is generating higher damping forces. Where there is a heavy spring rate, the rebound damping required to control that spring rate is generally a lot higher.

Simply put, if you lose damping force through fade, the vehicle will start bouncing around and can become less able to be controlled in terms of its dynamics. To prevent this, targeted piston sizes, along with just as focused valving specifications, are employed to meet the damping force needs and enable the springs to carry the required load.

Further, this needs to be sustainable.

It's uncomfortable and unsafe – particularly if under a high load level or towing – and it is increasingly difficult to predict and control the handling of the vehicle if these needs are not met with gear which is up to the task and will be sustainable.

"If you cannot keep the tyres on the ground, then you'll have all sorts of problems," James said.

"It's why we have general four-wheel drive aftermarket suspension for all of these requirements."

Gross Vehicle Mass Upgrading

Not every vehicle is targeted for a GVM upgrade, however, it stands to reason that once you reach a point where the level of load being carried, is close to, or exceeding, the OEM manufacturer axle ratings, that rating – and the vehicle's axle capacity – needs to be increased to enable the safe and legal use of the vehicle.

Not only that, if suspension is not increased from the OEM standard, and the vehicle is loaded to the maximum axle rating, the chances of reaching the full bump travel, depending on the circumstances, is high.

"If you have any travel there in the suspension, you will be riding on the bumpstops a lot more than they are designed to be ridden on," James said.

Key to mitigating this is consideration of the ride height, the amount of compression and rebound bump travel available, and whether the vehicle will be loaded to its axle rating or greater.

Minimising bump travel means, dynamically, the vehicle will handle on and off-road in a safe manner. It is also important for a safe ride and handling.

"Acceptable travel in compression and rebound is necessary when loaded heavily so you are not smashing into bumps, and then, when at ride height, you need a minimum amount of rebound travel so if going into a corner at speed and the vehicle goes into a roll motion, you're not lifting a tyre," James said.

"If you don't have the right amount of rebound travel in the suspension, you will lift a tyre."

For the most part, James said factory OEM shock absorber open lengths generally will not be enough to meet the rebound travel requirements after lifting the vehicle's ride height and will need to be modified after market.

He said standard to the range being developed, all suspension products were constructed with allowance for a small increase in travel. This applied to both independent, front and solid axle suspensions and was driven by the commitment to safety and performance.

James said for GVM upgrades, TJM worked to a consistent compression travel requirement when at maximum loading of at least two-thirds from design ride height, and a rebound travel requirement of at least two-thirds from design ride height of the original OEM application.

"It's not easy to achieve but the specific spring load rating that exists as a constant load for all suspension kits and that is designed around certain load ratings and is dependent upon the application," James said.

"That is the criteria we are working to."

Light Vehicles in Mining

In looking specifically in light vehicles tailored to mining applications, James cites the two-stage Hilux suspension. These two stages were developed in line with customer and fleet feedback around the discrepancies in ride height and travel which became apparent with inconsistent loads.

The Stage One rating increases the vehicle GVM from 3050kg to 3230kg. The Stage Two kit increases the vehicle's capacity to 3500kg. The stages are defined by the load-carrying capacity: Stage One accommodates for a Hilux which has less load bearing accessories permanently fitted to the vehicle all the time.

The fundamental difference is a leaf spring.



If you cannot keep the tyres on the ground, then you'll have all sorts of problems.



TJM employs real world testing of its equipment.

The 3.5t Stage Two has a 600kg constant load spring, so it is a six-leaf main stage, and two-leaf second stage. With the 3230kg kit there is a six-leaf main stage with thinner leaves, and a five-leaf main stage; and the axle ratings are also lower.

"The Stage Two kit has an axle rating change on the front from 1450kg to 1550kg. This is to account for the full suite of accessories fitted to the front end, for which you generally need to increase the front axle rating to allow for the increase load," James said.

"Then the rear suspension goes from 1700kg to 2 tonnes."

The Stage One kit is basically the OE axle ratings, so with travel, it is a matter of trying to maintain, then, trying to achieve that maintenance of travel with the different loads. This means loading up to 300kg less on a Stage One kit which equates to an increase from 1450kg to 1480kg at the front and from 1700kg to 1750kg at the rear.

That is all based on achieving the minimum travel we are looking for in ride height – whether the vehicle is fully loaded or unloaded.

Responding to Feedback

The development of the stages and the need to tailor these kits to account for travel and load were in direct response to feedback about certain fleet applications and the identification of challenges and anomalies in how vehicles with constant load were responding in the conditions in comparison to those with more widely varied loads.

"We found with certain fleet applications there was a requirement for a way the vehicles are set up to have different load and capacity rating," James said.

"If they don't have the constant load then the ride will be too high."

Feedback from fleet world – namely, customers at mine sites – identified the need for varied setups because one suspension rating was not suitable for all vehicles in the fleet.

For instance, vehicles used to carry tools, equipment and people, that had load on them all the time, had a requirement which was different to others with minimal accessories, and which would be loaded occasionally. The latter could get to the stage where they would exceed the GVM, necessitating an upgrade when that load was carried, but it was not a constant requirement.

Hence, it became a market requirement to have different load ratings, enabling the fleet to be built according to what was required of it on that site.

It was about having the range of products to suit all requirements because one rating was not necessarily going to suit a whole fleet of vehicles.

These are vehicles which are being driven all the time, so they needed acceptable ride quality and a level of comfort based on harsh environments.

Vehicle Variances

While these new stages were aligned, to a degree, to vehicle classifications on site, there were still variances – and overlap – in the application.

Take the Landcruiser 79, which is rated as an NA (light commercial) vehicle when in original OEM condition. However, with a GVM upgrade, and subsequent increase in axle rating, the modified Landcruiser will be pushed to the NB (medium commercial) category.

Classifications and changes within these will vary, vehicle to vehicle.

While a difference between the Stage One and Stage Two HiLux upgrades will not alter classifications on site, a 70 Series LandCruiser (with a GVM rating increase from 3300kg to 3950kg) will change from NA to NB classification, whatever the stage of upgrade.

An NB medium commercial classification will extend to 4.5tonne vehicles. This is followed by heavier vehicle classifications.



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TECHNICAL TALK

ADR testing being carried out.



Minimising bump travel means, dynamically, the vehicle will handle on and off-road in a safe manner.

Testing, Compliance And Approval

ADR (Australian Design Rules) and OEM Manufacturer compliance requirements stipulate that every Stage Two HiLux kit be assessed – this is whether there is any change to ADR requirement or not.

Every change needs to be submitted, with justification of modification.

This is to assess elements such as general braking performance – especially, stopping distance at lightly laden and fully laden, and fade vehicle handling requirements.

James said those ADRs were generally affected with every change in vehicle suspension, as well as weight and height.

TJM engineers, as a result, are required to undertake a complete suite of tests, as prescribed in ADR, to demonstrate compliance. Testing takes place for legal minimum standards, but he said there was also considerably more testing which took place to improve the performance and quality of the product.

Brakes themselves, the testing of parking brakes on a gradient when fully loaded, ESC (Electronic Stability Control), Fade performance and double lane change manoeuvres (overtaking) were elements included in the regime.

The latter of these tests was a TJM-stipulated test which measured the capacity of a vehicle to take a full swerve out of one lane and then swerve back into that original lane under full load while travelling at 100km an hour. While this testing was undertaken by a robot driver in controlled conditions, it was also completed by a real driver to enable the collection of subjective feedback and information about handling which could be paired with hard data measured and collected within the testing.

The rationale for such comprehensive testing is all centred around the changing dynamics of a vehicle under load and varied conditions. And, it all comes back to travel amounts: a vehicle which will top out on compression or rebound travel will compromise handling – and safety.

Testing Equals Quality

Hand in hand with compliance testing is the product and concept development, and prototype testing.

It is all a process of identifying what has been learnt, detected, used, improved, and what needs to be tried again.

In James' words: " You cannot substitute real-world testing".

In rough locations throughout the outback, vehicles are "instrumented up", then measured, tested and analysed, with the real-world data used to recalibrate lab testing.

Here, the whole system is assessed and validated, critical components are reviewed in detail and every possible component is considered – all under real conditions in a real-world setting.

"The data we gather in these conditions is really critical for us to ensure the testing is representative of the conditions which are out there," James said.

In Summary

Suspension is basically the system of tyres, tyre air, springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two. But while it's complicated, understanding what it does and why it's important doesn't need to be.

At its core, suspension is what controls the weight of your car and its contact with the road. This means that suspension is crucial to your vehicle's ability to carry loads and pull something in tow, while it will also dictate how comfortable your ride is over changing terrain and how your 4WD responds while braking, accelerating and cornering.

For all suspension requirements, services and products, call in at a TJM store where your vehicle will get the precise shock treatment it deserves. **AMR**



Suspension of Belief

Pedders Suspension & Brakes are Australia's premier fleet and mining vehicle specialists.

Suspension reliability and total vehicle payload are major considerations in remote and rough mining locations. Ensuring that suspension components are designed to operate without fade or failure in these conditions and that every vehicle is legally compliant from a GVM perspective are critical factors that need to be assessed and managed by mining operations.

The Australian Mining Review recently spoke with Pedders Suspension sales manager, Jason Moody, about the company's custom-designed, heavy-duty GVM upgrade suspension solutions for light and medium vehicles on-site.

GVM, GCM and Payload Explained

Gross Vehicle Mass (GVM) in simple terms is the total permitted maximum mass of a vehicle. It is the maximum operating weight or mass of a vehicle as specified by the original or additional stage manufacturer (after testing to all applicable Australian Design Rules) and includes a full fuel tank, a 75kg allowance for each occupant, all accessories and cargo, as well as any imposed load from a trailer.

Gross Combined Mass (GCM), on the other hand, is the weight of the vehicle plus the weight of what it is towing. It is the maximum allowable weight of the trailer plus the tow vehicle and all their combined payloads as is determined by the original vehicle manufacturer.

Payload refers to the maximum allowable weight to be carried in the form of general loads, accessories, passengers and tow ball weight. Pedders Suspension has many years of development, testing and manufacturing experience in all aspects of vehicle suspension and braking – particularly for offroad applications such as mine sites.

Its official and certified GVM+ upgrade program adds additional ADR approved payload to light and medium vehicles, including those commonly used on mine sites such as Hilux, Ranger, D-Max and Landcruiser.

Mine Spec Upgrades

Although manufacturers try to build the

most durable suspensions to suit the majority of their customers, often these OEM components do not last under the rigours of use on a mine site. In many cases a complete GVM upgrade is not required but all light vehicles can benefit from upgrades to certain suspension components to give longer intervals between services, greater vehicle safety, greater passenger comfort and reduced downtime.

Just like a braking system, a shock absorber transfers kinetic energy into heat. A vehicle's brakes do this to retard speed and a shock absorber does it to control the resonance of the spring and keep the tyre firmly planted on the road under a wide variety of road conditions.

However, just as brakes are prone to fade when they become too hot, shock absorbers can suffer the same fate. Pedders has invested an enormous amount of time, money and energy into developing a wide range of upgraded shock absorber options for popular 4WD vehicles.

The key features of these shocks are increased oil volume, increased piston shaft diameter and increased outer surface area. Each attribute contributes to a more durable unit that is better able to disperse heat and therefore resist fade. This creates a longer lasting shock, that keeps the tyre in contact with the road and provides greater safety for occupants.

There are also a number of mine spec components available such as greaseable bushes for use in light vehicles in underground mines that provide added protection in the harsh muddy, saline and acidic environment. Pedders' underground shocks also incorporate heavy-duty plastic and rubber dust covers, (rather than metal) which eliminate corrosion and provide longer life.

In keeping with the heat dispersion theme, Pedders also supplies a rear drum to disc conversion kit that includes Kevlar ceramic brake pads that work at a higher heat range for increased safety.

Its mine spec ceramic brake pads are

non-chamfered, non-slotted and are manufactured using Kevlar ceramic technology.

Test results from a fully loaded Hilux Gen 8 with Pedders' GVM+ upgrade, a Pedders rear drum to disc upgrade and the Kevlar ceramic brake pads fitted, showed a 34% reduction in stopping distance, when braking from 100kmh, compared to standard pads.

Fit for Purpose GVM Components

All GVM upgrade kits developed by Pedders come with brand new front and rear springs, shock absorbers, U-bolts, bushes, greaseable shackles, pins and heavy-duty top mounts.

Pedders' custom-designed suspension solutions ensure light vehicles are fit for purpose and compliant with road rules, occupational health and safety (OH&S) and insurance requirements. Jason says it's about identifying the build of the vehicle, what it is going to carry, then incorporating the right components to achieve the solution that each customer fleet operator is looking for. "For Landcruiser and Hilux, we offer a standard height leaf spring, a raised height variable weight spring, a raised height 300kg or 400kg constant load and an 800kg constant loaded leaf spring," he said.

"We developed these options because vehicles have a number of uses on site and we have to have the right spring for any given application.

"If you hang a bull bar and winch off the front of the car with a standard rate raised coil, it'll bring the front of the car down 30mm." The maximum a car can legally be raised in Australia is 50mm. Pedders typically lifts vehicles 40mm to keep driveline, vibration and wheel alignment within spec and have developed products around this. "After the 40mm lift, putting a bull bar and winch on drops it down by 30mm, leaving only a 10mm lift over standard height," Jason said.

"We have a raised loaded coil that you can put in, so that the vehicle with the bull bar and winch can genuinely sit at 40mm above standard."

R&D, Testing, Safety and ADR Compliance

Pedders creates a range of scenarios with matching solutions in its research, development and testing of GVM upgrades. Pedders' engineers use complex computer modelling incorporating Finite Element Analysis (FEA) to simulate various road surface conditions and vehicle loadings.

This software then allows them to examine the loads and stresses placed on all relevant suspension components in unison. This simulation allows engineers to develop a very accurate prototype, which is then fabricated and exhaustively tested in the workshop and under actual offroad conditions.

In order to achieve ADR compliance, Pedders must meet a number of Australian Design Rules related to ride height, braking performance, cornering stability, axle load ratings and even brake and headlight location and functionality. Independent engineers conduct a range of tests in accordance with the ADRs including the operation of the vehicle's electronic stability control (ESC) after the GVM modifications. In this particular test, a robot is positioned inside the vehicle and physically steers the vehicle through a number of prescribed cornering manoeuvres at given speeds.

The vehicle is normally fitted with outriggers to prevent an unexpected roll-over in the worst case. By passing this demanding test, Pedders are able to demonstrate that the GVM upgraded vehicle is able to maintain its OEM stability when fully loaded and is therefore safe to drive in any State or Territory in Australia.

Pedders also works with the Auto Innovation Centre (AIC) in Melbourne when testing stability and braking.

As a Second Stage Manufacturer (SSM) and having passed all required ADR tests, Pedders offers Federal compliance and VIN tags for all their approved GVM upgrades. GVM upgrade kits fitted to pre-registered, brand new vehicles receive new VIN plates detailing the new GVM ratings and tyre placard load labels.



Pedders bespoke Weight Matrix software helps users determine fleet vehicle weight in the virtual world.

Pedders GVM+ suspension kits are a must-have for mining vehicles.



The entire vehicle is then photographed on all corners, including the VIN plates and labels. This information is then submitted and lodged into Pedders' own web-based quality control program.

Pedders also offers post-registration GVM upgrades for different States, which will require further engineering checks on the vehicles.

Toyota Hilux (2020 onwards)

Two GVM kit options are available for the Hilux range – 3500kg and 3620kg. When the GVM is raised from the standard 3050kg to 3620kg, the 570kg payload increase places the vehicle in a different ADR compliance category, which requires additional indicators on the side of the vehicle that meet approval from the ADR.

“The reason we’ve gone up to that weight on this vehicle is because we’ve increased the front axle capacity from the standard 1450kg to 1620kg,” Jason said. “We always run a rear axle upgrade on the Hilux too as, unless you’re running a very large amount of weight on the rear axle to pull some weight of the front, the majority of dual cab utes on the market are over front axle capacity. Once you have two people sitting in the front of that single or dual cab, and you put a bull bar and winch on the front, it’s over front-axle capacity.

We have simulated this in our FEA testing and measured it on actual vehicles.” This especially affects emergency services vehicles in remote locations, which typically have bull bar and winches at the front of the car. Once additional lights and sirens are added, the front axle load is well over capacity. Pedders also offers a brake pad upgrade in their latest Hilux GVM upgrade kit, ensuring the vehicle meets or exceeds ADR standards.

The brake upgrade can also include a

drum to disk brake conversion on the rear. Especially beneficial underground, the disk brake swap at the rear provides self-cleaning brakes, eliminating the ingress of slurry and mud that can fill up and adversely affect the standard drum brakes.

Ford Ranger and Isuzu D-MAX

The GVM for a Ford Ranger can be increased from the standard 3200kg to 3500kg, equating to a 300kg increase in payload. New GVM upgrade kits, similar to the Hilux, will be released soon. Popular as a fleet vehicle, the Isuzu D-MAX comes with a standard GVM of 3100kg. Pedders can increase this to 3450kg – a 350kg payload increase.

Landcruiser 79 Series

Jason says the Landcruiser sits at a level of its own with its much higher OEM GVM capacity of 3300kg.

“No one builds a vehicle at that level,” he said. “It has its own GVM rating and payload that no other vehicle in that space offers. It is a workhorse, almost like a light truck and can almost do the job of a small Isuzu NPR-model truck.” The standard GVM of the Landcruiser is 3300kg. Pedders can upgrade this to 3950kg, delivering a 650kg payload increase.

Payload Calculator

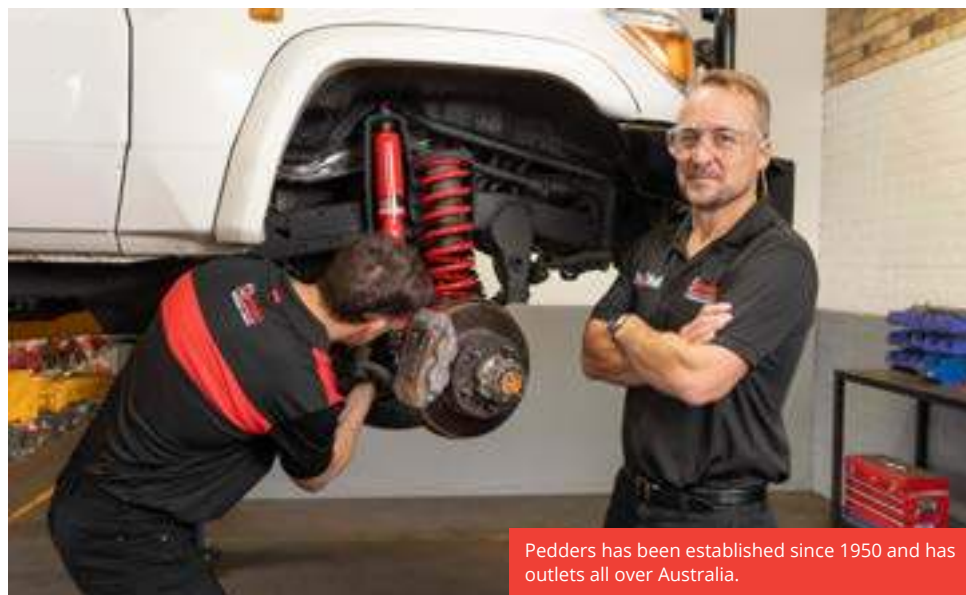
Pedders has developed an online weight matrix and payload calculator available exclusively to fleet customers. The calculator allows fleet managers to configure a particular vehicle with various accessories and load carrying requirements.

Within the software, fleet managers could, for example, pick a Toyota Hilux single cab chassis, then put a bull bar and winch on it, followed by a long-range fuel tank, a canopy and a tow bar. The program will return a list of key data points such as the resulting axle load weights, the new GVM and whether it is within specification with respect

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TECHNICAL TALK

Pedders rear drum-to-disc brake conversion kit ideal for popular light commercials used in the mining fleets.



Pedders has been established since 1950 and has outlets all over Australia.

to braking performance.

This is a valuable tool when quoting or tendering for mine spec vehicles, to ensure GVM requirements are incorporated into the fleet prior to submission of the tender.

Fleet managers can contact Pedders to find out more about this useful calculator. **AMR**

SOURCE
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**YOUR FLEET
GVM+ SPECIALISTS**



Designed for operators of constantly loaded light vehicles, the Pedders GVM+ upgrade program has been engineered, tested and certified as an official upgrade for load carrying applications.

Pedders GVM+ program will ensure that the vehicle is not only fit for purpose but compliant with the road rules, OH&S and insurance requirements. With a Pedders GVM+ Kit you can have peace of mind that you are meeting all SAFETY & LEGAL REQUIREMENTS for your business.

Key Features:

- Designed for Durability & Performance
- Mine Spec Engineered
- Harsh Conditions Tested
- Made to ISO9001 Quality & Safety Standards

The Pedders GVM+ upgrade solution adds additional payload to a selected range of load carrying and towing vehicles.

Contact fleet@pedders.com.au for more information or visit our website www.pedders.com.au/fleet-solutions/



Powering Through



FXM Freewheels from the RINGSPANN product range.

(Images: RINGSPANN)

RINGSPANN has spent almost 80 years developing itself as a leading one-stop-shop for mechanical power transmission products.

While headquartered in Bad Homburg near Frankfurt, Germany, the company now has a strong presence in Australia after setting up a dedicated office in Melbourne in 2018.

The Australian Mining Review spoke to RINGSPANN Australia General Manager Seshan Ramaswamy about how the company is servicing the Australian market with new products as well as the extensive support and technical know-how that comes with being part of a global company.

RINGSPANN is a leading technology manufacturer in freewheels, brakes, overload clutches and couplings, precision clamping fixtures, remote control systems and shaft-hub-connections—for example locking assemblies, shrink discs, rigid shaft couplings and locking elements.

The company has nine manufacturing facilities in Germany and other countries spread across the world.

RINGSPANN's service portfolio ranges from consultation and design and development, right through to the production of ready-to-install components.

Customer training and after sales support round off the RINGSPANN portfolio.

RINGSPANN is considered a premium manufacturer in all of the above product segments and is an international market leader in the area of freewheels.

Australian Presence

Up until 2018, RINGSPANN had been dealing with Australian customers through engineering distributors and other intermediaries.

"This was not achieving the maximum potential in terms of customer engagement and satisfaction," Seshan said.

"We wanted to better serve these customers so the thought process for setting up the Melbourne office began around the end of 2017 and then we started functioning from July 1, 2018.

"It has been a good journey and a successful couple of years."

Not even the pandemic could dampen customers' appetite for RINGSPANN'S one-stop solutions for high-quality components in industrial drive engineering and mechanical power transmission.

While the first few months of 2020 was "challenging", with enquiries from customers stopping between February and May, Seshan said the company finished the

year strongly.

"We did even better than 2019 which was really surprising for us," he said.

"It became clear that one of the big driving forces in terms of mining in this country is WA.

"Queensland and NSW are important too of course but WA is the engine room in terms of demand for our products."

However, Seshan said customers were still nervous when it came to a longer-term view on projects, in light of the sustained uncertainty around COVID-19.

"They want us to offer products and services with a quick turnaround and that's one of latest trends we have noticed with customers," Seshan said.

"We are able to provide quick answers to various questions and our manufacturing entities have got the capacity to turnaround solutions quickly.

"Whether our products are made in Germany or in RINGSPANN factories worldwide, we offer the same quality and uniform engineering standards, which is one of our strengths."

Custom-Made Solutions

Australian miners have also turned to RINGSPANN for its custom-made solutions. "We have made a conscious effort over last few years to not just supply standard products," Seshan said.

"Our portfolio includes standard products, however we want to understand what our customers' application is and we want to tailor our products to suit the application so we optimise the solution.

"If we are purely selling a standard product, we just become a sales office and we want to be an application engineering office.

"We talk with customers about their applications to see how we can custom-make a solution to bring about the best results in terms of the life of the component, and to optimise the economic outcome."

Here is an overview of RINGSPANN'S key product offerings:

RINGSPANN Freewheels

RINGSPANN freewheels of the FXM series launched in 1971 have been setting the global standard for almost 50 years.

These are a standard feature of drivetrains on numerous international machines and plant construction.

Equipped with the legendary "Sprag Lift-Off Type X", they offer low lift-off speeds and wear-free continuous operation.

Precision and compact design of the internal elements is a pioneering development of the RINGSPANN design and engineering department.

They offer a low maintenance 'fit and forget solution' on industrial drivetrains.

Exceptional X-geometry of the sprags allows FXMs to even be used with friction reducing solid lubricants.

The design also accommodates large runouts and therefore is well suited for use in plain bearing applications.

The entire FXM series, comprising of more than 40 standard sizes, have race diameters from 31 to 750mm.

Depending on the variant, they generate torques ranging from 110Nm to 1,230,000Nm.

They do not have their own bearing support and are typically used as backstops on intermediate shafts of spur gearboxes in conveyor pulley drives or as overrunning clutches in the gearbox units of bucket elevators, automatically engaging and disengaging main and creep drives.

The FXM series has been continuously developed over the years and adapted to new areas of application time and again.

It is one of the reasons why RINGSPANN engineering has a remarkably high level of design competence for this incredibly versatile freewheel type.

Design and development engineers can find technical data sheets, 3D CAD models and installation instructions for all FXM Freewheels in the company's online portal: www.ringspann.com.au.

RINGSPANN Couplings

Another important product offering in power transmission, design engineering, machine elements, connection technology and machine and plant construction are couplings.

While shaft coupling connects two shafts and handles the transmission of torques and rotational movements, they also fulfil a number of additional functions such as compensating shaft misalignment, dampening torque impulses and vibrations, protecting machines and drives against damages through overload, etc.

That is why many designs have emerged that can be differentiated in accordance with VDI 2240.

One could distinguish primarily between shiftable (manual, speed-controlled, direction of rotation-controlled, torque-controlled) and non-shiftable shaft couplings.

Since it is often not possible to cover all requirements with one design, there are often also other combinations of shiftable and non-shiftable couplings in industrial applications.

The non-shiftable couplings are differentiated between:

- Rigid couplings: The shafts are connected together rigidly by the coupling. Torques and rotational movements are directly transferred without a rotational angle offset. The couplings cannot, however, compensate any axial, radial or angular misalignment of the shafts.
- Torsionally stiff couplings: They act in the peripheral direction and are torsionally stiff, i.e. torques and rotational movements are transferred almost without rotational angle offset. Depending on the design, however, these couplings can compensate axial, radial or angular shaft misalignment.
- Elastic couplings: Equipped with an elastic element that transfers the torque from the drive side of the coupling onto the output side. Elastic elements are commonly made of plastic or rubber. In special cases, elastic elements made of steel are also used. Elastic couplings can also compensate axial, radial and angular shaft misalignment via the deformation of the intermediate elements.
- Highly elastic couplings: Characterised by a high degree of torsional elasticity and large spring travel. This enables them to have a high damping capacity and can thus reduce rotational vibration, load impacts, prevents resonance vibration and limits torque peaks.

RINGSPANN has been massively expanding its portfolio of non-shiftable shaft couplings. Across all eight models, the now available RINGSPANN spectrum of shaft couplings covers an astonishing range of nominal torques from 2.0 to 1,299,500 Nm.

The beneficiaries of its range are the core target groups in conveyor technology, crane construction and gear manufacturing, fluid and process engineering, raw materials industry and steel production.

RINGSPANN Brakes

RINGSPANN pneumatic, hydraulic and electromagnetic brake calipers boast braking torques of up to 40,000Nm for general mechanical engineering applications.

Its hydraulic brake calipers achieve higher braking torques of up to 600,000Nm for wind turbines and demanding mining applications.



Some of the installations in drive technology and machine construction requiring smaller braking torques up to a maximum 8000Nm are covered by RINGSPANN'S compact and lightweight electromagnetic disc brakes.

The brake calipers from RINGSPANN'S new series DT, FEA and H-ST are much slimmer in design than conventional industrial drum brakes.

The key reason for this is a constructional variation that saves an enormous amount of space.

The electromagnetic disc brakes from RINGSPANN rank among the essential components of countless drive systems in mechanical engineering and plant construction.

RINGSPANN'S electromagnetic disc brakes from its DH and DV series as well as EV and EH series are well received globally for various braking applications.

They can be deployed for stopping, control and holding (EV and EH brakes have an extremely low power consumption for the entire holding phase) and cover a wide application spectrum with braking torques ranging from 94 to 6590 Nm.

These compact industrial brakes come with German certification and are ideal for the Australian market.

RINGSPANN has developed an online brake calculation tool that is free for all after registering on www.ringspann.com.au.

This tool takes all important parameters into consideration: for example, mounting of the brake, brake disc form, friction block wear, ambient temperature and more.

The brake calculation program also enables the user to determine braking torque and clamping force on a specific brake disc diameter thus selecting a suitable brake for the application.

RINGSPANN Locking Assemblies

RINGSPANN'S locking assemblies are based on a superior frictional connection, the technical and fundamental underlying principle that RINGSPANN intends to remain faithful to.

The company's attention is devoted to the ongoing further development of the frictional locking principle.

RINGSPANN is especially focused on the targeted influencing of the key factor, the coefficient of friction.

The company not only profits from decades of practical experience with key users from all around the world, but also from its collaboration with universities within the scope of its activities in the FVA (German

Power Transmission Research Association).

As a long-time manufacturer of locking assemblies, RINGSPANN also possesses well-founded design knowhow in this industry and has its own testing facility for fundamental research and quality assurance.

All these aspects are what sets it apart as a reputed manufacturer of frictional shaft-hub connectors.

RINGSPANN is also able to use synergies from its other product groups such as freewheels, clutches, brakes, couplings, force and torque limiters for development work in the field of locking assemblies.

Its wide array of locking assemblies and competent technical support is unparalleled in the industry.

Consultants, product engineers and purchasers of RINGSPANN'S products will find key technical and design features on its website that will assist in their selection process.

The extensive product range currently offers 25 shaft-hub-connection series for torques ranging from 0.16Nm to 4,225,000Nm.

This product portfolio comprises of shrink discs, locking assemblies, locking elements (also called cone clamping elements), rigid shaft couplings, internally clamping star discs and star spring washers for ball bearing compensation, as well as clamping systems for mounting torque motors.

In the area of shaft-hub-connections connected via friction lining, shrink discs rank among the most important drive elements for mechanical engineers and plant manufacturers.

RINGSPANN'S three-part shrink discs were introduced to the successful standard series RLK 603 S which are ideal for conveyor systems, stirrers, mixing plants, construction machinery and wind turbines, offering powerful externally clamping connections for the play-free connection of hollow shafts or hubs on shafts with their very high torque capacity across a range from 18Nm to 156,700Nm.

Seshan has no doubt RINGSPANN will continue to strengthen its foothold in the Australian and global mining industry.

"The rest of 2021 looks promising for us, hopefully there are no major interruptions," he said.

"We are hoping for projected growth of ten per cent each year to 2025." **AMR**

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New shaft couplings: The range has expanded with five completely new models, including gear couplings, grid couplings, disc couplings, pin-and-bush couplings and jaw couplings.



RINGSPANN'S high-quality type RLK TC premium element: The abbreviation stands for true centring and refers to the extremely high level of accuracy with which these double-slotted cone clamping elements centre the hollow shaft to the shaft.



The electromagnetic disc brakes from RINGSPANN - indispensable components of countless drive systems in mechanical engineering and plant construction.



Excellence In Calibration

Additel ADT761A Automatic Pressure Calibrator.

In the mining and energy resources industry, the performance of measurement devices has never been so critical.

In a world where industry is unlocking the potential of automation, data-driven decision making, and improving safety processes, the systems involved are becoming ever increasingly sensor-driven.

The reality is that any system, no matter how well thought out, or however many millions of dollars are invested in its development, is only as good as the data feeding it.

This is as true as for rostering as it is for deploying the most sophisticated autonomous In Pipe Inspection Robots (IPIRs).

Equipment Accuracy Vs Redundancy

Any systems engineer worth his salt will have an appreciation of building in redundancy measures to deal with the probability of equipment failures.

But what if your sensors seem to work well, but in reality, are inaccurate?

How much could a flow sensor reading out by a couple of percent be costing your organisation over the course of months or years?

What are the consequences if a line bursts leading to serious injury, and it emerges

that line pressures have been running dangerously high for weeks – but have gone undetected due to a gauge that has drifted? At Zedflo, the company can help on two fronts.

As a supplier of premium calibration equipment, Zedflo can help upgrade, or kit out entirely from scratch your own calibration and testing crew.

Working with excellent quality manufacturers such as Additel and Metrel, Zedflo uses equipment calibration solutions in particular for pressure, temperature, electrical test and measurement and process instruments.

The company's National Association of Testing Authorities (NATA) accredited calibration laboratory has one of the top pressure scopes in Australia, approved (at time of writing) to certify equipment up to 280MPa (40,000PSI), and uncertainties down to 90ppm – covering the vast majority of instrumentation found in the field.

NATA is also assessing Zedflo's lab to cover up to 415MPa (60,000PSI), and electrical instruments such as DMMs, clamps, process calibrators and HV safety test equipment.

NATA Calibration

A NATA-endorsed calibration certificate can only be issued by a NATA-accredited laboratory and from within its scope.

It means that the calibration laboratory has been assessed and audited in accordance with the international standard "ISO 17025 – General requirements for the competence of testing and calibration laboratories".

This standard requires staff are technically competent and properly trained, as the lab uses only validated procedures, and its references and standards have unbroken traceability chains to International Standards.

The lab is assessed for a clearly defined scope, which is published on the NATA website for everyone to see.

The lab also has quality management policies and procedures in line with those followed in ISO 9001.

NATA-endorsed certificates provide confidence in the quality of measurements and calibration report.

Traceable Calibration

Obtaining a 'traceable' calibration certificate means that an instrument has been tested against a calibrated reference, but it does not offer any assurance on the competency of the technician or methods used, or where and when the reference equipment was calibrated.

This however does not mean that it is a bad calibration, it just means that the calibration

lab has not been accredited by NATA or other governing body to offer assurances about technical competency.

Is NATA Traceable Good Enough

When a company describes its service as 'NATA traceable', it usually means its reference equipment has a NATA endorsed calibration certificate.

NATA is an assessing and auditing association. It does not write nor maintain standards.

The term 'NATA traceable' is not a valid statement and this is really just stating traceable calibration.

Traceability can only be to a national measurement institute, which is responsible for setting and maintaining measurement standards.

ILAC and NATA

NATA is a body that assesses, audits and grants accreditation's to laboratories (as well as other service providers) for compliance with various international standards.

It works alongside industry leaders, academia and other accrediting bodies worldwide to ensure best technical practice is followed here in Australia.

The International Laboratory Accreditation Cooperation (ILAC) is the international



Additel ADT760 Handheld Automatic Pressure Calibrator.



NATA Accredited Pressure Lab.

organisation that holds accrediting bodies (like NATA) to account, ensuring quality and consistency around the globe.

A report bearing the ILAC mark is recognised and accepted virtually anywhere in the world.

NATA is one of around 100 accreditation bodies world-wide that are signatories to the ILAC Mutual Recognition Agreement.

Put simply, ILAC oversees technical accreditation globally, ILAC audits NATA, and NATA audits labs across Australia.

What Calibration Does Zedflo Provide?
Zedflo has capability for calibrating pressure, electrical, temperature and certain flow test and measurement devices.

It offers both NATA-accredited calibrations for items within the scope, and non-accredited traceable calibrations on other equipment.

Zedflo will inform when quoting whether a service is NATA accredited or not.

Though as previously noted, the non-accredited traceable service does not mean that it is a bad calibration – it simply means that the service has not yet been assessed for certain types of equipment and measurements.

All calibration work broadly follows the ISO 17025 compliant quality management system.

For some clients who would prefer a 'one stop shop' for all calibrations but requires them all to be NATA-accredited, Zedflo can

outsource the other calibrations that are required for NATA to external labs.

Just contact Zedflo with your requirements and it can quote accordingly.

Making The Choice

If the instrument is used only for indication purposes, typically only a traceable calibration is required.

Users may not require a NATA accredited calibration unless the item they are calibrating will be used for subsequent calibrations as a reference instrument, or the instruments are part of a quality process or measurement system.

An example flow in a petrol bowser, which would need to have a NATA-accredited calibration as it is part of a custody transfer, where the client is paying for the amount of fuel pumped.

In some industries where the instrument is used for reporting work to clients, the customer may request or require instruments that that are NATA-calibrated to be used.

Additionally, instruments that will be used as references for subsequent calibrations would typically require a full NATA-accredited calibration as it will maintain the chain of traceability and uncertainty. **AMR**

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Power Quality Analysers

Contact us today for a quote

Our NATA scope currently only covers Pressure. Electrical and temperature calibrations are traceable to national standards.

Let's Torque About Calibration



An automatic tyre inflator with wireless temperature transmitter.

Torque tools are precision instruments and should be serviced, calibrated and tested on a regular basis to ensure repeatable accuracy and optimum performance.

Xcalibration is a specialist in calibration services with a focus on the highly specialised needs of the torque control industry.

The Australian Mining Review spoke to Greg Hender of Xcalibration about how the company is constantly gathering feedback from customers to continually evolve and adapt to changing market requirements.

Greg explains how their team goes above and beyond to calibrate, service and monitor the condition of equipment to the highest standards.

Torque tools are thoroughly tested to address uncertainties in the entire calibration process.

By providing a snapshot of the health of the tool as well as its output, errors can be detected and addressed before they result in wear or damage to mining equipment worth millions of dollars.

This will prevent downtime but most importantly, it will prevent catastrophic incidents that can result in severe injury or even death.

History

Greg has been involved in the torque calibration industry for more than 20 years and has been operating Xcalibration since 2008.

"Onsite calibrations have always formed a big part of our core business and complement our fixed calibration laboratory," Greg said.

Xcalibration started out primarily doing torque calibrations, which also encompasses sales, repairs and adjustments as required, covering torque wrenches, hydraulic wrenches, manual and powered torque multipliers and testing of torque machinery such as track bolting machines.

The company's torque capabilities extend from one foot-pound (ftlb) up to 25,000 ftlb. Its calibration capabilities have expanded in line with the evolving requirements of the mining industry and now cover testing of pressure gauges, automatic tyre inflators and dimensional testing.

Torque wrenches

Torque wrenches tighten nuts and bolts to a specific torque value.

"The brands and types of torque wrenches are many and varied, however we only sell high quality ones so they will keep performing as required," Greg said.

They are also repairable as parts are held in stock.

They are used for many types of bolting jobs but become particularly important when used in critical applications, such as engine rebuilding.

For safety applications such as wheel nut bolting, there are new mechanical/ digital combination wrenches which allow the user to configure software for vehicle types, axle groups, stud settings, and a process which must be followed for job completion.

"This gives the process traceability and accountability which can be downloaded from the tool or the Bluetooth software," Greg said.

As a minimum, all torque wrenches should be calibrated yearly or every 5000 uses—whichever comes first.

However, the user should consider the amount of use, the working environment and the critical nature of their bolting application to assess whether these calibration intervals should be reduced.

"I have a customer which gets to 5000 uses within three and a half weeks so I recommend the wrench be tested every month, but it is up to the user to determine if a calibration interval is sufficient for them," Greg said.

Truck companies often opt for more regular calibration due to the regular and critical nature of their tyre usage.

When a torque tool comes in for testing, its model and serial number and owner details are recorded.

But more importantly, the team at Xcalibration will form a sound understanding of the who the customer is, which will determine how they treat the tool.

If it is of a critical nature, it will still adjust even the smallest of errors to bring it back

as close as possible to the nominal torque setting, to extend the life of the calibration.

Some of the digital wrenches can achieve outstanding accuracy, within a 0.2% margin of error while mechanical wrenches can achieve 0.5%.

Higher standards

The accuracy of a torque wrench is specified by the manufacturer, but the only way to be sure the tool is consistently providing repeatable and accurate results is to periodically validate its performance.

The old Australian torque wrench standard AS4115:1993 and international standard ISO6789:2003 have both been withdrawn and should no longer be used.

These standards have now been superseded by the new standard ISO6789:2017, part one and part two, to which torque wrenches should be calibrated.

It should be noted that if a customer has ISO9001 quality systems in place, they should consider asking for the new standard covered by part two to ensure they have a valid Certificate of Calibration.

This addresses the uncertainties involved in the entire calibration process as opposed to part 1, which is only a Declaration of Conformance.

Xcalibration carries out all its torque wrench calibrations in accordance with part 2 of the standard.

This involves roughly five times the amount of testing that is carried out to adhere to part 1.

"You've actually got to test the repeatability and reproducibility so it is a lot more in depth and a lot more work," Greg said.

"But the end user gets a much better result as we are able to provide them with a comprehensive report.

"This allows them to meet their internal quality standards but also means they cover themselves from a liability point of view.

"If you only have a declaration of conformance and a wheel comes off a heavy vehicle and kills someone, you may be legally vulnerable."

"As best practice we provide uncertainty calculations throughout our other torque processes and include them for hydraulic wrenches as well as manual and powered torque multipliers," Greg said.

Manual and powered torque multipliers

The traditional manual torque multiplier is still well used in the mining industry and should be calibrated to give the user confidence in the torque ratio that the multiplier delivers.

The high-quality ones are generally close to the stated OEM values whereas some of the lesser quality ones can vary wildly from manufacturers claims and should be used with caution.

"They might give you a ballpark figure of 10-1 but you might find that it might be no better than 8-1 or even 4-1," Greg said.

Poor machining means that when they are under load, internal friction robs the torque, which does not get applied to the output.

"The operator may think they are inputting 100Nm and getting 1000Nm out when in fact they are only getting 400 out and there is no way of testing that on site."

The performance of all torque multipliers can change over time due to wear, lubrication and damage, so it is good practice to have them calibrated.

Powered torque multipliers have a large presence in the mining industry due to the nature of equipment that is being regularly serviced and maintained where very high torque values are required.

Commonly referred to as Torque Guns or Nutrunners, these high-powered tools are used for applications such as ball mills, wheel nut bolting, cutting edges, undercarriage work such as tie rod ends, suspension bolts and struts, track plates, and rollers and idler cap bolting—to name a few.

Traditionally these have been air powered with shortcomings related to the air supply, so the informed user needs to be mindful of the air pressure and the supply to the tool while in use.

"You have a big multiplication factor there so if you have even just a tiny drop off in the performance of your air motor, that can drastically affect the output of the square



Battery torque guns with recording software.



A mobile calibration lab.



Calibration lab for on-site work.



A manual torque multiplier.



Calibrating a hydraulic wrench

drive end of the tool by a significant factor," Greg said.

"Not only that, you may have that hooked up to the airline and you may be using that out in the paddock 50 meters away from the compressor, so you actually get a lot of drag internally in the airline.

"And so you'll actually get a big drop off in the pressure, which won't be able to keep up with the demand from the tool, so you won't get the correct torque result."

The user needs to be very aware of the size of the airline and whether it needs to be increased to avoid drop offs in torque.

Technological improvements

The trend is now toward battery powered torque multipliers, with advancements in technology and software "coming a long way" in the last three to five years.

They are not subject to air supply issues and they are safer and easier to use without the concerns over using airlines, which can be a trip hazard and make it more difficult to work at heights.

They can also come with software that includes configuring batch and sequence processes with the ability to record these achieved values that can be downloaded later.

For example, the software could be programmed so that it prompts the operator to fasten a bolt at a particular time in a predetermined pattern.

For example, a company that manufactures hydraulic cylinders might have to tighten 10 bolts and they may decide to do that in three phases.

The first phase will tighten the bolts up to 50% at 500 Nm, the second phase at 750 Nm and the third at 1000 Nm.

A display screen will prompt the user to begin each phase as soon as the 10 bolts have been completed, and the tool can also be used for angles as well as the torque.

To ensure the pneumatic or battery powered torque multipliers are fit for duty they require regular servicing and calibrations.

Xcalibration monitors the condition of the tools, such as air and battery powered

multipliers, through calibration charts and tables, which covers both SI and imperial units for torque and pressure where required.

This includes the logging of air pressure versus torque output, which enables the torque multiplier to be set at the right pressure.

"The charts give you a snapshot of the output of the tool, but it also gives you a snapshot of the health and performance of the tool," Greg said.

Linear patterns indicate no undue wear or serviceability issues while non-linear results indicate a problem, such as a gearbox or motor issue, requiring further investigation.

All of these calibrations include uncertainty calculations as part of the process to ensure the best possible outcome for the user.

Hydraulic wrenches

Hydraulic wrenches have a place in industries when extremely high torque requirements are called for, where it is not unheard of to see these tools being used up to 25,000ftlb capacity.

More commonly they are used throughout the mining industry in the 1000 to 10,000ftlb capacity range.

"As they are capable of such high torque values, they need to be used with care and the user must understand how they work before attempting any bolting jobs," Greg said.

"Advantages include being able to use them for bolting as well as unbolting where time and wear cause bolts to become difficult to remove.

"These are extremely accurate tools when used with a hydraulic pump that has a calibrated gauge fitted to it."

These are available in a square drive or cassette style arrangement covering a large torque range.

"The advantage of the cassette drives is they can slip it over a nut or bolt where there is limited access whereas a square drive may not have that ability.

"As the cassette style of hydraulic wrench is quite common, we have a large range of

square drive adaptors in our calibration lab to cover all sizes from 19-135mm cassettes to be able to perform the calibrations."

Calibrations performed on these tools are also presented in chart and tabular format for ease of use and include uncertainty calculations as the standard.

Other testing for the mining industry

Xcalibration has been involved in testing and calibrating some of the Caterpillar and WTC track bolting machines.

This is a process where new earthmoving tracks are assembled and old ones refurbished with new track plates.

The track plates require bolting to the track chains (or links) and are bolted with either a hydraulic or electric bolting gantry over a track bench.

"As the bolting process is critical for the long life of the tracks, the bolting machines require periodic calibrations in situ whereby we use strain gauge torque transducers introduced to the bolting machine and track assemblies to check the performance of the track bolting machine.

"Testing can also cover the calibration of load cells built into these machines."

Pressure gauges

Calibration can ensure hydraulic wrenches are performing within their specified ranges, but the results may be affected if a separate pump with a pressure gauge is attached to it.

As these gauges control the input pressure to these tools, it is therefore critical to ensure that they are also calibrated to be fit for purpose.

"As a result, we expanded our capabilities many years ago to include calibrations of pressure gauges, pressure switches and pressure transducers used throughout the mining industry," Greg said.

"This helps to give the user confidence in the complete package being calibrated correctly."

Tyre inflators

Xcalibration now offers Automatic Digital Tyre Inflation systems for sale along with full service, support and calibration.

These can be configured in a variety of ways which may include configuring the software for different customer outcomes or incorporating Wireless Temperature Transmitters to sense tyre temperatures and adjust pressures accordingly while inflating.

These allow the user to step outside of the tyre blast zone and control the inflation process from a safe distance.

"Tyre inflation is actually a very dangerous occupation—if a tyre blows out, it has the potential to kill anyone within 20 metres in front of it," Greg said.

All pressure calibrations for pressure gauges and tyre inflators are performed to the MSA Test Method 1 and 2 which are superior methods to the outdated Australian Standard AS1349:1986.

Always evolving

Xcalibrations' capabilities now also include dimensional calibrations due to customer demand, enabling calibration of items such as dial gauges, micrometers and callipers.

"As part of our continuous improvement program we strive to deliver the best result possible," Greg said.

"So we are always looking for new equipment and processes including industry approved staff training to ensure they are qualified for the roles they undertake.

"This will allow us to deliver the best possible outcomes in the field of calibrations for the end user.

"Feedback from our customers and auditors is considered important in our efforts to evolve and adapt to changing market requirements."

Due to its vast experience in the torque industry, Xcalibration can offer calibrations and repairs for not only its end user customers, but also to others in the calibration industry where this is not their primary area of expertise. **AMR**

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To Be Precise

Trescal is the global leader in calibration services.

Each year, more than 70,000 companies active in the aerospace, automotive, pharmaceutical, chemical, energy, electronics and telecommunication sectors entrust Trescal with their calibration needs.

In 2019, Trescal took a significant step in the Asia Pacific region with the acquisition of the four leading Australian and New Zealand calibration service providers: IPAC Solutions, Australian Calibration Services, Celemetrix and Mobile Test n Cal.

The Australian Mining Review spoke with Trescal General Manager, Chris Body, IPAC Solutions' Branch Manager Alan Mortimer, Celemetrix' Technology and Compliance Manager Anthony Wynn and the CEO of Mobile Test 'n' Cal, Andre Borell, to learn more about calibration and why it is so important to industries around the globe.

What is Calibration?

"Calibration is the act of comparing a device under test (DUT) of an unknown value with a reference standard of a known value," Chris said.

"A person typically performs a calibration to determine the error or verify the accuracy of the DUT's unknown value.

"As a basic example you could calibrate a process thermometer by comparing its temperature reading against a more accurate calibrated reference thermometer.

"In some cases the DUT can be adjusted to reduce measurement errors.

"Calibration is important because it helps ensure accurate measurements, and accurate measurements are foundational

to the quality, safety and innovation of most products and services we use and rely on every day.

"Few people realize the critical role and importance of calibration in their daily lives.

"But calibration improves assurance of precise measurements required in research, development, and innovation, as well as the production of millions of products and services worldwide.

"Pause and look around your room right now; most of what you see was produced within tight measurement specifications assured by calibration."

Mine Sites and Calibration

Most equipment on a mine site is critical to its operation and in some cases, the equipment is too large to ship to a calibration laboratory.

Calibration services can be undertaken swiftly, on-site, with the services planned and completed as efficiently as possible to ensure as minimal a disruption to operations or offsite at a dedicated calibration service centre.

"Coordination and flexibility is everything with onsite calibration, particularly on mine sites which are often located in some of the harshest, fast-paced, and remote, environments in the world," Chris said.

"Some equipment may too critical to daily mining operations to be out of action for an extended period of time, it is critical to thoroughly plan calibration needs and time the services with the operation's scheduled maintenance downtime."

"A good calibration company will work closely with the client, on-site, to limit the

disruptions to their operations which results in less down time for clients and significant cost saving."

Equipment Hire

To reduce operational down time, a company can hire suitable calibration equipment and undertake calibration services when the equipment is out of action.

"Hiring calibration equipment can be a good option for short term projects where capex purchases are required," Chris said.

NATA Accreditation

NATA is Australia's national accreditation body for the accreditation of laboratories, inspection bodies, calibration services, producers of certified reference materials and proficiency testing scheme providers throughout Australia.

NATA is also Australia's compliance monitoring authority for the OECD Principles of GLP who provide independent assurance of technical competence and integrity of organisations offering testing, inspection and calibration services.

"NATA accreditation is formal recognition that facilities produce reliable technical results which increases community confidence and trust in a facility's services, mitigates risk, improves tendering success and facilitates trade.

"A NATA Accredited Laboratory is a laboratory that has been formally recognised by NATA for their quality management system and competency to perform certain test methods within their capabilities.

"Using a NATA Accredited Laboratory gives assurance to the client, that items such as staff competency, reference equipment accuracy and traceability are of a suitably

high-level and that their calibration procedures and methods are too."

Temperature Sensors and Thermometers

"Temperature sensors and thermometers are installed across all mine sites and form key components in environmental monitoring systems, weather stations and process plant equipment," Chris said.

"Some mining equipment operates at very high temperatures and that can become very dangerous, very quickly, unless accurately monitored and controlled.

"It is imperative to operate accurate equipment and ensure it is adequately maintained and reliable - calibration is key to managing such critical risks."

Pressure and Vacuum Gauges

"Mining equipment operating in harsh environments is subject to heat, dust, shock and vibration impact which can significantly affect its accuracy and working life," Chris said.

"Pressure and vacuum gauges are very common across a range of mining applications from industrial mechanical gauges to highly accurate digital systems.

"Calibration of pressure and vacuum gauges is critical to ensure equipment operates within its design and safety limits."

Torque Calibration

The dangers on mine sites are not limited to pressure and temperature, torque systems can also be very dangerous if not operated safely.

"Mine sites can have a multitude of torque equipment in operation from manual torque wrenches and screwdrivers to





electrical, pneumatic and hydraulic tools, with some hydraulic tools operating to as high 25,000Nm," Chris said.

"To ensure safety and best practise, torque equipment must be well maintained and calibrated regularly."

Gas Detector and Monitoring

Most countries require mining companies to monitor gas levels throughout their mine sites.

"Gas monitoring equipment can be fixed throughout the site with the ability to initiate site wide warning systems when dangerous gas levels are detected, or portable, often carried around by staff during their normal working day," Chris said.

"Gas detections systems require very regular calibration and checking, as sensors can become contaminated in harsh environments and need replacement."

Load Cells and Scales

Load cells and scales used to measure force and weight are used in a range of applications in the mining industry, from low accuracy dispatch scales to high accuracy loading systems.

"If not calibrated and checked regularly, the equipment will provide inaccurate readings which can result in inaccurate quantities, and also lead to unsafe lifting and loading operations," Chris said.

High Voltage Equipment

High voltage is a critical risk to personnel working at mine sites, located in some of the most remote, harshest environments in the world.

"Power and plant systems at mine sites operate a lot of high voltage equipment

and the regular testing and calibration of this equipment is paramount to minimise fatality risks and ensure the site is a safe environment for personnel," Chris said.

"High voltage is fatal if it is not treated with respect.

"Stringent safety protocols and suitable equipment which has been rigorously tested must be utilised in these environments to ensure the upmost safety levels are maintained."

Breathalyser Equipment

Mine sites are some of the most dangerous places to work in the world and mining companies make significant efforts to promote safe work environments by providing training to personnel, ensuring compliance with safety systems and frameworks and committing to calibrating and testing equipment.

The calibration effort extends to drug and alcohol screening equipment.

"There is nothing is more dangerous than someone being impaired by drugs and alcohol whilst operating some of the most dangerous equipment," Chris said.

"All mine sites have stringent drugs and alcohol polices and test not only their staff regularly, but also visitors to the site, as such, this equipment must be tested regularly and be well maintained."

Flow Meters

Flow rate monitoring is crucial for the operation of pump and plant infrastructure and is equally important in groundwater and environmental monitoring programs required at all mine sites.

"Mine sites must calibrate the flow meters

used to monitor flows across a mining operation to ensure the facility is operating efficiently, predict issues before they arise and also ensure they are operating within environmental limits and licence conditions," Chris said.

Electrical Instruments

As with high-voltage equipment, electrical instruments pose a considerable risk to personnel and the operability of an operation.

"State regulations state that all electrical instrumentation must be calibrated before use and mining companies must comply with this requirement to ensure appropriate health and safety standards are upheld," Chris said.

Trescal's Calibration Services

AMR asked Alan, Anthony and Andre about what services they can offer clients in collaboration with Trescal.

"IPAC has continued to offer extensive calibration services, utilising factory verification and calibration devices to both existing and new clients," Alan said.

"We have been well supported by Trescal's global technical network spanning across 30 countries and have had the opportunity to showcase our services on a global platform.

"We are still actively managing 200,000 assets annually and the number is growing annually."

Anthony said that backed by Trescal, Celemetrix continued to offer its customers – throughout Australia and New Zealand – repair and functional testing services across a range of test and measurement devices, safety equipment and mobile plant used in mission critical application.

"We have also continued to provide second tier support such as fleet management, compliance and quality audit reporting systems for customer owned equipment to ensure its availability and operational integrity," he said.

Andre said Mobile Test'n'Cal provides its customers with high voltage testing, calibration, inspection and repair services and have provided high quality work results for clients across Australia and New Zealand.

"Working with Trescal has put us on a global stage and given us the opportunity to collaborate across the calibration sector to provide full package solutions to our clients," he said.

"We do considerable work around high voltage testing using various standards and legislation on a wide variety of electrical safety items and personal protective

equipment in order to ensure they remain safe and provide the level of protection required.

"It has been a great opportunity to be able to collaborate with a global company and draw on experience from leaders in calibration across the world."

Trescal

Trescal is one of the largest multinational organisations, specialising in calibration, who are expanding globally to support clients from variety of sectors.

Operating in 30 countries, Trescal benefits from owning over 150 in-house laboratories and 220 customer on-site laboratories.

"Trescal aim to be the number one calibration service provider in countries across the globe," Chris said.

"Following our recent acquisition of four of Australia and New Zealand's leading calibration service providers, we can demonstrate a strong presence and support clients across the Asia Pacific region.

"In terms of capability, we offer a breadth of calibration products and services to benefit our customers.

"When it comes to calibration, there isn't much we can't do!"

What does the future hold for Trescal?

"Calibration is at the heart of our customers' production processes and quality systems," Chris said.

"It ensures the accuracy of their tests and measuring equipment.

"Today in 30 countries, more than 70,000 customers from all industries trust us to perform this critical and mandatory service.

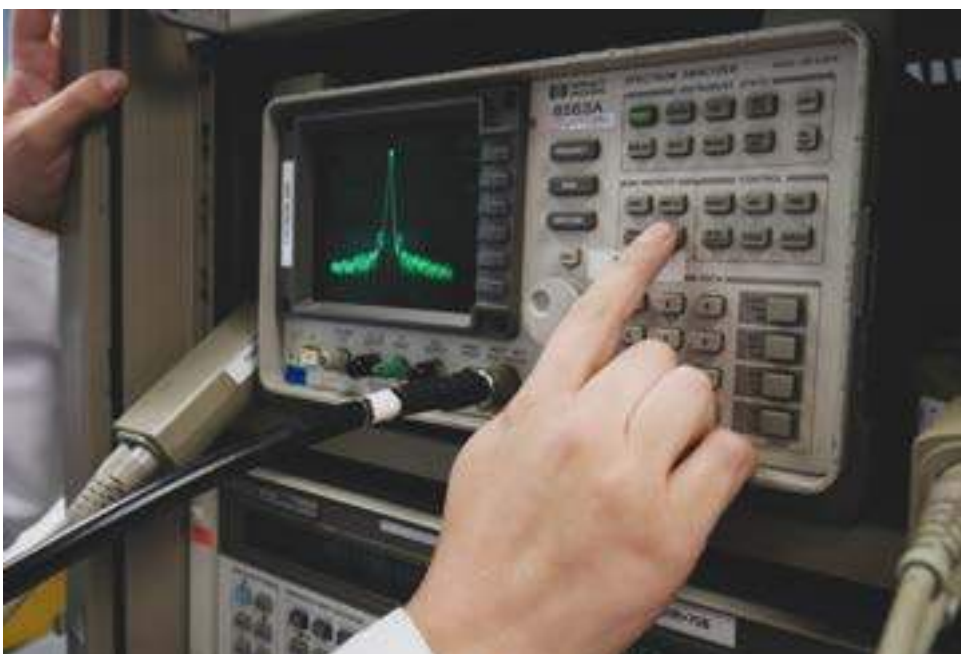
"As the worldwide leader of the calibration market, innovation and continuous improvement are essential to us.

"Every year we invest more than \$23m in new capabilities, laboratory refurbishments, automation, robots and training programs for our 3850 professionals.

"Such investments are key to guarantee Trescal's technical excellence and single source solution across the globe.

"We are excited for IPAC, Celemetrix, ACS and Mobile Test'n'Cal to join us on this thrilling journey." **AMR**

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Paste Fill Experts



Angled paste fill casing installation by AGE Developments.



Paste fill casing is installed/removed utilising AGE's hydraulic tong equipment.

Paste filling or back filling is a method used to dispose of mine tailings underground, backfill underground mine stopes, or to achieve both simultaneously.

Australian Mining Review (AMR) spoke with AGE Developments' lead mechanical engineer, Robert Peters, to learn more about their paste fill bore management services.

"One of the key difficulties in sustaining an effective paste fill operation is to maintain a serviceable conduit in which the paste material can travel from the above ground processing plant to the specified void or stope below surface without contamination," Rob said.

"This is most often achieved by cementing a large diameter conductor casing from surface to underground within a borehole, then suspending a replaceable wear casing inside through which the paste material can travel.

"In many cases we are contacted by a new client who is experiencing water diluted paste underground.

"Upon conducting a desktop review and downhole camera inspection survey, we quickly identify that there is no sacrificial internal lining installed and the main bore casing has been worn away exposing underground aquifers that are introducing excess water and diluting the paste.

Preventing Premature Failure

"Premature failure of the replaceable casing and subsequent cementing of the string into the main borehole is a common occurrence in replaceable wear casing strings when managed poorly," Rob said.

"This can make retrieval for replacement extremely difficult or impossible, forcing the need for a smaller diameter casing to be installed within the old string, or a new hole to be drilled entirely."

Premature failure is caused by highly abrasive paste freefalling at high velocity

which produces slurry erosion in localised areas of the string.

Once this erosion pattern is established, a channel will form and promote further erosion in the same region.

The channelling is caused by paste material falling in the casing string at terminal velocity and 'slopping' around inside.

"This channel will scallop extremely rapidly until the casing breaches which typically results in the paste fill casing being cemented into the outer casing," Rob said.

"If removal is possible, it will usually reveal that the majority of the replaceable casing material shows little wear other than at the localised point of failure.

"If the paste fill material can be backed up and the casing string remains full, the wear rate can be controlled by managing the deposition velocity and promoting a laminar non turbulent flow regime inside the casing string."

Premium Oilfield Casing

AGE Developments has repeatedly used premium threaded oilfield casing for many paste plant casing installations for over 20 years with tremendous success.

AGE Developments has used premium threaded oilfield casing for several reasons.

"Firstly, when installed, the internal diameter of the casing is flush at the threaded joint meaning turbulence of the paste material is avoided and the threaded joint ensures there is no change in mechanical properties created by standard welding processes," Rob said.

"The threaded nature allows for very fast installation when compared with alternative welded line pipe materials.

"Secondly, the material grades have far greater tensile strengths than standard line pipe material and there are many sizes and wall thicknesses available.

"Thirdly, ex-oilfield casing can be purchased at competitive prices.

"We typically recommend installing a surface feeder pipe consisting of one joint of seven-inch casing that acts as a funnel for a smaller diameter casing that controls paste velocity and maintains full casing flow to avoid premature wear channelling.

"There are many wall thicknesses and grades available for the seven-inch feeder casing joint. The most common casing size typically offered by AGE Developments is as follows (see Table 1 and 2).

Paste Fill Casing Strings

A main casing string generally sits below a surface feeder joint and is used to control paste fill velocity and maintenance of full flow-controlled injection.

AGE Developments typically recommend use of a four-and-a-half-inch casing string which depending on paste density can typically accommodate 150-180m³ per hour flowrates.

AGE Developments has the following casing string available on demand (see Table 3).

"If the quantity of casing required is high enough, specified mill runs can be ordered with wall thicknesses on the casing as great as 15mm in even higher tensile grades," he said.

Alternate (less common) sizes available (see Table 4).

Paste Fill Casing Installation

Threaded casing is installed utilising hydraulic tong equipment to torque the relevant threads to the manufacturer's recommended torque.

"Handling equipment certified typically to 150 ton lifting capacities is available off the shelf and allows for fast efficient installation," Rob said.

"Paste plant casing strings are generally lowered into a borehole with the use of

a main slew crane and auxiliary crane to suspend the hydraulic tong equipment.

"Depending on crane operator proficiency, typical installation or removal times for a 400m installation of four-and-a-half-inch casing will be in the vicinity of four to six hours."

Optimum Paste Fill

Inclined paste bores cause preferential wear on the lower side of any paste fill casing material installed and will promote channelling if full casing-controlled flow is not achieved: as such, the most efficient paste fill bore will be vertical and not inclined.

"A common industry misconception regarding Paste Fill boreholes is to install the borehole on a shallow angle to control paste velocity," Rob said.

"AGE Developments has encountered this at numerous mine sites around the world with the same resultant preferential localised wear on the low side of the bore casing with the remainder of the casing remaining untouched.

"Installing threaded replaceable wear casing inside angled holes is achievable however installation and removal timeframes are greatly increased.

"A far better way to control paste velocity and thus wear is by reducing diameter of the casing and maintaining laminar pipe full fill regimes."

In a Nutshell

AGE Developments provides a complete design, manufacturing, installation, and retrieval turnkey service for Paste Fill bores with an extensive track history. For more information, contact AGE Developments using the information below. **AMR**

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AGE Developments provides a complete design, manufacturing, installation, and retrieval turnkey service for paste fill bores with an extensive track history.

Table 1		Table 2: Alternate premium threaded surface feeder casing		Table 3: Tenaris TSH Blue premium threaded casing		Table 4	
Pipe Body OD	7" (177.8mm)	Pipe Body OD	7 5/8" (193.7mm)	Pipe Body OD	4 1/2" (114.3mm)	Pipe Body OD	5" (127mm)
Nominal ID	6.184" (157.07mm)	Nominal ID	6.765" (171.83mm)	Nominal ID	3.64" (92.5mm)	Nominal ID	4.276" (108.6mm)
Coupling OD	7.625" (194.46mm)	Coupling OD	8.5" (215.9mm)	Coupling OD	5.189" (131.8mm)	Coupling OD	5.563" (141.3mm)
Most Common Grade	L80	Most Common Grade	L80	Most Common Grade	TN110S	Most Common Grade	L80
Pipe Body Yield Strength in Tension	676,000lbs (306ton) based on L80 grade.	Pipe Body Yield Strength in Tension	778,000lbs (352ton) based on L80 grade.	Pipe Body Yield Strength in Tension	605,000lbs (274ton)	Pipe Body Yield Strength in Tension	350,000lbs (175ton) based on L80 grade
Pipe Body Internal Yield Strength	8160psi (56MPa)	Pipe Body Internal Yield Strength	7900psi (54MPa)	Pipe Body Internal Yield Strength	18,390psi (126.8MPa)	Pipe Body Internal Yield Strength	8290psi (57MPa)
Physical Weight	29lbs/ft (43.2kg/m)	Physical Weight	33.7lbs/ft (50.2kg/m)	Physical Weight	18.9/ft (28.16kg/m)	Physical Weight	18lbs/ft (26.8kg/m)



Rising to the Challenge



The company has developed an extensive array of inflatable packers built for a broad range of industries.

With the mining industry facing more and more complex downhole problems, it is paramount for suppliers to provide specialised, novel solutions.

AGE Developments does just that, providing a complete design, manufacturing, and operating service for traditional downhole bore consumables to completely unique bore systems, designed for any application.

AGE Developments has an extensive history of working within the mining industry and offering a range of services including CCTV camera inspections, water bore cleaning and repair services, and downhole fishing services by highly trained staff combined with continually evolving equipment.

As a company dedicated to servicing the onshore and offshore water, oil, gas, mining, and geotechnical investigation industries, it has developed innovative solutions to meet their clients' needs for over 35 years.

The company was founded by Andy Giacomel on the philosophy of providing a complete design, manufacturing, and operating service available 24 hours a day, seven days a week.

Australian Mining Review (AMR) spoke with AGE Developments' lead mechanical engineer, Robert Peters, about its innovative water bore service solutions.

Complete Bore Services

AGE Developments has been at the

forefront of downhole innovation since its establishment 35 years ago.

The company has developed an extensive array of inflatable packers built for a broad range of industries.

Packers can essentially be used throughout any stage of a bore's lifespan from initial testing, bore completion and bore remediation.

Typical applications for packers include:

- Isolation Packers
- Grouting Packers
- Injection Packers
- Frac (Fracture) Packers
- High Pressure Packers
- Moving End Packers
- Sealing Packers
- Annulus Packers
- Wireline Packers
- ESP Packers
- Riserless Pump Packers
- High Differential Load Packers
- Swage Packers

AGE Developments has an extensive history of working within the commercial water and agricultural industry from big scale water authority projects to local farming jobs and are involved in all stages of a water bore's life from initial concept, construction to remediation.

Downhole CCTV Inspections

"Through our many years of experience, the importance of mobile, robust and high-quality CCTV diagnostic technology

has become apparent for the inspection of water bores, water wells, dewatering bores, paste fill holes, back fill holes and vent shafts," Rob said.

"Whether the inspection requirement is for bore diagnostics, downhole fishing, submersible pump installation problem diagnosis, or to verify construction details, a clear video is crucial in diagnosing the cause of the problem.

"Anybody can put a camera down a water bore, however our experienced technicians, state of the art technology and experience in silty/mirky water mean that a clearer picture is exactly what you get when you engage AGE Developments for your down hole inspection needs".

AGE Developments has perfected the design of downhole CCTV diagnostic technology with the capability to tilt through 180° and rotate through 360° whilst focussing on any range.

The technology provides clients with the capability to inspect holes to depths of 2000m underwater and diameters ranging from 35mm to over 10m.

AGE Developments has also developed a fleet of fully equipped, purpose-built camera vehicles and other transportable units, strategically stationed around Australia.

"This gives us the capability of having our camera equipment and trained personnel mobilised to anywhere in Australia within a

day's notice," Rob said.

Additionally, AGE has camera units designed for high temperatures (up to 250°C) and portable handheld units available for clients to hire.

Water Bore Cleaning and Remediation

AGE Developments also offers various bore cleaning services to cater for different symptoms with proven techniques such as airlifting, scraping and brushing, high pressure jetting and chemical treatment to clean and remediate even the most deteriorated bores.

"We are frequently contacted by clients who believe that their bore is corroded out as they are experiencing the production of sand and silt," Rob said.

"Often the problems are not occurring due to corrosion or any mechanical damage but due to the presence of bacteria, calcification and mineralised deposit encrustation of the screened apertures which reduce the open area of the screens.

"We offer high pressure jet cleaning and chemical treatment services as an effective means of removing foul material from within the screen apertures, develop the natural gravel pack and aquifer outside of the screen ensuring a more effective and longer lasting clean."

Water Bore Repair

If an initial downhole camera inspection and subsequent cleaning program reveal

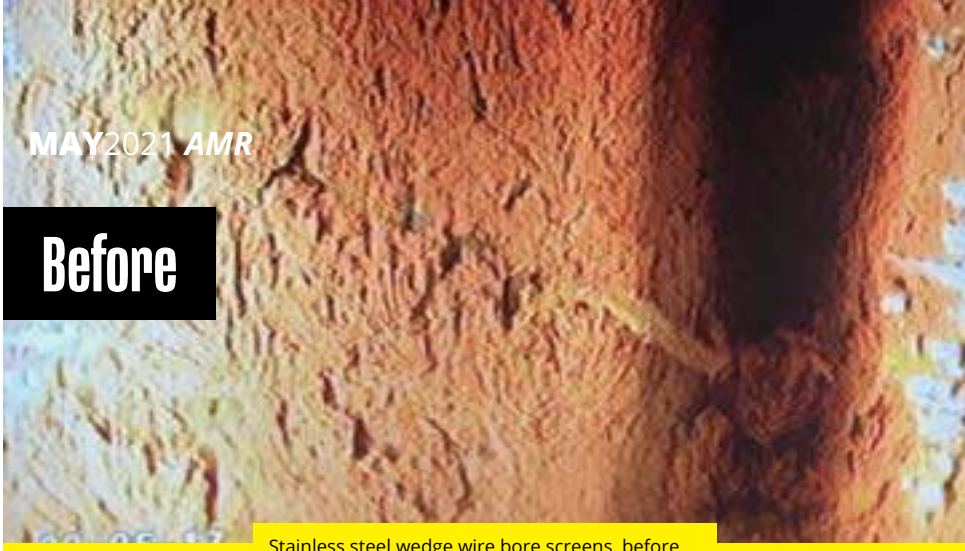


ESP, cable and Wellmaster pump column fishing with aid of specialist tooling and real-time downhole CCTV camera system.



Dewatering Bore Cleaning Services.

Before



Stainless steel wedge wire bore screens, before and after cleaning comparison.

After



Broken off/stuck drill bit that AGE fished from a drilled hole.

mechanical or corroded damage within the bore casing, AGE Developments is uniquely placed to offer water bore swage patch casing relining and screen polymer patch repairs.

Depending on the condition of the bore, it may only need to be relined intermittently, but in some cases, the complete well may need to be relined or even partially abandoned.

"We assess each bore on its own merits and prepare a bore specific repair program to meet our client's needs and statutory requirements," Rob said.

Downhole Fishing Services

"Over our history within the Pilbara region and Australia, we have developed an impressive array of both generic and custom fishing tools to assist in the extraction of dropped or stuck equipment downhole," Rob said.

"With our expertise and unique equipment, we have saved many clients from the need to abandon their bore.

"We stand out from the rest because we ask ourselves one question, "Why waste time fishing blind?"

"Whether we are fishing a pump, dropped casing, rods or even a spanner, with the

use of our camera equipment, we have the capacity to see the fish real time whilst carrying out operations."

Further to the bore cleaning, management and remediation services, AGE Developments has designed a riserless pump system which allows the casing of a bore to be used as the riser for an electric submersible pump by sealing and supporting the pump in the casing with an inflatable packer.

Dewatering Bore Pumping Solutions

The AGE Developments' Riserless Pump Packer is ideally suited to large, deep bores and offers even more advantages in new bores where the original casing and drilled hole diameter can often be reduced without any reduction in bore production rates.

"Our Riserless Pump Packer system presents an attractive alternative to traditional submersible pump completions," Rob said.

"The larger diameter riser leads to lower frictional head loss in pumping a well and thus lower power consumption which delivers great cost benefit to our clients."

Pump Columns

AGE Developments was engaged to develop an innovative solution for inclined deep dewatering bore pump columns subject to highly corrosive environments where traditional high tensile steel and fibre

reinforced pipe (FRP) pump columns are deemed unsuitable.

AGE Developments designed a custom stainless steel quick connect pump column which has been manufactured and load and pressure tested to resist hyper saline environments.

The column allows for easy installation via standard casing elevators and comes equipped with nylon locking mechanisms capable of handling the pump duty requirements.

In conjunction with the pump supplier, AGE Developments has successfully installed two pump columns down holes in excess of 850m.

Geotechnical Equipment

AGE Developments has also manufactured a complete range of inflatable packers for geotechnical testing applications.

Inflatable packers are often used to isolate a formation zone for in-situ permeability testing.

Rob said, "We supply all the ancillary equipment required for the tests, including flow meter assembly, pressure gauges and 24-hour backup support.

"Our test equipment is available to suit

NQ, HQ and PQ sized core holes, and can be configured to single or straddle system setups to test large or more specific zones."

NATA Testing

Since 1987 AGE Developments has maintained a fully equipped and staffed NATA Accredited Pressure Testing Laboratory.

"We are licensed to calibrate and test pressure measuring devices, hoses, pipes, valves, fittings and pressure vessels," Rob said.

"Contact AGE to discuss any pressure testing enquiries you may have with one of our trained technicians."

In a Nutshell

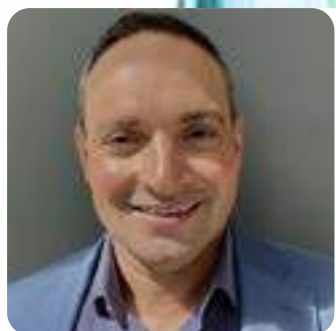
AGE Developments aims to help clients tackle any water bore issues head on and their innovative solutions help clients optimise performance in the safest possible manner.

AGE Developments really is the leader in industry when it comes to water bores, or any type of bore for that matter, and they certainly always rise to the challenge. **AMR**

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AGE Developments uses high-quality CCTV diagnostic technology for the inspection of water bores, water wells, dewatering bores, paste fill holes, back fill holes and vent shafts.



Daniel Sultana

APAC Director of Security and IoT Systems

Whilst manufacturers are scrambling to meet the new challenges brought about by the benefits of converging their Information Technology and Operational Technology (IT/OT) environments, there is another crucial aspect they must consider, too: how to monitor it all to reduce risk and optimise production efficiency.

Poor production efficiency can lead to congestion within manufacturing workflows, as well as production and order fulfilment and this ultimately has an impact on profitability.

Closely interconnected manufacturing environments enable businesses to learn and adapt, allowing them to reach much higher levels of production efficiency than previously achieved before the IT and OT environments were integrated.

To bring together IT and OT, infrastructure monitoring must allow the individual creation of maps and dashboards with the option of integrating elements from both worlds to deliver understandable and familiar data to IT experts as well as OT professionals.

The Risks of Exposing OT

Convergence requires exposing OT and this creates risks because security concerns have always been the main reason for the isolation of production away from IT.

Machines and facilities have always been shielded from the outside world.

Exposing production lines so that machines can communicate with customers, letting them make direct orders, for example, and with other aspects of the infrastructure requires opening up OT in new ways.

Communication Problems

Due to their isolation, machines and production facilities have never had to communicate with the exterior IT world.

As a result, proprietary systems and protocols were developed, which are not compatible with classic IT.

Universal protocols like MQTT or standards like Modbus TCP or OPC UA can put things right, but still, too few IT systems understand such universal languages.

Diverse protocols and standards handicap communication between IT and OT environments.

Rethinking Processes

Even simple Industrial Internet of Things (IIoT) initiatives require re-thinking and establishing new processes.

Traditionally isolated areas must be connected, and new processes must be established and continuously controlled.

To achieve and ensure this, a superior, central control station is required to monitor, visualise, control and regulate production and IT.

Preventing Downtime

In industrial IT, it is vital to inform the right person in the right place with the right information for every equipment failure event - in real-time!

It is essential to deliver this downtime information to the technicians and engineers that manage them in a way they understand in a single glance.

Sending an email to the system administrator is not sufficient for mixed IT/

OT environments.

A roles and rights system is required to establish individual alert management.

It needs a broad range of alerting methods like SMS or push notifications to reach people away from their desk. Finally, triggering an action to automatically solve issues is often a must.

Monitoring a production line to prevent bottlenecks

For a production line to function efficiently, relevant parameters to monitor are the output, overall run-time of production and the stop frequency of the line.

By combining various techniques and ideas, live monitoring of a manufacturing line can be implemented that provides valuable data for engineering and business decisions and for improving the output by removing any bottlenecks identified.

On a production line, they need access to data about how many products are manufactured, at which time and when gaps in manufacturing happened and why.

Often production data is collected manually on paper forms or entered into digital questionnaires post-production.

The production line or the control system cannot be altered or interfaced directly due to the very complex validation and verification standards used.

Manufacturers need to install passive sensors that detect objects passing along the production line and then collect the data in a central hub for further processing.

This will provide a convenient graphical

user interface for production metrics, which shows easy-to-read real-time graphics and summaries that are constantly updated throughout the day.

It is important to be able to show how production is doing at every given time in relation to the elapsed production time. A monitoring system needs to constantly send the current time of day, in minutes, to a sensor.

Then it is possible to calculate the percentage of time passed in the current production workday versus the produced products as a percentage of the total goal for the day. Using those two values, it's possible to show if production is on target or not.

This calculation is vital to be able to react in real-time to bottlenecks, causing delays in production output.

The frequency of production, i.e. output per hour, also provides historic analysis to test potential improvements in production efficiency.

Removal of Bottlenecks

The best way to solve bottlenecks is by monitoring metrics such as throughput, capacity and wait time.

Then it is possible to evaluate the consequences of those bottlenecks. What operations are being delayed as a result?

Thirdly, manage those bottlenecks. What can be done immediately to solve them?

And finally, work towards preventing future bottlenecks from arising. **AMR**

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