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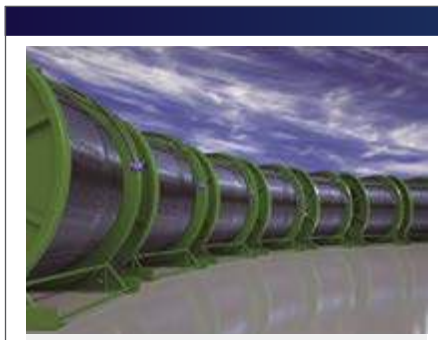
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Chalice Discovers New Mineralised Intrusion At Julimar

Chalice Mining Limited (ASX: CHN) has made a significant new discovery at its 100%-owned Julimar Nickel-Copper-Platinum Group Element (PGE) Project, located ~70km north-east of Perth in Western Australia.

Step-out drilling at the north-western limit of the Gonneville deposit has intersected a new shallow zone of high-grade sulphide mineralisation. The mineralisation occurs within a newly identified narrow ultramafic unit located approximately 70m above the hanging wall contact between the Gonneville Intrusion and the surrounding meta-sediments.

Managing Director and CEO, Alex Dorsch, said this discovery is considered significant because the new zone is located immediately south of the ~6.5km long Hartog AEM anomaly (within the Julimar State Forest).

In addition, it confirms that there are other mineralised intrusions in the area that have no EM response. As such, it is interpreted that the Hartog AEM anomaly may stem from the northern extension of this mineralised zone, which in turn may represent the very southern extent of an entirely new intrusion (Hartog).

Chalice's Conservation Management Plan for initial drilling at the Hartog-Baudin Targets within the Julimar State Forest (Stage 2 CMP) has been finalised and is currently under consideration by the WA State Government.

Approval is expected shortly, which will allow the first ever drilling across ~10km of strike length of the Julimar Complex.

While CMP approval is awaited, Chalice has been continuing step-out and infill drilling at the Gonneville deposit with six rigs. A total of 225 diamond drill holes and 460 RC drill holes (including RC pre-collars with diamond tails) for ~180,000m have been completed to date at the Project.

New assay results have been received for 129 holes, which were not included in the Gonneville maiden Mineral Resource Estimate (Resource) of 330Mt @ 0.94g/t Pd+Pt+Au (3E), 0.16% Ni, 0.10% Cu, 0.016% Co. Assay results are pending for a further 66 completed drill holes, with lab turnaround times currently averaging approximately four weeks.

New assay results have been received for drilling targeting: « The eastern (footwall) and western (hanging wall) contacts between the Gonneville Intrusion and surrounding meta-sediments; « Infill and down-dip extensions to the high-grade G1-G9 zones;

- Infill of the shallow Inferred sections of the Gonneville Resource; and,
- The non-magnetic pyroxenite and leucogabbro-rich north-western part of the Gonneville Intrusion.

"Extensional drilling in an area previously considered to consist only of metasediments has intersected a tantalising new shallow zone of sulphide mineralisation, which is interpreted to be the potential southern extent of a new Hartog zone," Mr Dorsch said.

"The moderate nickel, copper and cobalt grades observed are considered particularly encouraging. We believe that the new ultramafic unit intersected is very unlikely to be Gonneville, given that it is separated by ~70m of metasediments and appears to be highly deformed and geochemically different. The new discovery has once again upgraded the prospectivity of the >6.5km long Hartog target immediately north of the new intersections.

"After lengthy consultation with the WA State Government, we believe our low-impact approach to initial drilling in the State Forest is close to being approved. We have received positive feedback on our approach to minimising disturbance and we are eagerly awaiting final approvals for drilling to commence at this exciting new frontier." ***AMR***

De Grey Pounces With High-Grade Eagle Success

De Grey Mining Limited (ASX: DEG) has obtained further impressive exploration results from the Eagle zone at the world-class Hemi gold discovery in Western Australia's Pilbara Region.

General Manager Exploration, Phil Tornatora, said gold mineralisation at Eagle shows similar alteration and sulphide development as seen at the adjacent deposits of Aquila, Brolga, Crow, Falcon and Diucon. However, like Diucon, Eagle also shows, in parts, a strong structural overprint which can carry high gold grades and occasional visible gold.

"Resource extension and definition drilling at Eagle has continued to identify high grade mineralisation associated with quartz-carbonate veining, sericite-albite alteration and visible gold," Mr Tornatora said.

"A zone of high-grade intercepts at Eagle has now been intersected on several sections over a strike length of around 200m, and a down dip extent of at least 250m. Drilling in progress may expand the extent of high-grade mineralisation.

"Geological studies are continuing, however the high=grade mineralisation may represent a structural overprint on earlier intrusion hosted sulphide mineralisation.

These high-grade zones have the potential to positively impact Eagle pit shell optimisations, mining and processing schedules and significantly adds to the potential for underground mining below proposed pit designs.

"Resource definition drilling at Eagle to increase the resource confidence from JORC Inferred to Indicated is continuing so that the Eagle resource can be included in the prefeasibility (PFS) evaluation. Eagle was not included in the Scoping Study ten year evaluation period."

The mineralised intrusion at Eagle has now been intersected for 950m along strike, 200m in width and at least 350m in depth and remains open. Resource definition drilling to a 40m x 40m spacing above approximately 400 vertical metres is currently being prioritised to increase the resource confidence level from JORC Inferred to Indicated in areas of Eagle to be mined by open pit methods.

Resource definition drilling for the PFS will continue into the first quarter of 2022. Resource extension drilling at Eagle and the other zones at Hemi will continue throughout 2022. New pit shell optimisations to be conducted as part of the PFS are expected to extend the scoping study open pit mine designs.

Extensional drilling in the northwest of Eagle has continued to intersect mineralisation including 31m @ 2.1 g/t Au from 155.0m and 19.0m @ 1.8g/t Au from 192.0m in HMRC229 confirming potential for new lodes approximately 240m north of Eagle. ***AMR***

St George Mining Defines Another Standout Target With Mt Alexander Seismic

St George Mining Limited (ASX: SGQ) has identified another significant target for nickel-copper sulphides from the seismic survey recently completed at its flagship high-grade Mt Alexander Project, located in the north-eastern Goldfields of Western Australia.

Executive Chairman, John Prineas, said the first-ever seismic survey at Mt Alexander continues to deliver strong results with another outstanding new target for a potential massive sulphide deposit. "The north-south seismic lines completed at Mt Alexander straddled the Cathedrals Belt and stretched to the north into our 100%-owned Exploration Licence 29/548, where an underexplored east-west oriented structure – the Transits Belt – has been identified by shallow drilling," he said.

"Importantly, Cathedrals Belt style host lithologies were also confirmed in the drilling. "The seismic data has mapped the Transits Belt structure as dipping to the north, similar to the highly mineralised intrusive-host structure in the Cathedrals Belt to the south.

"S2 – the new, large target identified in the Transits Belt – has the same seismic properties as S1 in the Cathedrals Belt and just like S1 is interpreted to be a target for massive nickel-copper sulphides. "We are very excited to have two robust targets lined up for immediate drilling in our 2022 diamond drill programme."

Targets

The ongoing modelling and interpretation of the seismic survey data have resulted in the identification of a second compelling target for potential massive sulphide mineralisation. Data acquisition and processing for the Mt Alexander seismic survey was completed by independent contractors Apex Geo Pty Ltd and Dayboro Geophysical Pty Ltd, respectively.

Interpretation of the seismic data has been completed by independent consultants, Rock Solid Seismic. The principal of Rock Solid Seismic, Mr Graeme Hird, has industry leading credentials in hard rock seismic projects. Prior to launching Rock Solid Seismic, Mr Hird was Principal Interpretation Geologist at HiSeis – one of the largest hard rock seismic consulting firms in Australia.

Further exciting results from the seismic at Mt Alexander: The three north-south seismic lines completed at Mt Alexander commenced to the south of the east-west Cathedrals Belt and continued north into E29/548 (100% St George), where underexplored structures parallel to the Cathedrals Belt are situated.

Interpretation of the data from the centre line in the seismic survey (Line 2) has resulted in the identification of a large, new target – S2 – that has seismic properties consistent with the shallow massive sulphides drilled in the Cathedrals Belt. S2 is located down-dip in the Transits Belt structure, an east-west trending north dipping structure which has many affinities to the Cathedrals Belt.

It is the most prominent of the east-west structures identified on E29/548. The target is located approximately 350m below surface and has a dip extent of 400m.

The reflective properties of S2 are consistent with the reflective properties of the known massive sulphides that lie along Line 1 of the seismic survey.

Previous shallow drilling by St George has intersected ultramafics in the Transits Belt, giving further support that the structure has potential to host high-grade mineralisation similar to the Cathedrals Belt structure to the south.

Deep-seated intrusive network: The seismic data shows the Transits Belt structure and the Cathedrals Belt structure dipping to the north and converging at more than 1,000m below surface into what is interpreted to be a larger mantle-tapping structure, which would have been a primary conduit through which intrusive rocks and nickel-copper sulphide mineralisation travelled to the surface.

Deep magmatic structures of this kind are indicative of a large mineral system with the potential to host significant volumes of mineralisation.

Modelling and interpretation of the seismic data are continuing and it is anticipated that further material findings will be delivered that will assist ongoing exploration. ***AMR***

Panther Metals Ready To Pounce On The Back Of $5m IPO



Panther Metals Ltd (ASX: PNT) has commenced trading on the ASX following the completion of its oversubscribed $5 million IPO.

Managing Director, Daniel Tuffin, said that Panther, capitalised at $10.9 million, is ready to test its multi-commodity land package situated in the Tier 1 mining districts in Western Australia and the Northern Territory.

"Panther is extremely pleased with its IPO capital raising, which enables the rapid progression of exploration on our 100%-owned Western Australian and Northern Territory nickel and gold projects," Mr Tuffin said.

"The company has budgeted for an extensive exploration programme over the coming two years and will commence drilling soon after listing.

"Our near-term focus is on multiple drillready targets converting the existing nickel-cobalt JORC exploration target at the Coglia Ni-Co Project into a JORC compliant Mineral Resource Estimate followed by infill/extensional drilling at the Red Flag Nickel Sulphide and Merolia Gold projects commencing during the first quarter of 2022. "Historical drilling at our gold Projects, particularly at Merolia, where 4m @ 46.5g/t was intercepted at the Ironstone Gold prospect, suggests high-grade potential. We will be testing that with diamond drilling, beginning in early Q1 2022.

"I'd like to welcome our new shareholders and extend our gratitude to the existing investors, many of whom have followed their money and invested in Panther's IPO. We have an exciting future, and we look forward to updating you with drilling results in the near term."

In Western Australia, the company has assembled a highly prospective multi-commodity land package situated in the Tier 1 mining district of Laverton in the WA Gold Fields.

Approximately 48% of the IPO funding will be directed to exploring the WA portfolio with multiple drill-ready targets. Panther's portfolio includes:

- Coglia Nickel-Cobalt Project – Highly prospective for nickel-cobalt laterite mineralisation and potential to host nickel sulphide mineralisation. Drill ready
- Merolia Gold Project – A dominant landholding over some of the most prospective and underexplored ground in the region with multiple targets, including Ironstone, which previously recorded 4m @ 46.5g/t Au & Burtville East (5m @ 23g/t Au in prior drilling). Drill ready
- Red Flag Nickel-Sulphide Project - High definition AMAG, potentially followed by 4,000m of RC drilling to test any potential resulting targets and drill either side of the Woodline Well trend. Drill ready

  Mikado Gold Project – Plans to focus on initial drilling and the southern extensions.

Panther's portfolio also includes the following two Northern Territory Gold Projects which occur in the vicinity of the Tom's Gully (1.1 Mt @ 8.90 g/t Au) and Rustlers Roost (53.0 Mt @ 0.88 g/t Au) gold mines:

- Annaburroo Gold Project - Plans to carry out further field mapping, followed by an RC drilling programme.
- Marrakai Gold Project - Plans to carry out further field mapping, followed by an RC drilling programme

AMR

Queensland's Resources Red Tape, Objections Under the Microscope

Queensland's mining objections processes will be reviewed, red tape slashed, and major projects given case managers under a draft 30-year plan for the state's resources sector.

Resources Minister Scott Stewart said the proposed changes set out in the draft Queensland Resources Industry Plan – released by Premier Annastacia Palaszczuk in November – would support the investment certainty the industry needed to grow and diversify.

"By working together with industry and the community, the government will ensure our reform processes provide greater investment certainty," he said.

"This will help to grow the value of our resources sector and associated supply chains well into the future."

The draft plan includes:

- a review by the independent Queensland Law Reform Commission (QLRC), of the objections processes for mining leases, and their associated environmental authorities
- better coordination across departments on assessments through joint pre-lodgement meetings and cross government case managers
- better and more accessible data on assessment timeframes
- potential rent deferral for new economy minerals projects.

The review will look at whether existing objections processes for mining leases and environmental authorities are effective, efficient, and fair for landholders, community groups and miners.

Mr Stewart said the current process for mining leases did not provide certainty for any of the stakeholders – industry or communities.

"We've listened to industry, which is why our plan prioritises regulatory reform to ensure the sector continues to lead Queensland's economy and create jobs for decades to come," he said.

"By cutting red tape, we can build a more resilient, responsible and sustainable resources sector."

In addition, the review will consider whether an improved process could be extended to gas projects.

The draft also proposes:

- investigating support for junior and mid-level miners to prove their environmental, social and governance (ESG) credentials in international investment and buyer markets.
- increased government international marketing of the sector's ESG credentials to financiers and markets
- a government-stakeholder working group to focus on how else government can support the industry on ESG.

"Investors and consumers are increasingly ESG conscious, which means organisations that can demonstrate strong ESG credentials will be better able to attract these investors and customers in coming years," Mr Stewart said.

The draft plan has 43 actions that address six key focus areas:

- growing and diversifying the industry
- strengthening ESG credentials and protecting the environment
- fostering coexistence and sustainable communities
- ensuring strong and genuine First Nations partnerships
- building a safe and resilient workforce and
- improving regulatory efficiency.

It is open for consultation until February 2022 with the final plan due for release in mid-2022.

Visit **resources.qld.gov.au/qridp** for more information. ***AMR***

South Australia Accelerating Mineral Exploration

The South Australian Government will extend its Accelerated Discovery Initiative (ADI) until 2025, committing another $11.5 million to the programme.

The ADI provides co-financing to mineral exploration activities to attract greater exploration investment, bringing forward new mineral resource discoveries, jobs, Aboriginal employment opportunities and royalties.

The ADI also has a focus on supporting innovative technologies, collaboration and new exploration concepts to fast-track mineral exploration across South Australia. Minister for Energy & Mining Dan van Holst Pellekaan said the ADI plays an important role in maintaining South Australia's international leadership in mineral exploration development.

"We expect to receive a high level of interest during round three, with a funding of up to $3 million reflecting the global significance of ADI and the calibre of proposals," the Minister said.

"ADI is Australia's most diverse exploration co-funding programmr, offering support for traditional drilling and geophysics, as well as other non-conventional exploration techniques, frontier logistics support, technology and research innovation.

"With a heavy emphasis on new technologies, scientific endeavour, and upskilling, to boost discovery while reducing risk, ADI reflects the changing drivers in exploration.

"Successful projects will bolster activities and support innovative technologies to generate and test new exploration ideas and increase new data sets to help accelerate data sharing between entities within the exploration sector.

"In additional to innovative exploration programmes, ADI initiatives have fostered meaningful employment and upskilling of Aboriginal employees and businesses. So far, during rounds one and two, funding of $7.4 million was allocated to 36 initiatives."

Managing Director and Chief Executive Officer of Barton Gold, Alexander Scanlon said the ADI has allowed Barton to accelerate its innovation-driven exploration approach to the central Gawler Craton.

"ADI facilitated a trial of deep ground penetrating radar (GPR) in the region and early results are compelling," said Mr Scanlon. "The technique has not only found over 25 shallow new structures, but also their orientation, giving us clear, shallow targets for precise, high-efficiency and low-cost drill testing.

"We are looking at an order of magnitude gain in cost and time to target delineation, acquiring these targets for less than $200,000 over a one to two month period, versus $2 to $3 million of drilling over a one to two year period of time," he said.

Minister van Holst Pellekaan said Barton's recent success is another example of the benefits of the ADI not only delivering results for Barton but sharing the results publicly that will help other explorers unlock new discoveries. "It was pleasing to see round two heavily over-subscribed, with a total of 76 high quality applications received with 22 projects assessed against the project criteria to receive funding. We are anticipating a similar amount of interest for round three," said Minister van Holst Pellekaan.

Round 3 funding opens on 26 November 2021. For more information go to the DEM Accelerated Discovery Initiative website.

The extension of the ADI will significantly contribute to increased exploration activity and discovery of new mineral resources to achieve the South Australian Growth State target of $300 million in annual exploration investment. ***AMR***

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Moho Launches RC Drilling at Omrah Nickel Target

Moho Resources Ltd (ASX:MOH) has commenced an RC drilling programme at the company's Silver Swan North project to test the Omrah and Wise nickel targets in Western Australia.

Managing Director, Shane Sadleir, said the drilling programme is targeting an EM conductor for ultra-mafichosted massive and disseminated nickel sulphide mineralisation and other ultramafics in the vicinity.

"We are looking forward to testing the EM conductor at Omrah, given the potential for discovery of nickel sulphide mineralisation and the close proximity to Poseidon Nickel's massive and disseminated nickel sulphide deposits," he said.

On September29, 2021 Moho announced that three priority exploration targets for nickel had been identified for follow up drilling within its granted tenements at the Silver Swan North Project, 50km north of Kalgoorlie.

The identification of the targets followed the release of updated geological interpretations by the Geological Survey of Western Australia and a review of recent and historical geological and geophysical data by Moho's exploration team.

The Omrah prospect is host to an untested electromagnetic (EM) conductor which has been confirmed by interpretation of multiple surveys. The approximately 500m long conductive plate is centred at 155m depth, striking SE with a dip of 70° to the NE. The surface projection of the conductor is coincident with the footwall of a magnetic marker horizon.

A 3,000m RC and diamond drilling programme is planned to not only test the conductor, but also target additional ultramafic lithologies in the proximity. The rig will then move to the nearby Wise prospect to commence 1,200m of RC drilling to investigate magnetic anomalies associated with ultramafic rocks and anomalous historic nickel intercepts.

On October 21, 2021 Moho announced that it had been awarded a grant of $150,000 for the Silver Swan North project under the Exploration Incentive Scheme (EIS) program by the West Australian Government.

The CEI grant will be used by Moho to fund up to 50% of drilling costs associated with the RC and diamond drilling programme to test the potential komatiitic ultramafics associated with the Omrah nickel prospect. ***AMR***

Kopore Metals To Acquire Project In Uranium-Rich Niger

Kopore Metals Limited (ASX:KMT) has entered into a binding share sale agreement with Endeavour Financial AG to acquire 100% of Endeavour's uranium project in the Agadez region of Niger.

Under the deal Kopore will acquire Endeavour's wholly owned subsidiary EF Niger Exploration SARL.

The Project comprises three granted exploration permits (Permits) and one exploration licence application in the highly prospective Tim Mersoi Basin, considered one of the world's major uranium producing areas.

The Permits host the same geology that is represented at Orano's Cominak (now shut down) and Somair mines and the Imouraren (Orano), Madaouela (Goviex) and Dasa (Global Atomic) projects.

According to the World Nuclear Association, Niger was the 6th largest producer of uranium in 2021 and has been an exporter of uranium since the early 1970's.

The company has agreed to purchase 100% of the issued capital in EF Niger Exploration SARL (Target), a wholly owned subsidiary of Endeavour that holds the Niger Project Permits. In consideration, the company will pay US$100,000 to Endeavour (as reimbursement for historic shareholder loans) and issue Endeavour (or its nominees) 120,000,000 company shares at a deemed issued price of $0.02.

Under the terms of the Transaction, the company has agreed to spend a minimum of US$2 million on the Permits within the first 24 months (subject to any force majeure extension), with US$1.5 million of that amount to be spent on a drilling programme.

This obligation falls away if the company declares a Mineral Resource of at least 16Mlb of U3O8 at a minimum grade of 200ppm U3O8 on any of the permits.

The Permits

The Permits represent a 726km^2 landholding across three tenements in the uranium rich Tim Mersoi Basin. The most prominent uranium prospect on the project area is the Takardeit prospect, which has been reported by former owners of the Permits (where a maiden Mineral Resource estimate completed in 2010 reported an Inferred Mineral Resource of 23 million tonnes @ 210ppm, with an estimate of 11 million pounds of U3O8 at 120ppm cut-off grade. The mineralisation reported on this prospect is shallow and constrained below by a shale layer but remains open at both eastern and western ends.

Managing Director, Caroline Keats, said the opportunity to acquire highly prospective tenements in Niger's uranium-rich Tim Mersoi Basin is a unique opportunity for Kopore and marks the first step in the company's diversification into clean-energy focussed assets.

"The Tim Mersoi Basin is one of the most significant areas of producing sandstone-hosted uranium deposits in the world, with historical production generating nearly 145,000 tonnes of uranium since 1971.

"The tenements being acquired by Kopore are all in the same region as other uranium mines and other major uranium deposits, with one of the targets already recording a maiden Inferred Mineral Resource of 23Mt at 210ppm U3O8 for 11Mlbs using a 120ppm cut-off.

"The region is also infrastructure rich, with power, water, sealed roads and a nearby international airport in the city of Agadez.

"Post-acquisition, we're planning to undertake fieldwork and ground mapping before commencing a drilling program which will aim to upgrade the historical mineral resource to comply with JORC Code 2012 and to then increase it.

"The uranium tenements will be complementary to Kopore's exploration assets in Botswana's Kalahari copper belt and its earn-in and joint venture with Horseshoe Metals in tenements surrounding the historic high-grade copper-gold Horseshoe Lights Mine in WA." ***AMR***



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Australian Exploration On A High According To New Reports



BDO Australia's report on the financial health and cash position of Australian-listed explorers for the September quarter of 2021 continues to provide positive signals for the exploration sector, with exploration spending peaking to a seven-year high and evidence of growing investment throughout the sector.

Amidst the higher level of spending over the September quarter, cash balances continued to strengthen with 88% of explorers reporting cash balances of more than $1 million as at September 30, 2021. This was supported by their ability to raise $2.55 billion in the September 2021 quarter, on par with the $2.54 billion in the June quarter. 45 companies (which BDO terms 'Fund Finders') raised funds of $10 million or more and made up 70% of the total funds raised.

The BDO study found that the number of companies that lodged Appendix 5Bs broke the 700 mark for the first time since the June 2018 quarter, reaching a total of 704 companies. This is 26 more companies than the June 2021 quarter and 62 more than in the September quarter of last year.

The trend continued to be driven by the ongoing high level of Initial Public Offering (IPO) activity on the ASX, with 32 exploration companies that recently completed IPOs lodging Appendix 5Bs for the first time in the September 2021 quarter.

With the increased number of new entrants over recent periods, the exploration sector is showing signs of returning to the levels of activity only observed when we first commenced our analysis in June 2013.

Total exploration expenditure of $877 million this quarter matched the levels of 2013 and 2014, and average exploration expenditure of $1.25 million per company is now the highest we have seen. Encouragingly, this uptick in activity was observed to be well spread out across the industry rather than being skewed towards a small number of large exploration spends.

Investment spending also started to show signs of life with 56% of companies recording net investing cash outflows (13% higher than the two-year average), albeit still in small doses with the majority of investment spends under $250,000.

At the larger end of the market, in addition to the usual spending on the development of advanced projects, we also observed a heightened level of acquisition activity by companies pursuing opportunities both locally and overseas. Larger acquisitions were often funded by capital raisings conducted in the June and September quarters of 2021.

Battery Mineral Interest

Battery mineral companies were a prominent group this September quarter particularly with respect to the uptick in investment and financing. We note that this trend was first observed in the March quarter of 2021, but was less evident in the previous June quarter.

The rise of battery minerals is clearly linked to the global trends of rising electric vehicle (EV) adoption and lower carbon emission targets. This ties largely into the central theme of Environmental, Social and Governance (ESG), which is at the forefront of the minds of explorers and investors alike.

Exploration Expenditure Doubles

Total exploration spending in the September 2021 quarter more than doubled that of the September quarter of last year, recording $877 million. This also represented a 32% increase from the $666 million spent in the June 2021 quarter and is 60% higher than the two-year average of $547 million.

Since commencing its analysis in June 2013, BDO says it has only observed such levels of exploration expenditure in the initial four quarters from June 2013 to March 2014, which on average recorded a total exploration spend of $810 million per quarter.

"It is worth noting, however, that this was based on approximately 860 companies lodging Appendix 5Bs as compared to the 704 companies in the current September 2021 quarter. Average exploration expenditure for the September 2021 quarter therefore exceeded the $1.08 million of the March 2014 quarter, to reach a new eight-year high of $1.25 million," the report noted.

"We consider the stark increase in exploration expenditure to be a function of both the increased level of exploration activity within the sector as well as the rising costs for drilling, labour mobilisation and equipment hire. As noted in previous quarters, the demand for drilling services and equipment largely outweighed the available supply, leading to service providers being more selective with their contracts and raising the costs for their services."

BDO said that another positive indicator for the sector is that the increase in exploration expenditure was observed to be well distributed across the industry rather than being skewed towards a small number of companies with high exploration spends.

There was a notable increase in the number of companies with exploration spends of more than $0.3 million, with the largest increase observed for those companies with exploration spends between $2 million to $4 million, which grew from 60 companies in the June 2021 quarter to 72 companies in the September 2021 quarter. Furthermore, 230 companies spent more than $1 million on exploration in the September 2021 quarter, compared to the two-year average of 143 companies.

Among the 10 largest exploration spenders in the September 2021 quarter, six were gold companies, two were lithium companies and the remaining two comprised a nickel-copper company and an oil and gas company. The dominance in exploration spending by gold explorers is generally in line with the trend we have seen in previous quarters.

"We expect that the growth in exploration activity will continue in light of continual strong cash balances and the higher number of listed exploration companies, but note that this growth may continue to be constrained by the availability of resources, travel restrictions and a shortage of skilled labour," BDO noted.

Global rig figures show strong growth

New mineral exploration rig use figures released by leading global mining-tech company IMDEX have further revealed strong exploration growth allowing for seasonal factors in major mining regions internationally.

The rig use snapshot, contained in an IMDEX presentation to the Macquarie WA Forum on December 2, was taken in October and updates a similar assessment conducted by IMDEX earlier this year.

The figures, of surface and underground coring and RC rigs, show the fleet is close to capacity in Australia and New Zealand at 81%, up from 72% in April.

The European rig use in October was 50%, up from 39%, South America 48% (39%), Africa 57% (54%), Canada 65% (46%), Mexico and Central America 48% (44 %).

Globally, rig use increased from 46% in April to 55% in October.

The USA, at 64%, was down from 72% but North America as a whole was up from 49% to 59% utilisation.

IMDEX Chief Executive Officer Paul House said delivery times for new rigs had increased, and the sector was facing skilled labour shortages and mobility restrictions — but these were short-term constraints.

"We're seeing recovery and growth in all key IMDEX regions. This is flowing through to revenue, and is reflected in increasing demand for IMDEX HUB IQ connected sensors and software as companies continue to embrace innovation and new digital ways of working," Mr House said.

Australian Bureau of Statistics figures for mineral exploration for the September quarter showed an increase of 7.7% ($70.4m) to $982.4m.

Exploration related to existing deposits increased 5.8% ($34.8m) to $636.3m, and new deposits increased 11.5% ($35.6m) to $346.1m.

Mr House said there was continuing strong demand for gold, copper, and base metals, but that demand for critical minerals was expected to increase at a faster rate because of the push for decarbonisation.

The profile of exploration spending is shifting, through a combination of targeting, compliance, and drilling at depth.

He said the company's recent acquisition of Mineportal and investment in Datarock had added strength to IMDEX's geoscience analytics, AI, and computer visualisation capabilities as part of its integrated rock knowledge expertise.

"IMDEX technologies enable us to provide critical insights right through the mining value chain," he said.

"Our global presence is unrivalled and provides a compelling opportunity to embed real value for clients." ***AMR***



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Australia's Resource Sector Continues To Boost Export Earnings



New data has confirmed Australia's resources and energy exports continue to surge, despite the challenges of the past 12 months.

Federal Minister for Resources and Water Keith Pitt said the Australian Bureau of Statistics' International Trade in Goods and Services data for October 2021 shows our resources and energy exports continue to go from strength to strength.

"These latest figures confirm again the resources sector as a long-standing and major contributor to Australia's economy with coal and gas the star performers in the latest figures," Minister Pitt said.

"The sector is performing even better than it was before the COVID pandemic.

"Total resources and energy exports were $91.8 billion for the three months to October 2021, which is 41 per cent higher than for the same period last year.

"For the year to October 2021, resources and energy exports earnt $337.7 billion, which is an increase of 25 per cent on the previous 12 months making an enormous contribution to the national economy."

Minister Pitt said Australia's coal exports are thriving as strong demand and prices continue.

"Thermal and metallurgical coal exports hit $18.4 billion in the three months to October, which is double the earnings over the same period last year and 46 per cent higher than for the previous three months to June 2021.

"Demand for our liquefied natural gas saw exports reach a phenomenal $15.4 billion for the three months to October 2021.

"The figure was 161 per cent higher than for the same period last year and 54 per cent higher than for the previous three months to July 2021."

Total iron ore exports were $34.6 billion in the three months to October 2021, which was up nine per cent on the same period last year, but down 33% on the previous three months to July 2021. Exports for the year to October were $163.2 billion –49% higher than for the previous 12 months (to October 2020).

"The resources and energy sector already provides direct jobs for around 268,000 Australians and support the employment of over a million more.

"The growth shown in these earnings across the sector simply mean more jobs and more opportunities for Australia," Minister Pitt said. ***AMR***

Minerals Industry More Than Paying Its Way With The Taxman

The latest ATO Corporate Tax Transparency Report has confirmed that Australia's minerals industry contributes more company tax than any other industry and its contribution to the nation's economy and society is crucial.

The record tax payments are highlighted in a report by Deloitte Access Economics, commissioned by the Minerals Council of Australia (MCA), which shows that in addition to the large company tax, the industry paid $15.2 billion in state and territory royalties.

Between 2010-11 and 2019-20, the minerals sector contributed $238.8 billion in taxes and royalties to Federal, State and Territory governments.

MCA CEO, Tania Constable, said the figures show that mining companies contributed more than 40 per cent of all the company tax reported by the 2,370 corporate entities. "The report highlights that Australia's two largest taxpayers, BHP and Rio Tinto, paid more than $10 billion in company tax in the 2019-20 tax year," Ms Constable said.

"The industry pays the highest wages, generates substantial economic activity, pays the most company tax and delivers the most export revenue.

"A strong mining industry is essential to Australia's economic success.

"When mining is strong, all Australians win," she said.

Ms Constable said company tax payments from the minerals industry help fund better services for the community, including mental health, aged care and woman's programmes.

"Australian mining can be relied upon to pay its fair share of tax and royalties to pay for schools, hospitals and other infrastructure. "The industry track record of large company tax and royalty payments demonstrates the importance of a strong mining industry to the Australian economy.

"Mining companies support thousands of regional businesses around Australia and workers who provide essential services that keep the industry operating.

"They have also been supporting local communities through the COVID-19 pandemic, providing substantial donations to hospitals, charities, child care centres and schools." ***AMR***

Komatsu To Trial Revolutionary Technology At SA's Kanmantoo Mine

The Kanmantoo copper and gold mine in the Adelaide Hills is set to reopen in 2022 delivering 170 new jobs to the region whilst massively reducing emissions as a result of the successful use of revolutionary disruptive mining technology at the mine.

"Hillgrove Resources' decision to reopen the Kanmantoo copper and gold mine will deliver another boost for South Australia's surging economy and our reputation as international leaders in the adoption of cutting-edge renewable technology," said Deputy Premier Dan van Holst Pellekaan.

Hillgrove Resources' trial of the Komatsu "MC51 continuous miner" is the largest of its type in Australia. The machine uses DynaCut mechanical cutting technology rather than conventional drilling and blasting for mine development. The Komatsu MC51 allows for continuous hard rock excavation and eliminates operational delays from blasting making the technology safer, faster and more cost effective.

A $2 million grant from the South Australian Government has facilitated the use of the MC51 for underground mining at Kanmantoo mine, bringing the mine's potential opening forward.

Hillgrove Resources CEO, Lachlan Wallace, said crucially, being fully powered by electricity, the continuous mining machine is an enabler for green copper production and low emission mining as South Australia moves to net 100% renewable energy generation by 2030.

"It's a hugely exciting moment for Hillgrove. We have had excellent drilling results this year – the copper mineralisation extends at least 500m below the base of the open pit and remains open at depth," Mr Wallace said.

"Crucially, we also have the established infrastructure in place to utilise this opportunity and begin extraction in 2022. This trial, funded through a Government of South Australia grant, further accelerates this process.

"We are also proud of the steps we are taking to develop innovative approaches to ultra-efficient mining and the drastic reduction of emissions. The successful MC51 trial at our operations at Kanmantoo is clear proof of our Australian and global leadership position in this respect."

Local Member for Hammond, Adrian Pederick, welcomed the next stage of mining at Kanmantoo that will bring employment and other benefits to the local area.

"This $2 million investment by the Marshall Liberal Government is part of some $200 million invested in Hammond since March 2018," said Adrian Pederick.

Hillgrove is at the forefront of the drive towards emissions free mining in Australia and is exploring further site electrification opportunities, such as haulage, as the company prepares for the commencement of underground operations.

The MC51 has already created a portal towards the base of Hillgrove's completed open pit mine and will develop a 500m underground decline and a number of underground drill platforms to continue to explore the copper-gold mineralisation.

Post the trial, the underground decline will serve as the mine access from which the copper-gold lodes and be accessed and extracted.

The new underground mining technology has been developed in Australia by Komatsu Limited. The Komatsu MC51 continuous mining machine utilises Komatsu's DynaCut mechanical cutting technology. ***AMR***



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Mining and Minerals Sector the Shining Star for Tasmania

The mining and minerals processing sector was the bright light in Tasmania's record international merchandise export figure of $4.23 billion for the 12-months to October 2021.

64.1 per cent of Tasmania's exports value in this period were non-ferrous metals and metallic ores and metal scraps, with the value of metallic ores and metal scraps (like iron ore, copper, zinc, tin, gold and manganese) increasing by 64.6 per cent and non-ferrous metals increasing by 31.1 per cent when compared to the previous year.

The mining and minerals sector employs more than 5000 people, mostly in regional communities, and is a significant driver of the strong Tasmanian economy.

The ABS data also showed the strength of some agricultural exports, with the value of dairy products were up by 39.3 per cent and fruit and vegetables by 19.8 per cent over the period.

Tasmania's record $4.23 billion in exports was 18.6 per cent higher than the previous year to October and marks a run of three consecutive months when the annual export figures have exceeded the $4 billion mark.

China remains our major export market at $1.63 billion (up 6.7 per cent). Hong Kong and China combined are estimated to account for 74 per cent of exports of metallic ores and metal scraps, and 17 per cent of non-ferrous metals over the period.

South Korea was in second position for the value of exports for the period at $427 million (up 83.3 per cent), which was the largest increase in exports by value due to an increase in metallic ores and metal scraps. This was followed by the USA at $272 million (up 23.6 per cent) and Thailand $258 million (up 43.3 per cent).

Premier, Peter Gutwein, said the Tasmanian Government continues to back the mining sector with a range of programmes, like its Exploration Drilling Grant Initiative (EDGI) and Geoscience Initiative, to help unlock the full economic value of mining.

"The Tasmanian Liberal Government is the strongest supporter of our exporters and the booming mining and minerals processing sector and looks forward to increasing trade into the future," the Premier stated. ***AMR***

NSW Removes Another Barrier for Critical Minerals and Metals Products in the State

The NSW Government will make it easier for exploration companies to search for critical minerals and produce high-tech metals projects to drive the development of new technologies.

The Mineral Allocation Areas will be removed as a key plank of the Government's Critical Minerals and High-Tech Metals Strategy, aimed at driving future investment in the sector and establishing NSW as a global leader.

Deputy Premier and Minister responsible for Resources Paul Toole said the decision to remove Mineral Allocation Areas for Group 1 minerals such as copper, cobalt and zirconium means explorers can peg new ground and make new discoveries.

"We know we have the critical minerals, metals and rare earths that are going to be crucial to our future technologies such as advanced manufacturing, aerospace, ag-tech and renewables and now we're making them easier to get out of the ground," Mr Toole said.

"Early this year we called on expressions of interest for operators to explore for these kinds of minerals in the Mineral Allocation Areas of Dubbo, Forbes, Mundi and north and south Cobar and we received a fantastic response.

"This land has been locked up for the government to collect data, but now we are opening it up so that we can further support these vital projects and I know industry will be really excited to start exploring further afield."

Mr Toole said the Critical Minerals and High-Tech Metals Strategy, which includes the establishment of an Australian-first Critical Minerals Hub in the Central West, will help to shape a new and vibrant future for regional communities.

"We have the Strategy, the Hub and we've lifted these Mineral Allocation Areas, providing explorers and investors with greater confidence that we are serious about promoting the growth of this sector," Mr Toole said.

"That not only means jobs in new regional projects but broader economic benefits from shoring up supply chains, as minerals are extracted, processed and then used by major sectors within Special Activation Precincts and in building the infrastructure required for our Renewable Energy Zones.

"It's another piece of the puzzle in the NSW Government's plan to diversify what we have to offer on a global scale, and to help make regional communities in this state even greater places to live, work, play and invest."

The NSW Government's drive to become a major global supplier of critical minerals and high-tech metals will be realised with the establishment of Australia's first Critical Minerals Hub in the State's Central West.

Deputy Premier and Minister responsible for Resources Paul Toole announced the hub near Dubbo today while launching NSW's first Critical Minerals and High-Tech Metals Strategy.

Mr Toole said critical minerals and high-tech metals such as cobalt, nickel and copper will play a vital role in making NSW the number one investment destination for mining and advanced manufacturing.

"Critical minerals are just that – minerals that are critical to the manufacture of everything from electric vehicles to solar technologies and for which there are no ready substitutes," Mr Toole said.

"This Strategy delivers a clear vision to provide a key source of economic growth, diversify the NSW royalty base and create the advanced manufacturing jobs of the future in regional NSW.

"There is a global race on to locate, develop and establish secure supply chains of these minerals and metals. This Strategy will ensure NSW is in the box-seat to meet this demand."

Mr Toole said the Critical Minerals Hub was an Australian-first and would set NSW apart as a premier destination for investment in antimony, cobalt, copper, titanium, rare earths and zirconium projects as demand for critical minerals increases exponentially in the next 40 years.

"The Hub in the Central West will be a focal point for the development of this industry, including value-added processing, located close to existing, approved and potential mining developments," Mr Toole said.

"The hub could accommodate domestic e-waste recycling for eastern Australia, as well as the importation of e-waste from the Indo-Pacific region, so we can recover and recycle critical minerals alongside the exploration and mining of new resources.

"It will build on existing investments at the Parkes Special Activation Precinct as well as the $3 billion investment in Australia's first Renewable Energy Zone, which is centred around the Dubbo, Wellington and Mudgee regions.

"This demonstrates the commitment by the NSW Government to support mining and advanced manufacturing as we diversify the State's economy towards a lower carbon future."

Member for Dubbo Dugald Saunders said the strategy is a significant step forward for many key sites across regional NSW.

"This is a really important part of securing future jobs and prosperity in the Dubbo area, as we look towards new types of industry and manufacturing in the Central West," Mr Saunders said.

"Dubbo itself is the centre of the critical minerals activity in the region, and is the natural hub to provide many of the ongoing services which will be needed."

The Strategy includes further geological surveys to deliver more quality pre-competitive data for explorers, investigating the potential for copper production and other downstream processing opportunities for critical minerals, and providing assistance to mining projects to navigate planning and approval processes.

Background

What are critical minerals and high-tech metals and what are they used for?

- **Cobalt:** a key component in super-alloys for jet engines and lithium-ion batteries that power mobile phones and electric cars.
- **Tungsten:** used in making high-performance steel and is the material that makes phones vibrate.
- **Titanium:** has applications in surgical tools, prosthetics and implants, and is strong, light and corrosion-resistant.
- **Copper:** crucial for wiring to connect solar farms, wind turbines and electric motors.
- **Rare earths:** like neodymium form a component of powerful magnets used in generators, mobile phone speakers and microphones – also used in telecommunications and other high-tech medical and defence applications.

What are the key pillars of the Critical Minerals and High-Tech Metals Strategy?

- Establish Australia's first Critical Minerals Hub in the Central West
- Promote exploration for critical minerals resources
- Activate the industry through proactive development of supply chains
- Attract investment for critical minerals resources, downstream processing and recycling.

What does establishing a Critical Minerals Hub mean for the industry?

- The NSW Critical Minerals Hub is an Australian first and will help fulfil the supply chain link between mines and manufacturing.
- The appeal of more cost-effective, efficient and secure supply chains will give confidence to explorers, mining companies, and investors to set up and operate in NSW. ***AMR***



NSW Says Coal Certainty Will Deliver Job Security

Giving communities certainty for the future is the reasoning behind the NSW Government's decisions on coal mining in two different parts of the State according to Minister responsible for Resources, Paul Toole.

The Deputy Premier said a proposal to extend Dendrobium coal mine had been declared State Significant Infrastructure (SSI) given its importance to Port Kembla steelworks and its thousands of employees.

"Dendrobium is a critical source of coking coal for the Port Kembla steelworks and the decision to declare the project SSI will provide thousands of workers with greater certainty on the future of their jobs," Mr Toole said.

"This decision recognises the proposal's potential economic benefits, with the mine already contributing $1.9 billion to the State's economy each year, employing 4,500 workers and supporting another 10,000 jobs across the Illawarra."

The NSW Government also confirmed it would rule out future coal exploration in the Hawkins and Rumker areas in the State's Central West.

"In regard to the Hawkins-Rumker areas, it is clear that significant commercial, logistical, and social constraints mean there is a low probability of a thermal coal mine being developed on this greenfield site," Mr Toole said.

The Hawkins-Rumker areas will be removed from the map published with the NSW Government's Future of Coal Statement.

Minister for Planning and Public Spaces Rob Stokes said Dendrobium mine's proponent, South32, had taken into consideration concerns raised by the Independent Planning Commission.

"The decision to declare Dendrobium SSI followed support for a motion passed in the Legislative Council early this year. It will now go through a rigorous assessment process and the community will still have their say," Mr Stokes said.

"It is important to provide certainty to communities on the future of these sites, and the decision to rule out the release of Hawkins and Rumker for coal exploration does that."

An SSI declaration does not change the Department of Planning, Industry and Environment's rigorous assessment of the proposal to extend Dendrobium coal mine.

South32 can now request assessment requirements to prepare an Environmental Impact Statement which will then go on public exhibition for community feedback and detailed assessment. ***AMR***

Queensland Backs Vanadium Plant to Power New Economy Mineral Boom

Treasurer and Minister for Trade and Investment | The Honourable Cameron Dick

The Queensland Government will build and own a new processing plant for a key new resource mineral in Townsville.

The vanadium facility will be part of the Government's plan to make Queensland a leading producer and exporter of new-economy minerals and the home of new industries.

Premier Annastacia Palaszczuk said supporting even more jobs in more industries was a key part of Queensland's plan for economic recovery.

"We will continue to support our resources industry and the jobs it creates," the Premier said.

"That means new economy minerals like vanadium."

Treasurer and Minister for Trade and Investment Cameron Dick said the new facility is a major step forward for the state's growing production of new economy minerals.

"We want regional Queensland to be a global leader when it comes to everything that's part of the renewable energy revolution," the Treasurer said.

"Vanadium is used for the construction of large-scale grid batteries that store their charge in tanks of liquid.

"Because they hold their charge in a liquid form, redox batteries can be built to a much larger scale, powering larger communities for longer.

"Australia has the world's third largest deposits of vanadium resources, but right now we don't produce a single kilogram of processed vanadium.

"The mining companies looking to process vanadium at an industrial scale don't have the capital necessary to make that jump.
"That's where our Government can step in.
"Through our $520 million Invested in Queensland program, we will put at least $10 million towards this common-user facility, with the final amount depending on the outcome of the construction tender.

"A common-user facility can be used by multiple, smaller mining companies that do not have the available capital to set up their own processing facilities.

"This is an important step in attracting further investor interest and future off-take agreements.

"Once producers can see for themselves how processing occurs, they will have the confidence to invest in more manufacturing infrastructure and more jobs.

"We're in the final stages of site selection for the facility in Townsville.

"Mining companies will be able to transport ore from their mine site to Townsville, enabling them to begin producing mineral samples at scale."

The North West Minerals Province is a significant global source of these minerals, and the Palaszczuk Government is determined to keep supporting the resource companies that are extracting them.

Minister for Resources and Member for Townsville Scott Stewart said the project is a key milestone in delivering on the work of the North West Minerals Province Taskforce.

"In September this year, the Palaszczuk Government joined with Multicom Resources to announce the go-ahead for the $250 million Saint Elmo vanadium mine near Julia Creek.

"The Saint Elmo mine alone will support up to 400 regional jobs, laying the foundation for a potential next level industry in Queensland manufacturing vanadium redox flow batteries.

"Saint Elmo is just the beginning, with other companies progressing other potential vanadium mines in what could become a world-class vanadium hub in the North West, so having this processing facility in Townsville will ensure locals reap the benefits.

Minister Stewart said his Department of Resources would go to market in the New Year for detailed engineering assessments and costings for the plant.

Construction is expected to start in 2022, with the plant scheduled to begin operating in 2023.
Member for Thuringowa Aaron Harper said the mining, processing and exporting of vanadium in North Queensland would create local jobs.

"I welcome the development of this processing plant which will usher in new employment opportunities for Townsville, both at the site itself, and at the Port of Townsville where it will support jobs through exports," he said.

Member for Mundingburra Les Walker said the Palaszczuk Government is ensuring Townsville and the whole of North Queensland benefits from the renewable energy revolution.

"The Palaszczuk Government is already supporting major job-creating projects in the battery storage space with the proposed Townsville Energy Chemicals Hub at the Lansdown Eco-Industrial Precinct," he said.

"This vanadium processing facility is just adding another string to the bow of the Townsville economy, creating more jobs for locals." ***AMR***



Ravenswood Gold to Build Custom On-Site Photon Assay Facility

Mining technology company Chrysos Corporation and miner Ravenswood Gold have reached an agreement for the installation of a custom-built Chrysos PhotonAssay facility on site at the Ravenswood Gold Mine in Queensland.

Originally developed at Australia's national science agency, CSIRO, Chrysos PhotonAssay delivers faster, safer and more accurate gold analysis, and is an environmentally-friendly replacement for fire assay on-site and in the laboratory.

"Chrysos is proud to be partnering with Ravenswood Gold on this ground-breaking PhotonAssay installation at the Ravenswood mine site," Chrysos Corporation Chief Executive, Dirk Treasure, said.

"The adoption of PhotonAssay on site at the mine reflects Ravenswood's proactive approach to achieving excellence through technology and we look forward to working with them as they achieve their operational and sustainability goals."

Gold mining has been active in the Ravenswood region since 1868. In 2020 Ravenswood Gold purchased the site and committed to a major expansion of the existing mining operation. The growth plan includes establishing large scale modern bulk opencut mining operations in the former Buck Reef West and Sarsfield/ Nolans open pits, increasing the size of the processing plant, and constructing a new tailings storage facility.

Ravenswood Gold Chief Executive, Brett Fletcher, said this ongoing development is expected to increase gold production to over 200,000 ounces per annum, extend the life of the mine by 14 years, and see the Ravenswood mine become the largest gold operation in Queensland by 2022.

"The team at Ravenswood is excited to be partnering with Chrysos on the establishment of this high technology facility right in the heart of the mine site," Mr Flecher said.

"For us, the significant safety and sustainability benefits combined with low cost, high efficiency and lightning turnaround times delivers all the outcomes we are driving for.

"Being able to assay 500 to 1000 samples per day of our grade control drilling, metallurgical sampling and exploration drilling will support us in creating a mining and mineral processing hub we believe will be operating for decades."

Hitting samples with high-energy X-rays, Chrysos PhotonAssay causes excitation of atomic nuclei allowing rapid and enhanced analysis of gold, silver, and complementary elements in as little as two minutes. Importantly, the non-destructive process allows large samples of up to 500g to be measured and provides a true bulk reading independent of the chemical or physical form of the sample.

Market enthusiasm for PhotonAssay's operational and environmental benefits has endowed Chrysos with a strong sales pipeline and multiple new contract signings heading out to 2023, representing significant and sustained growth on current deployment numbers.

The company anticipates further global demand for PhotonAssay over the coming years in a worldwide market with room for approximately 350 units. ***AMR***



Hi-Tech Devices Take IMDEX Experts Global

Assisted reality devices are being used within Australia and globally to guide the installation and use of mining technology products from a distance, as the world grapples with the isolation brought on by COVID-19.

IMDEX has been assisting onsite workers that are thousands of kilometres away by delivering RealWear's flagship HMT-1 devices to its mining clients in South Australia, New Zealand, the United States and South America to circumvent the ongoing travel restrictions.

IMDEX global equipment integration engineer Chris Havenga said the hands-free aspect of the RealWear devices meant they had particular application for underground mining, where operators sometimes had to hold tools and tablets while working above eye level.

"COVID inspired innovation and change at IMDEX to ensure we continued to support our clients," Mr Havenga said.

"There are endless possibilities with the RealWear device.

"It's worth having a device supplied to clients along with our products and tools and if there are any issues, operators can put it on and get the experts to assist for that particular site at the time they are having the problem.

"We can join them remotely while they are working, assess the issues and provide a solution."

The RealWear technology is a rugged, head-mounted, voice-controlled device that offers hands-free operation for frontline workers.

The devices are equipped with a high-definition camera to take pictures and videos from the wearer's perspective, enabling IMDEX's experts to guide the worker and provide advice.

Two-way audio with optional noise cancellation and a high-resolution micro-display that sits below line of sight, allowing for maximum peripheral vision, give workers and IMDEX experts the real-time data they need to operate, inspect, and maintain equipment.

Use of the assisted reality devices emerged after IMDEX grappled with how to support clients in South Africa when sending support teams was not possible because of border closures.

Due to its success, Mr Havenga said the RealWear HMT-1 device could become a standard inclusion for IMDEX client support, along with manuals and tutorials.



A worker using the RealWear HMT-1 assisted reality device interacts with a team of IMDEX hardware and software engineers and product developers for guidance and advice.

The devices, which offer the same functionality as a tablet, enabled operators to consult manuals and other written material while dealing with on-site issues.

Realwear Asia Pacific Vice President John Higgs said it was a privilege to support IMDEX in its initiatives.

"HMT-1 devices provide a reality-first, digital-second experience," he said.

"Previously, industrial workers have not been able to use wearables, as they were overly immersive and not rugged enough.

"RealWear is unique in its ability to deliver hands-free connectivity without distracting the worker on a very rugged device capable of being deployed even in explosive environments." ***AMR***



Australian-Invented Battery Technology

A revolutionary green charging network for electric vehicles across Australia could be just around the corner for everyone.

VSUN Energy, the renewable energy generation and storage subsidiary of Perth-based Australian Vanadium Limited, completed the first phase of a trial of small 5kW-30kWh Vanadium Redox Flow Battery (VRFB) powered by solar energy, opening the way for standalone green powered electric vehicle (EV) remote charging stations anywhere in the country.

VSUN Energy's business development manager Zamien Sumich said VRFBs were the "missing piece of the renewable energy jigsaw" as they could handle all the requirements of EV charging but also scaled up to suit a wide range of projects.

"The VRFB is well suited to the capture and storage of large quantities of renewable energy, enabling stable power output," he said.

"Vanadium electrolyte doesn't degrade, meaning that thousands of EV batteries can be charged from the one station.

"The VRFB's long life, exceeding 20 years, makes it one of the most sustainable and long-lasting ways of storing renewable energy.

At the end of the battery's mechanical life, the vanadium electrolyte can be reused indefinitely."

VRFBs can handle high temperatures without the risk of explosion, making it suitable for remote areas through Australia.

AVL is developing the Australian Vanadium project and its managing director Vincent Algar said the initiative was part of the company's strategy to further develop the market for the battery storage technology in Australia.

"The intent is for Australian Vanadium to not just sell vanadium into the metals sector internationally, but to be fully vertically integrated onshore here in Australia," he said.

"In doing so, we are able to reduce the cost of these batteries while adding local value, content and job creation.

"While we are still in the development phase of the mining project, we are building a vanadium electrolyte manufacturing facility near Kwinana, which is expected to be in production by mid-2022 with an annual production of 33MWh.

"Once completed, AVL will be able to supply battery ready vanadium from its mine, into the electrolyte plant and into a battery, all in Australia with no offshore processing."

AVL will use VRFBs to power its mine site and processing facilities.

Tesla owner and Federal Member for Perth Patrick Gorman says Australia lagged behind the rest of the world with its uptake of electric cars.

"One of the barriers to take-up of electric vehicles in Australia [is] the distance between and availability of charging stations," he said.

"Having a stable renewable energy charging system for electric vehicles will be a big boost for the Australia electric car market."

VSUN Energy is collaborating with its Singaporean partner V-Flow Tech and EV specialists Gemtek on the project.

Gemtek Group commercial manager Florian Popp said Gemtek was developing expertise in integrated renewable energy EV charging solutions to suit Australian requirements for mining, agricultural and regional applications was a key focus.

"The VSUN Energy storage system's unique capabilities and operating life provide a substantial advantage in high temperature and remote environments," he said.

The VSUN Energy vanadium green powered EV charging station trial comes hot on the heels of Australian Vanadium Limited's announcement last week to install a standalone power system based on VRFB energy storage technology at IGO's nickel operation in Western Australia's remote Fraser Range region. ***AMR***

Crawford Boots In Exclusive South32 Deal

Crawford Boots, a leading industrial safety boots manufacturer and globally diversified mining and metals company South32 (ASX:S32) have agreed to a partnership that will see Crawford Boots become the exclusive footwear supplier to South32's Appin Colliery.

This joint development will provide miners at the Appin Colliery with Crawford Boots' high-quality, waterproof, industrial safety boots.

A former podiatrist that has worked with miners' feet for over 20 years, Penny Crawford has seen her fair share of injuries sustained from ill-fitted work boots being used in tough, uneven conditions.

"Workers in the Appin Colliery are dealing with muddy, rugged surfaces on a daily basis, so it is crucial for them to be wearing high-quality boots that properly fit their feet.

"Being able to share information with the miners here is really important, and it's fantastic to know that Crawford Boots will contribute to the health, safety, and longevity of their feet, which has a flow-on effect reducing the risk of knee and back pain."

The Appin Colliery, part of Illawarra Metallurgical Coal, is based about 75 kilometres south of Sydney and is steeped in coal mining history dating back more than 150 years.

"We want to fit out our employees with the best equipment possible, so this partnership is really exciting for us," said Lachlan Payne, Safety Specialist at Appin Colliery.

"It was really impressive to see Penny visiting the site to personally fit miners with the right boots for them and offer her expertise. This is the type of passion that we love to see from our suppliers."

Since being founded in 2013, Crawford Boots has become a supplier of over 40 underground mines across Australia. ***AMR***



An Elite Answer to a Major Safety and Productivity Issue

Sometimes it seems a simple solution can also be an ingenious one. Take for example Elite Industrial Equipment's Powered mirror systems.

Most motor vehicle drivers these days are used to adjusting their side mirrors by simply moving a switch up and down, or side to side.

Remarkably, that is not the case for large haul truck operators.

Currently, if a haul truck operator on a mine site wants a mirror adjusted they have to call the workshop and wait for a fitter to come out. The fitter has to then climb up to the mirrors, use two spanners to loosen the bolts that hold the mirrors and then adjust the mirrors while the operator is in the cab saying up, down, left or right. And then he has to tighten it all back up again.

According to Mark Gream, Elite Industrial Equipment's Project Manager, this may need to happen many times a day, for a number of different trucks.

"With the rugged nature of the mining environment there is naturally a high incidence of vibration, up to 4gs, and the mirrors themselves can easily vibrate out of position," Mark told the Australian Mining Review.

"So even though that operator has had them adjusted to his preference at the start of the shift, they may vibrate out of position during the shift and then he is no longer able to accurately back up to the loader or back into the Dump. So that may require an adjustment again.

"One of the biggest issues is when a mine is undertaking what they call hot seat changes, where the truck doesn't really stop so they can operate 24/7. So even on a crib break you still have to take that time to make adjustments.

For example, with me being 6 foot 2 and my relief is 5 foot 4, then there is that need again to have the various adjustments made. So, there could be multiple adjustments needed each shift."

While it may only take a fitter around 10 minutes to adjust the mirrors, there is also the potential issue of having to wait 30 to 40 minutes for a fitter to be available.

"So, there is not only major safety benefits, but there are also significant productivity benefits," Mark says.

Elite Industrial Equipment's Powered mirrors remove the hazards and downtime associated with adjusting mirrors. The operator can easily adjust the mirror in both vertical and horizontal planes using a 'hard-wired' controller inside the cab.

Recent trials have resulted in positive feedback with all operators indicating that they used the Elite Mirror at the start of every shift to suit their individual preferences and maximise the field of view.



A CLOSE-UP VIEW OF THE OF THE ELITE IN-CAB CONTROLLER.

Elite has trialled various prototypes of this Australian invention in the lead up to the release of the final product, which was successfully tested for four months in rugged conditions at a mine site in South Western Australia.

The system has been designed with simplicity in mind. Two electric linear actuators provide smooth movement for Pan and Tilt functions. The weight of the components is carried through the frame posing little impact on the moving parts. All components have been designed to withstand harsh mining environments.

Smooth Control of the unit is equally important. The electric controller has been designed to be compact, but tough.

Sometimes a simple idea, can be a real game changer. ***AMR***

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Australia Set To Maintain Top Ranking In Global Lithium Production

While not the largest holder of lithium reserves, Australia is set to maintain its dominant position as the leading global lithium producer.

In 2019, Australia produced 233,000 tonnes or 52.9% of global production, churning out more than twice the percentage of lithium as its closest rival, Chile (21.5%). The next largest producer was China with 9.7%.

However, while Australia remains the dominant producer, it still lags well behind its rivals in reserves.

In 2019, the world's Top 5 lithium reserves by country were:

1. Chile - 55.5% of the world's total
2. Australia - 18.1%
3. Argentina - 11.0%
4. China - 6.5%
5. U.S. - 4.1%

Export earnings on the rise

Australia's increasing production and a strong rise in the spodumene price is forecast to see export revenue increase from $1.1 billion in 2020–21 to $3.4 billion in 2021–22, with production from lithium hydroxide refineries forecast to add to earnings for a total export revenue of $3.8 billion by 2022–23.

Australian production is forecast to rise over the outlook period Australian production is now expected to rise over the outlook period, from 217,000 tonnes LCE in 2020–21 to 306,000 tonnes LCE in 2021–22 and 374,000 tonnes LCE in 2022–23.

Correspondingly, spodumene concentrate exports are forecast to increase from 1.5 million tonnes in 2020–21 to 2.5 million tonnes in 2022–23.

Price appreciation induced production increases Australia's production of spodumene concentrate in the June quarter 2021 rose by 8.4% quarter-on-quarter (and 15% year-on-year) to 58,000 tonnes LCE (circa 390,000 tonnes of concentrate).

According to the Federal Department of Industry, Science, Energy and Resources September 2021, Resources and Energy Quarterly, output is rising in response to surging spot prices, and contract prices can be expected to rise, which should boost production at operations using long term contracts.

The Quarterly report noted that Pilbara Minerals, production was stable in the June quarter 2021 at 77,000 tonnes of spodumene concentrate, but sales increased by 8.3% to 96,000 tonnes of spodumene concentrate.

The board of Pilbara Minerals has approved the staged restart of the Ngungaji plant (the old Altura plant) in December quarter 2021, after successful trial processing of ore. Production at the combined site is due to ramp up from around 380,000 tonnes a year to around 580,000 tonnes a year by mid-2022.

The incremental production to be processed through the Ngungaji plant is not yet committed in contract. The combined resources for the Pilgangoora stand at 308.9 million tonnes at 1.14% Li2O, up an incremental 40.7milion tonnes at 0.57% Li2O. A reserve update is due in October 2021.

Project development in Australia

A feasibility study on Liontown's Kathleen Valley deposit, near Kalgoorlie, was recently completed with the company suggesting production in 2024 at 50,000 tonnes a year (LCE). The company is working on compressing its development timetable.

The deposit is similar to Mt Holland. Core Lithium completed a positive feasibility study for its Finniss deposit close to Darwin. A recent equity raising and offtake agreements has the project fully funded to commence construction.

Production could commence in late 2022 to early 2023, after a low capital cost start-up of $85 million. Investigations are also underway on potential for an associated lithium hydroxide refinery. Gangfeng and Yahua have offtake agreements for 80% of the first 4 years of production.

Rising prices for lithium are supporting the recovery of Australian producers with two refineries under construction.

Lithium demand increasing strongly

World demand for lithium is forecast to increase from 305,000 tonnes lithium carbonate equivalent (LCE) in 2020 to 486,000 tonnes in 2021.

Demand is then forecast to reach 724,000 tonnes by 2023, as global electric vehicle uptake rises. The very strong increase in demand from 2021 to 2023 is based on increasing electric vehicle uptake — driven by government measures, lower vehicle prices and increasing model choice.

Consequently, there is a short-term supply pinch in spodumene, with auctions now available for the small amount of uncontracted tonnes that are available.

Lithium trade

Asia is still dominating lithium product demand, despite battery factories diversifying into Europe and the US. In further developments, battery manufacturer, LG, is set to increase cathode production in Korea and potentially reduce reliance on China for supplies of precursor material. There is also potential for a joint venture in mining to secure supply chains.

Lithium trade increased in the June quarter 2021 Over the June quarter 2021, China's lithium hydroxide exports increased by 19% quarter-on-quarter and 23% year-on-year, while lithium carbonate imports increased by 24% compared to the March quarter, and by 80% year-on-year. South Korea's lithium hydroxide imports for the June quarter 2021 rose by 7.1% quarter-on-quarter, while lithium carbonate imports rose by 35% quarter-on-quarter.

Japan's lithium hydroxide imports rose 70% quarter-on-quarter for the June quarter 2021, but fell 17% year-on-year, while imports of carbonate increased 63% quarter-on-quarter. Trade in lithium hydroxide between these nations tends to reflect refining patterns in China, whilst lithium carbonate is imported by these nations already processed (Figures 15.3 & 15.4). Australia's growing exports of spodumene makes up the largest share of global supply in lithium.

This then is typically processed into lithium hydroxide in China. However, in August 2021, Australia produced its first lithium hydroxide

Prices

Spot spodumene prices (delivered to China) rose to US$2,240 a tonne as at September 2021. Spodumene prices are forecast to rise from an average of US$435 a tonne in 2020 up to an average US$1,190 a tonne in 2022 and US$930 a tonne in 2023, with contract pricing under negotiation. Lithium hydroxide prices are forecast to rise from US$9,890 a tonne in 2020 to US$15,160 a tonne in 2023.

EV demand

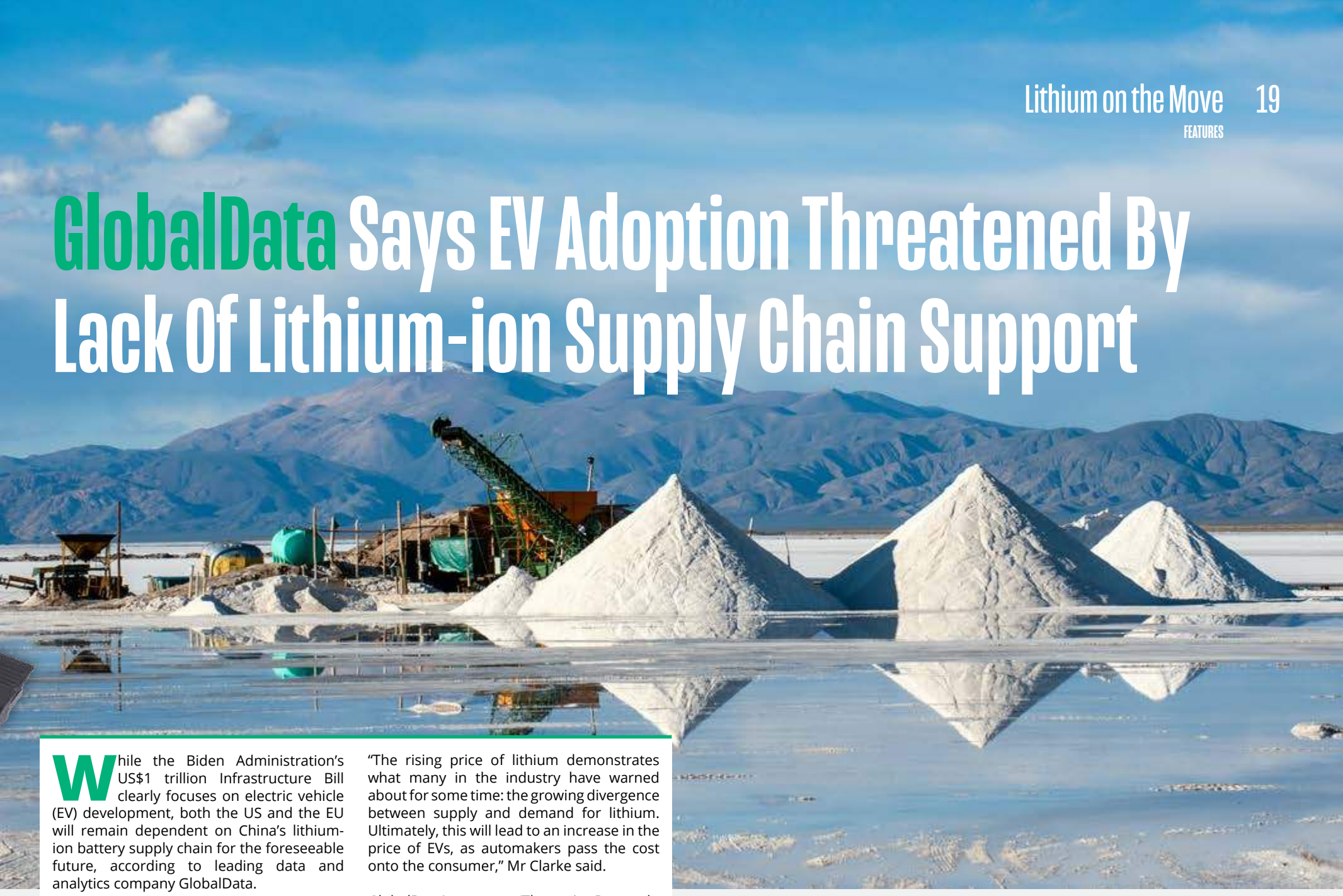
Global electric vehicle (EV) sales exceeded three million units in 2020, and the Resources and Energy Report suggested growth is likely to continue over the rest of 2021 — with sales forecast at about five million units, up from the last forecast of 4.4 million units.

However, according to the Department of Industry, Science, Energy and Resources, there is more than usual uncertainty in the forecast, due to a semi-conductor shortage in the auto industry, but auto-makers are expected to prioritise electric vehicles over combustion engines. Longer term, demand is projected to rise to about 30% of vehicle sales annually by 2030, given manufacturers' declarations of capacity hikes and recent strong sales trends.

EV growth drivers

The European Commission released a proposal for stronger emissions standards on vehicles which would require average emissions of new cars to come down by 55% on 2021 levels by 2030 and 100% by 2035. The US administration approved targets of a 50-52% reduction in emissions by 2030 from 2005 levels. These targets mean security of supply for battery grade chemicals may become a big issue for customers, with a shortfall in battery grade products projected towards the end of the outlook period. ***AMR***

GlobalData Says EV Adoption Threatened By Lack Of Lithium-ion Supply Chain Support



While the Biden Administration's US$1 trillion Infrastructure Bill clearly focuses on electric vehicle (EV) development, both the US and the EU will remain dependent on China's lithium-ion battery supply chain for the foreseeable future, according to leading data and analytics company GlobalData.

"You can't just click your fingers and make a fully working lithium-ion battery supply chain appear – it takes time," Daniel Clarke, a Thematic analyst at GlobalData, said.

"The recent decision by Johnson Mathey to withdraw from UK battery manufacturing demonstrates just how hard building a supply chain can be.

"Western economies are quite far behind China already, with the country having held an 80.5% share of lithium-ion battery capacity in 2020. Even with the US and EU's best efforts, China will still dominate by 2026, with an expected 61.4% share.

"Further, China is strikingly dominant in both chemical refining and the production of cathodes and anodes - all critical parts of the supply chain. In the meantime, the US and EU remain vulnerable in this important future market."

According to GlobalData, the price of lithium carbonate is set to rise worldwide, from just overUS $10,000 in 2020 to nearly US$14,000 in 2024.

"The rising price of lithium demonstrates what many in the industry have warned about for some time: the growing divergence between supply and demand for lithium. Ultimately, this will lead to an increase in the price of EVs, as automakers pass the cost onto the consumer," Mr Clarke said.

GlobalData's report, 'Thematic Research: Electric vehicle batteries (2021)', notes that one of the core challenges for EV adoption is keeping the cost of a lithium-ion battery as low as possible.

"Batteries are already the most expensive part of an EV. Cell costs would need to be notably below $100 per kilowatt hour for mainstream production to take off, but this isn't looking likely," Mr Clarke said.

"Any increases in cost will be a blow to the decarbonization agenda of advanced economies, as well as lead to a deceleration in the decarbonization of the automotive industry.

"To reduce future bottlenecks, governments at COP26 need to incentivize investment into new mines for raw materials needed in EV production, as well further develop sustainable lithium-ion battery supply chains.

"Unfortunately, mines can take up to seven years to build, and demand for EVs is increasing by the day." ***AMR***

Liontown Roars At Kathleen Valley With DFS Confirming Tier-1 Global Lithium Project

Australia's reign as the world's leading lithium producer has been boosted by news that Liontown Resources Limited (ASX: LTR) has confirmed the huge potential of its Kathleen Valley Project In WA with the completion of a Definitive Feasibility Study (DFS).

Liontown and analysts agree that the Kathleen Valley Project has the potential to be developed into a leading second-generation lithium-tantalum mining and processing operation in Western Australia's Northern Goldfields.

Building on the PFS completed in October 2020, the DFS outlines a Tier-1 global lithium project with exceptionally strong financial and technical merits, combined with a class-leading sustainability and ESG framework that is being fully integrated with the Project's development, details of which will be released in Q4, 2021.

Liontown's CEO and Managing Director, Tony Ottaviano, said the DFS delivers exceptional results including a further increase in project NPV8% to $4.2 billion and an Ore Reserve which underpins a ~23-year mine life at a planned initial processing rate of 2.5Mtpa, ramping up to 4Mtpa in Year 6 of operations.

Mr Ottaviano said this will see Kathleen Valley become one of the largest new lithium producers globally, with annual production of SC6.0 commencing at ~500ktpa and ramping up to ~700ktpa at globally competitive cash operating costs of US$319/t SC6.0 (Years 1-10, excluding Royalties).

"The completion of the DFS marks a major step towards Liontown becoming a substantial global lithium producer and, together with the Updated Downstream Scoping Study, lays very strong foundations for our aspiration to become a world-class battery materials company," Mr Ottaviano said.

"At the initial planned production rate of ~500ktpa of spodumene concentrate, Liontown will represent 5.7% of the world spodumene market and 4% of the lithium market on a Lithium Carbonate Equivalent (LCE) basis, with a project that has been conservatively designed to incorporate realistic capital and operating cost assumptions that take current market conditions into account.

"Importantly, the increased capital estimate of $473 million delivers an optimised and much larger initial project when compared to the 2020 PFS. It also takes into consideration the cost inflation currently seen in the resources industry and incorporates upfront allowance for several key items of plant and equipment.

"This will allow us to scale-up rapidly to 4Mtpa throughput and 700ktpa spodumene concentrate production in Year 6. That is a compelling and attractive growth pathway that will see Kathleen Valley very quickly grow to become a top-5 global producer in LCE terms.

"The DFS also applies independently sourced long-term pricing assumptions which we believe establishes the project on very firm footing while retaining exposure to the huge upside of spot lithium pricing – which is currently significantly higher than the assumed weighted price of US$1,392/dmt FOB of SC6.0.

"The other key highlight of the DFS is the way that we will incorporate our ESG framework into the project development right from the outset. This includes the sector-leading adoption of renewable power generation to deliver a low-carbon footprint and the early inclusion of the Tjiwarl Native Title Holders, and heritage considerations in the design, planning and layout of the Project.

"We are extremely proud of the work that has been done over the past three years to get to this point especially in regard to the extensive metallurgical test work program which has consistently demonstrated the ability to make 6-6.5% grade concentrate, and I would like to acknowledge the incredible in-house team at Liontown, as well as our consultants, who have worked so hard on the delivery of this world-class DFS.

"Importantly, we have been progressing financing and off-take discussions in parallel with the DFS, and they are now at a very advanced stage. By publishing the DFS outcomes, our key stakeholders will have increased transparency and certainty around the Project parameters, putting us in a position to execute on our off-take and funding strategy and advance rapidly towards a Final Investment Decision, which we are targeting for Q2, 2022.

"With Liontown now firmly established on a trajectory to become Australia's next major lithium producer, this is an exciting time for our shareholders as we move from exploration to full-scale development at Kathleen Valley, finalise off-take and funding discussions and secure the backing we need to commence project execution.

"This is a major new Australian resource project, in a futurefacing commodity, that we believe will deliver exceptional long-term returns for our shareholders, all of our other key stakeholders and the State of Western Australia."

The DFS is based on a long-term weighted average price assumption for SC6.0 of US$1,392/tonne and incorporates realistic assumptions for capital and operating costs that take into account the current extremely competitive environment in the WA resource sector as well as cost escalation in materials, services and salaries.

Mr Ottaviano said an exceptional level of interest has already been received from potential customers and off-takers. This has been accompanied by a very high level of interest from project financiers, investment banks and equity funding groups.

An integrated and value-adding ESG focus was adopted as part of the DFS, ensuring that project permitting, social licence and engineering-related initiatives are permeated throughout the mine schedule, power usage/supply mix and project layout. Importantly, an economic 'yardstick' was attached to all ESG considerations to ensure they add value to the project.

New funding

The market's support for the project's future was highlighted in early December when Liontown successfully completed a ~A$450 million institutional placement of approximately 272.7 million new fully paid ordinary shares.

In addition to the Placement, the company has also announced a Share Purchase Plan at the same price as the Placement, which is expected to raise up to A$40 million, with the Placement and SPP to raise total gross proceeds of up to ~A$490 million.

Mr Ottaviano said the strong demand from both domestic and offshore institutions for this landmark equity raising is testament to the world-class nature of the Kathleen Valley Project and represents a strong endorsement of our development pathway.

"The Placement was well supported by existing Liontown shareholders and will also see new investors join the register. The introduction of these high-quality institutions together with the support shown by current shareholders has ensured that we emerge well capitalised with certainty of funding for the Stage 1 capital cost of the initial 2.5 Mtpa development at Kathleen Valley."

The company intends to use the proceeds from the Offer, in conjunction with existing cash on hand, towards the following purposes:

1. Kathleen Valley development costs
   - Ordering of critical long-lead items
   - Mine establishment and construction capex
   - Pre-production costs
   - Sustaining capex for the first year of operations

2. Corporate costs, working capital and the Offer costs
   - General corporate costs
   - Working capital requirements
   - Offer costs including Joint Lead Manager fees and legal fees

3. Exploration and study costs
   - Kathleen Valley and Buldania Resource drilling
   - Downstream Pre-Feasibility Study
   - Buldania studies
   - Testwork
   - External consultants

AMR





Strong Market Support For New Perth Lithium Player

Perth-based lithium exploration and development company Winsome Resources (ASX: WR1) received strong interest on its first day of trading on the Australian Securities Exchange in late November.

With a portfolio of high-grade lithium assets in Quebec, Canada, and global demand for lithium soaring, Winsome peaked at $0.295 per share during day one trading, up from its initial listing price of $0.20. By market close, the stock settled at $0.265, or 32.5 per cent up, with more than 15.5 million shares traded.

The company completed a heavily oversubscribed Initial Public Offering to raise A$18 million, which will be used initially to fund an intense exploration and drilling campaign of the current assets.

Winsome Managing Director Chris Evans said the strong response from investors was pleasing, although "somewhat expected" given the current interest in lithium.

"It's an exciting time to be in lithium and today's results affirm investor appetite for this growing commodity, while demonstrating the high regard in which investors hold our assets in Quebec," Mr Evans said.

"We have, with equal measures of skill and luck, picked probably the best time imaginable to be listing on the ASX with a lithium-focused exploration company.

"Global demand for lithium is at an all-time high, fuelled largely by a surging interest in electric vehicles and battery storage."

Winsome will now focus on developing a resource and progressing its three projects in the James Bay region of Quebec – Cancet, Adina and Sirmac-Clappier – towards production.

The company will focus on high quality spodumene concentrate, suitable for conversion across multiple battery applications.

"At Cancet, the most developed of our three projects, there has already been more than 5,000m of diamond drilling completed and the project boasts a JORC exploration target of 1 to 2 per cent lithium oxide," Mr Evans said.

"We intend to expand the drilling to develop a maiden resource, while simultaneously exploring for new areas of mineralisation on the remaining 350 or so claims at Cancet that have thus far been exposed to relatively little exploration.

"The same will occur at Adina, where we have already completed about 1,700m of diamond drilling.

"At Sirmac we will be doing grass roots exploration to confirm the presence of lithium mineralised pegmatites that look like they extend on to our property from known adjacent lithium resources."

With more than 99 per cent of the world's lithium reserves located in Australia, Argentina, Chile and China, Mr Evans said the company's assets offer jurisdictional diversity and opportunities to contribute to the expanding North American battery industry.

Quebec is noted as one of the world's most supportive, lowest risk mining regions in the world, renowned for its world-class infrastructure and support for mining developments.

It is at the forefront of the North American push to develop its own EV battery supply chain, with lithium being one of the key base ingredients needed to make this happen.

AMR

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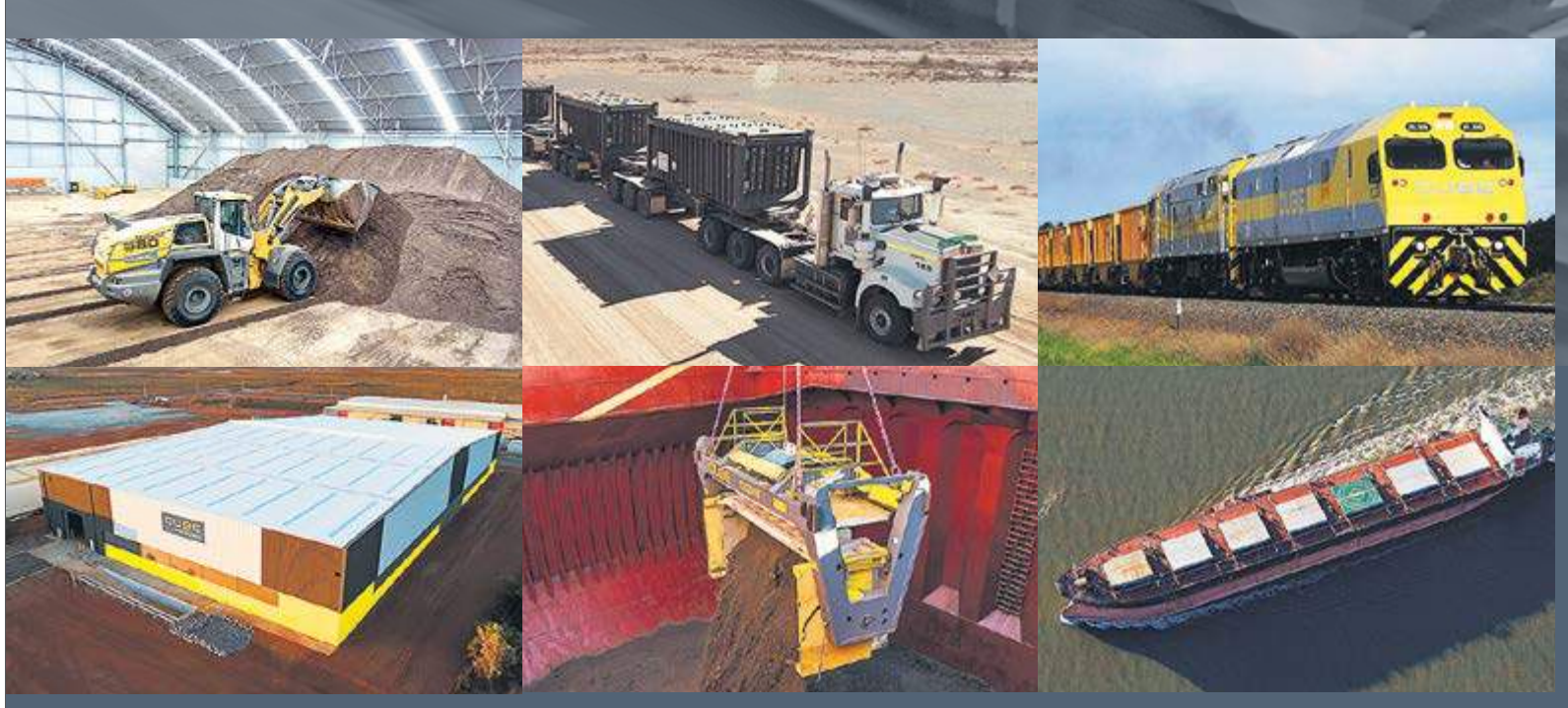
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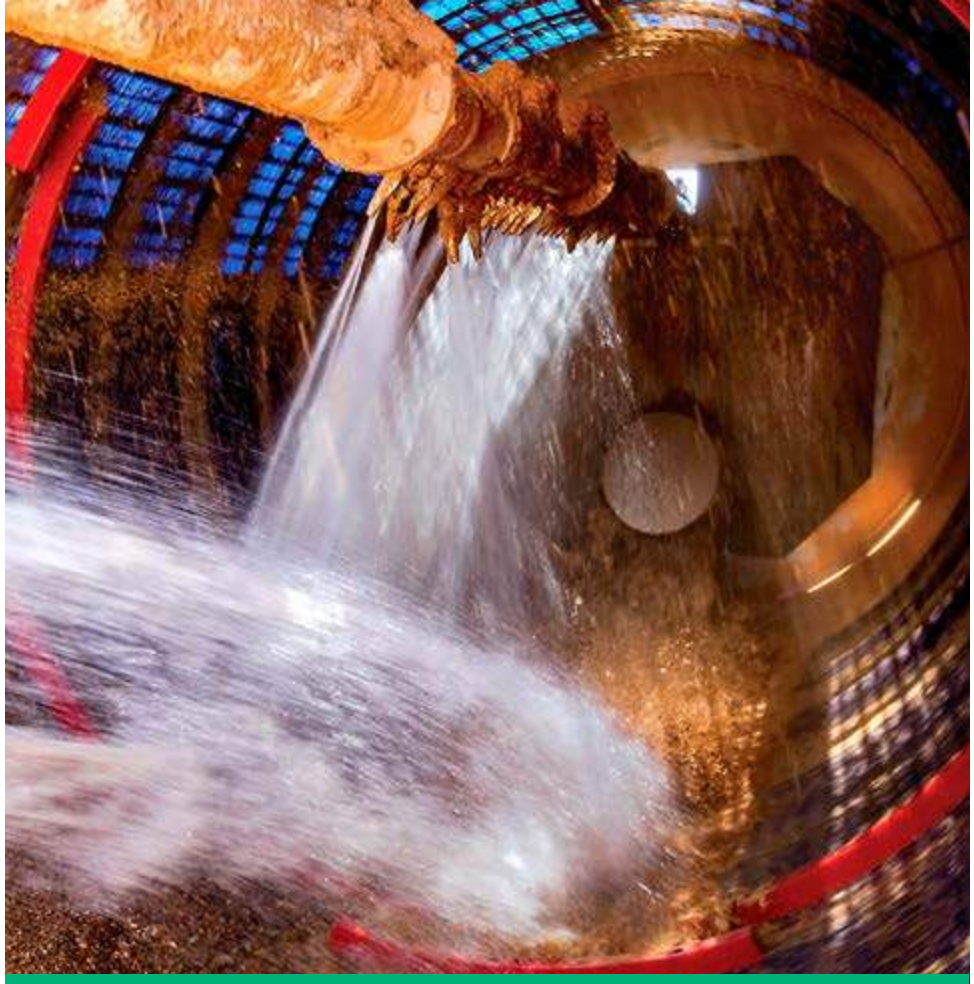


Image Resources' 3.7Mtpa conventional wet concentrate plant producing a high-quality HMC.



Image Resources's classic, dry open-cut mining standard truck and shovel fleet.

Targeting Growth

High demand for mineral sands commodities, along with limited supplies, are driving the substantial rise in mineral sands commodity prices.

In fact, the big story for 2021 has been rising commodity prices and Q3 CY2021 was no exception with the average benchmark prices for zircon up 8.3%, ilmenite up 7.5% and rutile up 4.3% quarter-on-quarter.

This has delivered increased cashflow and profitability in 2H CY2021 for Image Resources (ASX: IMA) from its mining operations at Boonanarring, a 100%-owned, high-grade, zircon-rich mineral sands project, located 80km north of Perth in the North Perth Basin in WA.

Image Resources managing director and chief executive Patrick Muntz says rising commodity prices are always positively welcomed by mine operators.

"Especially when price rises are so substantial, as in the case of zircon, rutile and ilmenite, and especially when operating costs remain in check, as in our case," he said.

"The net effect is that added revenue simply flows to the bottom line to improve profitability to the benefit of shareholders.

"For Image, rapidly rising commodity prices may also serve to delay certain capital costs such as for relocating mining and processing operations to our Atlas project and may serve to increase total ore reserves if a lower cut-off grade can be justified."

Growth and Sustainability

Image Resources has 12 zircon/titanium projects in its fully-owned portfolio, all located in WA within an area of 1200km^2.

Only the first of these 12 projects (Boonanarring) has been developed, with production of its heavy mineral concentrate (HMC) starting in December 2018.

Contained zircon at the project represents 80% of total revenue and approximately 6% of global production.

The second project (Atlas) is being developed and will be operated at after depletion of Boonanarring's ore reserves.

Image is planning for plant and equipment to be relocated to Atlas at a cost of $25m following depletion of ore reserves at Boonanarring in Q1 CY2023.

While operating at Atlas with its three years' current ore reserves, the Hyperion and Helene projects near Atlas are planned to be permitted for development to extend mine-life in the Atlas area.

The third project (Bidaminna) is under feasibility study and planned to be operated as a second mining centre over a likely 10-year mine life in parallel with Atlas.

Image is also investigating opportunities to self-fund investments and acquisitions in zircon and titanium projects outside its current portfolio that are development-ready and have substantial mine life.

The company also wholly-owns gold-focused tenements and the adjoining current Farmin tenement southeast of Kalgoorlie, WA, which has the potential to be a profitable gold production centre.

Atlas Project (including Hyperion and Helene)

Atlas was included as part of Image's Bankable Feasibility Study (BFS) published in 2017 and detailed project development planning began in Q4 CY2020.

The project is about 160km north of Perth (80km north of Boonanarring) and has current ore reserves of 9.5Mt at 8.1% HM.

The plan outlined in the BFS was for the wet concentration plant (WCP) and associated equipment, infrastructure and mining operations to be relocated from Boonanarring to Atlas in late CY2022.

The mining and processing plan for Atlas is expected be the same as for Boonanarring using dry mining and producing an HMC for export under existing HMC off-take agreements, including potentially increasing total mineable ore reserves using a lower cut-off grade.

Atlas is a high-grade deposit and has coarse-grained minerals which favour high recoveries, very much like at Boonanarring, but with a strip ratio of approximately 1.2:1 (Boonanarring 6:1), translating to significantly lower mining costs at Atlas.

The zircon content of the HM in the ore at Atlas is lower however at 11%, compared to 24% at Boonanarring.

The 100%-owned Hyperion and Helene projects (mineral resources of 5Mt at 6.3% HM and 13.2Mt at 4.3% HM respectively), are located to the immediate north of Atlas, and are potentially within economic pumping distance from the planned location of the Atlas WCP.

Both projects are being assessed as part of the overall plan to extend the mine life in the Atlas area.

Eneabba Tenements Acquisition

At the end of November 2021, Image Resources made an announcement that it had entered into a binding agreement with Sheffield Resources Ltd to acquire a package of mineral sands tenements in the historic Eneabba mining district, located 275km north of Perth, WA.

These tenements contain mineral resources estimated at 211Mt at 3% total heavy minerals (THM) for 6.3Mt contained THM.

Total consideration offered for the acquisition is $24m in cash, to be paid out of the Image's existing cash reserves of $50m as at 30 September 2021.

Mr Mutz says the company is pleased to have the opportunity to acquire a package of tenements that only rarely comes onto the market.

"Sheffield's divestment decision coincides positively with Image's desire to identify and secure potential development projects outside of its current portfolio, as a critical component of its growth strategy," he said.

"This acquisition provides the company substantial opportunities for additional mine life as well as production expansion potential."

Acquisition of the Eneabba Tenements does not change Image's current development plans for its 100%-owned Atlas and Bidaminna projects.

Initial plans for projects associated with the Eneabba tenements is for potential operations of a single larger or two smaller projects in parallel with potential operations at Bidaminna and Atlas.

These plans are being formulated in conjunction with the development of Image's annual budget for CY2022 and will likely include securing land access, pre-development drilling and data collection to support heritage requirements, infrastructure planning and environmental permitting for at least one of the key projects.

Boonanarring Q3 CY21 Production and Prices

HMC production in Q3 YTD was 3% higher than forecast, despite a 63% reduction in HMC production during Q3 QoQ, following the quarterly record high HMC production of Q2.

Record quarterly low HMC production for Q3 was a result of the indirect impacts of unusually high rainfall events in July and August and fully saturated ground conditions at Boonanarring.

These wet conditions added substantially to the total downtime required for the relocation of the feed preparation plant (FPP) from Block A to Block C, and contributed to a pit wall slump on the eastern high wall of the mine, which prevented access to higher grade Eastern Strand ore and resulted in quarterly record low ore grades being processed.

Despite the delayed HMC production in Q3 and stubbornly high HMC shipping costs (more than double forecast costs of A$35/t), market guidance on production, sales and costs for CY2021 was maintained.

Image's benchmark price for zircon rose a further 10.4% above the Q3 average price, to US$1,800/t on 1 October 2021, and in total, zircon has risen 25% since the start of 2021.

The company's benchmark price for ilmenite has risen a total of 46% and a total of 39% for rutile in 2021.

The market price for zircon in China is US$2,600/t which is a further 45% higher than Image's 1 October 2021 benchmark price, suggesting Image's benchmark price will likely continue to rise.

Studies are also underway to determine if higher commodity prices and recent more favourable FX will support the conversion of additional mineral resources to ore reserves at Boonanarring and Atlas, with the goal of extending mine life at Boonanarring into Q1 CY2023, thus deferring the planned relocation to Atlas, while at the same time potentially expanding the ore Reserves and mine life at Atlas. ***AMR***



The acquisition of the Eneabba tenements consists of 8 exploration licences, 3 mining leases and 1 retention licence covering 8 project areas, with the largest project, Yandanooka (pictured here), containing mineral resources estimated at 60Mt at 3.0% THM for 1.8Mt of THM. *(Image Source: Sheffield Resources Ltd)*

PROJX has Proud and Successful Association with Image Projects



When you look through ProjX's catalogue of project activity, it is particularly noticeable that the company has had a significant involvement with a number of the new and long-running Western Australian resource developments.

This includes Galaxy Resources' Mt Cattlin Lithium operation, VRX Silica's Arrowsmith North Silica Sands Project, Element 25's Butcherbird Manganese Project and Shark Bay Resources' Useless Loop salt project.

It is also notable that the specialist project management, engineering and project execution company has had a lengthy and successful relationship with Image Resources and in particular the Atlas and Boonanarring Heavy Minerals mining operations north of Perth.

Atlas work

Image Resources was granted a Mining Lease for its 100%-owned Atlas Mineral Sands Project in April this year. Atlas was included as part of Image's Bankable Feasibility Study (BFS) published in 2017 and was contemplated to be mined after all available Ore Reserves at the nearby Boonanarring project are mined out.

Located 165km north of Perth and 90km north of the currently operating Boonanarring project, Atlas is a shallow and high-grade open pit mine. Mineralisation extends from surface to 16m depth and has an average thickness of 3.5m and a maximum thickness of 12m.

The project is expected to commence when Boonanarring is depleted, at which time key infrastructure, including the existing wet concentrator plant (WCP), will be relocated from Boonanarring to Atlas.

ProjX has had a lengthy involvement in the Atlas planning process and is currently undertaking a number of key activities at the project, including:

- Project managing and assisting with the development phases of the project;
- Managing the workers accommodation design development and approvals process; and
- The supply and installation of bore lines.

ProjX will also assist Image with the management of the all-important project execution phase, including design, engineering, construction management and commissioning.

The current forecast for completion of mining and processing at Boonanarring is late CY2022 with the move to Atlas to follow immediately after.

Boonanarring Work

Since managing the construction of Image's maiden mining operation Boonanarring, ProjX has successfully completed a range of work for Image Resources at Boonanarring over the years including multiple relocations of the Feed Preparation Plant (FPP) and various upgrades of key processing equipment.

ProjX's ongoing and close relationship with Image has no doubt played an important role in assisting Image Resources increase production at this important Western Australian project over the years.

ProjX Skills

ProjX provides end-to-end project solutions founded on the core principals of project management.

Working across all industries and collaborating with the industry's best, ProjX will tailor the management of a client's project to ensure that its objectives are met and expectations exceeded.

ProjX can provide the full suite of professional project delivery services, from engineering design and drafting, scoping, estimating and scheduling, through to site management and construction management.

The company specialises in project management, engineering and project execution within the mining, resources, commercial construction, and heavy industries.

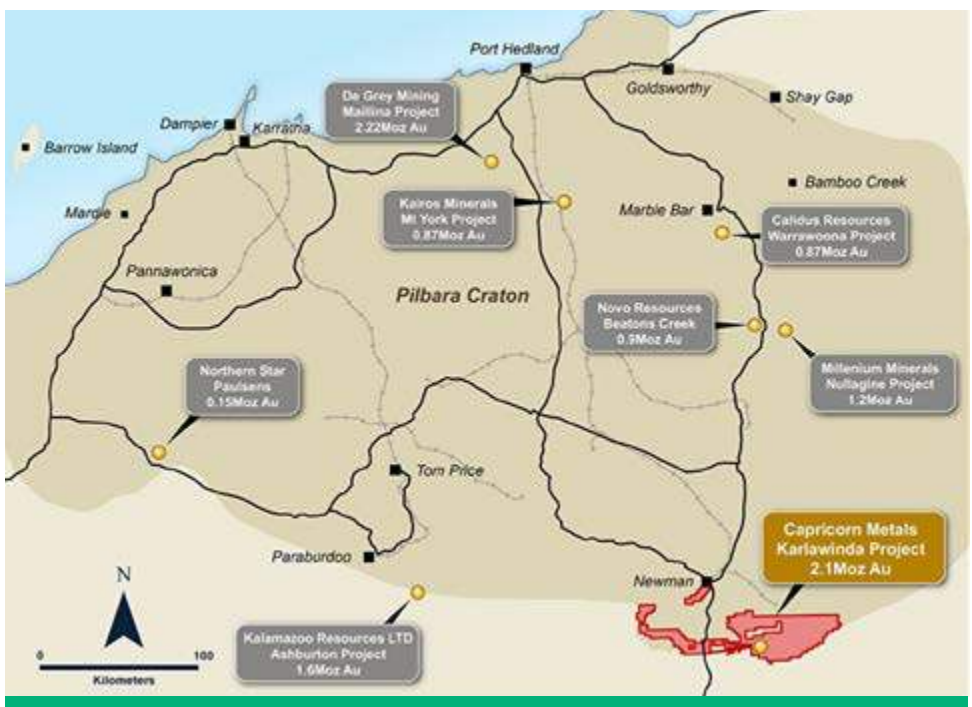
With offices in Perth and Bunbury, Western Australia, ProjX serves clients across Australasia, with tailored project solutions ensuring it is the project management company of choice for a wide range of customers throughout the region.





Australia's Newest Gold Producer

Karlawinda processing plant



Location of the Karlawinda gold project.

Capricorn Metals (ASX: CMM) has successfully transitioned from explorer to gold producer.

Its stand-alone Karlawinda gold project, a long-life and high-margin project in Pilbara, WA, is expected to produce 110,000-125,000ozpa of gold over 10-12 years on current reserves, with potential for mine life extension.

Construction of the Karlawinda gold project completed on time and on budget in June 2021 and first gold of 386oz was poured in late June 2021.

Gold production, including gold-in-circuit, for the first week of operations was 2360oz.

Within two months, the project was nearing full steady-state operations, generating strong positive cashflow.

Continuous ore production was achieved in the third quarter of 2021, producing 24,329oz with a gold recovery of 92.6%.

The project is currently ramping up towards commercial production.

Capricorn executive chairman Mark Clark says the transition of the Karlawinda gold project to full operations is progressing rapidly.

"To be within our long-term gold production run rate target range and to be closing in on full steady state operations in only the second month after the first gold pout is a credit to Capricorn's operations team," he said.

"We will look forward to seeing the project become a very strong cashflow and profit generating business for the company."

Mining and Processing

The mine is open pit with 3-stage crushing, a 7.5MW ball mill and carbon-in-leach (CIL).

The expected processing plant throughput capacities are 4.5-5Mtpa in the oxide/fresh ore blend in the first three years and 4-4.5Mtpa in solely fresh rock ore in years four and beyond.

In the September 2021 quarter, mining in the Bibra open pit moved a total of 2.1M BCM, with about 1.5M BCM of waste material mined and utilised primarily for the construction of the second lift of the tailings storage facility (TSF).

The second excavator and truck fleet was mobilised to site at the end of the June quarter in 2021, with mining activities reaching full capacity by the end of the September 2021 quarter.

Construction of two additional CIL tanks provides additional leaching time for the anticipated higher processing plant throughputs.

The commissioning of the CIL tanks and the sealing of the airstrips are expected to be completed in the December 2021 quarter.

Gold Hub in Iron Ore Country

Karlawinda is located in iron ore country, also known as the Pilbara region of WA.

Situated about 70km southeast of Newman, Karlawinda is south of other major gold mining projects in mines in and around the Pilbara Craton.

These include De Grey Mining's Maillina project, Kairos Minerals' Mt York project, Norther Star's Paulsens, Novo Resources' Beatons B reek, Calidus Resources' Warrawoona project and Millenium Minerals' Nullagine project.

Pilbara is also home to world-class iron ore mines belonging the likes of BHP, Rio Tinto, Fortescue Metals Group and Atlas Iron.

Gold Mineralisation

Karlawinda includes the significant Bibra deposit and other outstanding exploration targets including the Francopan prospect.

Gold mineralisation at the Francopan prospect was discovered in 2005 by WMC Resources, with Independence Group (IGO) acquiring the project in 2008, resulting in the discovery of the Bibra gold deposit in 2009.

In 2016, Capricorn then acquired the project and has drilled 147,000m and increased resource by 329% from 650Koz to 2.145Moz.

Other key achievements include the granting of a mining lease, approval of all major permits and signing of major agreements.

Mount Gibson Gold Project

On 28 July 2021, Capricorn Metals announced that it had executed binding agreements to acquire 100% of the Mt Gibson gold project about 280km northeast of Perth in the Murchison region of midwest WA.

The acquisition increased Capricorn's total resources to 4.2Moz, including the resources and 1.2Moz ore reserve at Karlawinda.

"The purchase of the Mt Gibson gold project is an outstanding opportunity for Capricorn to grow beyond the now operational Karlawinda project," Mr Clark said.

"The project has a proven gold endowment, is located in the world class mining jurisdiction of WA and has been subject to a very limited modern exploration.

"There is every reason to be optimistic about the opportunity with the last gold production over 30 years ago from very shallow open pits when the gold price was around A$450 per ounce.

"We look forward to undertaking an extensive drilling programme to infill and significantly extend the shallow drilling depths to allow an update to the current 2.1Moz resource."

Mt Gibson further announced on 15 December 2021 that all key mining tenure at the Mt Gibson gold project had been granted, covering 8km of strike hosting the current 2.08Moz gold resource.

Capricorn Metals will commence resource expansion and exploration drilling programmes of more than 110,000m in January 2022.

This recent acquisition of the Mt Gibson gold project provides a significant step for the company to become an Australian-focused multi-asset gold producer, along with exploration opportunities to grow its resource base to beyond the current 4.2Moz. ***AMR***

Additional CIL tank construction at Karlawinda.



Let's Go, METS

The Karlawinda Gold Project is located in the Pilbara region of WA, 70km by road southeast of Newman.

Karlawinda is an advanced gold project which includes the Bibra deposit and numerous outstanding exploration targets including the Francopan prospect.

The project area is close to key infrastructure and mining support services.

Gold mineralisation at the Francopan Prospect was originally discovered by WMC Resources Ltd in 2005.

The project was subsequently acquired by Independence Group (IGO) in 2008 resulting in the discovery of the significant Bibra Gold Deposit in 2009.

Capricorn acquired the project in February 2016.

At the time of acquisition of Karlawinda from IGO by Capricorn, approximately A$12m had been spent on regional exploration, resource evaluation and prefeasibility activities.

The team have a non-typical philosophy of building plants themselves using contractors rather than managed by an engineering company.

They have a successful history of doing this with Moolart Well and Garden Well.

Mark Clark is the current Executive Chairman of Capricorn Metals and is well-known in the industry for his strong financial stewardship and focus on delivering shareholder returns. Previously Managing Director of Regis Resources, Mr Clark grew Regis from a small explorer with a market capitalisation of around $40m to the significant gold producer it is today with a market capitalisation in the order of $2.5b.

The culture within Capricorn Metals and the leadership team is one of practical hands-on doing-it-yourself.
Their staff have gained valuable experience over a number of projects.

They are also characterised by low turnover and a loyal group of employees.

METS Engineering congratulates Capricorn Metals for delivering a new gold project under budget and on schedule in what is a new gold province.

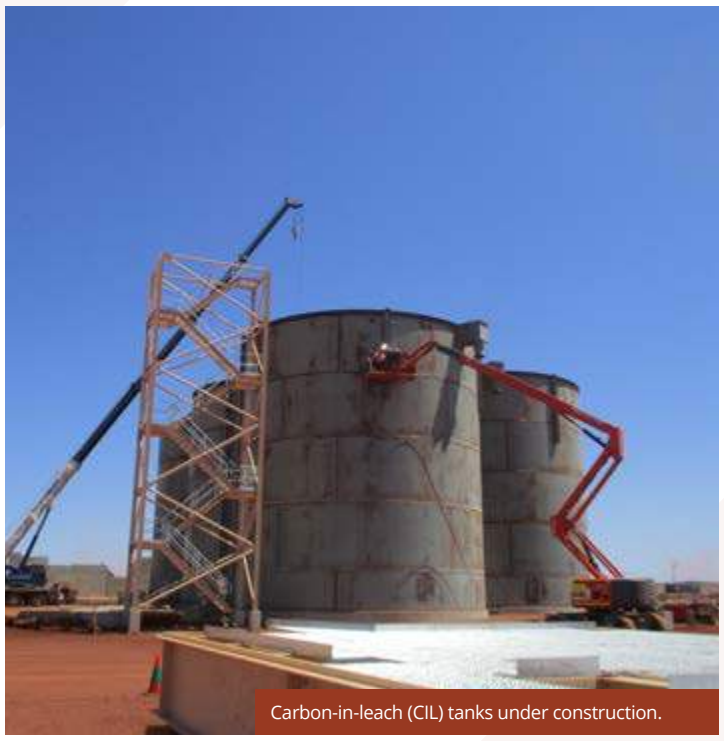
METS Engineering is proud to have assisted Capricorn in a small way to achieve their project objectives.

About METS Engineering
METS Engineering is an innovative and leading edge team of engineering specialists that dare to venture where no one else can.

With more than 30 years' proven track record delivering successful project outcomes for clients, from engineering design and hydrometallurgy to mineral processing, smelting and pyrometallurgy, no project is too large, small or specialised for METS.

What started in Perth, WA, in 1988 as an engineering consulting firm specialising in mineral processing within Australia, has now evolved to service 2000 global clients in more than 30 countries, with 5000 projects completed to-date.

METS Engineering is committed to reducing its and its clients' carbon footprints and is actively involved in new energy projects including converting natural gas to hydrogen and the growing lithium batteries sector. ***AMR***



Carbon-in-leach (CIL) tanks under construction.



METS Engineering: crushing plant foundations.



HMR Plays Key Role In Karlawinda Start-Up

HMR Engineering (HMR) was engaged by Capricorn Metals Ltd for the installation and commissioning of a CITIC Ball Mill at the Karlawinda Gold Project during 2021.

HMR provided specialised services and tooling for the installation and our collaborative working approach with both the Karlawinda site and CITIC-HIC Australia resulted in a safe and satisfactory completion of project.

During and after the installation, HMR was also engaged to assist with technical issues, problem solving, commissioning and additional work scopes in other areas of the project, which highlights HMR's capacity and capability to go above and beyond for our clients.

HMR continues to support the Karlawinda Gold Project with ongoing maintenance services, and we look forward to continuing our mutually supportive and successful relationship with the site and Capricorn Metals Ltd into the future.

HMR has carried out installations and various other projects throughout Australia and overseas, and our combined workforce enables us to offer experienced installation, maintenance and technical consulting services worldwide, specialising in crushing, grinding and power transmission equipment and systems

Founded in 2011, HMR Engineering is a quality service provider to the heavy industrial and mining industries specialising in grinding mills and industrial gearboxes. HMR has a goal of making a difference in the mineral processing service industry, and a focus on technical knowledge gained from years of on-site experience. ***AMR***



2018 Endeavour Mining - Hounde Gold Project - Mill Installation Services.



2019 Teranga Gold - Wahgnion Gold Project, Mill Installation Services.



HMR ENGINEERING

2021 Karlawinda Gold Project
Mill Installation

HMR Engineering has extensive experience in Australia and overseas installing and commissioning grinding mills along with a variety of other plant and equipment utilised in the minerals processing industry. Our professional and knowledgeable staff will deliver your installation safely and on target.

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Nelson Silos Expands to Keep Up With Booming Demand

As Australia moves out of a period of drought, the improved weather conditions have led to a boom in demand for agricultural silos. **Eric Nelson, Managing Director of Nelson Silos,** explains how his company is keeping pace.

Business is booming for silo manufacturer Nelson Silos, as farmers flock to increase their storage capacity.

Eric Nelson, the company's Managing Director says the demand is partly due excellent weather conditions across the country.

"On the east coast, many of these farmers have just come out of a drought into near perfect weather conditions for growing," he says.

"The price of grains and legume is also up significantly, which is improving profitability as well."

On farm storage allows farmers to wait until they have a stronger negotiating position before they sell Without storage, many farmers must sell their grain at harvest time when the price of grain is at its lowest.

Facing increasing demand, Nelson Silos has invested significantly into expanding its manufacturing facilities.

Part of this has been installing a new paint booth at its main Rochester facility.

Instead of now spraying individual silos, the booth can handle two to three silos at a time. In addition, temperature controls allow Nelson Silos to dry the paint at a consistent 20°c.

Nelson says the paint booth can also apply spray to the interior of silos with specialised coatings to act as corrosion inhibitors.

"These are mostly for our superphosphate silos, which use a steeper cone and have a more robust and larger outlet," he says.

"Superphosphate, depending on its type, is hydroscopic which means it can clump together. It can also be highly corrosive, which is why the internal coating is so important."

In addition, the company has installed four elevating towers, with another two planned. Nelson Silo's farm silos are built to handle up to 200 cubic metres in capacity. They are fully manufactured in the company's factories before being shipped out across Australia. The elevated towers allow easier access to bolt in wall sheets and place the roof section on the silo.

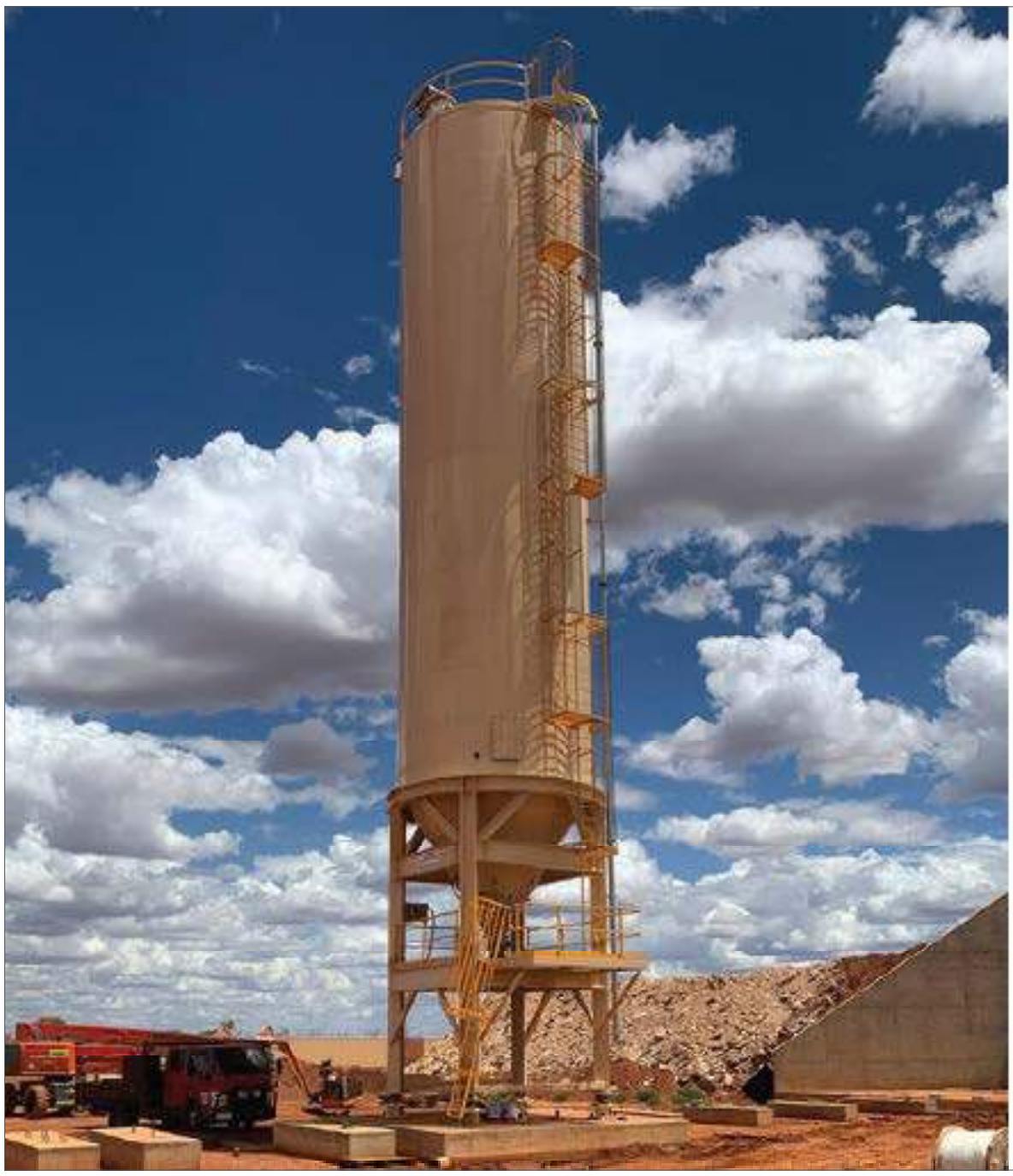
Additional gantry cranes have also been purchased to handle the growing sizes of silos. Nelson says the demand for taller silos has meant the business has had to adapt.

Transport plays a major role within the business. The company owns a fleet of eight prime movers and eight low-loader trailers, along with three heavy trailers. This allows the -:ompany to deliver silos to Darwin, Port Headland or Kalgoorlie itself, instead of through contractors.

"We don't use contractors because it gives us more control over the customer experience," Nelson says. "Our delivery team can also do the installation side of things, with staff in the pilot cars for heavy transport vehicles."

"That's one of our secrets for reducing time spent on site. The people handling the installation have done it literally 50 to 60 times before."

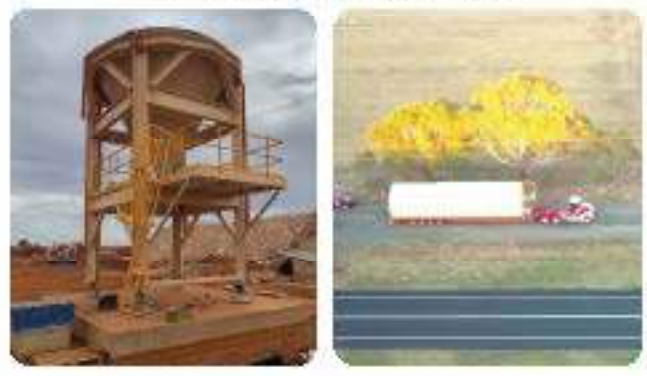
Nelson Silos is continuing further upgrade its manufacturing capacity. As part of this, the company is looking into building another assembly factory in northern New South Wales to streamline assembly." ***AMR***



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North by Northeast

Underground operations at Moranbah North mine.

This is no case of mistaken identity – a humble but productive mine in Queensland is one of the major contributors of high quality hard coking coal to the world.

Moranbah North mine is an underground longwall in the northern part of the Bowen Basin in Central Queensland, producing premium hard coking coal, with operations expected until 2033.

With reserves totalling 261Mt of coking coal, this makes it one of the largest coal reserves in the world, mined from the Goonyella Middle Seam.

In CY2020, Moranbah North produced 4.4Mt of metallurgical coal (CY2019 was 6.1Mt).

Its parent company Anglo American owns 88% of the mine, with the remaining 12% owned by joint venture partners.

The Grosvenor mine is Anglo American's adjacent longwall metallurgical coal operation, which uses Moranbah North's coal processing infrastructure.

Anglo American Metallurgical Coal
Anglo American's coal portfolio is centred around metallurgical coal assets in Australia that serves the steelmaking industry.

The mining giant is the world's third largest producer of metallurgical coal for steelmaking and its operations serve customers throughout Asia, Europe and South America.

The tier one metallurgical coal assets include Moranbah North and Grosvenor mines (both 88% ownership), located in Queensland.

Since 2015, the global mining company has more than halved its production footprint of thermal coal production in South Africa.

Australian Production
In CY2020, a total of 16.8Mtpa of metallurgical coal was produced in Australia, spread across Anglo American's Moranbah North, Grosvenor, Dawson, Capcoal, Grasstree and Jellinbah mines in Queensland.

Export metallurgical coal production guidance for CY2021 is 18-20Mt.

Studies are underway for the expansion of the Moranbah-Grosvenor coal handling and preparation plant to increase capacity by 4-6Mtpa.

In December 2020, the company completed the transaction to provide equal ownership across its integrated metallurgical coal operations at Moranbah North and Grosvenor, through the sale of a 12% interest in Grosvenor mine to the minority joint operation participants in Moranbah North.

Open cut operations were scaled back at Dawson and Capcoal in response to reduced demand for lower quality metallurgical coal.

Displacing Diesel
Australia's largest rail freight operator, Aurizon, and Anglo American are working on a feasibility study to assess hydrogen-powered trains for bulk freight.

The study will explore the application of Anglo American's proprietary hydrogen fuel cell and battery hybrid power units in heavy haul freight rail operations.

If successful, there could be further development of a hydrogen fuelled heavy haul locomotive prototype.

Focus will be on the potential deployment of Anglo American's hydrogen power technology on Aurizon's Moura rail corridor that operates between Anglo American's Dawson metallurgical coal mine and the Gladstone Port, and the Mount Isa rail corridor that operates between the North West Minerals Province to Townsville Port, via Aurizon's Stuart Terminal.

North West Mineral Province
The North West Mineral Province contains about 75% of the Queensland's base metal and minerals, including copper, lead, zinc, silver, gold, cobalt and phosphate deposits.

The province also has the potential to become a globally significant supplier of high-quality vanadium to the energy storage and steel markets with a number of projects under assessment.



This fuel cell electric vehicle (FCEV), owned by Anglo American, is being used regularly on UK roads.

The 180km Moura rail corridor from Dawson to the Gladstone port, and the 977km Mt Isa rail corridor from Mt Isa to Townsville Port both use diesel fuelled locomotives.

Carbon Neutral by 2040
Anglo American has taken a global lead in the development of green hydrogen solutions for its ultra-class 290t payload mine haul trucking fleet.

Anglo American chief executive in Australia, Tyler Mitchelson, says the company is committed to carbon neutral operations by 2040 and is aiming to reduce its Scope 3 emissions by 50% in the same timeframe.

"We know that we cannot achieve all of this alone, so we are working with partners along our value chains and outside our industry to find technical solutions to decarbonise," he said

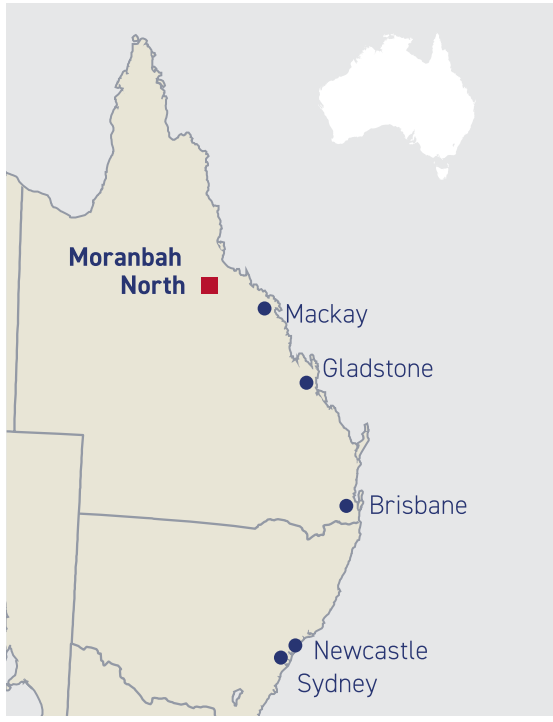
"This collaboration with Aurizon is a great example of the power of partnerships to help address the urgent issue of climate change, while we also look to catalyse new markets to support the development and growth of the hydrogen economy."

Hydrogen-Powered Technology
Anglo American technical director, Tony O'Neill, said this agreement with Aurizon marks the first time the mining company's hydrogen power technology could be tested beyond its existing mine haul truck programme.

"Displacing our use of diesel is critical to eliminating emissions at our sites and along our value chain," he said.

We believe that our innovative hydrogen-led technology provides a versatile solution, whether for trucks or trains or other forms of heavy duty transport."

Aurizon is Australia's largest rail freight



company, with the decarbonisation of its supply chains at the centre of its target to reach net zero operational emissions by 2050.

Aurizon has also commenced research & development for battery-powered trains with a number of industry parties and Australian universities.

Decarbonising Supply Chains
Aurizon managing director and chief executive Andrew Harding says hydrogen offers enormous opportunity in decarbonising and continuing to improve the competitiveness of Australia's export supply chains.

"This is especially true for bulk products underpinning the Australian economy including minerals, agricultural products and fertilisers, industrials and general freight," he said.

"Zero-carbon hydrogen-powered trains would also significantly boost the current environmental benefits of transporting more of Australia's bulk freight on rail.

"Rail freight already produces up to 16 times less carbon pollution per tonne kilometre than road.

"Aurizon is excited to be teaming up with Anglo American on this project, particularly given their success to date in developing unique technology solutions for use in mine haul fleets." ***AMR***

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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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Ahead of the Curve



Blackrock Mining Solutions have revolutionised the Australian mineral resources sector with their industry first dust reduction system; a new and innovative approach to occupational health and safety for underground mines.

Designed to combat dust disease, the Wet Applicator Pumping System is an expertly crafted product introduced in partnership with specialist contract company Ventsec.

It is engineered specifically to New South Wales and Queensland Government standards and suitable for various activities, including installing ventilation control devices; supporting roadway concrete work; coal clearance areas; roadway repairs; underground switch rooms and marshalling areas.

Along with a range of civil applications, the System is a perfect for ventilation and sealing activities; strata consolidation; instant damming and water control and strata sealing for the prevention of gas emissions.

Blackrock Mining Solution's Director Richard Campbell said the Wet Applicator Pumping System was already proven to be a step forward in the prevention of staff health hazards, with feedback so far very positive.

"In a nutshell, we wanted to make mining environments safer for workers," Mr Campbell said.

"We know there are health risks in these workplaces due to workers being exposed to airborne contaminants.

"We know there are production pressures, with operations now able to use emplaced cementitious products whenever they need without interruption.

"There are also new legislative requirements and restrictions for companies to work with that makes it crucial to control dust exposure.

"So, after extensive research and development, we landed on this product.

"It supports mining operations and provides increased control over health risk, productivity and compliance.

"But that's not all – the applications for this product are limitless."

Mr Campbell said Ventsec and Blackrock Mining Solutions were already on the cusp of an innovation pipeline for the Wet Applicator Pump; a product brimming with versatility.

Ventsec have focused on developing product delivery, waste minimization and eliminating suspended loads, as well as utilizing a waterproof enclosed pod capable of transferring product directly to pumps.

Green credentials are also at the forefront of product development, with Ventsec and Blackrock Mining Solutions both dedicated to creating environmentally friendly products

Meanwhile, the businesses are currently exploring a range of additional capabilities, including pairing dust mitigation with the delivery of quality grouting for strata support.

For more information, visit https://www.blackrockmining.net/

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VENTSEC WET APPLICATOR PUMPING SYSTEM FEATURES:

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- Audit and inspection
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- Design and certification for stoppings and other VCDs
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- Better yields (up to 30% better)
- Competitive product pricing
- Competitive and flexible pump hire arrangements

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Blackrock Mining Solutions may have started out small but we have always thought big.

In an industry-first move, we joined forces with Ventsec to create the Wet Applicator Pumping System.

This innovative system is available for hire or purchase and can be tailored to suit each client's individual needs.

The Wet Applicator Pumping System comes with comprehensive training packages and unrivalled after sales support, services and specialty advice.

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Aurelia Metals On A Golden Run





NSW-focussed Aurelia Metals (ASX: AMI) has completed a record breaking 2021 and is in line to continue its golden run in 2022.

Interim Non-Executive Chairman, Susie Corlett, told shareholders recently that 2021 was a year of positive achievements for the company.

"Throughout 2021, your Board was focused on delivery against strategy, and embedding sustainability and resilience into our business in order to deliver long term value to shareholders.

"Given the challenges created by the pandemic, it could have been easy to lose focus on safety. Your Board is very proud of our team, delivering a 58% reduction in Total Recordable Injury Frequency Rate over the year.

"This is an exceptional achievement by any measure – made even more so in the current climate of uncertainty. Aligned with our newly inculcated vision and values, which we call 'The Aurelia Way', over the past 12 months we supercharged our focus on sustainability initiatives across the company.

"This focus saw us reduce our Recordable Environmental Incident Frequency Rate by a remarkable 82% and exceed our targets in respect of lead indicators for safety and environmental performance. Whilst our focus remains on continuous improvement, these achievements reflect both strong leadership and group wide discipline."

The Aurelia Board also used 2021 to introduce shareholders to its maiden three Year Sustainability Plan. The plan outlines milestones the company is committed to delivering over coming years.

"We acknowledge that we have much work before us to achieve the standards we have set for ourselves. In our Annual Report, we outlined commitments in the areas of safety and wellbeing (including sexual harassment and psychological safety at work), diversity and inclusion, climate response and responsibility, First Nations heritage, environmental management and social responsibility. The Company has detailed work programs underway and looks forward to reporting on progress against these commitments."

Record Production

FY2021 saw Aurelia exceed its production guidance and in areas exceed it, delivering record annual gold equivalent production 181,000 oz.

"As we aimed to maximise margin generation across the business, we achieved record underlying EBITDA of $169 million and 125% growth in underlying NPAT to $86 million," Ms Corlett said.

"Across the year we reinvested $26 million in growth capital, and a further $21 million in exploration and evaluation. With highly attractive near term growth and development options before the company, the Board chose not to pay a dividend - electing instead to accelerate toward growth.

"In FY2021, the company invested in both inorganic and organic opportunities. Inorganic growth saw us develop a stronger, more diversified operating base. We grew from two to three operating assets through the acquisition of the Dargues Gold Mine in NSW: a project which at the time of acquisition was still in ramp up.

"Whilst post acquisition operational performance at Dargues was initially below the Board's expectations, Aurelia's systematic and disciplined approach to integrate this asset has delivered consistent performance over the past quarter. We are pleased Dargues is performing in line with our investment thesis and are excited about prospects to convert exploration success into mine life."

Ms Corlett said while the company continues to assess inorganic opportunities on a highly disciplined and judicious basis, the Board believes Aurelia's exceptional organic growth options will deliver highest returns to shareholders in the immediate term.

"Over the past year, organic growth saw the delivery of a 63% increase in Mineral Resources across the portfolio. This not only underscores the exceptional prospectivity of our land package, but is a bell weather for likely reserve growth over the coming 12 months.

"Our assets are located in richly mineralised geological postcodes, with attractive targets that remain untested. Aurelia continues to match the strong prospectivity of our assets with a material, unwavering commitment to exploration.

"This is a strategy that has served us extremely well. It has been another standout year, delivering stunning exploration results across the portfolio. We remain both excited and confident about continuing to unlock further value as we execute our work programmes. As we look to the future, the next 18 months promises to be transformational for Aurelia's shareholders. "Our growth pipeline is enviable, and growing. I will highlight two flagship projects we are advancing in FY2022.

"The Federation project is shaping up to be one of the most exciting polymetallic discoveries in Australia's recent history. It was not long ago that I stood beside the drill rig, with Aurelia's General Manager of Exploration and Business Development Adam McKinnon, as drill core from the discovery hole into this greenfield asset was being pulled to surface.

"This was mid 2019. To now have line of sight to the potential delivery of production from Federation in under four years is a fantastic achievement for our team. The Feasibility Study is ahead of schedule, early works have commenced, and the Board expects to make a final development decision in mid 2022.

"Great Cobar is a substantial, undeveloped copper resource within the footprint of the Peak line of lode. The deposit has been growing in size and scale as we have continued to extend known mineralisation with the drill bit.

A "Pre Feasibility Study is due for completion shortly and a decision to mine will be taken by the Board over the coming calendar year. This decision will take into consideration another recently discovered copper orebody that is located next to existing development at Kairos.

"With that said, my most important message is to recognise the dedication our people. It has been a year that has seen many of our team go above and beyond the call of duty, having been separated from their families due to border restrictions, with some having faced significant personal hardships.

"Through the year, Board governance was strengthened with the addition of Helen Gillies, Bob Vassie and Peter Botten as Non-Executive Directors. These Directors were selected following an evaluation of our Board skills matrix, taking account Aurelia's ambitious growth and sustainability plans."

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JTMEC – your trusted partner in electrical solutions.

JTMEC is a leading electrical contracting company specialising in providing turn-key electrical services and products.

The business began in Kalgoorlie, WA, and has since grown across Australia servicing some of the largest companies in mining, tunnelling, construction and infrastructure.

With locations in Sydney and Orange in NSW, Kalgoorlie and Perth in WA, Mt Isa in QLD and Hobart in Tas, JTMEC's 220-strong workforce are well-placed to support local industry and communities.



JTMEC transport services going from Orange to Adelaide, Melbourne and Mt Isa.


A JTMEC substation installed at an underground mine.



Some of the underground fleet parked at JTMEC's Orange cables workshop.


At a valued client's mine site.

JTMEC has been a proud provider of services to Aurelia Metals for nine years and looks forward to continuing its relationship for another decade.

Aurelia owns three operating gold mines in NSW, with the Peak and Hera mines in the Cobar Basin and the Dargues mine in south-eastern NSW.

JTMEC general manager Scott Bell says Aurelia Metals is a fast-rising star in Australia's mining industry with its growth and expansion plans.

"With the Federation underground project coming on board soon, we look forward to further supporting Aurelia in meeting its production targets," he said.

"Our work with Aurelia is varied, ranging from development work, to production and operations, to work in the mill.

"We have a great working relationship with Aurelia and this has only improved over time."

JTMEC itself is no stranger to underground projects with its specialties being mining, construction, tunnelling and construction projects.

While other mining contractors specialise in one or two services, this 100% Australian owned and operated business offers a full electrical and powering service right around the country.

"JTMEC offers a complete mining service," Mr Bell said.

"We offer turnkey solutions from supplying pumps and labour, to substations and jumbo pump starters.

"Our offices are strategically located around the country and we can easily service mine sites in any capacity, including short-term contracting work and shutdowns.

As a testament to JTMEC's proven performance, the business has grown 33% in the last year.

"We look to grow another 25% this year and keeping our great working relationship with Aurelia is very important," Mr Bell said.

JTMEC is also aiming to expand into the Sydney market with its tunnelling and infrastructure capabilities.



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PJL's Commitment to New Solutions Measured by Clients in Tonnes

Mechanical and engineering business PJL Group have plugged a gap in the mineral resources sector with their newly launched FLEETMINE and WEARWOLF lines; two new offerings expertly designed to save operators from lapses in productivity.

Launched just last year, FLEETMINE is a mobile equipment hire provider servicing the underground hard rock mining industry with a range of machinery, including Underground Loaders, Trucks, Development Drills, IT's and ancillary equipment.

FLEETMINE has been well received by the Australian mining industry and is largely renowned for addressing shortfalls in new equipment supply and covering for major breakdowns.

According to PJL Group East Coast General Manager Chris Plummer, the line is also considered the service of choice for projects driven by base metal prices and is a solid alternative for new contractors to owning their own equipment.

He said it was in great synergy with the launch of WEARWOLF in 2020 – an alternative solution to OEM G.E.T. systems providing reduced costs without the need to change lip plates or cast corners.

"The transition to the WEARWOLF product is seamless," Mr Plummer said.

"It's a new product on the market providing long term sustainable cost savings and supply chain solutions addressing current market conditions around parts shortfalls.

"No modification is required to the machine to use the WEARWOLF product; all you need to do is fit to the bucket and start saving dollars.'

"Current customers are enjoying up to a 55% reduction in cost per hour operation, enabled by superior wear material and a competitive price with local onsite support available across Australia and stock held on both the east and west coasts."

Mr Plummer said both FLEETMINE and WEARWOLF were launched to accommodate major shortages in the mining market for underground hire equipment and underground mobile equipment wear products.

He said with more than a century of combined industry experience within the management team, PJL Group are well placed to launch specialised services and offer clients flexible solutions for their equipment and material requirements.

Founded in the New South Wales mining town of Orange in 2006, the company is Australian owned and operated, with a range of permanent sites across the country.

Thriving from humble beginnings to a workforce of more than 200 personnel, the business is renowned for 'keeping equipment on the job' and providing crucial services to the mining, earth moving, drilling and construction industries.

According to Mr Plummer, PJL Group has a commitment to innovation and a passion for improving processes and solutions for clients.

He said this focus had seen them become a highly respected partner in industries where flexibility, quick decision-making and fast turnaround times were essential.

"Our guiding principle is engineering opportunities into solutions," Mr Plummer said. "We do this by being the best in the world at providing quality customised services and solutions driven by creating value for our customers

"We are deeply passionate about developing the strengths and skills of our people and have an excellent team on board to assist our customers in achieving their production targets."

For more information,
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Stawell Gold A Gift to Local Community

One of Victoria's premier gold mines is now also the site of the development of a significant new study into "dark matter".

The Stawell gold mine is located 250km northwest of Melbourne and adjacent to the town of Stawell, famous around the world as home of the historic, annual running race.

The Stawell district is a historic goldfield dating back to 1850s. The current operator, Stawell Gold Mines Pty Ltd (SGM), commenced mining in 1981 and operates the mine under Mining Licence 5260 (MIN5260).

The State's premier gold producer until 2008, Stawell was restarted three years ago and has produced roughly 2.5 million ounces, with the owners having identified the potential for a major expansion to production after uncovering extensive high-grade gold within the Magdala Basalt Dome.

Stawell Gold Mines has involved the progressive mining of gold in a series of open pits and extensive underground workings. The surface operations encompass an approximate area of 380 ha. The site's underground workings extend from the Magdala portal in a north-westerly direction underneath the town.

In December 2017, private equity group Arete Capital Partners acquired a controlling interest in Stawell Gold Mines and related assets in Western Victoria, with the intention of returning the site to production by expanding the existing exploration programs to build the mineral inventory for the site.

Throughout 2018, underground exploration took place allowing SGM to shore up future reserves resulting in the transition from care and maintenance towards restarting production in early 2019. This was followed by a period of recommissioning the processing plant and re-starting underground mining operations with the first production firing taking place in December 2018, and the first gold pour taking place on 31 January 2019.

Stawell Gold Mines is focused on building strong community relations based on trust and respect. Stawell Gold Mines maintains strong and positive relationships with the community, while understanding the importance of clear communication and transparency with stakeholders.

The Stawell Gold Mines Community Hub provides stakeholders with information relating to the environment, community and site activities. Stakeholders seeking additional information on any of these aspects are encouraged to contact Stawell Gold Mines directly.

Since the renewal of the mining licence precludes open cut mining on Big Hill rehabilitation works are being progressed to backfill the Davis Pit. Progressing of the conceptual rehabilitation plan to a final design includes:

- Material types for backfill and stability
- Hydrology/run-off design
- Vegetation design
- Consultation with the landowner on the final design.

Stawell Underground Physics Laboratory (SUPL)

SGM welcomed Australian Federal Government's $5 million funding and the Victorian State Government's $5 million funding to proceed with the construction of the Stawell Underground Physics Laboratory (SUPL). This laboratory will be the first in the Southern Hemisphere and second in the world. The only other laboratory is located in Italy in the Northern Hemisphere.

The Stawell Underground Physics Laboratory is being built deep underground, in a working gold mine in the town of Stawell, Victoria.

With the development funded by both state and federal governments, a team of scientists and engineers are building an underground laboratory in the search to discover the elusive nature of dark matter, one kilometre underground.

This is a dawn of a new era for this regional town and the next, significant, step in the ground-breaking international collaboration amongst leading physicists working on the SABRE project.

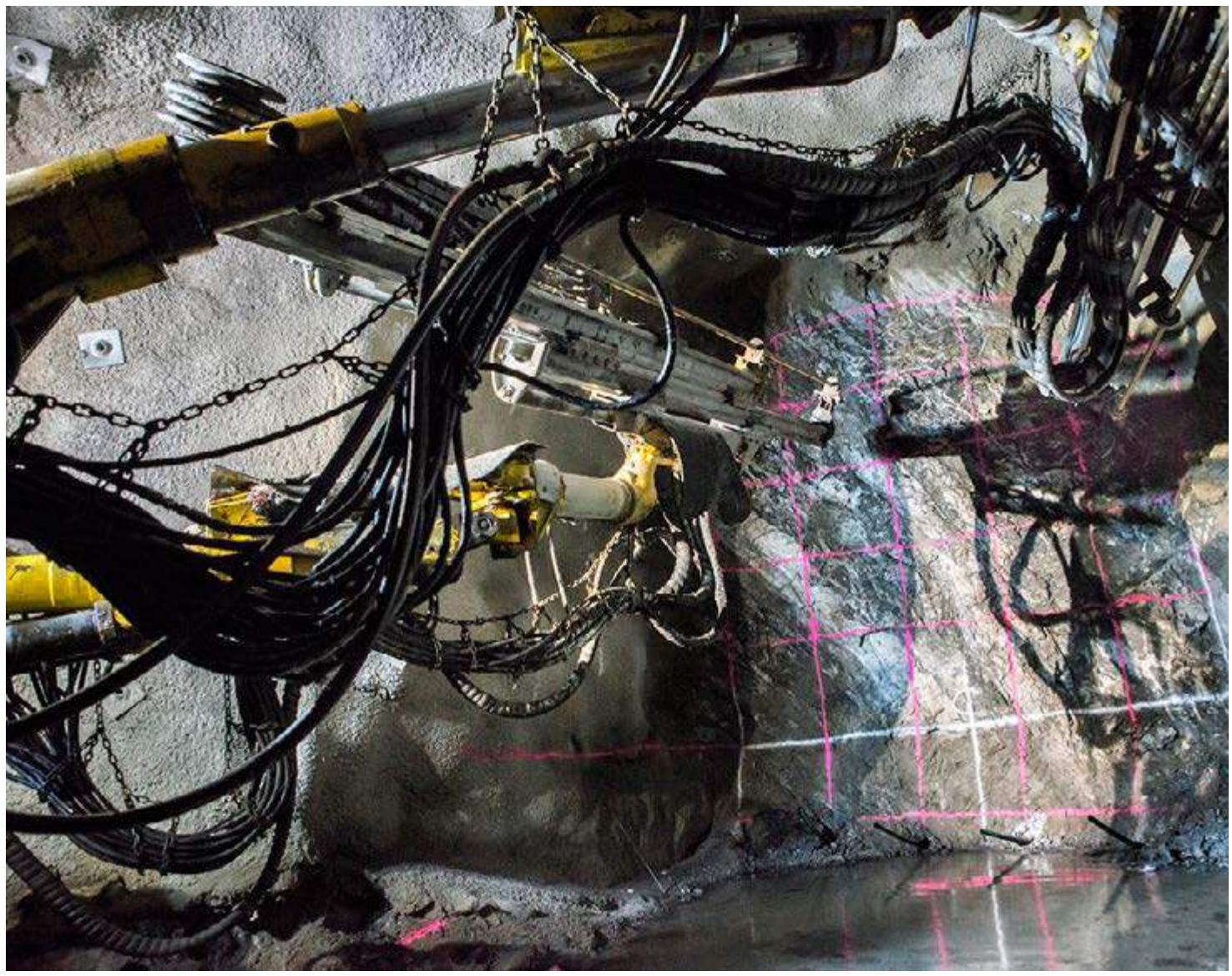
A proposal by the Centre of Excellence for Particle Physics was made in 2014 to set up a dark matter research facility in Stawell using disused sections of Stawell Gold Mine's underground tunnels, and the development of the Stawell Underground Physics Laboratory began.

Construction of the laboratory is underway, with operations expected to commence in early 2022.

About the Science

The underground laboratory will provide a dynamic environment for advances in ultra-sensitive detectors, ultra-low radiation techniques, spin-technology translation, and highly trained graduates ready to lead innovation in both the global search for dark matter and cutting-edge technological development to benefit Australian industry.

In conjunction with the new Centre of Excellence for Dark Matter Particle Physics, the Stawell laboratory ushers in an exciting new development in the search for dark matter, and the understanding of how our universe was formed. ***AMR***







You Know the Drill

Deepcore Drilling has a long-standing relationship with Stawell Gold Mines, with over 15 years' experience providing specialised diamond drilling services to the mine, in both underground and surface operations.

As a leading industry expert, Deepcore Drilling has the experience and capability to carry out deep target and directional drilling of up to 2km, short-hole production and in-fill drilling, as well as complex programs for multiple intersections using wedging and navigational drilling methods for both mining and civil projects.

Deepcore Drilling CEO Don Macdonald says the company aims for excellence in everything it does and offers a premium service at a competitive price.

"Deepcore Drilling is an innovative diamond drilling company, a true industry leader, and is continuously raising the bar," he said.

"We deliver customised drilling solutions for both surface and underground client needs. When our clients have a problem, we have a solution".

The award-nominated sound enclosure is an example of how Deepcore Drilling supports its clients and the community.

"The Sound Enclosure is the solution to the problem that many mining sites face," Mr Macdonald says.

"The Enclosure maximises productive mining activities while successfully meeting all stakeholders' and communities' needs for safety, minimal environmental impact (reduced footprint), low noise and visual amenity."

Always one step ahead with technology and innovation, the latest addition to Deepcore Drilling's fleet is the powerful LF™160.

When paired with the FL262 FREEDOM™ Loader, one of the industry's first 100% hands-free rod handling solutions, this combination can be customised for any requirements, providing surface drilling exploration at the highest safety standards and with maximum productivity.

Deepcore Drilling's fleet includes track, skid or truck mounted, as well as electric or diesel-powered and top-drive or chuck driven, with capability to 2.5km depths.

Deepcore Drilling's field operations span across regional Victoria, New South Wales and North Queensland, operating 24/7, to support our clients needs.

Its crews are highly experienced operations, logistics and dedicated field maintenance personnel, dedicated to achieving excellence.

Deepcore Drilling is lead by a team of highly qualified drillers, geologists, safety and industry professionals, all with vast array of experience including in mining, ensuring all work is completed to the highest standards in all areas.

Other expert services include specialist geotechnical drilling techniques (for example, packer testing and hydrofracking) and the ability to conduct de-watering drilling in mines with high volumes of water flow.

Deepcore Drilling has the know-how, expertise and strong track record in delivering quality drilling services across Australian and Asia-Pacific mining operations.

To find out more,
visit **deepcoredrilling.com**

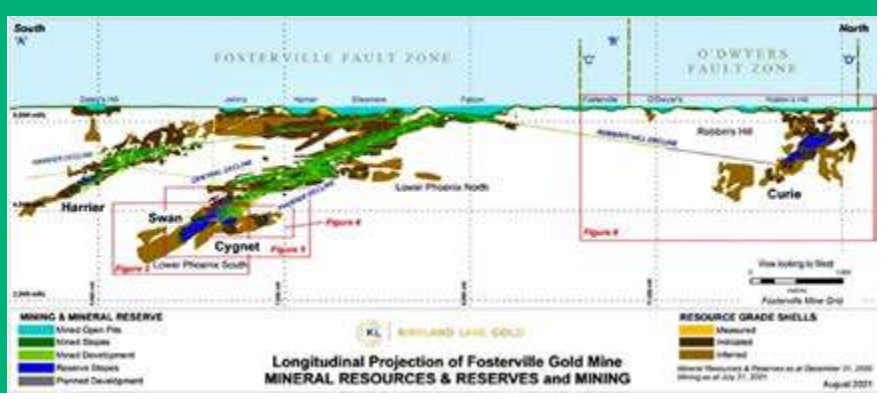
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Fosterville gold mine in Victoria, Australia.

GOING FOR GOLD



Fosterville is Victoria's largest producing gold mine and its parent company, Kirkland Lake Gold, has an aggressive exploration strategy of multiple gold systems over the next decade.

In the latter half of 2021, new high-grade, visible gold (VG) mineralisation were intersected at the down-plunge of Swan Zone in Lower Phoenix (500m from deepest mineral reserves), along the Cygnet fault in newly-identified sub-parallel structures to Swan Zone and also at Robbin's Hill (1000m down-plunge from the deepest mineral reserves).

Kirkland Lake Gold president and chief executive Tony Makuch says these results continue to support the company's views that substantial potential exists to discover new high-grade mineralised areas and extensions to grow mineral reserves at Fosterville.

"Following completion of the new P3912 underground drill drift, we commenced an extensive underground drilling program down-plunge of the Swan Zone in Lower Phoenix and have already returned a number of high-grade intersections containing the same quartz with VG mineralization that accounts for the ultra-high grades found in Swan," he said.

"While the down-plunge extension of Swan Zone is obviously a key target for future growth in mineral reserves and mineral resources, we are also very encouraged by continued favourable results at Cygnet, a parallel structure near the Swan Zone.

"The results at Cygnet include new high-grade, VG-bearing intersections as well as the identification of new splay structures and opportunities for further growth of the Cygnet fault system to the north."

Further exploration priorities for Fosterville in 2021 included continued drilling of Curie and Herschel faults at Robbin's Hill and underground drilling at Robbin's Hill from the new exploration drive commenced in Q3 CY2021.

"Turning to Robbin's Hill, drill results continue to confirm the size and scale of the target areas at what we expect to become our second mining operation feeding the Fosterville Mill," said Mr Makuch.

"Along the Curie Fault, we have now intersected VG mineralization up to 1,000m down-plunge from current mineral reserves and at elevations from surface similar to where we first detected VG in the Lower Phoenix and Harrier systems.

"With the progress achieved advancing the new Robbin's Hill decline, we have now commenced underground drilling at Robbin's Hill to support future exploration of the Curie, Herschel and other Fault targets.

"Underground drilling from the new decline will significantly improve the efficiency and effectiveness of the Robbin's Hill exploration programs.

"We currently have nine underground and eight surface diamond drills operating at Fosterville, with a total of 210,000metres of drilling expected to be completed during 2021."

Revised Drill Intercept – Lower Phoenix System

Kirkland Lake revised its underground drill assay result on November 5, 2021, increasing the grade of VG intercept in hole UDH4051 located down-plunge of Swan Zone, 500m from deepest mineral reserves.

The drill result initially reported for the Lower Phoenix VG intercept was 51.7 g/t Au over 2.6 m (estimated true worth, or ETW, 2.2 m), including 215 g/t over 0.6 m (ETW 0.5 m) in hole UDH4051.

However, the revised intercept is 207 g/t Au over 2.6 m (ETW 2.2 m), including 947 g/t Au over 0.6 m (ETW 0.5 m).

The grade revision for the intercept represents a four-fold increase from the previously reported result.

The revision followed additional review of the assays released on August 30, 2021 from the Fosterville mine and resulted from an analytical error at independent assay laboratory, On Site Laboratory Services.

"The correction to the intercept in hole UDH4051 is significant as, at 207 g/t over 2.6 m, it is extremely high-grade and is located 500 m away from our deepest mineral reserves in Lower Phoenix," said Mr Makuch.

"With the very high concentrations of gold we get in the quartz with VG mineralization at Fosterville, the revised intercept provides increasing evidence that there will be additional high-grade lenses that we can identify as we drill to extend the deposit down-plunge from current mineral reserves."

The error in the initial report was identified during a subsequent review of the sample batch, which was assayed using an Atomic Absorption Spectrometry (AAS) instrument to measure gold in solutions.

The analytical method required solutions for extremely high-grade gold samples to be diluted, and dilution calculations applied to the AAS readings to return the gold assay.

On Site Laboratory Services identified that a transcription error had occurred, and that a dilution calculation had not been applied to two results in their initial report.

Comparable results for the updated UDH4051 intercept have since been returned for screen fire (metallic screening) assay, and the Chrysos PhotonAssay techniques.

All other intercepts originally reported on August 30, 2021, remain unchanged and include:

- Cygnet: 258 g/t over 1.8 m (ETW 1.4 m), 142 g/t over 2.0 (ETW 1.5 m), 49.4 g/t over 4.1 m (ETW 3.4 m), 27.5 g/t over 6.0 m (ETW 4.3 m) and 67.1 g/t over 0.3 m (ETW 0.3 m)
- Curie fault at Robbin's Hill: 81.3 g/t over 2.6 m (ETW 2.5 m) and 23.1 g/t over 2.2 m (ETW 1.4 m).

Operational Highlights

Fosterville is the second largest producing gold mine for Kirkland Lake Gold, after Detour Lake mine in Canada.

Mining methods include open stoping techniques with the application of cemented rock fill where applicable.

Underground mining is conducted using a conventional fleet including jumbos, production drills, loaders, trucks and ancillary equipment.

Processing methods include crushing and grinding of ore, followed by flotation, bacterial oxidation and CIL circuits.

The modern sulphide treatment plant is one of the world's leading BIOX systems, achieving record recoveries, and the mine site also has a gravity gold circuit.

Fosterville achieved full-year production guidance of 400-425Koz in Q3 CY2021 and revised its target to +500Koz for 2021.

It was on track to beat full-year CY2021 operating cash costs per ounce (USD230-250/oz), recording USD184 in its Q3 reporting season.

Fosterville is also Australia's second largest gold mine by production in Q3 CY2021 at 135Koz, topped by Newmont's Boddington gold mine in WA at 162Koz.

About Kirkland Lake Gold

Kirkland Lake Gold is a low-cost senior gold producer operating in Canada and Australia that is targeting 1.3-1.4Moz of production in 2021.

The production profile of Kirkland Lake Gold is anchored by three high-quality operations, including the Macassa Mine and Detour Lake Mine, both located in Northern Ontario, and the Fosterville Mine located in the state of Victoria, Australia.

AMR

Growth on the Horizon



Compliance Contracting will look to grow their project portfolio in Financial Year 2022, as the Victoria-based company becomes the service provider of choice for Australian mining operators.

Headquartered in Ballarat, the business provides electric, mechanical and civil engineering services to the country's critical industries, including the energy, manufacturing, construction and agricultural sectors.

Since it was launched in 2008, the company has become an industry linchpin renowned for expertise across a full-scope team of project managers, supervisors, electricians, fitters, welders, machine operators and trade assistants.

Particularly experienced within Victoria's thriving gold sector, Compliance Contracting has powered dozens of operations, including high-grade gold mine Fosterville.

Located just outside Bendigo, the low cost underground operation has been open since 2005 and brimming with exploration potential, premium gold and enough metal stashed in reserves to shock analysts.

The mine is accompanied by a range of quality infrastructure, including Fosterville Mill – a 2275 tonne per day ore processing facility.

Compliance Contracting Founder Paul Stamp said Fosterville Mine operator Kirkland Lake Gold was one of many clients that had engaged his business to provide engineering services.

He said each client had wide and varied needs, but Compliance Contracting's diverse service offering meant the company was well-positioned to accommodate many complex and challenging projects.

"We have completed many projects over the years," the Managing Director said.

"One memorable project was for Powercor, which powers more than one million Victorian homes.

"They engaged us for the construction of a 132KV 220KV Terminal Switchyard.

"It's fed from Mount Mercer 131Megawatts High Voltage Wind Farm and it involved a fair bit of work.

"We established a control room and outdoor yard Earth Grid, with site power, installation and amenities wiring."

The Powercor project is one of dozens of critical power developments Compliance Contracting has delivered across Victoria, with other highlights including servicing Stawell Gold Mine, Mandalay Resources, Hill View Quarry, CGT Castlemaine Gold and Olam Orchards almond processing operation.

Outside the south-eastern state, Compliance Contracting has served several other mining operations, including New South Wales Aurelia Metals, South Australia's Oz Minerals, Western Australia's underground mining contractor Byrnecut and Queensland's Ernest Henry Mining.

Reflecting on Compliance Contracting's extensive work portfolio, Mr Stamp said his business had developed a reputation for providing high-quality turn-key solutions for both large and small projects.

He said the company was known for getting jobs done quickly, safely and within budget, no matter the complexity or environment.

"We service a wide range of unique projects across major industries," Mr Stamp said.

"Our focus is on safety, service and great execution."

Complementing the company's full suite of services is their equipment rental offering, based at their Ballarat workshop.

Clients can choose from a range of generators, transformers and machinery and plant equipment for hire, as well as testing equipment to ensure their operations are running smoothly.

For more information,
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Lithium Power Plays



The Calix flash calciner and electric pilot scale plant (BATMn Reactor).





Midstream demonstration plant design model.

The year 2021 has been a busy one for the world's largest independent hard rock lithium operation.

Pilbara Minerals (ASX: PLS) owns 100% of the Pilgangoora operation, which produces a spodumene and tantalite concentrate, and two processing plants (the Pilgan and Ngunjagi plants) – all based in the Pilbara region of northwest WA.

The company is positioned to become a major player in the rapidly growing lithium supply chain with its low-cost, quality spodumene, including a growth strategy focused on becoming a fully-integrated raw materials and chemicals supplier.

Mid-Stream Project and Calix Testwork Update

As the study for its mid-stream lithium chemicals project, announced in May 2021, nears completion, work-to-date supports exporting a value-added lithium product from the Pilgangoora project.

Calcination test work at Calix's pilot scale BATMn reactor confirms a high conversion rate of more than 95% for fine flotation spodumene concentrate produced from Pilgangoora.

This targets a lower carbon emission footprint through electrification of the calcination process powered by renewable sources, including reduced freight quantities, thereby potentially reshaping the global spodumene supply chain with a cleaner and more efficient solution.

While technical and engineering work on the mid-stream product demonstration plant has been completed, the study will continue to focus on economic and commercial evaluations in early 2022.

Subject to all results from the study being successful, this paves the way for the formation of a joint venture between Pilbara Minerals and Calix, as part of their Memorandum of Understanding (MOU), to develop the plant and commercialise this unique process technology.

Objective – Superior Lithia Carrier Product

Pilbara Minerals aims to produce lithium salts from fines-flotation spodumene concentrate which could support downstream lithium raw material and cathodes demand.

The company is therefore developing a new refining process to produce high purity lithium phosphate precipitate from Calix-calcined fines spodumene concentrate.

Large developments are occurring through all segments of the lithium-ion supply chain.

Several prominent forces shape the industry including product cost (per lithia unit), product quality (purity), carbon energy reduction and waste management (particularly for the European market).

Pilbara Minerals' objective is to deliver a superior value-added lithia product that exceeds across these metrics.

A preferred process route and end-product has been narrowed down to, using both the calcination processing technology and chemical concentration process.

Australian spodumene is a raw material feed to a high-value chemical industry that is largely conducted outside of Australia.

Producing a high lithium-content intermediate salt product on site at Pilgangoora, will result in a portion of the value traditionally retained by downstream spodumene converters outside of Australia being retained in-country.

The value-added mid-stream product is also expected to be able to access diverse markets worldwide.

Ngungaju Plant Restart

First spodumene concentrate from the coarse circuit at the Ngungaju plant was achieved in mid-October as part of the staged restart of the operation.

Commissioning and ramp-up of the plant has since continued in parallel with construction works and plant maintenance activities.

A combination of equipment failures, additional maintenance downtime required for key plant items to be replaced and/or upgrade, as well as the mining industry labour shortages led to the utilisation of the facility being lower than initially forecast.

Commissioning of the fines circuit is targeted for the latter part of the March quarter in 2022 and, until then, lower overall lithia recoveries are expected.

Full ramp-up of the Ngungaju plant, with improved lithia recoveries, is expected by the middle of CY2022, at which time targeted annual production capacity is expected to be 180,000-200,000dmt of spodumene concentrate.

Coarse concentrate production to-date is approximately 5,500dmt.

Pilgan Plant Improvements

Construction of the Pilgan plant improvements project was completed in early October 2021, followed by commissioning and ramp-up of the new facilities soon after.

This project is expected to debottleneck the facility and increase production capacity, particularly from the fines flotation circuit.

A total of $22m was invested in this project, which was completed both on-time and on-budget.

The project ramp-up is expected to be completed in early 2022, and with this, the plant's annualised spodumene concentrate production capacity is targeted to increase from about 330,000dmt to 360,000dmt-380,000dmt.

Pilbara Minerals continues to undertake engineering and design works to support phased increases in the production capacity of the plant to +1Mtpa for the combined Pilgangoora project.

Pilgangoora Production

Pilbara Minerals has revised its guidance for the December quarter in 2022 and for FY22, with production expected to be 84,000dmt-95,000dmt of spodumene concentrate, previously 90,000dmt-115,000dmt.

Annual concentrate production guidance for FY22 is updated to 400,000dmt-450,000dmt, previously 460,000dmt-510,000dmt.

These are due to delays in the Ngungaju plant restart and the Pilgan plant improvements project, particularly commissioning, ramp-up and extended plant shutdowns.

This is further impacted by the extended border closures in WA, with mine sites having difficulties accessing key personnel in construction, production and maintenance jobs.

Ken Brinsden, Managing Director

Pilbara Minerals managing director Ken Brinsden says the company has made excellent progress in the construction and initial commissioning of the expanded facilities at Pilgangoora, with construction of the Pilgan improvements project being delivered on time and on budget.

"That said, as we have started ramping up capacity across the entire Pilgangoora site, Pilbara Minerals has not been immune to the skilled labour shortages currently impacting the WA resource sector," he said.

"As a result of these impacts, which have delayed elements of our commissioning and ramp- up plans, we have updated production guidance for the December Quarter as well as for FY22.

"Notwithstanding this, Pilbara Minerals remains incredibly well-placed to make a significant contribution towards satisfying the world's burgeoning appetite for lithium raw materials.

"Recent price developments are underlining the emergence of significant raw material supply shortages and Pilbara Minerals is doing everything in its power to respond quickly to customer demand with additional production capacity, both in the short and medium term.

"We have also been making excellent progress with our mid-stream strategy to develop value-added products from Pilgangoora through our partnership with Calix."

Other Developments: POSCO JV and Solar Farm

In October last year, Pilbara Minerals finalised a joint venture with POSCO for the development of a 43Ktpa jointly-owned lithium hydroxide conversion facility in Gwangyang, South Korea, with commissioning expected from the September quarter in 2023.

This supports Pilbara Minerals' objective of becoming a fully integrated lithium raw materials company and diversifies the global customer base.

In the same month, Pilbara Minerals also awarded a 15-year contract to Pacific Energy Group subsidiary Contract Power Australia to construct, operate and maintain at 6MW solar PV farm.

The solar array is estimated to displace 3.8m litres of diesel fuel per year and its design facilitates the potential inclusion of battery storage at Pilgangoora.

AMR

The Best in the West



Multidisciplined Australian company Westforce Construction have delivered a successful upgrade to Pilbara Minerals' Pilhgangoora Project; one of many under-budget and high-quality expansions in their extensive work portfolio.

Established in 2006 as an earthworks and concrete specialist, Westforce fast developed into a major contractor within the mineral resources sector, renowned for their civil and structural construction capabilities.

While primarily servicing mining operators, Westforce has a significant client base spanning Water Corporation, Public Transport Authority, Main Roads, Western Power and the Defence Department, making it the company of choice for many government projects.

With capacity to carry out a wide range of timely work, Westforce was also most recently considered the contractor of choice for Pilbara Minerals, which engaged the company to grow their operation.

Managing Director Phil Clarke said his team performed a combination of trenching, detailed earthworks, and the installation of intricate concrete structures both quickly and cost-effectively.

"The works consisted of an upgrade to Pilbara Minerals' lithium mine site at Pilgangoora, in the Pilbara," Managing Director Phil Clarke said.

"They were a critical part of developing the existing filtration process plant at the mine site.

"The job included the installation of a two-storey filter process building, along with the installation of various concrete ring beams, complex concrete ground slabs, footings, plinths and columns to support numerous water tank and mechanical plant of various shapes and sizes.

"The works were delivered in a very tight time frame in a restricted work environment under budget and to very high standards of safety and quality."

Westforce's work will support continued production of high-grade lithium at the Western Australian mine, located on one of the world's largest hard rock lithium deposits.

The deposit is considered a critical part of the global lithium supply chain and is serviced by two processing plants, enabling Pilbara Minerals to increase speed to market and blend products to accommodate buyer preferences.

The Westforce development will support Pilbara Minerals' strategic long-term business goals, including strengthening the operator's place within the lithium raw materials and chemicals value chain.

Executive Director Paddy Kearns said Westforce were engaged off the back of a lengthy pipeline of high-quality work, a safety-centred approach and quick project executions.

He said project success was underpinned by Westforce employees, whom he described as the strongest attribute of the business.

"They are truly the backbone of Westforce," Mr Kearns said.

"Our team has experience and expertise in all aspects of civil and structural construction, including mine site process concrete, non-process infrastructure, substations both civil and mechanical and erecting structural steel buildings.

"Other work within our capacity includes but is definitely not limited to; power line footings, brown field detailed excavation, design and construction of tilt panel buildings, RC post tension slabs and RC water processing tanks.

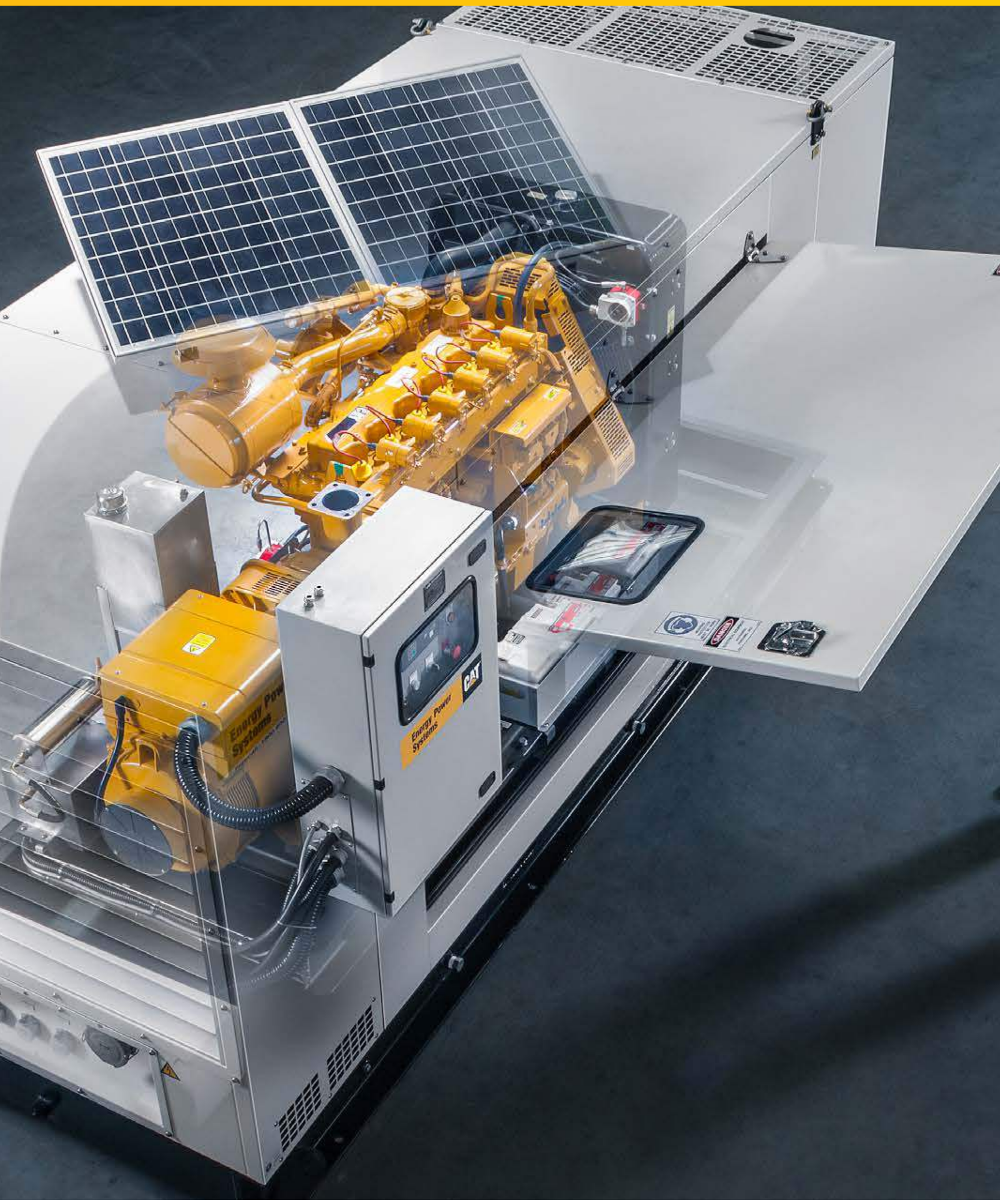
"We do major concrete works, earthworks and building work; servicing operations large and small.

"We are a diverse and dynamic civil construction specialist offering collaborative and innovative solutions, propped up by our core value – maintaining strong relationships."

For more information about Westforce Construction, visit
www.westforce.com.au

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ONE NETWORK.
ONE CALL 1800 643 514

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THE POWER YOU NEED

Energy Power Systems Australia (EPSA) is the authorised supplier of Cat® engines, generators and power solutions in Australia, Papua New Guinea and the Solomon Islands.

EPSA rents, sells, designs, engineers and commissions Cat® engines, generators and custom-built power solutions – from individual units to multi-megawatt power stations.

With the introduction of Cat® Hybrid Microgrids that incorporate solar, wind and battery energy storage, and generator sets capable of running on green hydrogen, EPSA is helping customers transition to renewable energy, mitigating the risks and maximising the commercial and environmental benefits of emerging technologies.

Whatever your energy and power requirements, EPSA has you covered. Talk to us about the power you need.

GENERATORS | **COMPRESSED AIR** | **TEMPERATURE CONTROL** | **MINE COOLING**

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Industrial Silver Lining



Steuler rubber linings offer optimal protection for steel constructions, such as vessels, pipes, process towers, and gas scrubbers and even concrete structures, such as those found in water treatment plants. They resist the chemical effects of acids, bases, salt solutions and water vapour – even at elevated temperatures and when subject to temperature fluctuations.

Materials, know-how and service: STEULER-KCH is a leading full-service supplier of Linings.

With our team of experienced industry professionals, we are known for our innovative developments, proven application technology, detailed consultancy, planning and engineering services.

Our network of international subsidiaries and affiliates, comprising more than 750 fitters and supervisors, ensures that installation is performed within deadline.

If required, this network can manage the turnkey implementation of your project from start to finish.

Whether your project involves the construction of a new plant or the professional renovation and optimisation of an existing one, STEULER-KCH guarantees you the most technologically advanced materials and efficient project implementation – and has done so for over 100 years.

The industrial sector is where we're at home. Whether it's in the chemical, hazardous waste incineration, ceramic or power generation industry – we have the right solution for every component and plant system requiring reliable, long-lasting protection against corrosion and high chemical, thermal and mechanical stresses.

Coatings, rubber linings, acid-resistant linings and refractory brick or thermoplastic liners: STEULER-KCH always comes up with a convincing solution, whatever the application.

We're also specialists when it comes to refractory linings and kiln furniture, as well as apparatus, vessels and piping systems.

Contact us now
(see details in the advertisement below)

AMR



Coalroc bring the Kovaco Electric Skid Steer loaders to the Australian Market



Already making waves in the European and North American Market, the world's first electric skid-steer loaders are coming to Australia. KOVACO Electric introduces its two machines, the standard-sized Elise900, remotely controlled MiniZ 400. Free of emissions and noise and significantly cheaper to run and maintain

WHY ELECTRIC?

Making a skid-steer loader electric-powered has various advantages, some of them obvious, some less so. Of course, the "green" aspect comes to mind first This is not one of those cases, however, when being environmentally friendly means paying more or getting inferior performance. In fact, the opposite is true. With KOVACO machines, the Elise900 and MiniZ 400, you can get your green credentials while also saving money and gaining unique new capabilities.

With their zero-emission, quiet operation, the KOVACO machines are perfect for working in places with tight regulations, indoors or any location where not disturbing the peace with noise or emissions is paramount. This opens a whole new world of possibilities to these skid-loaders, especially as the small, remotely-controlled MiniZ 400 is able to operate in tight spaces where it would be impossible to use traditional heavy equipment.

Of course, both MiniZ 400 and Elise900 are also a great way to reduce your company's carbon footprint. Even when using grid-sourced electricity, they are much more efficient than their diesel-powered counterparts, significantly reducing the CO_2 emissions – especially in countries with a renewables-heavy energy mix. Even better results can be gained when using your own renewable electricity sources, which will make the operation carbon neutral.

SAVING MONEY

In business, however, money usually comes first. And with KOVACO, you don't have to choose between being eco-friendly and financially savvy. You can have both at once.

We did a large comparison of the overall running costs of several diesel-powered skid-steer loaders produced by our competitors. Our survey included Bobcat S 570, CAT 232 D 3, JCB 190, John Deere 318G/E, Case SR210, Kubota SSV 66, Wacker Neuson SW 20, Gehl R 190, New Holland L 220, Volvo MC 95 C and Mustang 1900 R. The average running costs of all these machines came to $7.66 per hour.

At the same time, the KOVACO Elise900, a comparable machine in every respect, costs only $1.66 per hour to run. That equates to $48 in savings per one 8-hour shift.

The main reason is, of course, that electricity is cheaper than diesel fuel (and if you have your own source, like solar panels, you can save even more), but it doesn't end here. The maintenance costs of an electric powertrain are also significantly lower, with fewer moving parts that need replacement. Even the tyres have to be changed less often.

Overall, our estimate means that you save $6,000 for every 1,000 hours of operation. After 3,000 hours, you have already saved roughly 30 % of the cost [VD1] of our Elise900 skid-steer loader purchase price – 12 to 17 thousand dollars, depending on which competitor you compare the Elise900 with.

With the purchase price of the Elise900 being roughly comparable to that of most of the compeition, this means huge savings after just one year of one-shift-per-day operation.

MORE CAPABILTIES

Being electric, our skid-steer loaders are not only better for the environment and usable even in places where noise and emissions are a problem, like indoors or in residential neighborhoods. The batteries, which are the heaviest part of the vehicle, are mounted very low in the chassis, making for an extremely low center of gravity.

This translates into extremely good off-road performance. They can safely go where conventional loaders can't, remaining stable even with a side tilt of up to 47 °. This opens up a whole new set of uses which would be impossible with traditional machines.

Our machines can also be equipped with a wide range of attachments – 16 are available for Elise900, ranging from various buckets, hoes and dozer blades to specialty items like brushcutter, auger or forestry mulcher – which make them a truly universal piece of equipment.

CUTTING EDGE TECHNOLOGY

Hand-in-hand with our highly advanced powertrains come a wide range of hi-tech features that move working with our machines to a new level.

From basics like LED working lights in all directions, there are some that are far from the norm among work machines, like Bluetooth connection for smartphones or a rear camera for the Elise900.

The biggest party trick, however, is the remote control. While this is the only way to operate the MiniZ 400, it is also available for the larger Elise900. This comes in especially handy when working in dangerous environments where having the driver inside the vehicle would be an unacceptable risk.

STRONG BRAND

While KOVACO Electric is a new name in the world of construction machinery, the KOVACO company has a long, successful history. Founded in 1991, its tradition of engineering excellence spans three decades.

In 2014, the company decided to move the world of construction towards sustainability by introducing a line of electric skid-steer loaders. This plan was realized with the Elise900 and later its smaller brother, the remote-controlled MiniZ 400.

ABOUT COALROC

Established in 2001, Coalroc is a leading provider of underground coal mining services and a distributor for KOVACO Electric.

The Queensland-based company also has a workshop in New South Wales, enabling it to support Eastern State operations with a range of underground equipment, service capabilities and personnel solutions.

Among their offering is equipment and labour hire, out-bye services such as water and air pipe work as well as conveyor installations and conveyor retractions.

Coalroc is focused on ensuring smooth productivity by minimizing downtime, as well as providing turnkey solutions, project management, design expertise and maintenance and back up services.

For more information on Coalroc, visit **https://www.coalroc.com.au/**

For more information on KOVACO Electric, visit **https://www.kovacoelectric.com/en**

AMR

Brute Force Vibrators

High quality and well-engineered equipment is a necessity in the mining and extractive industries.

Oli Vibrators is a global leader in industrial vibrators and flow aid with a well-established network across the world and Australia.

Whether it's on a screen, feeder, separator or perhaps a bin, silo or chute, most equipment in these harsh environments requires excellent reliability and robustness. The Oli vibrators are built with heavy duty ductile cast iron with superior bearings and are IP66 rated to International Standards.

Now, with its "Greased for Life" option and extra heavy-duty range, Oli has the entire market covered.

Part of the global OLI Group and Wolong Motor Group, OLI Vibrators Australia is a leading supplier of brute force vibrators for mining and the extractive industries throughout the world.

As a global leader in vibration technology, the name OLI® has been synonymous with expertise in brute force vibration for more than 60 years and is known for its price to performance ratio being second to none.

OLI Australian General Manager Mark Thompson said it's always been about quality.

"Our focus is on manufacturing high quality products and delivering the best solutions to meet the customer's specific needs," he said.

"Product performance and reliability — whether out on site or in the processing plant — is of paramount importance, especially when it comes to mining and quarrying.

"There's a limited timeframe to work in, and our customers need to know that the equipment will be working as it should, when they need it."

From the "super big" to the very small electric vibrator range right through to pneumatic and flow aids, OLI has the vibration solution to meet every need.

Mining, quarrying and other mineral processing facilities put equipment under extraordinary pressure to perform for extended periods of time.

When it comes to selecting the appropriate specialist vibratory motors for bespoke vibrating materials handling, sorting, and processing solutions, Australian equipment specialists and manufacturers turn to OLI Vibrators.

From loading pits and conveyers through to dewatering, separation, processing equipment and even the heavy haul vehicles themselves, OLI Vibrators designs and manufacturers specialist vibratory motors for the extractive industries across Australia and the world.

While it may seem a straightforward solution to place a vibrating unit on a vehicle or piece of equipment to separate materials and/or get them moving, nothing could be further from the truth.



Oli Vibrators designs specialist vibration technology for even the harshest environments.

Mr Thompson said selecting the right vibratory solution is definitely not a "one size fits all" solution.

"Specific materials respond differently to different amplitudes," he said.

"Different frequencies and vibration strengths have different ranges of influence on different materials."

Oli Vibrators work with clients to design and purpose-engineer bespoke screening, separation, and materials handling solutions to suit each individual application and material stream.

Vibratory motors are designed to perform as specified and for the long-term to prevent breakdowns and downtime at mine-sites.

Oli has a comprehensive range of products and spare parts available locally, supported by staff with extensive product knowledge and local industry expertise.

This ability to access products, spares and expertise quickly minimises both equipment manufacturing lead times and downtime for repairs and/or service.

For further information, please visit: **www.olivibrators.com.au**

AMR



A Cut Above the Rest

HD Plasma and Laser Cutting Services provides an innovative and dynamic profile cutting service to all steel manufacturing industries within Australia.

The purpose-built, multi-function, steel processing business located in Bibra Lake, WA, is seen among the leaders in the steel cutting industry.

Laser Cutting
The technology of the HD Plasma and Laser Cutting Services machines delivers superior performance, giving the ability to provide clients with exceptional quality, together with 24-hour operations, shorter lead times compared with other conventional laser cutting machines.

- Cutting table size 4000 x 2000mm
- Capable of processing up to 20mm thickness mild steel
- Capable of processing up to 20mm thickness QT Material
- Capable of processing up to 32mm thickness aluminium
- Capable of processing up to 25mm thickness stainless steel

Plasma Cutting
HD Plasma and Laser Cutting Services operates three plasma machines - one Kinetic K4000 and two Kinetic K5000.
These state-of-the-art, heavy duty combination plasma/oxy/machine centres can process a wide variety of materials at an extremely fast rate.

The 62m plasma cutting bed, together with 24-hour operations, allows high volumes of cutting to be achieved with short lead times.

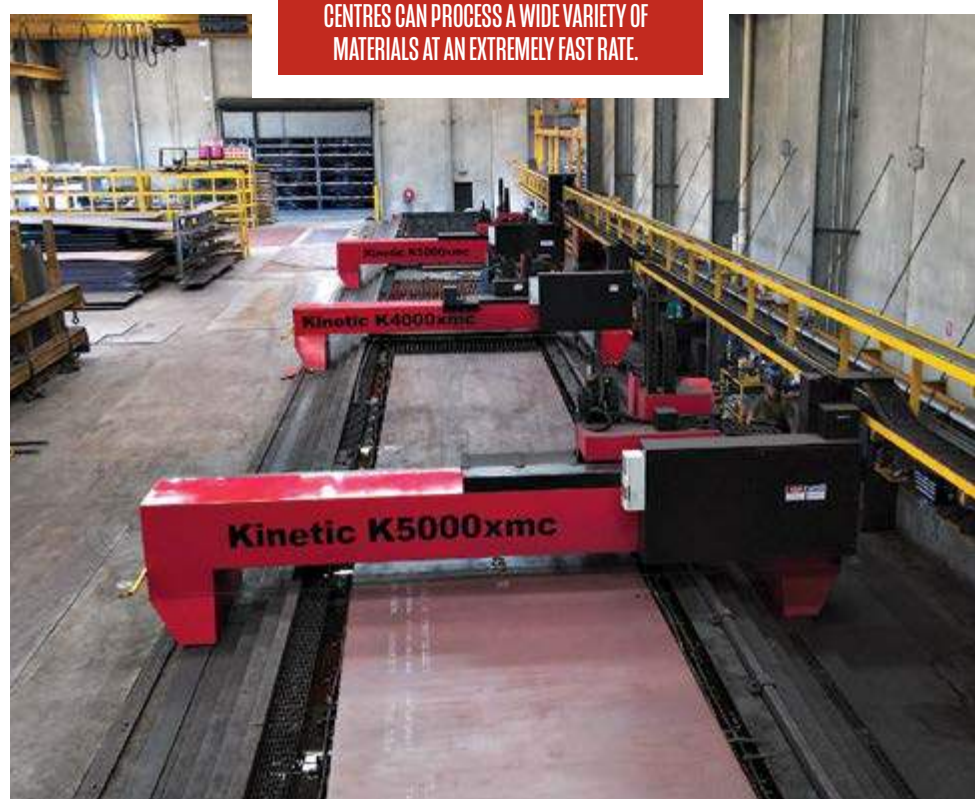
- Counter sink/counter bore
- Drilling – 3mm up to 60mm
- Plasma cutting – 3mm up to 50mm
- Oxy-cutting – 60mm up to 300mm
- Bevelling – up to 50mm with maximum of 45°

Steel Plates
HD Plasma and Laser Cutting Services holds steel plate in stock.

Plate is sourced from quality local and imported steel mills, to cut a wider range of materials at a greater thickness range than most of its competitors. ***AMR***



THE STATE-OF-THE-ART, HEAVY DUTY COMBINATION PLASMA/OXY/MACHINE CENTRES CAN PROCESS A WIDE VARIETY OF MATERIALS AT AN EXTREMELY FAST RATE.



GRADE	THICKNESS (mm)
AS 3678-250	UP TO AND INCLUDING 300mm
AS 3678-350	UP TO AND INCLUDING 300mm
FLOOR PLATE M/S	UP TO 10mm
BOILER PLATE - ALL GRADES	UP TO 80mm
QUENCHED AND TEMPERED	UP TO 80mm
CARBIDE OVERLAY	UP TO 40mm
ALUMINIUM PLATE	UP TO 32mm
PGI, ZINCANNEAL, GALVANISED & COLORBOND	UP TO 6mm
STAINLESS STEEL - ALL GRADES	UP TO 40mm

A cut above the rest

HD PLASMA & LASER CUTTING SERVICES





HD Plasma & Laser Cutting Services Pty Ltd is a purpose built, multi-function, steel processing business located in Bibra Lake, Western Australia.

We can deliver an innovative and dynamic profile cutting service to all steel manufacturing industries within Australia.

HD Plasma & Laser Cutting Services philosophy of progressive service to our customers is what is bringing us to the forefront of the steel cutting industry.

A continual process of system and service development and refinement is where our key advantage lies. We constantly find new ways to add value to the service we deliver to you.

Progressive service and quality is about staying one step ahead.

Services


LASER CUTTING


PLASMA CUTTING


OXY CUTTING


DRILLING/ C-SINKING/TAPPING


CAD/ CAM


PRESSING


ANCILLARY SERVICES


STEEL PLATE

PHONE: +61 08 9418 8462
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81 Discovery Drive, Bibra Lake WA 6163
Email: sales@hdplasmacutting.com.au



Lifting You Up

Auslift Equipment, Crane & Access Hire have partnered with some of the world's biggest companies in access, such as **JLG, Genie, Snorkel, Hyster Forklifts, DHE Attachments, JD Power, Bullant Trailers** and **Haulotte.**



For the best in one-stop-shop solutions for sales, hire, second-hand, ex-hire and maintenance of access equipment, look no further than Auslift Equipment.



Auslift Equipment has large range of Elevated Work Platforms (EWPs) for sale with clients benefitting from our buying power.

Auslift Equipment is a family-owned company with over 30 years' experience in the equipment hire and construction industry.

We originally began as an industrial and domestic building company owned by the Surace family.

Our founders are all trades people that have done the work in the field, not just talk about it!

Our experience sets us apart in the industry, and recommendations regarding machinery comes from this field experience.

We know how it works because the chances are we have built it or worked on it!

Equipment Growth
Honesty, integrity and genuine care saw the business grow rapidly.

This led to the purchase of our first mobile crane and a handful of access machines to keep up with the demands of building division.

Slowly the equipment count kept building up and the machines were being hired out to other trades people while not in use.

The range of machinery in our hire fleet means we also get to see how they perform in real life situations being used by a huge range of trades in in almost any situation.

As the construction industry tightened up on their safety standards, and today's OH&S standards came into effect, the demand for machinery increased further.

This led to an increase in demand for machinery hire experts and Auslift Crane & Access Hire was born.

Lifting Higher
Auslift Access Hire has been combined with the sales arm of the business under the umbrella of Auslift Equipment.

Partnering with some of the world's largest companies in access, such as JLG, Genie, Snorkel, Hyster Forklifts, DHE Attachments, JD Power, Bullant Trailers and Haulotte, we are able to offer hundreds of different types of machines to help our clients get their jobs done safely and quickly.

We can supply scissor lifts from a small electric 13-foot indoor unit all the way up to an outdoor diesel 53-foot unit.

These machines are vastly different, and so are their uses – ask us about the range and which machine will best suit your situation.

Our Popular Ranges
Our most popular units are 19-foot and 26-foot narrow machines which can be towed on trailers.

These allow massive flexibility for trades to take the units where they need them when they need them!

No trucks or late deliveries to worry about, the scissor lift is on a trailer behind your work ute.

We also supply the Snorkel narrow rough terrain diesel scissors on trailers, which are very popular with a huge variety of trades and facilities.

Boom lifts start from small electric 30-foot indoor units, all the way up to the mighty Snorkel 2100SJ which has an amazing vertical platform height of 66-meters and a horizontal outreach of 35-meters.

We have all sorts of machines for experienced operators and major projects – tell us about your project and ask us which machine can help you get the job done well.

Hyster Forklifts, DHE Attachments
Pairing with Hyster forklifts also gives Auslift a solution to all your loading, unloading and warehousing needs. Hyster has long been associated with reliability, durability, and no fuss machines.

German design and know how ensures that they are work ready and tough.

From a small pallet jack to a massive 45-tonne loader, we can supply the whole range with full factory warranties.

There will be a unit to suit your lifting needs. Talk to us about your requirements for the best advice.

Our partnership with DHE attachments also pairs perfectly with Hyster forklifts.

Our massive range of materials handling equipment also ensures that there is a solution to your warehousing and materials movement problems.

Forklift jibs, drum handlers, tipping bins are some of our most popular products.

If we don't have something suitable on the shelf, chances are our Australian facility can fabricate and certify a unit to your needs.

Yes, Australian made products still do exist! See some of the range on our website.

Elevated Work Platforms (EWPs)
We pride ourselves in delivering top quality machinery and service that exceeds customer expectations.

Auslift Equipment has large range of EWPs for sale.

Auslift is a multi-brand dealer, we have no bias to brands of equipment, we only wish to provide solutions to our client's EWP needs. We have a constant supply of brand new, near new and used machinery for sale coming from our hire fleet.

Our buying power in new machinery allows us to give you fleet pricing on all machinery. This in turn helps us increase our buying power which helps us keep our hire rates cheaper. Our buying power also ensures the best prices in the marketplace, no matter the brand or type of equipment that our clients need.

Professional advice by industry experts and integrity has been the key to Auslift evolving into one of the leading EWP companies in Australia.

One-Stop-Shop Solutions
Auslift's team of equipment specialists has over 60 years combined experience in the construction and heavy equipment industries. We know how machinery works in the field. We are able to also provide specialist advice to clients for their needs.

Auslift is committed to providing solutions and long-term relationships as well as setting a benchmark in customer care and support.

All equipment is supplied directly by the manufacturers with their full warranties and service.

Preventative maintenance programs can also be included in purchase agreements, dependent on clients' needs.

There is a constant supply of new machinery in stock, coming throughout the year, but there are certain models which need to be booked in advance.

All our second-hand machinery is put through our workshop to be fully checked to ensure it meets and exceeds all Australian occupational health and safety standards.

Our ex-hire fleet units give you the peace of mind knowing that these machines have been properly maintained throughout their life and come with a full-service history.

We also have near new machines (from approximately 12 months old) for sale.

The Auslift Family
All this growth has happened whilst still being able to maintain the close-knit family aspect with the next generation of Surace descendants helping to form and secure the expansion of the company.

Today, our family has been proudly extended to not only include new staff, but also include our customers who have been with us from the beginning.

Talk to us about how Auslift Equipment can help your business work safely, efficiently with greater productivity.

Welcome to the Auslift Family!

AMR

AUSLIFT EQUIPMENT

Australia's Leading Machinery Sales and Hire Company

AUSLIFT IS ON TIME, EVERY TIME

- ✓ Expert Advice on Boom lifts and Scissor Lifts
- ✓ Australia Wide Delivery
- ✓ Factory Backing and Warranties
- ✓ Meets all OH&S and Australian Standard Compliancy Standards
- ✓ Massive range of New Machinery & Used Machinery
- ✓ Full list of OEM Spare Parts for all machinery

Access Equipment Sales and Hire

For more than 30 years, Auslift has provided lift and height access equipment to businesses throughout Australia. Our services cover rental and sales of equipment for all types of lifting and reach requirements.

Our range of equipment includes:

- **Knuckle Boom Lifts** (Working Height from 12m to 38.1 m)
- **Straight Boom Lifts** (Working Height from 15.44m to 58.57m)
- **4WD Diesel Scissor Lifts** (Working Height from 10.2m to 18m)
- **Electric Scissor Lifts** (Working Height from 7.6m to 14m)
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POWER/SWITCH







A local eastern states supplier of concrete and quarry products has switched 100% of their mains electricity supply over to renewables.

Mawsons, a family business founded in 1912, made the switch to a combination of solar, wind and hydro power as part of their broader Social Responsibility and Sustainability Policy.

The renewable energy strategy is designed to significantly reduce the environmental impact of Mawson' 50 sites across regional Victoria and southern NSW.

Mawsons managing director, John Mawson said he is very proud that his company is the first Australian concrete and quarry business to make a complete switch to renewable grid electricity.

"We believe that this is the right thing for us to do and that now is the right time to do it" he said.

"Anything that helps to reduce global warming and lower the chances of drought and bushfires in the future is well worthwhile.

"We also believe in helping local industries to grow and the renewable power sector is a major investor and employer in regional Australia."

Mawsons began buying their mains supply electricity from Engie, a European company that generates and sells electricity all around the world, since the start of September (2020).

The Australian division of Engie owns several of the largest renewable energy facilities in the country and also sources power from other wind, solar and hydroelectric generators. Specialist energy purchasing consultants, 1 Circle, negotiated a flexible, long-term network supply agreement for Mawsons.

When asked about power prices Mr. Mawson was positive on the long-term benefits.

"While renewable power has been a little more expensive, we expect that costs will continue to come down," he said.

"We also have a program installing solar collector panels across many of our sites."

Mawsons expects that these collectors will generate additional sustainable power to be fed back into the grid and allow the company to further lower costs.

It is anticipated that these benefits will flow through to clients with improved environmental credits and reduced product costs.

About Mawsons

Mawsons have long been recognised as specialists in concrete and quarrying.

A leading construction materials supplier across regional Victoria and southern NSW, Mawsons operates more than 16 hard rock quarries and sandpits and around 40 concrete plants.

Mobile concrete batching, crushing and screening equipment hire are part of the services that Mawsons' offer.

Mawsons also operates seven NATA-accredited materials testing laboratories across their wide footprint.

Milbrae joins Mawsons

Mawsons purchased Milbrae, a significant concrete, quarry, mobile crushing and mining services business, on October 1 2021.

Milbrae, which was established in 1969 by the Woods family, will continue its brand and operations as part of the acquisition.

"It is a great opportunity and privilege for our company to be able to combine with Milbrae and continue the growth of these strong regional Australian businesses," Mr Mawson said.

The combination of these two businesses stretches across the transport, mobile crushing, screening and concrete services industries across NSW and Victoria and into South Australia.

Milbrae's fixed quarries at Rankin Springs, Walleroobie, Warburn and Cootamundra supply a wide range of quality quarry products. The Milbrae sites complement Mawsons's sites which extend from Broken Hill to Seymour and Glenrowan.

With the full network of hard rock, gravel and sand quarries, Mawsons and Milbrae produce products to meet client demand – concrete aggregates, asphalt and sealing aggregates, crushed rock, specified and non-specified road base, railway ballast and gabion rock, as well as bulk fill.

Major Mining Projects

Mawsons and Milbrae have been instrumental in major mining projects, including Hera Resources, Evolution Mining, Cristal Mining, Xstrata, CBH Broken Hill, Perilya and Kirk Lake Gold. Volumes exceeding 250,000 crushed tonnes per month and 5000 cubic metres of shotcrete per month have been safely delivered.

Mobile Concrete Batch Plants

Mawsons and Milbrae mobile concrete batch plants can easily move to and be set up on-site, ready to efficiently and reliably produce and deliver concrete for project requirements at a rate of up to 60m^3/hour.

Mawsons mobile concrete plants feature: highly-skilled batching teams; 50t cement silo capacities; compliance with critical safety requirements for mine and building sites; environmentally compliant; powered by on-board generators or plug in mains power; on board 8000l water tanks; well matched components with no bottlenecks in production; backed up by its own quality constituent material supplies; innovative, in-house technical back-up; full traceability of accurately documented batch records.

Other Services:

Apart from concrete, quarry and landscaping services, Mawsons also provides a range of mobile and transport services to meet client production schedules.

Highly qualified and experienced technical people offer skilled support and can help clients meet quality, compliance and performance specifications.

An extensive transport fleet supports Milbrae and Mawson's mobile crushing and quarry services, ensuring the availability of product when and where clients require them.

The vehicles can be deployed to meet any contracting requirements for a range of industrial, commercial and mining projects.

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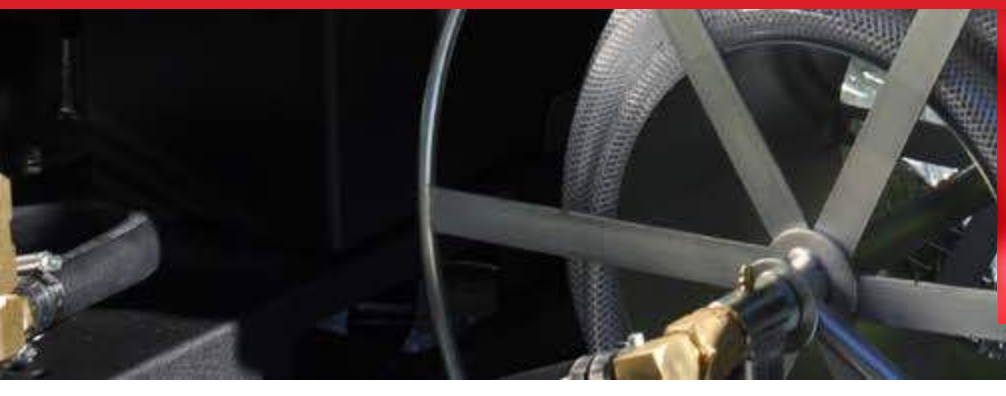
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THE AUSTRALIAN MINING REVIEW



The Aussie team demonstrates the Hydrotek steamer's easy controls.

Machinery Maintenance...



Essential for Su

Nobody's got time for unscheduled maintenance. When it's unplanned it throws everything into chaos. That's why planned maintenance, quality record keeping and top class maintenance teams are the difference between success and failure.

The team at Australian Pump Industries understands that fast and efficient cleaning of equipment is essential to keep mines running. The company produces machines that are designed specifically for the toughest cleaning tasks on the planet. The key inspiration for the company's progress in mining is the experience of its executives who come out of the big machinery business.

"We understand what it is to have to maintain and service a 150 tonne face shovel or conveyors that may stretch hundreds of kilometres that cannot be allowed to have unscheduled breakdowns," said Aussie Pump's Operations Manager Hamish Lorenz.

"You can't maintain big gear without it being clean enough to see what's going on. That means using both high pressure water or steam, or both! he said.

Aussie's Evolution

When the company started making pressure cleaners, they had an idea that machines should be robust and capable of taking the beating that Australian consumers can hand out. Sophisticated European gear didn't seem to be working with fragile products simply not going the distance.

Beginning with hot dip galvanised frames around diesel engine drive pressure cleaners, the company began to get serious feedback from not only the hire industry, the biggest supporter of the company's products, but from mines and quarries around the country.

"We realised that a 4,000 psi 10 hp diesel drive pressure cleaner would deliver better results cleaning mine plant. We wondered why others weren't making them when we started. Of course, our competitors soon followed but, we were first because we understood that high pressure can be a great substitute for high volumes of water. All mines know that every drop of water is precious and to use even a litre unnecessarily is not very clever" said Lorenz.

The company moved on to genuine Mine Spec machines with lessons learnt from working with Australia's biggest mine operators. That led to the evolution of pressure cleaners equipped with e-stops, battery isolation, super heavy duty frames with OH&S friendly integrated lifting bars to enable the units to be moved easily.

Enter the Mine Boss

The Aussie Mine Boss product range, inspired to a large extent by experiences with Coates Hire, berthed a genuine Australian product that was designed for the toughest jobs on the planet. There are Mine Boss machines now working as far away as locations such as Mongolia, in copper mines in Chile, in Indonesian gold mines, as well as in PNG and around the south pacific.

The Need for Steam

From there the company experimented with imported plastic cover type European steam cleaners in the 3,000 psi 120 degrees steam category. Those machines did the job but, were susceptible to failures not the least because of premature coil failure, breakages of plastic covers and electrical failures based on operators always using the machines at maximum temperature.

"We learnt some valuable lessons," said Lorenz, "and wound up designing our own machines and getting them made by one of Europe's leading manufacturers. The Northern Italian company make them to our specific specifications.

The result was the Aussie Admiral super heavy duty 3,000 psi steam cleaner. With the capacity to produce 19 lpm and 3,000 psi at 130°C steam, the machine proved invaluable for maintaining mining and construction plant.

"The combination of high pressure and high flow with steam meant huge time savings in cleaning everything from conveyor gear drives to tractor engine and transmission repairs" said Lorenz.

Aussie Admiral Advantages

Contrary to most manufacturers of electric steam cleaners, Australian Pump decided to go with a range that would have only four pole heavy duty 1400rpm motors. That concept of big 4 pole motors, with IP56 motor protection meant long trouble-free motor operation matched with the heavy duty slow speed triplex pumps.

The pumps all feature a brass head, 1450rpm speed and solid ceramic pistons for long



uccess



Aussie's 4,000 psi "Admiral" steamer has an infinitely variable temperature control.



These big Cats are prepped with an Aussie Hydrotek steamer before maintenance.

trouble free life. Those ceramic pistons, as opposed to ceramic coated pistons, are capable of providing long uninterrupted wear sometimes for decades.

That combination of pump and motor is the foundation of the performance and the units feature a flexible coupling between the motor and pump to provide a smoother and cooler drive.

The machines were built with a heavy-duty steel chassis with four wheels for stability. A front mounted bumper is built into the chassis and the cover, instead of being a polypropylene mix, is high quality stainless steel.

These features make the machine foolproof: Timed Total Stop (automatic shutdown, ex number of seconds after the gun is closed).

1. **Safety thermostat to protect the pump in the event of overheating.**
2. **A micro leak detection with a warning light so the operator knows if there is a leak in the hoses, connections or gun and therefore to stop the machine.**
3. **Low fuel sensor and warning light.**
4. **Low water cut out and warning light control to prevent damage to the pump.**
5. **Best of all, the machines offer Intelligent Auto Switch Off to switch the machine off 20 minutes after non use so it automatically is turned off from running.**
6. **Ignition Boiler delay ensures low fume emissions when the boiler starts up.**

To help the operator get the job done fast, an integrated high pressure detergent injection system was included. That enables the operator to spray the machine with detergent before rinsing with steam.

"With the right detergents, non-caustics preferably, the job can be done significantly faster" said Lorenz.

The 18 litre diesel fuel tank enables a 10 hour shift to be accomplished without having to refuel the machine. While the machine is 415 volt, 50 htz, the power to supply heat to the boiler is through a diesel system with a top quality diesel fuel injection pump.

New 4,000 psi Steamers

What really signifies our leadership in this area of business is the development of the first 4,000 psi Aussie Admiral. Called the Aussie Admiral 4000, the machine has all the same features of the standard unit with commonality of components from the chassis upward. The pump is heavy duty triplex pump capable of delivering 15 lpm at 4,000 psi.

The Company claims that extra 1,000 psi, delivered at 130°C steam saves time, and more importantly, saves water. Australian Pump know that every drop of water on a mine site is valuable and to waste it on unnecessarily long and tedious pressure cleaning jobs is a mistake.

"Using the 4,000 psi machine at around 90°C saves diesel fuel, water and operator time" said Lorenz. Some mines have standardised on our 4,000 psi machine and are replacing lower performance 3,000 psi machines with this high pressure model" he said.

High Pressure Accessories Save Time.

Cleaning a big plant frequently means the need for longer length hoses than the standard 10 metres supplied with most high pressure steam cleaners. The Aussie range is no different with a standard hose being a 10 metre double wire braid Aussie blue pro steam rated hose.
The Company offers full range of both standard steel and stainless steel hose reels. They can take up to 75 meters of high pressure hose, giving the operator a facility to walk around the job without having to move the pressure cleaner during the washdown.

"It's a no brainer" said Lorenz. Other accessories that include a hot turbo, designed to take up to 90°C can multiply the machines effective cleaning pressure by up to a third. Thus a 4,000 psi machine like the Aussie Admiral 4,000 can deliver the effects of a 6,500 psi machine. Again, significantly cutting times when used on the right jobs.
"Blasting mud or clay off the sprockets and tracks of a dozer, excavator or similar tractor equipment is a breeze with the turbo" said Lorenz.

All Aussie machines operate with a variable temperature rating from ambient liquid temperature all the way through to the maximum 130 degrees on the big Admiral range.

For clearing the build-up of grease and caked on dust Aussie Pumps recommend a turbo lance. Used in conjunction with hot water at around 70 through to 80 degrees it is a very effective. Other options include flat surface cleaners, telescopic wands and even grit blast kits that can be used for stripping paint or blasting off rust build ups on machines.

"Using the right accessories with the right machine can play a huge part with building efficiency and making maintenance easier and, more pleasant for the technicians involved" said Lorenz.

Keeping Operators Safe

Australian Pump have worked hard to develop machines that Class A units that do not require operator certification. That's a huge benefit for the pressure cleaner operators. Not having to go through the process of RTO certification not only saves money but also means that two operators are not required as you would for say a B Class machine in the 20 or 30,000 psi range.

For more information on A and B classification machines contact Australian Pumps for a free, easy to read handout that delivers a brief summation of the official standard document.

24 volt wet/ dry vacs

Apart from the range of 240v heavy duty vacs with capacities up to 200 litres, the company has also introduced a 10 litre 24 volt vac you have setup inside the cab of a dump truck, grader or excavator.

The whole idea is that the operator can clean out their cab on the change of shift. This has already been trialled and is particularly successful in the Hunter Valley coal mines and will no doubt be easy to get Union endorsement based on its obvious health advantages for the operators.

"The vacs are inexpensive and are part of our standard Aussie Eco-Clean range and are fitted with Aussie Microweb 99.9% filters" said Lorenz.

Mobile Steam Cleaners

The company has it's big engine powered steam cleaners operating in a range of mines around the country. They're also working in New Guinea and New Zealand.
Called the Aussie Hydrotek range, these machines are now available in 75dBA configuration (the Hydro-Hush) and delivery up to 5,000 psi steam from mobile platforms completely independent of power.

Being able to operate a Hydrotek machine on site, sometimes in the field where a breakdown has occurred is a huge gift to the industry. The company preaches that using a lower performance machine in the 3,000 psi 15 litre range simply will not produce the quality or speed of result that using a 20 litre 4,000 psi steamer will achieve! Yes, those machines are also available from Aussie in Class A and do not require operator certification.

"A 3,000 psi machine on a trailer might look like a bargain but when you consider the time taken to carry out the task is double that of a bigger 4,000 psi unit, operators realise that it's a huge mistake", said Lorenz.

Aussie Hydrotek machine in the huge Ok Tedi Gold Mine in Tabubil in New Guinea where they keep a huge fleet of dozers and dump trucks clean and serviceable.

For further information on the Aussie evolution as a major supplier of hot water machines to the mining industry contact Australian Pump Industries
www.aussiepumps.com.au
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The choice of filters plays a crucial part in the efficient and effective operation of machines.

Pushed to the Limits



MANN-FILTER has established itself as one of the go-to brands for machinery by supplying products to meet even the most demanding of manufacturer requirements.

Filter technology is put to the test every day at mine sites and construction sites.

Reliability is paramount in these harsh environments and the choice of filters play a crucial part in the efficient and effective operation of machines.

MANN+HUMMEL, a leading filtration expert and the trusted development partner to engine and vehicle manufacturers worldwide, delivers perfect solutions for machine filtration systems.

Its strong global premium brand MANN-FILTER offers a comprehensive range of filters in OEM quality for the independent aftermarket for every construction and mining machine.

MANN-FILTER

Using MANN-FILTER in 100% OE quality means excellent engine protection, optimised service intervals, reduced maintenance costs and machine downtime as well as increased operational efficiency.

- Oil filters: ensure the effective removal of contaminants in the oil circuit, reducing friction in bearings and moving parts for a long engine life.
- Fuel filters: reliably separate dirt, rust, water and other particles that cause wear and corrosion for a perfect protection of sensitive injection components.
- Air filters and air cleaners: are extremely robust and filter the air intake efficiently and reliably with a very high level of dirt separation. High dust holding capacities ensure long and efficient machine running times.
- Cabin air filters: offer almost 100% protection against undesired particles and hazardous fumes.
- Hydraulic Filters: In an environment of high operating pressure MANN-FILTER protects the hydraulic system against unnecessary wear, corrosion and abrasion.
- PreLine® Prefilter Systems: provide highly efficient filtration and separate more than 95% of water present in the fuel according to ISO 4020, thus meeting the specification set by leading manufacturers of fuel injection systems.

The extreme strain placed on the vehicles means an increased need for maintenance and for regular filter replacements.

MANN-FILTER has established itself as one of the go-to brands for machinery by supplying products to meet even the most demanding of manufacturer requirements.

About MANN+HUMMEL

MANN+HUMMEL is a leading global company in filtration technology.

Among the solutions are filter media and simulation technologies, liquid filters, air filtration and intake systems for various mobility and industrial applications, membrane technologies for municipal and industrial water, as well as wastewater treatment.

Air and molecular filtration technologies for building filtration, industrial applications and cleanrooms are offered and used in power generation, microelectronics or operating rooms.

These include stationary and mobile air purifiers for indoor, semi-open spaces and outdoor areas for a variety of applications including filtering viruses, free allergens, bacteria or fine dust and nitrogen oxides from ambient air. ***AMR***



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Focused and Delivering Sustainable Technology Solutions to Mine Tailings Management



Innovative Filtration Solutions is revolutionising the way mining operators manage waste with their new screw press dewatering method; a creative way to separate solids and liquids.

The inventive process filters tailing solids from process water and consolidates the solids into easily handled bulk material.

Already proven to be a successful initiative in coal mining and other operations, the screw press is European built and specifically designed to enhance the sustainability of waste materials – known as tailings -- created when the target mineral is extracted from ore.

Innovative Filtration Solutions Technical Director Lukas Wimmler said the method was high-efficiency, and low in operating and maintenance costs, making it the perfect solution for operators looking to improve the viability of their mine site.

"There is world wide recognition of growing and uncontrollable risks of mine tailing liquid containment failure," Mr Wimmler said.

"Environmental contamination is a key threat to the viability of the mining industry and existing technology is just not meeting performance demands.

"Liquid mine tailing management is possible with our technology and equipment.

"Innovative Filtration Solutions have always been a company focused on the environment, with a significant amount of our work dedicated to municipal waste water.

"Living in one of the world's most arid countries, we recognise the mining sector must include items such as safety, water recovery, sustainability and solids handling."

To address waste issues, Innovative Filtration Solutions has dedicated themselves to providing environmentally friendly products, equipment, processes, manufacturing and designs, as well as continually developing their industrial knowledge base.

Based in Western Australia, the business is a group of in-house technical experts that provide consulting services, a variety of dewatering equipment, after sales services and ongoing maintenance work.

Mr Wimmler said the screw press method was an old technology that had been repurposed for mining and tailing applications, when traditional filtration or thickening technologies fell short or were too restricted.

After investigating how they could transform existing technology to manage waste better, the business found that some basic modifications could make screw press suitable for tailings, a relatively new breakthrough for the mining sector.

He said screw press was the answer to common but less effective strategies for managing tailings like tailings dams, which use a lot of land, have questionable sustainability credentials and struggle to reuse water.

"Tailings are traditionally more challenging to work with," Mr Wimmler said.

"Many technologies have been tried on tailings.

"They haven't always failed but are frequently unable to live up to expectations, especially on fine materials and (swelling) clays.

"After some successful tests with the screw press technology, we also found it could handle both ultra-fines and coarser material, most of which could be processed to a stackable solids cake for disposal or co-disposal.

"This technology has now been installed on several sites and is ready to go now."

For more information, visit https://www.ifs-consultants.com.au/

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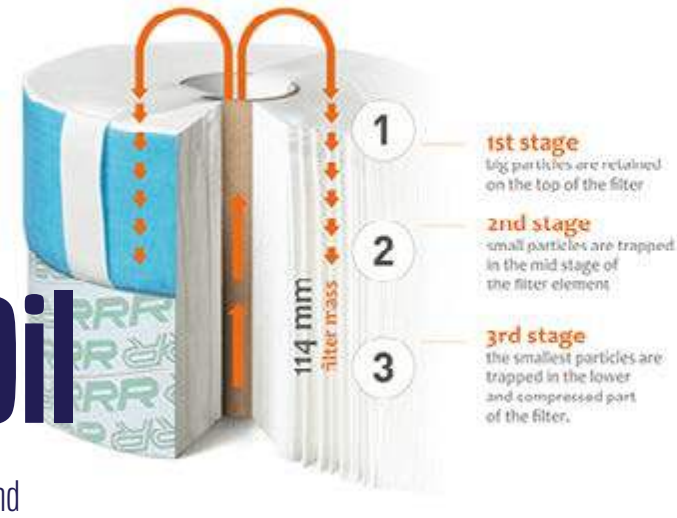
Innovative Filtration Solutions Pty Ltd (IFS) is a company specialising in commercial filtration. IFS provide comprehensive knowledge of all aspects of mechanical separation, based on solid/liquid.

Tailings Filtration with the Screw Press:

- Ideal for fine materials and clays
- No filter media (such as filter cloth)
- No dynamic loads
- Low wear (1-3 rpm)
- Low energy and low carbon footprint
- Low cake moisture
- High availability

The Screw Press is an existing wastewater technology that has been re-applied to mining, and specifically tailings applications, where regular filtration or thickening technologies have signification restrictions.

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Perfectly Clean Oil

Triple R Filtration Australia is the leading provider of Triple R Filters and Tan-Delta oil condition sensors in the Australian market.

Engine oil filtration
Increased demands to extend oil change-out intervals on engines has resulted in the use of synthetic oils being used on modern engines. These synthetic oils have resulted in oil change-out intervals being significantly increased, thereby reducing costs associated with oil changes. Extended oil change-out intervals have also impacted the filter used on the engine. Change-out of the filter element is in most cases associated with a change-out of the oil and the filter element has therefore had to be adapted to meet this requirement.

Filter elements have also had to adapt to other aspects of modern engines.
- Improving fuel economy
- Improving power
- Reducing emissions

Clean oil improves fuel economy and power output by reducing friction and wear on moving parts of the engine. Increased wear causes oil to enter the combustion chamber, burns with the fuel and is exhausted into atmosphere as particles and hydrocarbons.

Full flow and by-pass filters
Filters usually installed and supplied with the engine are referred to as full flow filters.

A variety of housings makes the Triple R filter solution **suitable for any size engine**.



The total flow rate of the lubrication pump is directed through this filter to lubricate the engine. By-pass filters are an addition to the full flow filter. A flow of oil is directed from the main oil supply into this filter to enhance filtration capability. Filter media used in by-pass filters is specifically designed to capture small particles which the full flow filter cannot.

Soot
Soot and sludges in engine oil are formed as a by-product of incomplete combustion. When the air and fuel mixture fails to ignite completely, there is leftover particles. These particles find ways into the lubricating oil and is reflected as soot. It is very rare that the engine combusts completely, so most engines will produce soot.

Extended oil change-out intervals increase the risk of high soot build ups in the engine oil. Full flow filters installed on engine have limited ability to remove this soot as particles are too small for the filter to remove. By-pass filter however have the ability to remove this soot and sludges in oil.

Oil change out intervals
Oil change-out intervals are almost always dictated by the engine manufacturer. These intervals are based on distance or operational hours of the engine. There is an increasing trend to further extend these intervals.

Testing of oil samples has shown that this can happen after the recommended interval has elapsed.

Triple R by-pass filters
Triple R filter elements have unique features which make the element suitable for by-pass filters used on engine. No other filter element on market displays these unique features.

1. Engine oil enters the filter media in a radial direction. This ensures that oil is directed into the thick 114mm of depth media.

2. A 1st stage of filtration ensures that larger particles are trapped in the least compressed filter media. By doing this, element lifetime is extended.

3. In the 2nd stage, the filter media, which is now more compressed, ensures that smaller particles are being filtered out of the oil. This again ensure maximum filter lifetime.

4. In the 3rd stage of filtration, the filter media is compressed at maximum by means of the outer wrap, which traps all small particles in the oil.

The filter element has a very large volume of cellulose filter media contained within. This volume or area of media ensures that the element is effective at removing contamination as well as ensuring extended lifetime of the element A selection of housings makes the Triple R filter solution suitable for any size engine.

Selection of the type of filter housing is carried out quite simply by the sump size of the engine. Housings are typically available in aluminium, steel and stainless steel and range from single element housings to multiple element housings.

Housings are supplied with integrated valves needed for functioning of the filter as a by-pass filter fitted onto the engine. This makes installation hassle free with no other control valves to be installed.

Oil condition sensors fitted on-engine
Our expertise extends into providing solutions for on-line oil condition sensor solutions. These sensors are installed on-board engine and provide feedback to the user on condition of the oil. Use of continuous real time on-line oil condition sensors reduces risks associated with infrequent oil sampling and gives the user transparent information on oil condition to make more informed decisions on oil change outs.



Plug and play solutions for logging and retrieving data.

Tan-Delta
Triple R Filtration Australia is proud to represent Tan-Delta oil condition sensors in the Australian market. We are the leading provider of Tan-Delta sensors into Australian market. The Tan-Delta sensor outputs the condition of the oil as an easy to understand value. Installation of the sensor is trouble free and the outputs from the sensor can be integrated with ease.



The **Tan-Delta** sensor is packaged into a mobile kit format.

Features
- Unique sensor technology measuring remaining useful life of oil
- Analyses the electro-chemical properties of oil with unrivalled accuracy
- This accuracy allows the sensor to also measure other contamination in the engine oil such as fuel dilution, wear metals and water in oil.
- Easy to understand output values
- The sensor also outputs the rate of change of the oil. This is a very useful value as it indicates the rate of oil degradation
- Plug and play solutions for logging and retrieving data
- Data communicated to a Cloud based platform if required

The sensor is also packaged into a mobile kit format. This allows the sensor to be used to measure condition of the oil on multiple compartments without the need of permanently installing one. ***AMR***

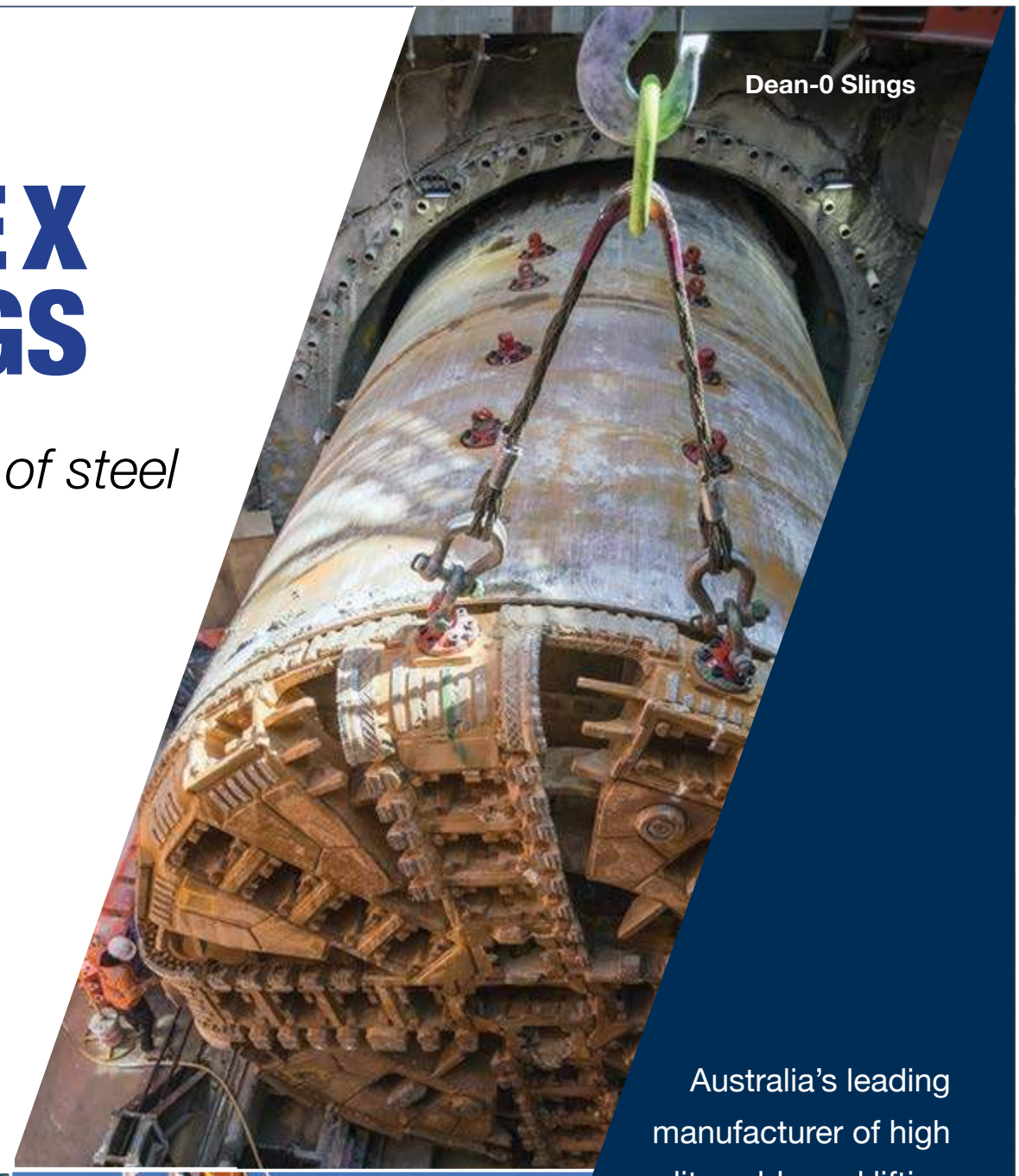


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Znergy Cable and Znergy Mining Oil & Gas is a division of Aryam Australia Group, an Australian owned business that is a manufacturer of Australian designed and engineered products.

We manufacture global electrical components, electrical cables, as well as solar and renewable energy components.

We invest in cutting edge technology and are experts in crafting low and high voltage cables, as well as specialist products for mining, fire, low smoke zero halogen, shipping, and instrumentation.

We also cater for oil and petrochemicals, gas, solar, undersea submersibles, and industrial cables.

With a vast range of products on offer, Znergy cables have HV capabilities of up to 512KV and can be found in nuclear plants and space agency projects.

Aryam Australia Group has a Head Office in Brisbane and has presence in all continents. This includes sales offices in USA, NZ, Singapore, India, China, Vietnam, and Fiji.

Our manufacturing range under **Znergy Cable Division** include LV, MV, HV, EHV (512KV) Mining (Type 241 and 209), Tunnel Boring Machine (TBM), Solar (TUV), Submersible, Fire rated and other specialised cables.

Our solar range is particularly popular as more and more businesses look for environmentally friendly alternatives.

Solar cables are expected to play a large role in addressing the world's energy issues, while being an inexpensive, reliable and clean solution for businesses, particularly as production costs decline.

Solar cables are safe, efficient, eco-friendly and ideal for long-term outdoor use, even in extremely harsh weather conditions and are perfect to protect equipment that needs to be safeguarded from the elements.

We design these cables to function at a normal maximum conductor temperature of 90°c for 20,000 hours and a maximum conductor temperature of 120°c for 20,000 hours.

Under typical usage conditions, these cables can last roughly three decades and are specially designed for solar power systems and other applications like as free hanging, movable and fixed installation.

They can also be buried under ground in constructional covered systems, used indoors and in in workplaces with risk of explosion, such as hazardous industry or agriculture.

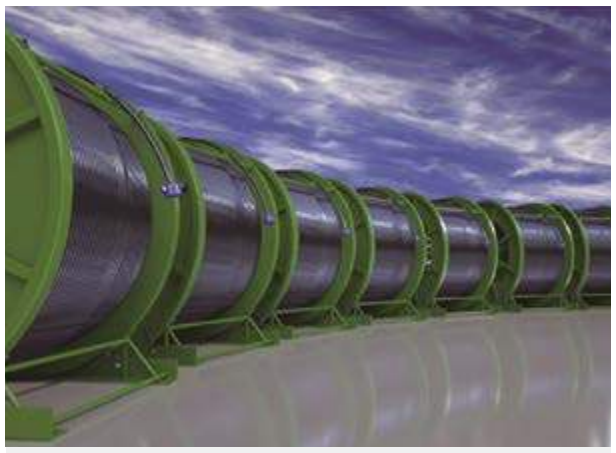
Meanwhile, our manufacturing range under **Znergy Mining Oil & Gas Division** includes highly specialised **Coiled Tubing** (Carbon Steel, CRS and Titanium Alloy), with highly advanced methodology enabling several kilometres of uncut lengths manufacturing with laser welding, **Capillary Tube** (Hydraulic Control Line, Chemical Injection Line), **Encapsulated Cable** (PDC/TEC, Flat Pack) with TEC Steel pipe armour.

We also supply highly specialised and engineered **Take-Up and Pay-Off Units** with **Drop-in Drum** independent hydraulic systems that can be mounted on trailer or on ground.

These can be custom designed to suit specific application and needs of the customer and is designed and engineered in Australia with local understanding and expertise.

The Znergy team can be contacted via
email: **sales@znergycable.com**
or by phone: **1300 347 922**

AMR



Coiled Tubing

(Carbon Steel, CRA, Titanium Alloy)

Coiled tubing is a jointless tubing formed by welding several sections of flexible tubing with a length of more than 100 meters through butt welding or inclined welding.

The length of coiled tubing is generally up to several hundred meters to several kilometers. It can be wound on a reel and used for specific downhole operations such as workover, drilling, perforation, stimulation, well completion and logging. For applications in acidic environments, Znergy has developed high-chromium corrosion-resistant alloy coiled tubing and titanium alloy coiled tubing.



Capillary Tube

(Hydraulic Control Line, Chemical Injection Line)

Znergy provides austenitic stainless steel, duplex stainless steel, nickel-based alloy, Monel alloy welded pipe and seamless pipe. Other alloys and sizes can be manufactured according to different requirements.

Product Features

- Austenitic stainless steel has strong anti-rust and corrosion resistance, as well as excellent forming and welding characteristics.
- Duplex stainless steel has better resistance to uniform corrosion, stress corrosion, pitting corrosion, and crevice corrosion than austenitic stainless steel, and its corrosion fatigue and wear resistance properties are also very good.
- Nickel-based alloys and Monel alloys have high corrosion resistance and high-temperature strength, and can be used in high-temperature, high-pressure and high-corrosion environments.



Encapsulated Cable

(PDC/TEC, Flat Pack)

Encapsulated cable is special equipment used to deal with the harsh environment in the development and production process of oil and gas reservoirs.

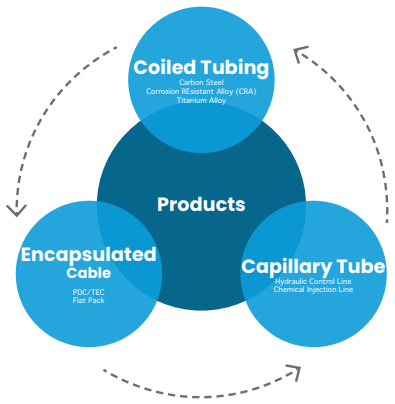
It is a product that uses metal materials such as stainless steel and nickel-based alloy steel to protect cables and other components from downhole pressure and corrosion environmental factors and uses polymer encapsulated materials to provide additional mechanical protection. It mainly includes PDCfTEC (Permanent Downhole CablefTubing Encapsulated Cable) and Flat Pack.



Mining Cable (Trailing & Reeling Type 241 & 209) & Tunnel Boring Machine (TBM) Cable







Znergy
mining oil & gas

Sales 1300 347 922
Email sales@znergycable.com
Web www.znergycable.com | www.znergy.com.au



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Measuring Success

Abstec Calibrations have shortened their lead and turnaround times for clients following a successful revamp of their laboratory workflow, as part of a suite of innovations to improve and expand their service offering.

Established in 1995, the South Australian team have thrived as an in-demand technical services company offering calibration and maintenance support for measuring and testing equipment.

The Australian owned and operated business is experienced in the mineral resources sector and has capacity to service oil and gas operations, the construction sector and defence industries, as well as accommodating manufacturing, aviation, medical, research, education and food and beverage needs.

Abstec Calibrations Operations Manager Daniel Wiering said accurate calibrations were vital to the smooth running of many critical industries, allowing operators to ensure high processing standards and trade compliance.

"Calibration is important because it helps ensure accurate measurements are taken," Mr Wiering said.

"Improperly calibrated equipment can cause measurement errors which may have an impact on the quality and safety of your measurements, products and services.

"Accurate measurements are the foundation of quality and safety of most products and services we use and rely on every day."

Abstec provides calibration in accordance with internationally recognised standards and is accredited by the National Association of Testing Authorities – NATA.

Among the company's most popular products is the equipment in the Crystal range – featuring some of the global industry's most preferred digital gauges and calibrators.

Crystal recorders can collect readings with lightning speed at ten times per second, as well as store up to one million data points.

Often doing the work of three to five devices combined, the favoured products are known to include a wide range of capabilities, replacing your data logger, chart recorder, multiple test gauges, and in some cases even a basic deadweight tester with a single device.

Meanwhile, Mr Wiering said the business also offers dimensional, electrical, force, mass, pressure, and torque calibrations, as well as being capable of calibrating analytical or industrial precision scales and equipment onsite.

"The value of a holistic service for example a laboratory with a broad scope of accreditation such as Abstec Calibrations is that you can save money and time on logistics by using one service provider," Mr Wiering said.

"Abstec Calibrations is continually working on improvements to our scope of accreditation and calibration and measurement capability.

"Most recently, we have improved our laboratory workflow to reduce lead and turnaround times for our clients.

"Additionally, NATA Accredited calibration is necessary to meet quality system requirements, and to ensure that your calibration provider has been audited for technical competence."

"Abstec calibrations have been NATA accredited since 1995."

For more information, visit abstec.com.au

AMR



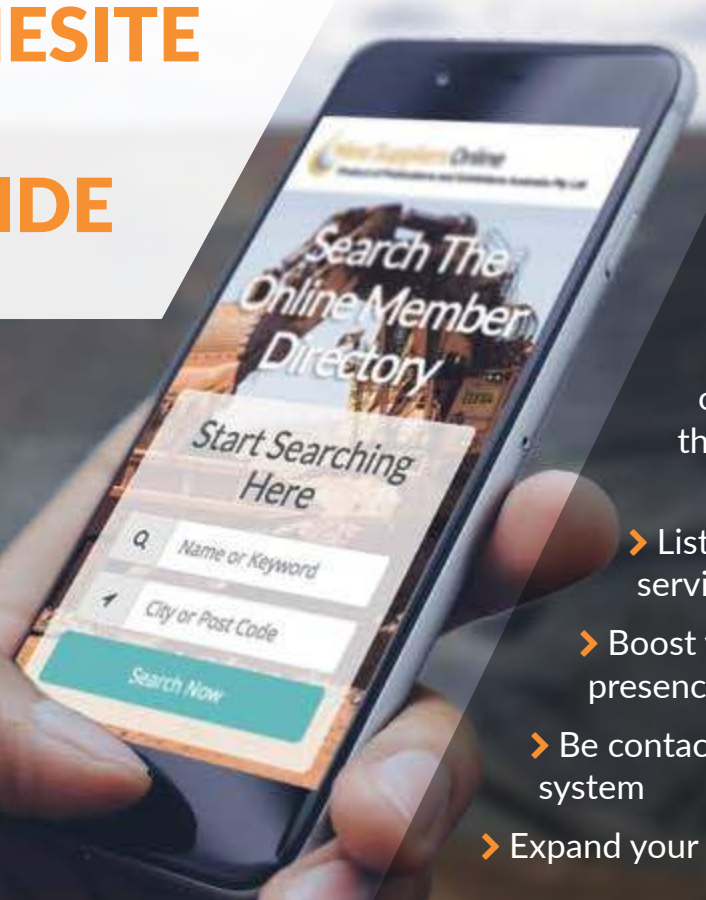
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GROWING with INDUSTRY

A.C. Whalan is a family-owned business that began over 80 years ago.

We supply pipes, valves, fittings, hoses and composite products to the mining and infrastructure industries

Family is important to us and is a core value of our business.

The way we engage with our customers is a strong reflection of the company's culture and values.

Our people are our most important asset at A.C Whalan.

Our team bring together a wealth of knowledge and experience in all pipes, valve and fittings applications, as well as a customer focused approach to all inquiries.

Our team will always find solutions and ensure we supply full packages on time and on budget.

Arnold Clement Whalan established A.C. Whalan & Co Pty Ltd and commenced trading in 1939.

The business traded as a stock and station agent with business involvement primarily in agricultural activities, such as the supply of rural produce, fencing and feed.

The nature of the business lead to the supply and delivery of grain and dry feed to both the local farming community and mining industry.

At the time, pit ponies were used to haul the hand dug coal in dolly cars to the surface of the underground mines in the area.

This is where A.C. Whalan & Co Pty Ltd commenced its association with the mining industry.

Our involvement grew steadily, supporting the resurgence of the resources industry in 1970s and 1980s.

The company's original site was located at Lidsdale and ideally situated to service the Western coalfields.

During this period, mining and industrial supplies became the core business of the company, as manufacturers approached A.C Whalan & Co to be their distributors and representative.

Pipes, valves, and fittings (PVF) soon became the major focus and identity of A.C Whalan. Customers were established across New South Wales and Queensland in the mining, industrial and civil infrastructure markets.

A.C. Whalan's product range is sourced through multiple supply channels.

Local inhouse manufacturing and local distributor agreements with Australian companies along with importing of product from multiple countries not only provides our customers with all their PVF requirements, it provides our customers access to multiple brands, competitive prices, and a vast stock holding of products.

We have a large stock holding of products at our regionally based branches allowing us to work with our customers to ensure we have the stock available that they require.

A.C. Whalan are passionate about putting our customer first, and all things pipes, valves, and fittings.

This is why we ensure "fit for purpose products" are provided to our customers from the first time they engage with us.

Helping customers has been embedded into the company's behaviour and culture since the very beginning.

A.C. Whalan have become a trusted leader in the mining and infrastructure industry for the supply of pipes, valves, fittings, hoses and composite product.

For more information, visit https://acwhalan.com.au/ ***AMR***





POLYLINE INDUSTRIES – Tough Plastics Fabrication

Polyline Industries is a company specialising in High-Density Polyethylene (HDPE) fabrication with products ranging from air ventilation ducts to pump floats and barges.

According to Polyline, ventilation products fabricated from High-Density Polyethylene are superior to their steel and fiberglass counterparts for a number of reasons:

- Inert - Will Not Corrode
- Flexible
- Inbuilt noise absorption
- Durable & impact resistant
- Lightweight
- No maintenance
- Low air friction

Since 1999, Polyline Industries has built a reputation as a well-known and trusted industry leader in plastics fabrication.

They first gained traction in the underground mining sector by introducing a number of unique products into the industry including poly-ducting, plastic detonator boxes, submersible poly pump floats and an underground poly pipe welding system to name a few.

Polylines product range includes items that are now standard issue in the most productive underground mines.

Polyline only needs a drive plan with ventilation duct run and diameter to select or custom fabricate duct sections for your needs for that job, removing the need to plan product selection yourself.

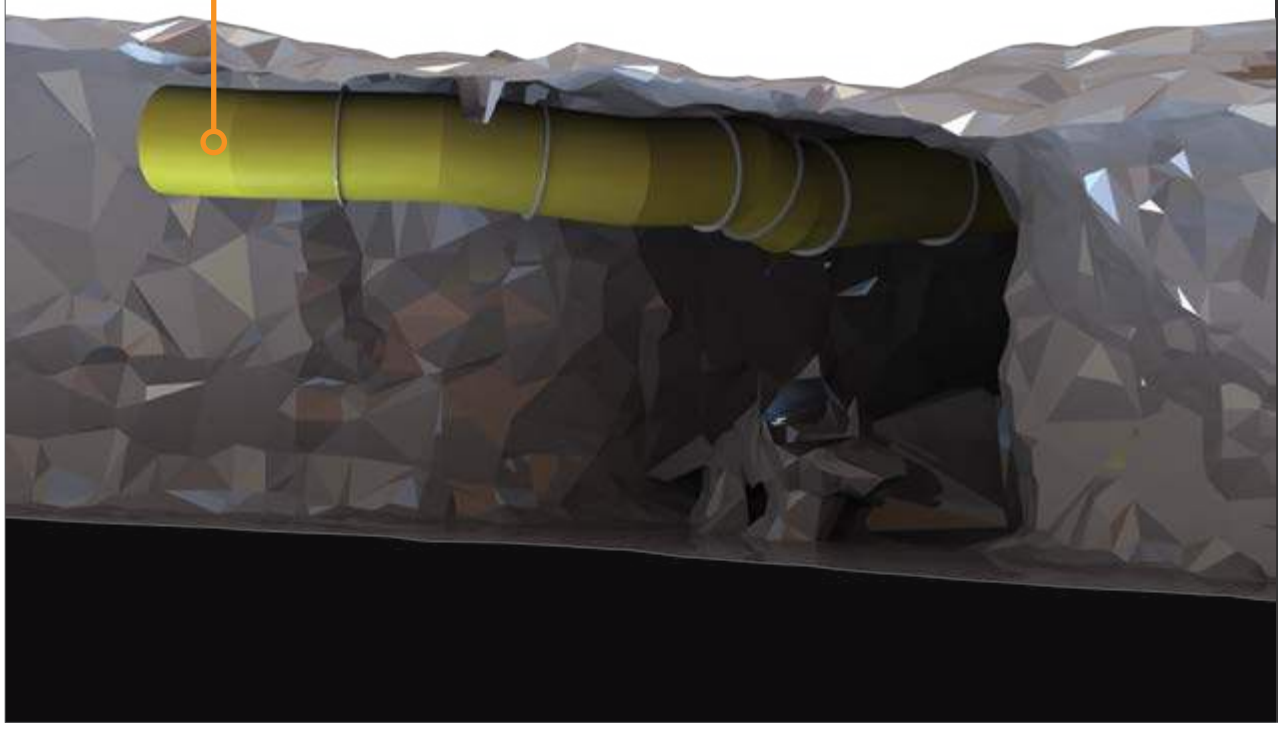
With tough plastics proving to be a superior alternative to steel, aluminium and fibreglass Polyline is fully equipped and committed to delivering you solutions that work! ***AMR***



Polyline Industries

Clearing The Air With Superior Ventilation Products

Polyline Industries is an innovative leader in the fabrication of ventilation products from High-Density Polyethylene (HDPE) which are **SUPERIOR TO THEIR STEEL AND ALUMINIUM COUNTERPARTS.**







Polyline Industries
Tough Plastics Fabrication

55 Cutler Road, Jandakot,
Western Australia, 6164

08 9414 1535
polyline.com.au

PIPELINE TO SUCCESS



Founded in 1975, Trans Vent is a proudly Australian spiral tubing manufacturer dedicated to supporting the occupational health and safety of the industrial and mining sectors.

With team of specialists across their Queensland and New South Wales locations, the business combats dust and fumes with their expertly crafted tubing and piping products.

Sales Manager Daniel Cronshaw said their solutions were manufactured in Australia, made from Australian steel and specially designed to enhance workplace safety.

He said their product mix and services were also uniquely shaped by Australian mining needs and a commitment to efficient, reliable and affordable work.

"We pride ourselves on short manufacturing times and always try and offer a quick turnaround," Mr Cronshaw said.

"For certain products, we also hold a large stock holding.

"For operators in remote locations, we engage our sister company CMP Manufacturing – which supply mobile mills for onsite pipe forming.

"Whether the project is large, small or challenging, we are able to help."

TRANS VENT PRODUCTS:

SPIRAL WELDED PIPE

The spiral welded tubing and piping is welded instead of lock formed at the seams, providing improved strength, and making it virtually leak-proof. Ideal for high pressure, the product comes in a large range of imperial sizes and a variety of thicknesses, grades and mild steel or stainless steel.

DUCT FITTING AND ACCESSORIES

The fittings and accessories come in a variety of sizes and materials, each boasting an array of applications. This includes dust and fume extraction and other uses such as column formers, pier liners, air conditioning, tunnel and mine ventilation, void and span tubing and much more. Trans Vent accessories and fittings include round bends, oval bends, joiners, end caps, flanges. mounting brackets transformations, reducers offsets, T and Y pieces, volume dampers, register take-offs and insulated ducting.

PIPING SOLUTIONS

Trans Vent galvanized steel culvert tubing is suitable for drainage and under-the-road irrigation applications. Both affordable and available in a variety of corrugated profiles, the product is strong and flexible, coming with the option of getting precast concrete drain trimmings for finishing ends.

SPIRAL PIERS

Lightweight and cost-efficient, pier liners are perfect for concrete foundation forming, while void forming tubes are ideal bridge spans and concrete decking. Similarly affordable and uniquely made of steel, Trans Vent column formers are highly resistant to water, can be built to required lengths and do not struggle under the weight pressures.

SPIRAL DUCTING

Round spiral ducting is a great alternative to square ducts and used often for AC ducting, ventilation, dust, and fume extraction and more. Similarly, oval ducting is ideal for space saving in air conditioning, dust and fume extraction and ventilation applications. Trans Vent also offers insulated ducting across a range of sizes, including 25mm or 50mm insulation.

For more information,
visit **www.transvent.com.au**

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DEDICATED SPIRAL TUBING AND DUCTING EXPERTS



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- Versatile and varying fittings and accessories
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RETRA is a WA-based manufacturer and distributor of products that are fit-for-purpose across industry workplaces. Our hoses, nozzles & reels come in configurations to suit various needs and can be customised to your unique requirements.

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- Diesel & Chemical Transfer
- Service & Lube Trucks
- High Pressure Washing



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Ensuring safety with MOXI

Well-established company MOXI have become sought-after within the domestic mineral resources sector for their auditing, inspection, classification and design support capabilities, underscored by years of industry experience.

With locations in Australia, New Zealand and Asia, the company a globally-recognised training course and professional services provider offering contemporary practical education for the mining, oil and gas, utilities and infrastructure sectors.

MOXI Managing Director Sam Zacha said the business was founded to reduce workplace hazards, demonstrate competency and offer training management solutions for both large and small clients.

He said MOXI specialised in making sure an operation was running at optimal efficiently and developing ways to plug shortfalls.

"We conduct audits, inspections, classifications and offer design support tailored to your requirements," Mr Zacha said.

"Our strong and dedicated team of professionals are experienced across a wide range of industries and understand fully what clients need to get a job done efficiently and safely.

"At MOXI, we will help you get proactive about safety."

Based in Perth, MOXI have been working to reduce workplace hazards with their renowned and comprehensive services; a suite of professional offerings designed to keep operations safe and productive.

Among MOXI's comprehensive offering was consultation and inspection surrounding Electrical Equipment in Hazardous Areas.

The business can accommodate a full range of electrical needs across a system, including installation, maintenance and inspections.

It performs electrical equipment design reviews, classification of hazardous areas, trace heating maintenance and repair, general offshore electrical contracting as well as dossier building support and maintenance.

Other services with a proven track record included preparation and maintenance of client's ex equipment register, maintenance of ex equipment and ex enclosures, installation and maintenance of lighting systems and installation of small design scopes and modifications.

Also in demand were the company's core crew electrical support, competency assured technicians, fire and gas cable and detector installations and customised services.

Meanwhile, Mr Zacha said MOXI's risk reduction and competency-based programs had been a big drawcard for the mineral resources sector, as regulations lean heavily on operators to provide foolproof working environments.

He said there was hunger in the market for training solutions that helped people understand safety risks and solutions, rather than just walking operators through usual compliance measures.

"We make sure our training is up to date and practical, enabling us to offer courses that feel like more than just a box-ticking exercise," Mr Zacha said.

"The offering is diverse, with flexible delivery and are in tune with a company's strategic plans and goals, job roles, potential career paths and everyday practicalities, like schedule, location and availability.

"The training solutions are world-class, sourced from local and international training providers and adapted to suit the standards and regulations unique to a client.

"We are constantly developing new strategies to better service hazardous working environments, and we are routinely examining and changing the way we deliver training, so we can meet the needs of a wider variety of people."

For more information,
visit https://www.moxi.com.au/

AMR

What makes an EEHA Dossier?

moxi / HA SERVICES
•Inspections •Consulting •Training

EEHA Dossier

- Classification Report
- Maintenance Management Plan
- Manufacturers Documentation
- Certificates of Compliance
- HA Classification Drawings
- Equipment Schedules
- Cable Schedules
- P & ID Drawings
- Intrinsically Safe Calculations
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RTO #: 51160
Electrical Contractor #: EC11916

Drillman

Authorised Dealer throughout APAC for Getman



Drillman in conjunction with Orica recently completed the installation of a charge unit on Getman Explosive Charger.

Getman Corporation recently appointed Drillman as their exclusive authorised dealer and service provider throughout Australia, PNG, and NZ.

This dealership includes the full range of Getman underground support equipment; from shotcrete machines, concrete transit mixers, elevated platform machines, explosive chargers, personnel carriers, pallet handlers, crane machines, lube machines, and cable stringers.

Getman is a preferred global supplier of mobile mining equipment, with over 65 years of experience in customer-focused solutions for the underground mining industry.

From production support, explosive chargers, ground support and material transportation, their products are purpose built for the mining industry.

Drillman is a leading manufacturer and service provider to the geotechnical, and oil and gas sectors within Australia.

Last year, Drillman signed an agreement with Sandvik Mining and Rock Technology to acquire its Mineral Exploration Business. This acquisition is the next step for the Drillman business, enabling a global footprint and diversification of the Drillman portfolio to complement the Mineral Exploration sector and aligning their future strategic growth.

Drillman now has the capability and footprint to provide exploration drilling equipment and consumables for both underground and surface operations globally.

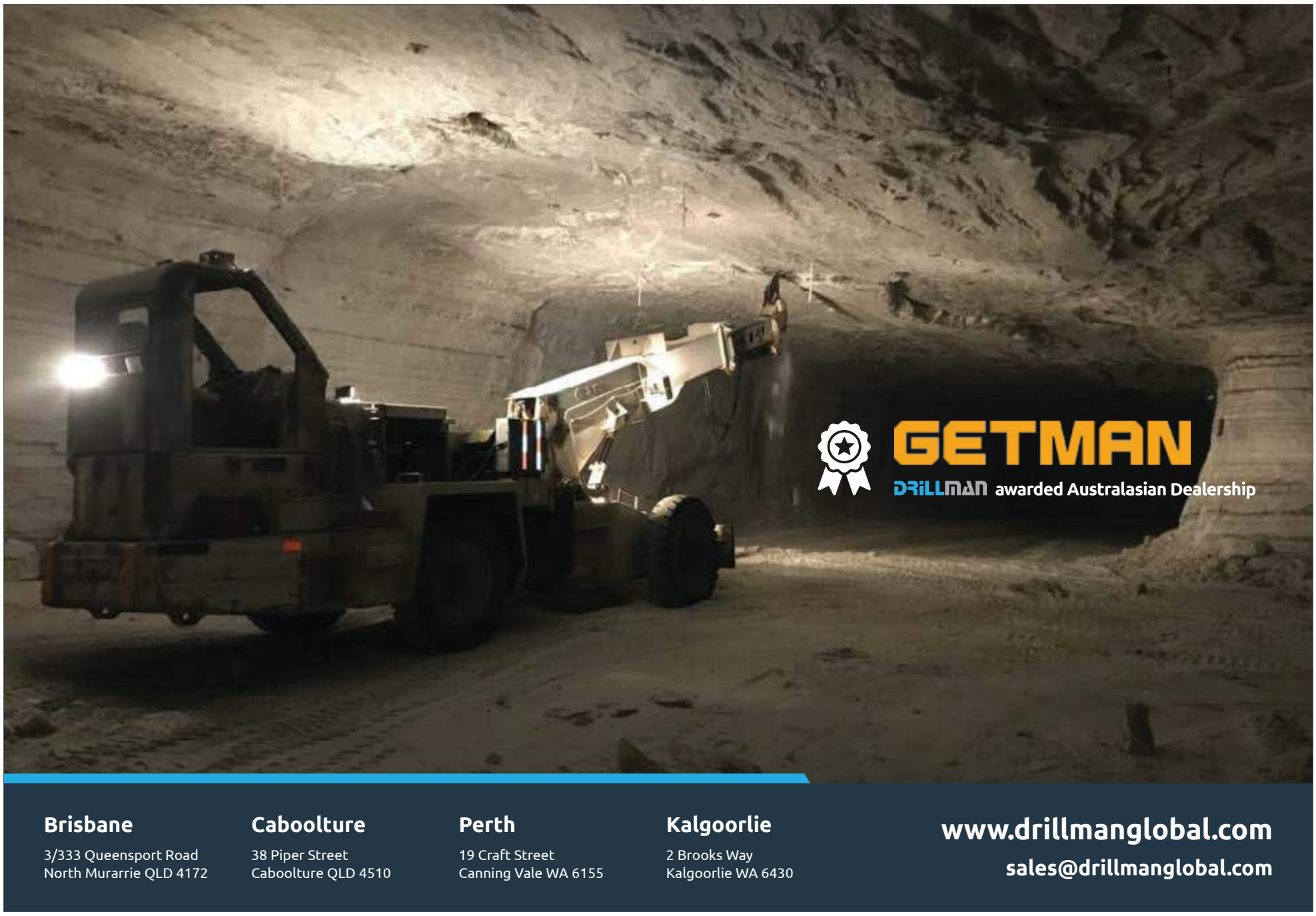
Drillman support services includes inhouse design, research development, engineering and manufacturing and rig rebuilds.

In conjunction with Orica, Drillman recently completed the installation of a charge unit on Getman Explosive Charger for Glencore's Mount Isa Mines underground operations.

The Orica Charger is the first to be installed on a Getman unit, ensuring fast relocation and rapid set up incorporating the Getman elevated work platform.

This helps the Getman unit to provide a delivery system, capable of loading a range of densities, and provide full control during charging.

Drillman's collaboration with Getman helps to deliver end-to-end solutions for our clients in the underground mining sector across the Asia Pacific region. ***AMR***



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www.drillmanglobal.com
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Tick-TOKU

Point your phone camera here to view interactive online version!

Offering a range of products which combine precision and innovation, Air & Allied Sales (Pacific) Pty Ltd has been a leading supplier of pneumatic products for operators in the mining, construction and resources industries for over four decades.

Since 1974 Air & Allied Sales (Pacific) has imported and distributed industrial air tools, chain hoists and winches for above and underground mining applications, all of which meet regulatory requirements, including ATEX and other certifications.

We are an accredited Australian Trusted Trader (with Australian Border Force), as well as being certified to ISO 9001:2015 (Quality) ensuring our customers are working with a reputable and reliable company.

Air & Allied Sales (Pacific) is dedicated to offering unique products with definite advantages in quality, performance, durability, reliability and safety for the operator and environment in which they are used.

We are the sole authorised importer for Toku air tools, construction equipment, chain hoists and winches.

Made in Japan, Toku's models have been specifically designed to be used in hazardous environments and have proven durability in industrial, offshore and underground mining industries.

Known for their exceptional quality control and testing, Toku is a leading manufacturer of pneumatic tools and equipment.

Features of our Toku chain hoists include a built-in load limiter as standard, high quality vane motor and planetary gear with long-life grease, durable high strength housings, failsafe automatic disc brake, choice of cord or pendant control, emergency stop (pendant control), mechanical end stop system, precise variable speed control and explosion proof.

While Toku winches boast a quick engage clutch, light weight and compact, dual brake system as standard (failsafe automatic brake and manual band brake) and durable cast iron housings.

With chain hoists and winches ranging from 250kg to 100 tonnes, and a comprehensive range of accessories and spare parts, we have a large inventory of products available for prompt dispatch.

Air & Allied Sales (Pacific) offer an in-house repair & workshop facility allowing service and repairs to all brands of pneumatic tools, chain hoists and winches with quick turnaround times.

We offer unparalleled technical assistance and after-sales support for both our imported products as well as other brands.

Managing Director Marcus Ghikas said it was the supply of such high-quality products and services which allowed customers to enhance their production schedules, whilst reducing operational costs and improving safety within their processes.

Air & Allied Sales (Pacific) is thrilled to present **Additive Manufacturing / 3D Printing** to their customers which will further enhance solutions to meet precise requirements. Recent investment in a **Six-Sigma Certified** Industrial grade resin printer allows the capability of producing parts with the look and feel of injection moulded items, without the challenges of MOQ's.

The resins used have fully documented specifications including fire retardant, low-static, high temperature and UV stability results.

This enables engineers to design the ultimate in high performance precision products to exceed design outcomes.

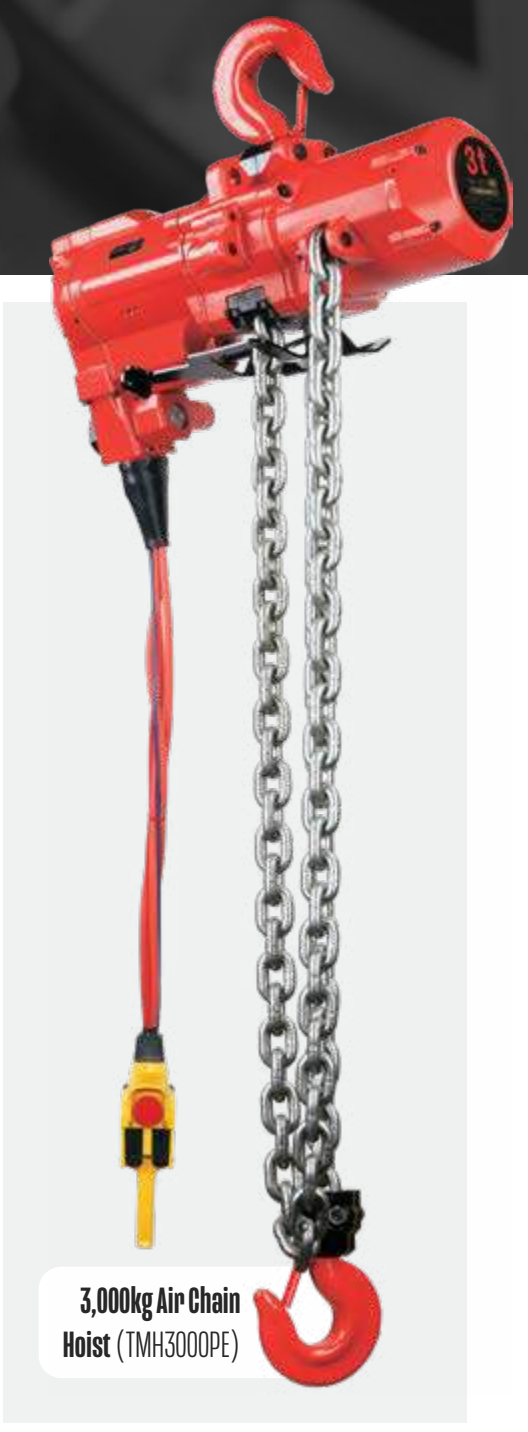
Also available is a **3D Laser Scanner** - the latest and greatest.

It allows for faster, more detailed scanning in harder to reach areas.

The scanner can be used in reverse engineering, inspection, design and product development.

Air & Allied Sales (Pacific) listen to our customer's requirements and work closely with them to provide purpose designed and engineered solutions for their specific applications.

Our unique trademark is a combination of industry-wide knowledge, continual product development and most importantly, a true passion for what we do! ***AMR***



3,000kg Air Chain Hoist (TMH3000PE)

Click any product on this page for more information

TOKU



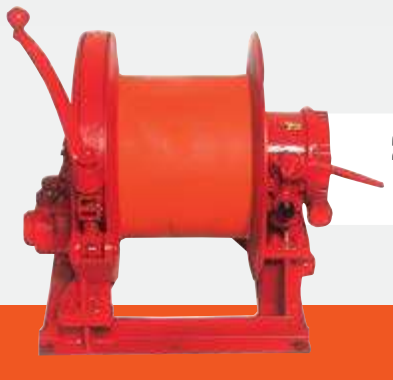
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1" Ind Straight Impact Wench (MI42EFS)



Industrial Chipping Hammer (AA3B)



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Universal Success

Our clients call **Universal Cranes** for their most technically challenging jobs.

This is because of our commitment to understanding our clients' complex lift requirements, and responding with an innovate, pragmatic and safe team. In 2019 we received a Letter of Commendation for our performance on a challenging lift in North Queensland.

Universal Cranes was engaged by Wilmar Sugar Mills to provide planning, scheduling, crane hire, and project management for the installation of a new 220t capacity pan for their Pioneer Mill facility in the Burdekin Shire.

Universal Cranes provided cranage, engineering and personnel for three key components of the calandria upgrade project: 180° calandria Rotation, calandria installation and installation of a second smaller capacity calandria.

The 220t capacity pan had to be lifted into place in three separate components: the bottom cone, calandria, and top cone and body.

At 68t, the calandria was the heaviest item ever lifted into any of Wilmar Sugar Australia's factories.

It was a significant milestone for the client's Burkedin regional team, as in recent years Wilmar returned to an in-house fabrication strategy and this was the largest vessel ever fabricated in their workshop.

Universal Cranes was thrilled to support the team in the installation of the pan, supporting Pioneer Mill to continue competing in the international sugar market.

While the calandria was still being manufactured, it needed to be rotated 180° so the fabrication team could complete welding on the underside of the vessel.

The calandria consisted of 200 pipes which had to be hand welded. Universal Cranes used a truck to enter the workshop with the trailer jacked up, the calandria was then lifted onto the trailer and rolled out to the cranes.

The cranes picked up and rotated the unit 180 degrees and then lifted calandria back on to the trailer where it was rolled into the workshop for final welding.

Universal Cranes rotated the calandria with a 50t lug specialised Rudd which was custom designed.

Once completed, the 220t calandria was installed into the Pioneer Mill.

This required careful planning of the crane build, with a 230t counterweight tray needing to manoeuvre in the extremely limited space around the mill and associated infrastructure.

Our 130T Liebherr 220T Grove + Franna assisted in the lift.

A second calandria also required installation into the mill which was completed swiftly by the Universal Cranes team.

With extensive experience working in processing facilities, often in tight and restricted sites, Universal Cranes has the expertise to provide safe and pragmatic lifting solutions to the mining sector.

Visit our website at
universalcranes.com
for more information.

AMR



GLOBAL has the right DIRECTION



Global Directional Drilling has kept ahead of contemporary mining needs with their trenchless drilling service; an innovative method that slashes project costs and environmental impact.

Established in 2000, the leading Southeast Coast company specialises in pipeline installations, pipe bursting and pipe ramming, while offering a full suite of mine specific equipment including trucks and machinery.

It has a dedicated cable hauling and project management division, enabling an expert team to carry out a project from conception to completion, with a focus on efficiency, safety and environmental impact reduction.

Global Directional Drilling Manager Troy Tsakissiris said minimizing harm to land and ecosystems had become a foundational value throughout the Australian mineral resources sector and his business had been specially shaped to accommodate that.

"Reducing environmental impact is increasingly important, particularly to mining operators in ecologically diverse areas," Mr Tsakissiris said.

"These operators feel a responsibility to manage their projects and the long term health of the environment and surrounding communities.

"Directional drilling helps our clients reduce their environmental impact.

"It allows underground systems to be installed without the need for open excavation.

"This method can significantly cut down project costs, reduce safety concerns and yes, lessen environmental impact."

While Global Directional Drilling has an extensive mining client portfolio, the business has provided underground service installations for a wide range of projects across multiple industries.

The team have worked with commercial organisations, state and local governments and a variety of utility providers, including supporting gas, electricity, water, sewage and telecommunication developments.

With more than two decades of experience, the business has become a pillar within the energy, civil, agricultural, and mining industries with capacity to service projects throughout Australia.

Just last year, it joined Global Drilling and Exploration Group, an established drilling services provider across Asia Pacific, Europe, Middle East, Africa, and North America.

Mr Tsakissiris said becoming a member of the Group would only strengthen Global Directional Drilling's ability to innovate, bring to market fresh drilling solutions and keep ahead of the global curve.

He said the company was constantly adapting to industry needs and improving their work processes to ensure they can accommodate modern requirements, while remaining on the hunt for the newest drilling methods and technologies to ensure they stay first choice among operators within the sector.

"Our focus on safety and productivity is fundamental to how we deliver our services, and our fleet of equipment are continually optimised to ensure maximised availability and minimal downtime," Mr Tsakissiris said.

"At Global Directional Drilling we develop new and innovative solutions to cater for clients that have unique and difficult projects, using our 21 years' experience.

"And sometimes, if need be, we look abroad for inspiration.

"At the moment, we see innovation in how directional drilling is used.

"Not just for difficult pipeline installations, but also for dewatering, Geotech investigations and gas drainage.

"We have two decades of experience in directional drilling, and we have completed a wide range of projects with a focus on safety and excellent completion rate."

For more information, contact
Troy on **globaldd@bigpond.com**
or **0402 123 858**



Horizontal Drilling Specialists

Global Directional Drilling is a leading Southeast Coast horizontal drilling company delivering a diverse range of services to projects from the city to the country.

Specialising in trenchless pipeline installations, horizontal drilling, pipe bursting and pipe ramming, GDD have provided underground service installations to a wide range of clients including State Government departments and local councils, mining companies, and commercial organisations.

Our focus on safety and productivity is fundamental to how we deliver our services and our fleet of equipment are continually optimised to ensure availability and minimal downtime.

Troy Tsakissiris / +61 402 123 858 globaldd@bigpond.com www.globaldd.com.au

Game Changing Precision



United. Inspired.

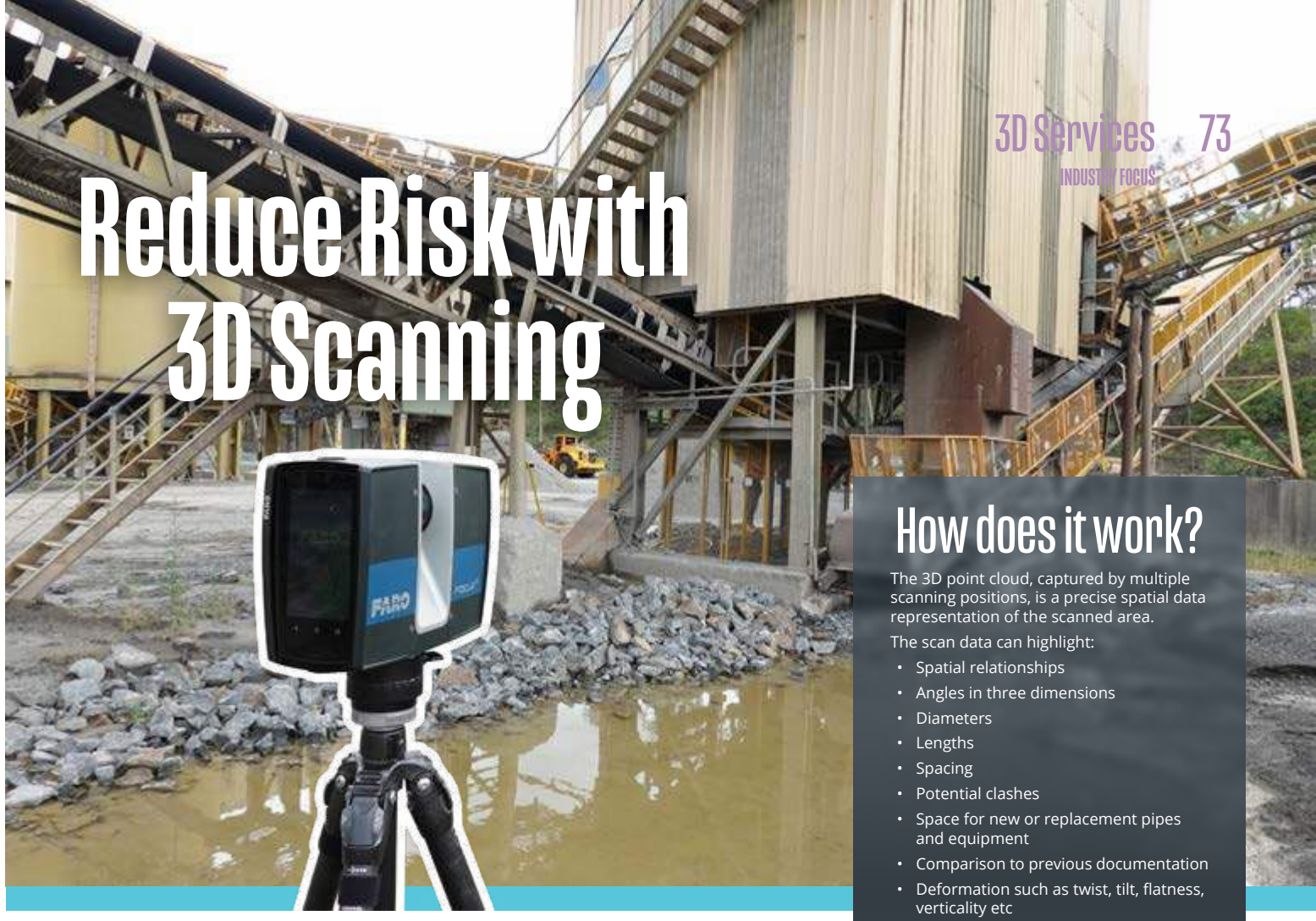
Flexibility, versatility and reliability

Maximise productivity in small spaces with the Simba S7. This hydraulic long-hole drill rig is built for small spaces and tough drilling conditions. The Simba S-series is designed with the bottom line in mind. The result is rugged performance, improved safety and flexible automation that lets you add the functionality you need to this versatile rig.

Epiroc

epiroc.com/en-au

Reduce Risk with 3D Scanning



When plant and machinery need to be re-designed, repaired or replaced, manual measurement methods can't be relied on. Enter Scan Hub and their specialists in 3D laser scanning.

The Scan Hub team has more than 40 years' combined experience in managing diverse and complex technical projects across Australia, with the skills and capability to effectively manage multi-site projects for local and national clients.

Scan Hub chief executive Terry Robinson said the team can capture environments and objects efficiently and accurately with the latest scanning equipment and software technologies.

"We capture reality in 3D and we're helping to transform the world into a digital landscape," Mr Robinson said.

The scope of applications for 3D laser scanning and CAD modelling is many and growing.

The built environment and objects can be scanned with millions of 3D points in minutes and stored as a 3D point cloud with millimetre measurement accuracy.

Traditional survey methods pick up tens to hundreds of measurements, we pick up millions of points that are millimetre and spatially accurate.

Site survey based on "old school" manual measurements is full of risk.

Human error can lead to measurements being forgotten or missed and the drafting team may make assumptions based on the incorrect measurements, which lead to expensive mistakes down the line.

"By engaging an expert laser scanning operator like Scan Hub, you're using technology that basically captures everything within the defined area that the client wants captured; and it's brought back to the office so that it can be viewed in 3D, measured in 3D and drafted in 3D," Mr Robinson said.

Nothing falls through the cracks because if there's any important areas in a particular structure, we make sure we get those highlighted to us by the client.

The data collected with 3D scanning also allows mining operations to significantly reduce costs overall – and reduce the risk of something not fitting or clashing during construction or installation.

"Scan Hub will save you time and money by scanning your plant, objects, site, pipes, plant or machinery with highly accurate 3D laser scanning," Mr Robinson said.

Our Australia-wide team have the right tools and know-how to scan, 3D model and produce 2D fabrication documents from 3D point clouds.

"We'll help you avoid costly mistakes."

More information:
1300 903 240
terry@scanhub.com.au
www.scanhub.com.au

AMR

How does it work?

The 3D point cloud, captured by multiple scanning positions, is a precise spatial data representation of the scanned area.

The scan data can highlight:

- Spatial relationships
- Angles in three dimensions
- Diameters
- Lengths
- Spacing
- Potential clashes
- Space for new or replacement pipes and equipment
- Comparison to previous documentation
- Deformation such as twist, tilt, flatness, verticality etc

3D laser scanning not only picks up every detail the scanner can "see", but also captures high resolution 360-degree panoramic 3D overlay images which significantly improves remote inspection and modelling work.

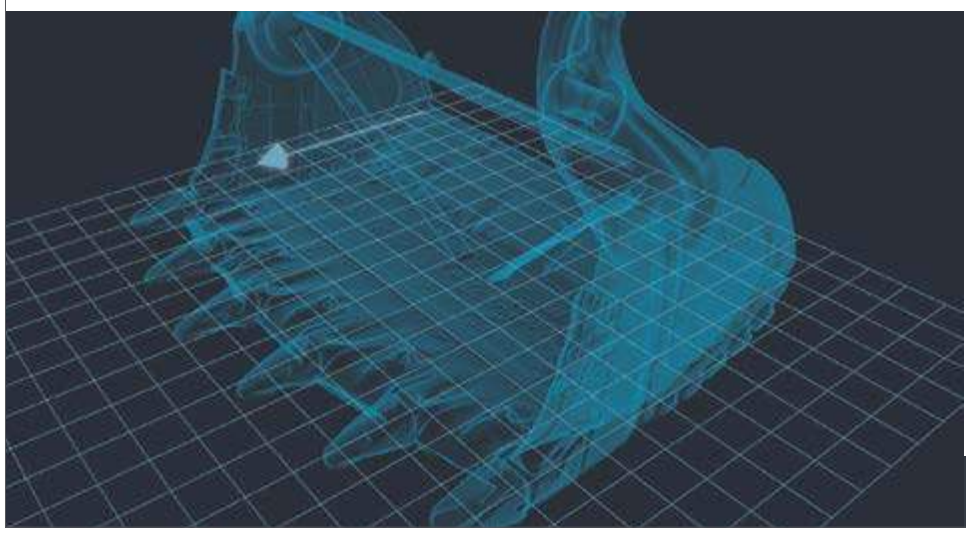
The panoramic photographs are overlaid with the point cloud so the viewer or CAD operator can quickly switch between the two.

The resulting 3D point clouds, high resolution images and 3D model forms the baseline for not only the immediate work to be performed but future works not anticipated in the present.

The laser survey baseline is also important for before and after analysis to assess the work done.



THE EXPERTS IN
3D LASER SCANNING
AND MEASUREMENT



scanhub

From a single rivet to an entire plant, Scan Hub has the equipment and expertise to capture 3D environments and objects in mm precision and real-life colours and textures.

3D LASER SCANNING

- 3D Laser scanning for all structures – marine, mining, engineering, heritage, buildings – anything
- High accuracy laser equipment with mm precision
- Experienced and skilled operators
- Laser hand scanning of smaller objects for reverse engineering
- Processing of scan point clouds to mesh or CAD format

PROCESS-MODEL-MEASURE-ANALYSE

- Scan to CAD – end to end process from laser scanning to 3D CAD models and 2D fabrication documentation
- Deformation Analysis and Measurement
- Experts in 3D modelling from point cloud data
- New design clash analysis
- Skilled team experienced in a wide range of CAD tools

REDUCE YOUR COSTS AND RISK

- Highly skilled operations and competitively priced
- Our laser scanning services will reduce your risk, costs and errors in site measurement surveys
- 20 years' experience in managing complex projects Australia wide
- Strong focus on accurate project scoping, quoting and on-time delivery
- Will fly-in-fly-out Australia wide

1300 903 240 | terry@scanhub.com.au | www.scanhub.com.au





Up High at Hi-Tech Metrology

METROLOGY IN MINING & HEAVY INDUSTRIES

Heavy industries and mining usually mean difficult conditions, and oversized equipment. Within this realm, it's the measurement equipment that needs to come to the part, and not the opposite.

This is where the portability of Creaform 3D measurement technologies really stands out as a major benefit. Whether for a mechanical adaptation or for monitoring the wear level, Hi-Tech Metrology's skilled personnel along with Creaform's technologies can quickly resolve the issues faced by companies working in these sectors.

3D SCANNING AND REVERSE ENGINEERING

Engineering time for developing mechanical products can be significantly optimized through using accurate, representative digital models. Experts from the Hi-Tech Metrology's Applications Team can create such quality models.

- 3D scanning: acquiring data on very large, complex systems (laser / mid-range 3D scanners)
- Design intent, as-is state, or congestion simulation
- Stress, deformation and product specifics analysis
- Inspection and quality control of heavy vehicle and industrial equipment
- Reverse engineering for production tooling, rolling equipment, heavy machinery, etc.
- Assessing as-built / assembled conditions

CONTROL AND WEAR QUANTIFICATION

Monitoring wear levels for production equipment takes place during planned shutdowns, and thus must be carried out efficiently. The Creaform 3D measurement technology is perfectly suited for such applications, since it can acquire data very quickly, without having to move the equipment. Plus, this technology makes it possible to collect a very large volume of measurements, which can be used in different projects such as research & development, operations or preventative maintenance.

- Mill inspection & analysis
- Mill liner design and optimization
- Shortened production shutdowns thanks to a fast 3D data acquisition
- Highly repeatable data
- 3D scanning possible even in tight spaces
- Monitoring of wear levels and prediction of mechanical failures

ABOUT HI-TECH METROLOGY

Hi-Tech Metrology was founded in 1992 to support and promote the Sheffield Measurement range of Coordinate Measuring Machines throughout Australia and New Zealand.

Today our extensive range of metrology and scanning equipment combined with a complete array of support services and offices throughout Australasia enable us to tailor complete solutions incorporating hardware, software and engineering for virtually any measurement or reverse engineering task.

HOW WE CAN HELP YOU

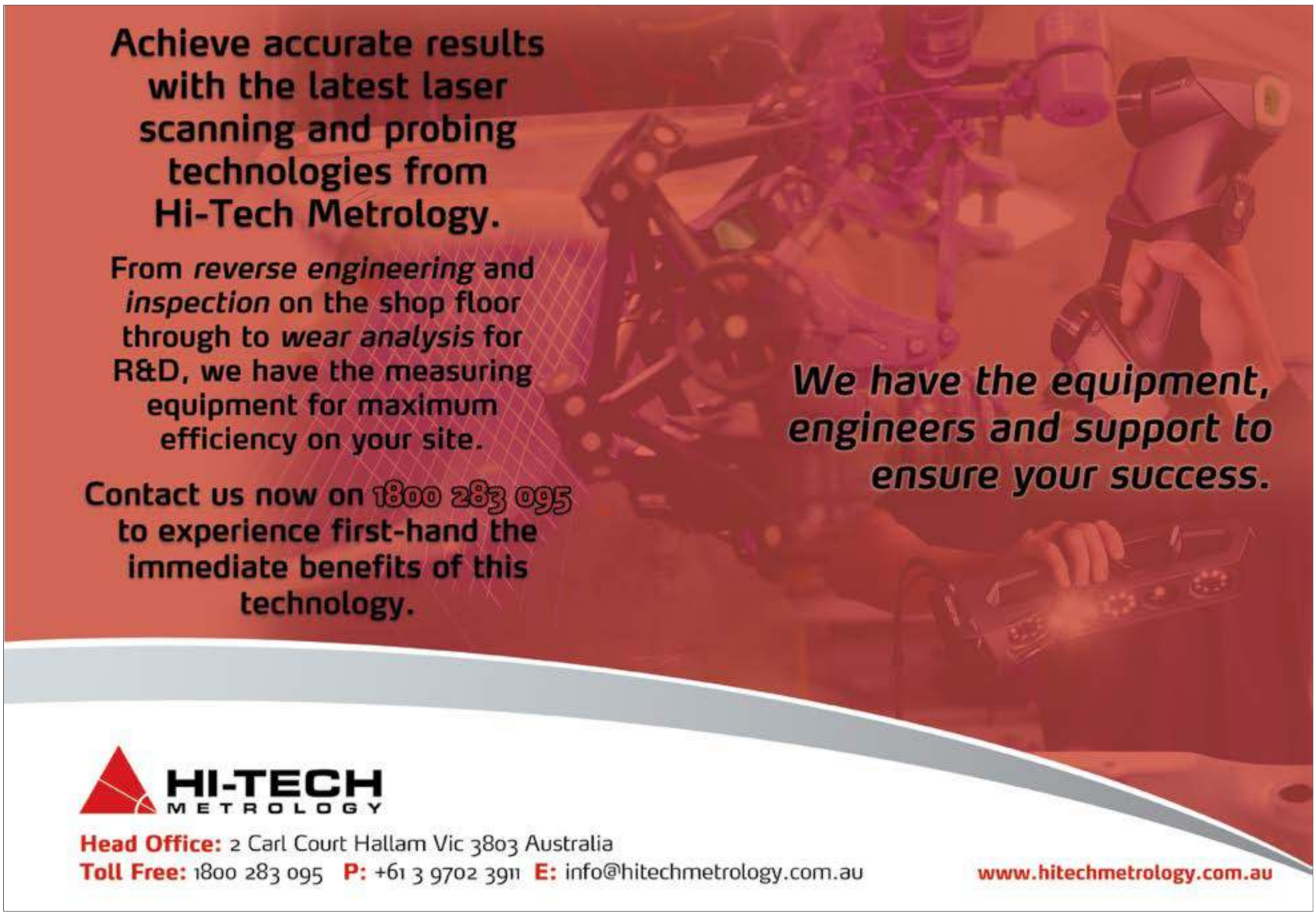
Hi-Tech Metrology's services include on-site and 'offline' metrology inspection services, meaning our personnel and portable metrology equipment can run for hours independent from a ground power source.

For the purpose of reverse engineering, non-destructive testing for mechanical wear and damage assessments, or simply dimensional inspection, Hi-Tech Metrology have the skills, experience, expertise and equipment to help you ascertain quickly and efficiently the key data sets for your projects. This frees up the time and resources required to perform the subsequent analysis tasks and if required take corrective actions in order to improve your business performance.

Our business units have been developed to help and support clients with all of their measurement needs; whether it is a capital equipment purchase, support of existing equipment, or provision of contract measurement services. All these business units form part of a unique Australian business, one that strives to provide the best possible products and service to our existing and future customers.

hitechmetrology.com.au
1800 283 095
info@hitechmetrology.com.au

AMR



Fear Not Food Waste



Labour is one of the major challenges for mining operations, with about 60,000 fly-in, fly-out (FIFO) workers in Australia requiring housing, feeding and caring for while on-site, usually in remote areas.

Large amounts of people inadvertently create enormous amounts of waste, which is costly, financially and environmentally, alongside being a health and safety concern.

Food waste, usually one of the biggest portions of a FIFO village's waste, is a significant contributor of greenhouse gas emissions globally, more than airline traffic and steel production combined.

This is compounded by the added logistical challenges of transporting waste over long distances for disposal offsite.

The WasteMaster Solution
Green Eco Technologies provides a unique solution by helping mine sites recycle food waste on-site with its innovative WasteMaster solution. The technology is Australian designed, Australian manufactured and patented in 41 countries.

This recycling technology diverts food and organic waste from landfill, leaving a much smaller quantity of pathogen-free and virtually odour-free, nutrient-rich residual material.

FIFO accommodation centres in Australia and South America are taking advantage of WasteMaster's benefits in reducing their CO_{2e} footprint.

The system is easily installed on-site, requiring only a three-phase power supply and an air vent.

For every 500kg of food waste loaded into the WasteMaster system, it outputs around 100kg of compost-like, high-calorific value, residual material, that can be used for power generation through anaerobic digestion, land rehabilitation and other purposes depending on the feed stock.

The system is also monitored remotely 24/7 by Green Eco Technologiesto ensure trouble-free operation. In the event of an unplanned interruption to normal operation, or even for necessary servicing, a service engineer will travel to site to manage maintenance requirements.

How It Works
WasteMaster's management software takes complete control of the process.

The operator pushes the full bin of food waste into the bin lifter and presses the load button, leaving the WasteMaster to do its work, even unloading the residue automatically when processing is complete.

The diagnostic and remote monitoring functions make food waste conversion a 'set and forget' operation, providing a window on real-time processing, with integrated data capture also supporting accurate environmental reporting.

This innovative process does not require the addition of bacteria, other additives or water, so no special skills are required to operate the system and no plumbing is needed.

Instead, the cell walls of the food waste are blasted with charged oxygen molecules, which are taken form the ambient air to accelerate decomposition. The moisture in the waste is evaporated and vented into the air as humid, odour-free vapour.

At the end of the process, the weight of the organic waste is reduced by up to 80%.

United Nations' Sustainable Development Goals
According to the Food and Agriculture Organisation (FAO) of the United Nations, one third of all food produced globally for human consumption, 1.3bt, is wasted annually, causing an estimated 14% of the world's greenhouse gas emissions.

The methane gas emissions generated by rotting food waste in landfill is 25 times more damaging than CO_2 as a greenhouse gas.

Working in support of the UN's 17 Sustainable Development Goals, Green Eco Technologies strives to conserve precious and diminishing resources and to preserve the planet for future generations.

To find out how you can reduce your costs and also achieve your sustainability goals contact Green Eco Technologies now (details in the advertisement below). ***AMR***



Compressed Air Power for Australian Mining



PMV Compressor. Kaishan Permanent Magnet Variable Frequency energy saving technology.

Mining is Australia's biggest and most valuable industry with a wealth of mineral assets extracted every day for both export and a growing local manufacturing market.

Open cut and vast underground mines with kilometres of tunnels are located in remote regions in extremely harsh environmental and industry invoked conditions.

Due to the inherent challenges and dangers of working deep underground where dusty and wet conditions exist, compressed air has proven to be the safest and most energy efficient source of power available.

Using compressed air as opposed to diesel or electric alternatives provides mining operators with a safe, clean, reliable and cost-efficient power source.

With mining operations requiring compressed air in some form, fixed, mobile and re-locatable compressors are employed in a wide range of mining applications including the following:

DRILLING: Used for exploration drilling to extract core samples from prospective mine sites to powering the stope face drills that prepare for explosives operations or break down and crush the rock face for extraction.

BLASTING: Compressed air systems offer safer mediums for use in blasting operations. High velocity compressed air can be utilised in mining operations to safely set off explosives.

SMELTING: Mined ore is heated and melted to extract precious metals. Smelting plants are usually located near mining operations with compressed air used for instrumentation, agitation, cooling and other air power operated processes.

AIR AGITATION: Ample oxygen supply is essential to promote the reaction between gold, silver, and cyanide. Because regulated control of aeration during agitation is essential to maximise the separation and extraction process, variable speed controlled air compressors are ideal for the purpose.

INSTRUMENTATION: Clean, dry air supply is essential for the operation of critical mining instrumentation.

REFINING: Once separated from the slag, extracted metals are heated to 700°C then blown with compressed air to oxidise and separate other alloys which may still exist within the metal.

VENTILATION: Air compressors generate and deliver the air required for ventilation and oxgen supply throughout mining tunnels and refuge bays.

PNEUMATIC MACHINERY AND TOOLS: Mining operations require the use of a variety of compressed air driven equipment including drills, cutting and extraction tools, loaders, conveyors etc. Air supply must be available on demand utilising variable speed and pressure control to suit the various applications. With no electrical or motor components, compressed air driven equipment is safer to use and less subject to wear and tear.

Applications for compressed air in mining operations is a highly-specialised industry with compressors designed, configured and installed to meet exacting requirements that recognise and cater to the safety and efficiency parameters of each application.

These include all aspects of the complete compressed air supply and delivery system from compressor to end application.

As electrically or diesel powered, portable air compressors can be a safety hazard in underground situations, surface sited compressors are more commonly used.

On demand air supply control is vital through both the compressor and receiver pressure vessels.

Most mining operations utilise a variety of air compressors from portable models to larger capacity surface sited rotary screw models with variable speed controls to regulate the flow and pressure of air being supplied for any given application.

Kaishan Compressors have supplied and installed air compressors and systems for Australian mining operations for over 40 years.

The company has developed specialised, mobile and fixed compressors including 2-Stage and PMV (Permanent Magnet) variable speed rotary crew compressors and tank mounted compact models suited to a wide range of mining applications.
Kaishan has also designed and built large skid mounted compressors that can be moved around the mine site as required.

Kaishan Compressors for mining applications are built to withstand the harshest conditions with the latest world class, energy efficient technologies, highest quality engineering and rugged housings.

SUPPORT: Any downtime in the mining industry can be a very costly occurrence and that is why Kaishan Compressors support all their products with a nation-wide mobile technician workforce on 24/7 call. Our mobile service vehicles carry a comprehensive stock of spare parts and our technicians are trained and experienced in rectifying any compressed air problem with any type or brand of equipment.

CUSTOM SERVICE PROGRAMS: Kaishan Compressors work with our customers to develop service programs that cater to their specific needs ensuring continuous monitoring and peak operation of their compressed air systems.

SYSTEM ASSESSMENTS AND UPGRADES: We can survey current compressed air installations to detect air leaks and malfunctions that can severely affect the costs and efficiencies of vital mining operations. On request we can then repair and/or upgrade system components as required to restore maximum efficiency. ***AMR***

KAISHAN 2-Stage Rotary Screw Compressors. Energy efficiency for the highest demands in the mining industry.



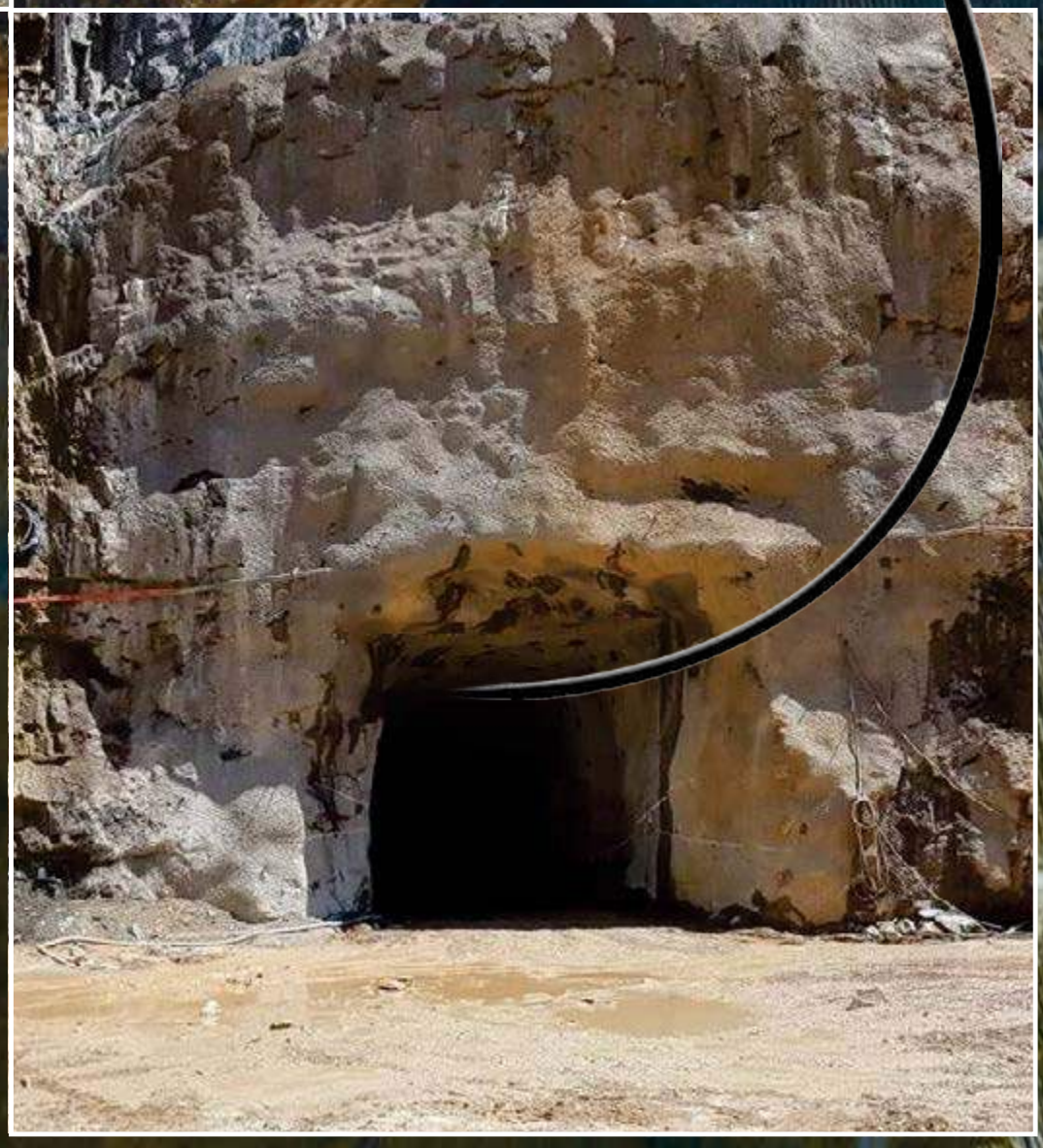


IT'S ALL ABOUT QUALITY AIR



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 Compressors 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 Compressors 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

KAISHAN

Engineering the Future





Certified System
Quality
ISO 9001

*Warranties referred to are subject to conditions



*T&C'S AVAILABLE ON WEBSITE



Workhorse Workwear: The Smart Choice

When it comes to safety workwear and safety clothing for the mining and resource industry there are subtle differences that make one brand's range unique to the Australian market.

Workhorse Workwear provides quality safety workwear that is uniquely suited to Australian conditions.

Launched in 2014, Workhorse Workwear has become a staple workwear brand for large mining and industrial operations looking to provide protective and affordable uniform solutions to their teams. Now in 2021, Workhorse has been focussed on bringing more customer-driven innovation to the market, resulting in improved comfort and safety across its extensive workwear range.

Innovation Designed To Support Australian Conditions
Workhorse aims to deliver real value to large mining and industrial businesses who need safety workwear to protect employees from Australia's harsh conditions while at the same time ensuring that the employees embrace the use of the workwear.

Part of this has been the development of a stretch element in the new range. By including more stretch fabric, the garments fit workers bodies and allows more movement for people on-site doing active jobs. When you are working up to ten hours a day, a uniform that can fit and move with you can make all difference for comfort and efficiency.

Combatting Heat And Sun
The Australian environment presents a range of challenges for safety workwear including ensuring that workers are protected from the suns UV rays while providing adequate ventilation to mitigate the effects of heat stress and heat stroke.

The Workhorse range has incorporated direct feedback from customers showing that Australian mining and resources workers show a strong desire for cotton-based fabrics in safety workwear.

Australians love wearing 100% cotton and the Australian high-visibility standard has now been modified to allow workwear ranges to use the natural cotton that Australians want.

There are also a range of other initiatives that combat the effects from the sun and heat including UV resistant fabrics, collars that can be pulled up around the neck and bents to allow heat to escape from key locations within the clothing.

These are all aimed at keeping workers protected from heat stress and exposure to the sun.

Ethically Sourced
Understanding supplier commitments and performance across multiple operation areas such as responsible business practices, quality and compliance and sustainability, means the Workhorse brand is can better support customer expectations and coupled with in-house technical expertise and site visits, deliver on customer objectives.

As part of its quality assurance practices, surveillance audits of factories producing its Workhorse safety workwear are conducted. Not all workwear is the same.

Point of difference is key when selecting safety clothing and safety workwear.

The revelation that all safety clothing and workwear isn't the same is often discovered when organisations selecting clothing for workforces based solely on cost comparisons rather than the conditions faced by the workforce.

By selecting a brand like Workhorse, mining and resource companies have the assurance that the product is ethically sourced, meets some of the industries strictest quality standards and ultimately that the workwear will work effectively in mitigating the hazards that workers are exposed to.

It is an assurance that is backed by Blackwoods, Australia's oldest and largest provider of industrial and safety supplies.

Delivering True Value
There are five key pillars of the Workhorse Workwear range that gives customers the confidence they are getting a workwear solution that guarantees protection and value:

FIT FOR PURPOSE: Designed in Australia, based on feedback from Australian and New Zealand customers.

INDUSTRIAL STRENGTH: Durable and designed to last in the harshest environments. Tested to meet the AS/NZS Standards.

PEACE OF MIND: Developed and backed by Australia's leading industrial supplier.

AFFORDABLE: Real pricing, no middleman, no fancy advertising.

QUALITY CONSTRUCTION: Manufactured in SEDEX approved factories alongside Australia's leading workwear brands.

Workhorse Workwear is exclusive to Blackwoods. With over 2.5 million units sold, Workhorse is one of Australia's key workwear brands. ***AMR***







WORKHORSE WORKWEAR STANDS FOR YOU

Workhorse WORKWEAR

The worker, the business owner, the safety officer.
We are fierce in our desire to protect workers and get them home safely.

Workhorse Workwear designs and creates industrial strength garments, working with our customers to deliver quality solutions that are functional, durable, appealing, and fit for business.

Workhorse takes pride in being your smart choice in workwear.



Workhorse Workwear is exclusive to Blackwoods.
Scan the QR code to view our range catalogue today
or contact our team to discuss how we can work with you.

Blackwoods

13 73 23 **blackwoods.com.au**

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THE AUSTRALIAN MINING REVIEW

Build A Warrior Workforce



Jobfit and their partner business Baseline Onsite deliver medical services to remote sites.



Jobfit are the experts in providing detailed pre-employment medical checks, which are proven to reduce lost time at work.

Large workforces at mine sites require customised health and wellbeing solutions.

Choosing the right occupational healthcare provider is important when it comes to managing a variety of medical requirements on remote sites.

Jobfit chief executive Vik Dogra says the health and safety of staff are essential in optimising company productivity and reduce lost time to injuries.

"Screening workers with pre-employment medical assessments before they go on-site means we can identify any medical issues they may have and make the site aware in order to manage these health conditions better," he said.

"In some instances, access to good medical facilities is hours away so it really helps save lives if health conditions are identified and measures can be put in place on site to avoid any critical health incident.

"There is clear evidence that points to reduced lost time at work with these assessments.

"As workers become more aware of their health conditions, it gives them a better quality of life, better management of conditions, even on remote sites."

Jobfit has been partnering with businesses for 25 years to create a healthy workforce.

Starting out in Adelaide, with their first client being a mining company, Jobfit has since expanded its footprint to more than 40 centres nation-wide, servicing many industries including transport, logistics, retail and mining.

From pre-employment medicals and drug and alcohol screening to injury management, vaccination programs, work fitness assessments and telehealth and medical expert services, the list of specialised occupational health services that Jobfit provides is endless.

Jobfit has around 300 employees across its sites and more than 5,000 clients.

"Another exciting milestone has been bringing on board Baseline Onsite as part of the larger Jobfit family," Vik said.

"Baseline operates out of remote mine sites, and we now have about 200 plus staff delivering services on remote sites for our mining clients, including onsite medical services, emergency response, onsite training, and safety and security personnel."

What does the future have in store for Jobfit? A lot, according to Vik.

"Jobfit has experienced double-digit growth year-on-year in the last four to five years," he said.

"We will continue to experience that level of growth in the coming years through both organic growth and acquisition growth strategies."

Six new Jobfit centres are expected to be up and running in the first quarter of 2022 and a couple of acquisitions are underway that will take the company to become one of the largest occupational healthcare providers in Australia.

Jobfit aims to be the provider of choice for most corporations.

"We will keep investing in our people and our systems, and we will always keep our clients at the forefront of our future planning," Vik said.

"Jobfit continues to develop technology and software that is industry-leading, making our services more accessible to our clients, with faster turnaround times, all while adhering to their compliance requirements." *AMR*

25

Jobfit is proud to be celebrating 25 years of partnering with the mining industry.

Jobfit is a national occupational health company, with wholly owned clinics operating in metropolitan and regional locations across Australia and New Zealand.

Find out how Jobfit can partner with your business for a healthy workforce.

1300 61 61 65
info@jobfit.com.au
jobfit.com.au

JOBFIT

Pre employment medicals

Health surveillance

Injury management and prevention

Onsite medical services

Drug and alcohol screening

Work fitness assessments

Medical expert services

PumpEng Global Launch For Game Changing Tough Submersible Pumps



Perth based pump design and manufacturer, PumpEng, is busy rewriting the record books for dewatering pump performance. Over the last year, the company has opened new interstate offices and connected with a network of keen international distributors.

PumpEng Startup
PumpEng evolved from a venture between Paul Meneghel and the owners of Galvin Engineering.

With over 100 years experience in foundry processing and manufacturing, they set out to improve the design of mass-produced submersible pump components for Australian operating conditions.

As company founder, Paul drew on his extensive experience with submersible pumps in mining, stretching back to the 1980s. His initial vision was for pump parts tough enough for Australian conditions. PumpEng has grown well beyond Paul's original 2001 intention to improve pump component design. PumpEng is a manufacturer with its own patents.

PumpEng pumps are breaking industry pump performance records. PumpEng is expanding its interstate offices as well as a global network of distributors. It has brought a new standard of quality dewatering systems to the industry.

The PumpEng team collaborated with Australian maintenance and mining staff to become a well-established specialist submersible pump supplier to several industry sectors, with underground mining as the prime focus.

PumpEng Vision
The PumpEng vision is to be the specialist in 'tough submersible dewatering pumps' based on:

Innovative thinking: Solutions are backed by a vigorous R&D program and commitment to improving product performance and installation practices.

Availability: Product sales, hire and aftercare accessible via a branch network.

Reliability: A tried and tested range of pumps designed to last longer.

Consultation: The PumpEng Way is a step-by-step process of exploration, inspection and delivery to ensure the right pump is used correctly.

Data: Ongoing support is continuously sought and provided through repair data, site inspections and quarterly reporting to create sustainable improvement.

A Good Day At Work
PumpEng's focus is to create a good day at work for staff and clients. A good day at work means different things for different people. However, if there are no surprises because the right pump for the job is selected, installed and maintained correctly, the chance of unexpected events is greatly reduced. Reduced pump failure means significantly less impact on project productivity, safety and the bottom line. Performance data from satisfied clients is testimony to the success of this approach.

PumpEng has developed a team of experienced staff whose mission is to create a good day at work for customers. This commitment extends to the design, manufacture and supply of pumps, right through to the expedient repair/rebuild and full aftermarket support of the product range. This work is all aligned with the PumpEng Core Values and Behaviours. PumpEng has also partnered with major foundries and quality engineering facilities located within Australia and abroad to facilitate the reliable supply of quality parts and pumps.

The PumpEng Way
It is not just pump life that has the industry excited. PumpEng are committed to a data-driven approach to their operation. Collating, analyzing and reporting the facts, in easy to follow trends, provides an open and honest platform for the PumpEng team to work closely with the industry to continually improve underground dewatering.

A pump that doesn't require replacement and repair generates benefits beyond just reducing maintenance costs. It also means reducing the number of times an operator needs to interact with water and electricity. This is a welcome development for underground mining managers.

There is also a reduction in labour costs and the potential for expensive production delays caused by pump failure. All these benefits have significant implications for underground mining operations, so there's no wonder PumpEng is getting some cut through in a competitive market.

The PumpEng Range
The PumpEng range reflects a commitment to innovative design and quality components.

The company has a preference for long-lasting metal components, and this has won them an industry- wide reputation for delivering extraordinary mean time between failure results in the toughest sumps miners can throw at them.

Pumps manufactured and supplied by PumpEng include the following pumps.

JetGuard
JetGuard® has an all-metal wet end with a high chrome impeller and is designed for use in the harshest environments where polypropylene fibres for shotcrete, high amounts of aggressive sulphides or drill fines and tramp are present in the wastewater.

The hydraulic water curtain guards against fibre entering the pump. JetGuard is suitable for underground mining, surface mining and general dewatering applications. It is available in 10kW and 20kW in 415V or 1,000V in 50 cycle and 480V or 600V in 60 cycle.

Guardian
No more pumps with rubber and polyurethane components! The Guardian is an upgrade to the Raptor range. It incorporates an all-metal wet end and the high chrome impeller which extends pump life and reduces repair costs. The Guardian is available in 8 kW to suit all markets. With the 20kW model to be available soon in the same combinations.

Raptor
This pump is suitable for underground mining, surface mining, construction and general applications. Parts interchangeable with other OEM supplied BIBO ranges. The Raptor is available in 5kW, 8kW and 20kW to suit all markets.

ScatPump
This is a heavy-duty submersible slurry pump with high chrome impeller and agitator. Flows available up to 100 l/s and heads up to 32 m. ScatPump is available in 1.5 kW - 22 kW to suit all markets.

Metal Vest
The all-metal design of MetalVest™, together with the impeller constructed of Hrc provide a longer wear life which extends the life of this high head dewatering pump and reduces repair costs. The MetalVest™ are available in 37 kW - 110 kW to suit 50 cycle markets.

PumpEng Is A Full-Service Provider
PumpEng® offers a full range of services for submersible pumps, including:

- Australia Wide Hire
- Genuine Parts
- Improvement Focused Repairs
- Ongoing Consultative Data-Based Support

PumpEng Is Expanding
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AUSTRALIA - 2015230662 | CANADA - 2941904 | USA - 10514047
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Wingtra pilot easily guides the fixed wing drone around a crane.

C.R. Kennedy and Wingtra Flying High

It wasn't that long ago that drones were considered something more akin with science fiction or spy movies, however in recent years these Remotely Piloted Aircraft Systems (RPAS) have become increasingly important on many resource projects.

For mining companies, the use of drone technology is continuing to expand, with the technology's speed and accuracy proving to be significant in acquiring data in almost all parts of a mining operation.

Professionals who adapt drones into their mining operations quickly realise the significant added value they bring to their industry.

Drones in mining can improve the overall efficiency of large mine site and quarry management by providing accurate and comprehensive data detailing site conditions in a very short time.

They can also help ensure this data can be safely produced by on-site workers who have minimal surveying experience, saving costs, time and potentially improved worker safety.

Along with the increasing demand for drone usage in the commercial sector, has come a development race for the creation of even more efficient technologies.

One of the leaders in that area is Swiss company Wingtra, the developer of the most advanced VTOL (vertical take-off and landing) drone for mapping and surveying.

The recently released WingtraOne GEN II's unique set of features allows its users to minimise flying time and get more work done, be it another project in the field or analysing data at the office, with the Wingtra RPAS up to eight times faster than multi-rotor drones and up to two times faster than standard fixed-wing drones.

WingtraOne can carry a variety of payloads, including multispectral, thermal, and high-resolution 42MP cameras. The high-resolution camera allows one to capture more ground detail with every picture and cover a larger area per flight.

With an onboard high-precision PPK GNSS receiver, users no longer need to lay out ground control points (GCPs).

The WingtraOne's VTOL feature allows for the safety and convenience of take-off and landing like a multi-rotor, whilst enjoying the flying efficiency of a fixed wing aircraft when flying a mission.

C.R.Kennedy & Company

Melbourne-headquartered technology, innovation and solutions specialist C.R.Kennedy is the exclusive Australian representative for Wingtra and says its unique technology is a game-changer.

"The WingtraOne really is the best of both worlds," says C.R. Kennedy's WA RPAS Sales Manager, Graeme Carleton.

"It has the benefits of a fixed-wing drone, which is where it gets its endurance from, but it also can operate from a small footprint."

According to Graeme, clients regularly complained about the hassle of finding the space to land traditional fixed-wing drones on site, or of the damage traditional fixed-wing drones would often sustain skidding along on their bellies in unforgiving terrain.

"Even after one flight, you can start damaging your drone during a landing. But with the vertical take-off and landing capability of the WingtraOne, you can avoid risking damage to the drone and your camera, but still cover a really large area," he said.

The combination of sophisticated software and innovative design allow the WingtraOne to autonomously take off and land vertically, meaning that the equipment is also protected from another common hazard – operator error.

To support its valued clients and customers C.R. Kennedy now employs over 260 people across all divisions. All its product specialists, qualified surveyors, support staff and factory trained service technicians can advise on the best solutions and provide customers with the very best equipment for their needs. Customers have support and service from an unmatched national network.

Faster data collection and expanded coverage mean fewer people in the field for less time, lowering the man-hour costs associated with data collection.

Happy customer

Another fan of the Wingtra system is Tim Maw, a Senior Mine Surveyor at FQM Australia Nickel.

"Having used many different RPAS system I have found the Wingtra to be an extremely reliable and durable system. Our sites have challenging conditions, including lots of mud, which makes it hard to operate a fixed wing drone but the Wingtra can land and take off vertical in a small area which allows for easy operation," Tim recently told Australian Mining Review.

"The Wingtra RPAS can survey large areas very quickly without the need to have many battery changes. Being a VTOL drone, it has the same advantages of a fixed wing aircraft in terms of range and efficiency but without the dangers and hassle of finding an open landing site for a belly land.

"The camera payload that the Wingtra uses (Sony RX1R II) is one of the best cameras for mapping and photogrammetry. It has a very low distortion lens and produces very precise photogrammetry models and aerial imaging easily with the Wingtra flying at 120m.

"The Wingtra is one of the easiest RPAS system to use. The flight planning software is easy to use, and there is a checklist the pilot must complete before taking off. The drone also runs checks on itself before committing to take off.

"Once in the air the flight planning software displays the Wingtra's status and position within the flight plan clearly and it is very simple to pilot. We have had surveyors with little to no drone flight experience become fully confident and proficient quickly and with little training."

Whether it's a mine, highway or an industrial complex, with WingtraOne you can now take on large projects that were previously impossible to map with a drone. And it takes you just a few hours. ***AMR***



Tim Maw, FQM Australia Nickel Senior Mine Surveyor Tim Maw has had great success with the Wingtra system.



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Midwest The Valve And Control Specialist Since 2001

Midwest Valves & Controls is a specialist in selecting industrial valve, pneumatic system, water, diesel, oil, grease pump and hose products for distribution Australia wide.

The company has built a reputation is a reputable supplier of industrial equipment, with a particular expertise in supplying industrial valves, chemical dosing and water transfer pumps.

Established in 2001, the company can supply clients with the latest equipment to all parts of Australia.

For overseas manufactured equipment the company relies on purchasing from Australian importers, apart from the VAHN-TECH range manufactured in Canada and Samsung Precision valves from Korea that we purchase directly.

It also supples some Australian manufactured valves still manufactured in Australia, for example some produced by John Valves in Victoria, which it resells.

Midwest Valves & Controls has commercial arrangements with those suppliers that have ISO standard quality policies.

With its business continuing to grow, Midwest Valves & Controls is in the process of moving to a larger facility in Gulgong.

The business is led by manager, Peter Willis, whose sales experience in the industrial valve industry traces back to 1989.

Midwest Valves & Controls has the expertise to obtain, deliver and provide after sales support for industrial valves, pumps, diesel, urea/DEF handling equipment, lubrication equipment and instrumentation supplies.

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With regard to the Glen shouldered butterfly valves, These valves have the following specifications:

- Designed to meet international standards
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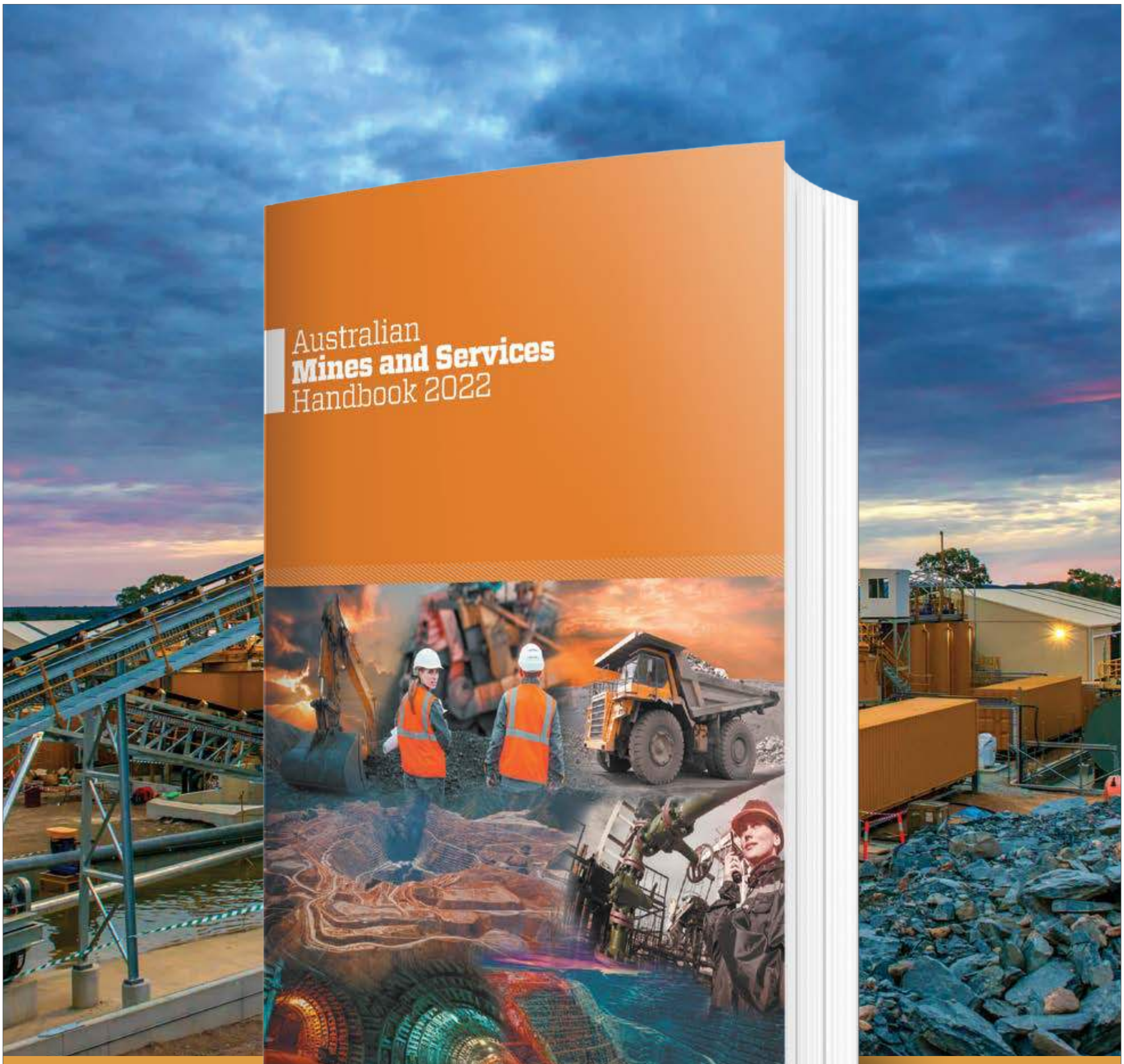
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Supporting Local



Since its inception in 2014, Mudex has been supporting local suppliers.

"Supporting local has been one of the foundations that the business has been built on" says Dave Williams, Managing Director of Mudex.

"We're proud to be a part of the support local and Australian Made campaigns and being able to manufacture most of our products in Australia means that we have grown the business at an impressive rate and increased our stock holdings while also increasing our market share. Our manufacturing workforce has increased in the last 12 months and we are proud to be offering young people a chance to start their careers in the mining industry with us."

"What started mainly as Aussie pride and doing the right thing by buying local and creating local jobs in manufacturing, saw us in good stead through the start of the pandemic as we saw global supplies affected, our own supply chain wasn't impacted very much and we were able to double our production to keep up with our customers' requirements, as well as substantially increasing our stock holdings at all of our stock points across the country."

"The increase in stock holdings and our ability to innovate in house and have a quick turnaround on products that are still under refinement, and undergoing testing on site, has improved the service that we can offer to our customers around the country," says Cameron Fleming, Regional Sales Manager.

"Being able to offer premium products that I know work makes the job all the more enjoyable."

Mudex has grown to become one of the leading drilling fluids manufacturer in Australia. It also has a strategic partnership with Northstar (USA) and Mayanstar (Mexico) making them the largest privately owned non-oilfield drilling fluids company in the world. This partnership assists them to source products that are not able to be obtained locally in Australia.

Mudex's manufacturing and head office is located at 5 Coulson Way, Canning Vale in Perth WA. ***AMR***

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Applying Functional Safety to Rail Mounted Mobile Machines

Rail mounted mobile machines are prolific in the mining industry and are used in many applications such as stacking of material on stockpiles, reclaiming of material and the loading of large bulk carrier ships.

In normal operation these machines are usually operated remotely (but not always e.g. ship loaders) but due to their size and capability there are many personnel, financial and environmental risk scenarios associated with their operation and maintenance, for example:

- Collision with other machines, maintenance equipment, tie-down cradle
- Collision with stockpile
- Operating beyond final limits
- Boom tip overspeed (increases risks if any collisions)

Depending on the machine type and installation the above scenarios can all lead to machine collapse and potential multiple fatalities. These machines are designed to meet the requirements / load cases specified in AS4324 (mobile equipment for continuous bulk handling of materials) but this does not prevent machine collapse in certain load cases.

Historically mobile machines were installed with hardwired safety circuits and protection devices such as emergency stops, pull wire switches, limit switches and relays which were designed to meet safety category levels (e.g. Cat 3). These category levels were introduced in 1997 via European standard EN594 and adopted by AS4024 (Safeguarding of Machinery).

In 2006 the European Standard ISO13849 was released and introduced the term 'performance levels' (PL) to specify the ability of safety related parts of a control system (SRP/CS) to perform a safety function.

The main improvements associated with the use of the performance level concept is the rating of the quality of the components used in the safety design and quantifying the level of circuit monitoring, known as 'diagnostic coverage'.

More recently the AS61508-2011 standard has been employed on mobile machine and similar applications. The advantage of AS61508 is that it is based on the 'whole of life' safety lifecycle process and uses a Safety Integrity Level (SIL) model which takes into account low, high and continuous demand modes of operation.

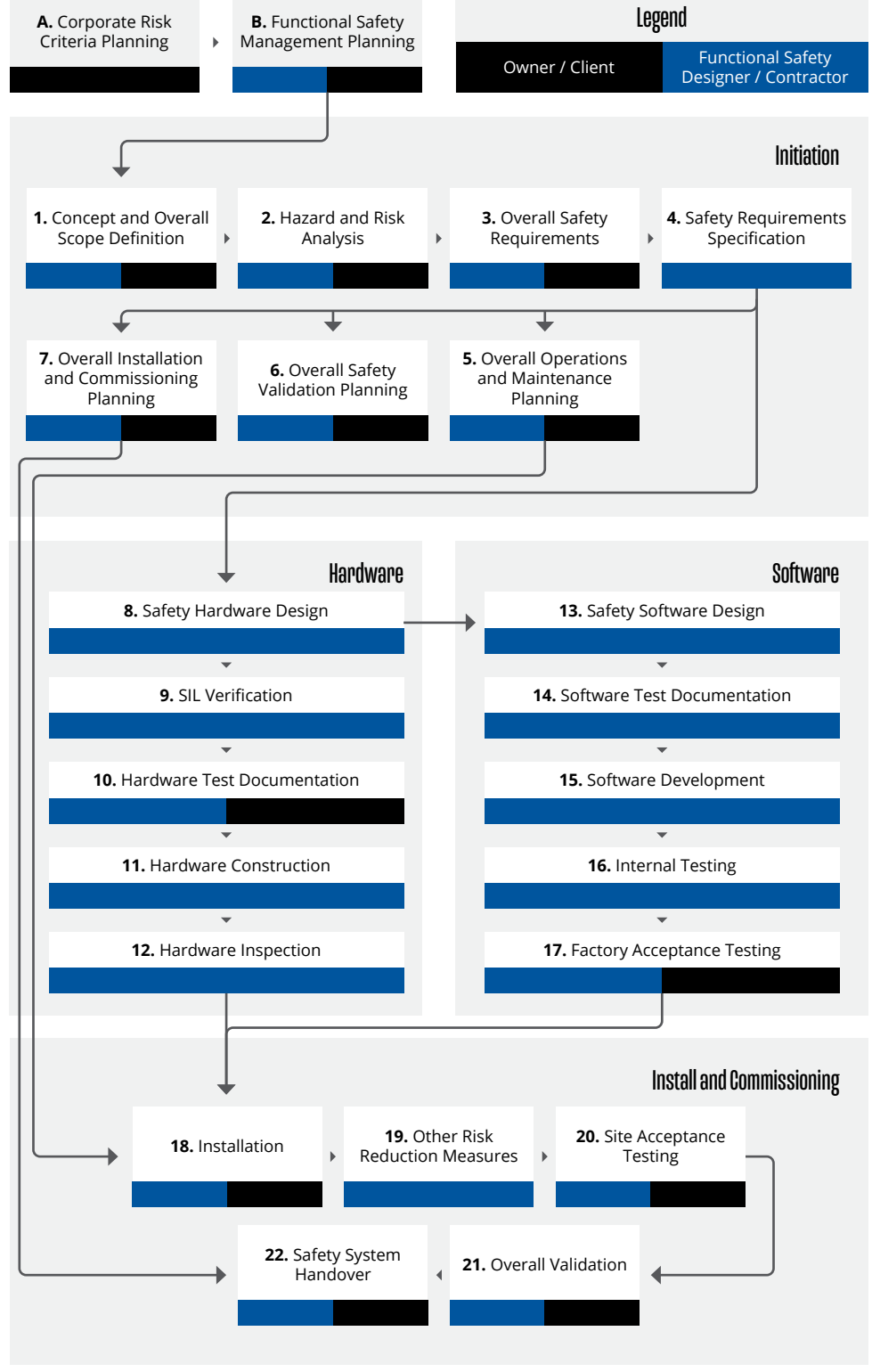
Whereas AS4024 uses a simple decision tree to determine risk and does not include the design of programmable electronic safety-related systems (e.g. safety PLC) which is a major deficiency for more complex applications. Take note that one element missing from AS61508 is the design of other risk reduction measures (i.e. guards, barriers, procedures) which is not within the scope of AS61508.

AS62061 (safety of machinery) is another standard which can be used but it only covers the 'realisation' phase of the safety lifecycle and does not include 'low' demand modes of operation which are often applicable to mobile machines. It also does not include the design of other risk reduction measures. In summary there are now a number of standards available to an electrical / control system designer for implementation of functional safety on a new or existing mobile machine:

- AS4024 – Performance / CAT Levels
- AS62061 – Safety Integrity Level
- AS61508 – Safety Integrity Level

The designer may decide to use a combination of one or more the above standards as the basis for their functional safety design. The approach and standards to be applied for a particular project or site will be detailed in the functional safety management plan. In general, the use of a SIL model and lifecycle phases described in AS61508 are preferred by many mining owners and end-users with complex applications such as mobile machines. Other risk reduction measures can be addressed by applying AS4024.

A typical functional safety lifecycle (which is a modified version of the AS61508 lifecycle) is shown following. The figure shows the lifecycle stages that are typically completed by the owner or functional safety designer.



The risk assessment / hazard identification phases (2 and 3) are critical to the functional safety design. The risk assessment determines all hazards relating to the equipment under control and the risks associated with those hazards. For this reason, it is essential the risk assessment workshops include knowledgeable representatives from engineering, maintenance and operations.

Once the hazardous scenarios (based on the client's screening criteria) are identified a quantitative risk assessment method as recommended by AS61508 such as LOPA (layer of protection analysis) is used to calculate the tolerable risk (LOPA) gap. Each scenario is classified as either high demand or low demand depending on the assessment of the demand on the safety related system:

- Low demand – demand on system is no greater than one per year, e.g. machine boom impacts stockpile
- High demand – demand on system is greater than one per year, e.g. boom conveyor running above roadway

For low demand mode the LOPA gaps are expressed as a Risk Reduction Factor RRF:

Safety Intregrity Level (SIL)	Target Risk Reduction (or RRF)
4	>10,000 to ≤ 100,000
3	>1,000 to ≤ 10,000
2	>100 to ≤ 1,000
1	>10 to ≤ 100

For high demand mode the LOPA gaps are expressed as a Probability of a Dangerous Failure per Hour (PFH):

Safety Intregrity Level (SIL)	Probability of Dangerous Failure per Hour (or PFH)
4	$\geq 10^{-9}$ to $< 10^{-8}$
3	$\geq 10^{-8}$ to $< 10^{-7}$
2	$\geq 10^{-7}$ to $< 10^{-6}$
1	$\geq 10^{-6}$ to $< 10^{-5}$

The safety functions are identified and documented and a SIL target for each function is allocated based on the above tables. Typically, safety functions for mobile machines are required to prevent / detect the following conditions:

- Long Travel / Slew / Boom Tip Overspeed
- Slew Over Travel (collision between stacker structure and tripper)
- Stacker Boom Conveyor Running over Roadway (ore stream striking personnel)
- Stockpile Collision Side (e.g. Stockpile collision)
- Stockpile Collision Underside (Boom grounding)
- Vehicle Collision
- Machine to machine collision (Stockyard anti-collision system)

The safety functions are implemented by the designer of the safety related electrical control system, with the following devices commonly used in the applications for mobile machines. Where possible / available all devices shall be safety certified (IEC61508 certification preferred):

Logic Solvers

- Safety PLC (e.g. Rockwell GuardLogix, Schneider Modicon M580)
- Safety software - use of safety certified logic instructions

Input / Sensing Devices

- Safety I/O (dual channel with diagnostic capabilities, e.g. discrepancy, short circuit, open circuit detection)
- Safety encoders (slew, luff, long travel position and speed)
- Final limit devices (limit switches, proximity switches)
- Pressure transmitters
- GPS (non-safety, used for diagnostics only)

Output / Final Elements

- Solenoid valves (brake lift, luff hydraulics)
- Dual contactors (DOL drives)
- Variable speed drive safe torque off (STO) and safe stop 1 (SS1) functions (long travel and slew drives)
- Hydraulic and electromagnetic brakes

The safety position detection system implemented on the mobile machines is an important component of the safety hardware design. The recent improved availability of safety encoders which use safety rated communications to the safety PLC has meant that a safety certified position detection system can be implemented. This system normally comprises of the following devices:

- Dual redundant SIL3 rated safety encoders for each of long travel, slew and luff motions (e.g. Allen Bradley, TR electronics, Posital)
- Calibration switch per encoder with uniquely identifiable strikers (e.g. Sick TR4 proximity switch, Turck inductive proximity switch)
- GPS (non-safety devices used for diagnostics)

The use of redundant encoders allows the system to detect failure modes outside of the instrumentation itself. The GPS is used as a key diagnostic measure for long travel and slew positioning due to the negligible common-cause failure modes with encoders. The table below summarises a typical voting arrangement used for long travel and slew encoder positioning systems: ***See Table 1.***

Determining how to implement functional safety on legacy mobile machines is an important consideration for many end users / owners. It is critical that they are not ignored because they are an 'existing installation' and that the risk assessment / hazard identification process is performed as would be done with a new machine.

If the risk assessment process results in actions that are technically difficult to implement these should be considered on a case by case basis with a so far as is reasonably practical (SFAIRP) approach used to manage these risks. For example, emergency stop devices on machines are considered a complementary protective measure and provided they comply with the requirements of local legislation and AS4024 they may not need to be upgraded.

Once a safety system is handed over to the end user / owner there are many considerations needs to be managed to maintain the integrity of the safety system, e.g.

- Competency of maintenance and engineering personnel (management and recording)
- Change management system
- Proof testing
- Operation and maintenance plan / procedures

The owner / end user needs to ensure that all relevant safety documentation is handed over, this can be in the form of a Functional Safety Dossier.

In summary companies have a legal, ethical and financial duty to manage and limit the risks posed by their operation. Following a systematic risk management process and implementing a rugged, well designed safety system as discussed in this article to manage these risks is an important part of fulfilling these obligations. ***AMR***

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Table 1.

Healthy Devices	Operation Restrictions	Operation Arrangement / Description
2 x Encoders, 1 x GPS	No restrictions	For machine to operate in this case two encoders must agree position values with GPS. No restrictions are required in this case. (1oo2D)
2 x Encoders, 0 x GPS	No restrictions. High prominence alarm is raised to alert the operator. Time restriction – all affected machine motions are tripped when the timer expires.	For machine to operate in this case, two SIL3 rated encoders must agree position values with each other. The system must be restored to have the GPS functioning correctly to prevent shutdown of the machine within set time period. After the timer expires, the affected machine motion is tripped. All automatic sequences of the machine are interlocked and tripped. (1oo2)
1 x Encoder, 1 x GPS	No restrictions. High prominence alarm is raised to alert the operator. Time restriction – all affected machine motions are tripped when the timer expires.	For machine to operate in this case, one SIL3 rated encoder must agree its position value with the GPS. The system must be restored to have the second encoder functioning correctly to prevent shutdown of the machine within set time period. After the timer expires, the affected machine motion is tripped. All automatic sequences of the machine are interlocked and tripped. (1oo1D)
1 x Encoder, 0 x GPS	**Faulted** – no operation	The affected machine motion is tripped. All automatic sequences of the machine are interlocked and tripped. (1oo1)



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