

MANUFACTURING



AAMC

**MAKING IT
IN AUSTRALIA**

*Our Advanced
Manufacturing Future*



ADVANCED MANUFACTURERS CAPTURE
HIGH VALUE
DRIVING **COMPETITIVENESS AND EXPORTS**



FOREWORD

The world stands on the cusp of momentous change. Technological advances of seismic proportions are creating new industries and transforming old ones.

It is in this context - as companies and governments around the world navigate these advances - that we share this series of Australian advanced manufacturing showcase stories with you. This is by no means an exhaustive record; indeed there are literally thousands of innovative manufacturers around the country tapping new areas of growth and taking their ideas to global markets. The stories in the following pages illustrate the many and varied pathways manufacturers can take on the road to success.

Formed in 2013 under the auspices of Ai Group, the Australian Advanced Manufacturing Council brings together industry leadership to drive success. Today AAMC members include some of the best known names in Australian manufacturing: enterprises like the ANCA Group, making a global name for Australian ingenuity in machine technology; aerospace and transport local heroes, Marand, and Quickstep; and Australia's own multinationals including shipbuilder, Austal, biotech company, CSL, and medical device manufacturer, Cochlear; as well as Australian subsidiaries of global companies like Agilent Technologies, Cook Medical, Northrop Grumman, PPG Industries, GE, Boeing, and Ford, all companies with a keen focus on Australian talent and innovative capacity.

This publication is both a record of Australian achievement and an acknowledgement that the world is not standing still, and nor can we.

John Pollaers
Chairman
Australian Advanced Manufacturing Council

Innes Willox
Chief Executive
Australian Industry Group

AAMC MEMBERS AND CONTRIBUTORS



THINKING DIFFERENTLY THINKING COLLABORATIVELY THINKING GLOBALLY

Dear Reader

At the AAMC, we have been collecting fast facts about Australia and how we compare in advanced manufacturing measures. Many of these show we have the creative talent, the problem solving capacity, and the research infrastructure to build globally competitive high-value manufacturing.

Our vision is for an Australia ranked in the world's top advanced manufacturing countries, rich in knowledge intensive industries that drive a diversified sustainable economy.

But international competition for high value industries is intensifying, and there are gaps in Australia's innovation ecosystem.

Significant technological developments are disrupting long-established characteristics of industry, driving convergence in some sectors, opening new doors and closing old.

More than 70 per cent of global trade is now in intermediate goods and services¹. Production chains are spread across multiple countries and across multiple firms, and the income created within these global value chains has doubled over the last 15 years. In general, the greatest value from providing inputs to an innovative product goes to the countries whose firms provide critical, differentiated technologies.

Australia is still a minor player in global production sharing, but there are early signs of Australian manufacturing reaping gains from joining these networks, specifically when companies focus on skill-intensive high value production².

The evidence also shows that Australian technological capabilities are comparatively more valuable than the global average - and businesses engaging with export markets are more successful. Yet, the export intensity of Australian manufacturers (measured as the share of total domestic value added produced by the manufacturing sector to meet foreign final demand) was the lowest in the OECD in 2011 (25.6%) and lower than in 2008 (28.3%)³.

There are other challenges, in particular in skills development, education, the regulatory environment, and research-industry collaboration. Innovation and Science Australia, led by Chair, Bill Ferris, and Chief Scientist, Alan Finkel, has been working to fully identify these challenges and propose solutions, as part of its far-reaching 2030 Strategic Plan, due for release in late 2017.

Advanced economies around the world are investing in their knowledge capacity - and increasing the value-density of their manufacturing. We are fortunate in Australia to have many manufacturing companies demonstrating creative and technological prowess - and business acumen - and taking their innovations to the world. A number of them share their inspirational stories and insights here.

Jennifer Conley
Executive Director
AAMC

¹ OECD, WTO, & World Bank Group. (2014). Global Value Chains: Challenges, Opportunities, And Implications for Policy. Report prepared for G20 Trade Ministers Meeting Sydney, Australia, July 19. ² Australia's share of total OECD exports of GVC products has been better than the global average, doubling over the past decade. <https://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/other/Global-production-sharing-and-Australian-manufacturing.pdf> ³ OECD & WTO. (2015). TRADE IN VALUE ADDED: AUSTRALIA. OECD: http://www.oecd.org/sti/ind/tiva/CN_2015_Australia.pdf



I'VE SEEN FIRST-HAND HOW A

CULTURE OF INNOVATION

EMPOWERS

AN ORGANISATION TO
ACHIEVE THINGS IT NEVER
THOUGHT POSSIBLE. 

Maureen Dougherty, President, Boeing Australia, New Zealand & South Pacific

Team members from Boeing Aerostructures Australia and Boeing Research and Technology - Australia prepare a robot specifically designed to work alongside people. James Lauritz Photography



NORTHROP GRUMMAN



Australia's defence global supply chain initiatives are world-leading policies that other countries should look to emulate, says the head of Northrop Grumman Australia, Ian Irving.

"We're looking at the Australian model and seeing if we can implement the same approach in other countries. I think it's a great testament to what the defence industry has done, that we as a company have picked up that model and have applied it elsewhere," Mr Irving says.

"I am trying to ensure that Australia is the exemplar of our overseas markets."

Northrop Grumman, a leading global security company, has a strong customer base in Australia and has been supporting a variety of both defence and civil programmes here for more than 20 years.

As well as security, it is a key supplier in the defence, information systems, and public safety communications markets, providing a range of capabilities and technologies including the RAAF's Wedgetail, F-35 and the Super Hornet programmes.

The firm's local annual turnover is just shy of \$200 million, and management expects that to grow by at least the 5 per cent forecast by the Defence White Paper for the entire industry.

The local division has grown quickly from just five staff three years ago to nearly 500 now, partly due to the acquisitions of Qantas Defence Services in 2014 and M5 Network Security in 2012, but also through organic growth, and Mr Irving says the firm is looking to add to its scale in coming years.

"The trajectory we are on will be maintained with some of the large programs coming up. The Defence White Paper shows us that there should be plenty of opportunity, so coupling our portfolio with local capability will be the key for our future success," he says.

Mr Irving has 28 years' experience in the Australian defence industry, and has been in his current role since July 2013. He commended the motivation of multinationals to incorporate local Australian manufacturers in their global supply chain (GSC) process, to become globally competitive, and give them access to world markets.

"The defence department really was a leader there — the government's wisdom in establishing the GSC program to motivate the larger primes to reach out to local industry," he said. "That's a real bonus for Australia. What we need to do now is leverage the new initiatives government is placing through the White Paper, focusing on innovation and the establishment of significant local content in our defence program."

He says Australia does have the kind of unique expertise that can compete with, and even outperform European and American companies in setting up some greenfield sites for manufacture.

But the government needs to back local industry and buy local when it can. This would deliver companies the credentials to market their offerings to overseas buyers.

"It is very hard to export to foreign overseas programs if you haven't sold to your local customer. So we're looking to the government to back industry a little bit more to give local companies a fighting chance."

Mr Irving notes that GSC offerings to date have mostly been at the component level, and says Australian manufacturers need to move "up the value chain" and supply technology elements and unique innovation offerings into the GSC.

"We're not going to be pumping out thousands of base model components, but we can make complex subsystems where the labour isn't such a drain on cost. So while there is a lack of scale, it does have benefits in the way these firms can be flexible and agile," he says.

Northrop Grumman has a database of around 140 local suppliers, awarding around \$32 million to local small and medium enterprises in recent years. The firm plans to "really focus and double down" on increasing the flow to key suppliers in Australia in the coming years.

Still, the local firms must prove themselves to be globally competitive and equal to their counterparts in North America and Europe.

"There is no charity here," Mr Irving says. "In global markets today there are few boundary impediments to working in any location. So Australia's industry really needs to be globally competitive to be considered as a partner in global supply chains."

COCHLEAR



When Professor Graeme Clark defied the naysayers to invent the first cochlear implant in the early '80s, he was set to transform the lives of hundreds of thousands of people.

The first recipient, Melbourne man Graham Carrick, hadn't been able to hear for 17 years. When the sound processor on his implant was switched on, nothing happened for 15 minutes.

Then everything changed. "I heard a 'ding dong' and I said to myself 'bloody hell!'" Carrick recalled on the 30th anniversary of the world-first surgery. "Tears ran down my face."

Many iterations of that technology later, Cochlear is continuing to break new barriers – and its own records. Last financial year, the ASX-listed company posted record sales of \$941 million.

Headquartered in Sydney, Cochlear operates in more than 100 countries, with 3000 employees worldwide.

Senior vice president of manufacturing and logistics, Greg Bodkin, says a quest to constantly improve customer service and chase innovation has kept Cochlear ahead of the curve.

It now has three main worldwide competitors, but Mr Bodkin says Cochlear is two or three times larger than all of them. Cochlear reinvests about 12 per cent of its annual earnings into R&D to ensure it has a technology advantage over its competitors, says Mr Bodkin.

He says Cochlear's latest speech processor, the Nucleus 6, is almost unrecognisable from the technology pioneered in the '80s, which was worn on the body in a similar way to a Sony Walkman.

Like every upgrade, the Nucleus 6 sound processor, which automatically adjusts to different environments (for example a noisy restaurant), has led to an increase in demand.

Even more innovative has been the range of wireless accessories that Cochlear has linked to the Nucleus 6, allowing the wearer to better hear family or friends, or sounds coming from their TV or smartphones.

Mr Bodkin says it's the only true wireless technology in the world for use with cochlear implants.

As an Australian manufacturer and exporter whose products are sold in the major markets of North America, Europe, the Middle East, Africa, and the Asia-Pacific, the company continues to look for ways to remain competitive in a global environment, says Mr Bodkin.

He says Cochlear has refined the way it operates, always striving for improved operating efficiencies and effectiveness. Applying Lean principles and automation has been a big part of making the company as competitive as possible.

"There are certainly things that we would have done 15 years ago that we don't do today," says Mr Bodkin.

While the company has moved some of its non-core functions overseas, the precision manufacturing work still takes place at three manufacturing sites across Sydney and Brisbane.

"The manufacturing of the implants or manufacturing of a speech processor is quite difficult – it requires a lot of skill and a lot training," says Mr Bodkin.

He believes that Australian manufacturers shouldn't waste time trying to compete against low-cost, low technology products.

However Mr Bodkin says that many technology competitors have manufacturing operations based in North America and Europe. Australian manufacturers can continue to compete on niche products by repurposing their own technology, products or skills, he says.

As for Cochlear, emerging markets such as China and India, plus an ageing global population point to enormous potential for continued growth.

The company recently supported Australian-Indian movie *unINDIAN*, starring cricketing great Brett Lee. The movie's main female character works at Cochlear, with some of the scenes filmed at Cochlear's offices.

"We saw it as a chance to get our brand out there, and also to increase the awareness of hearing loss as an issue," says Mr Bodkin, who adds that many overseas countries still don't screen babies for hearing problems at birth.

Typically, three in 1000 people in the world will experience a condition that makes them suitable for a cochlear implant, says Mr Bodkin.

Meanwhile, decades after Professor Clarke's original breakthrough, Cochlear's mission remains the same, even though it's now carried out on a much broader scale.

"Every day we give around 200 people that couldn't hear yesterday a chance to hear," says Mr Bodkin.

GE AUSTRALIA



The Industrial Internet is profoundly transforming global industry and infrastructure, connecting machines, big data analytics, and people. It allows you to combine brilliant machines with best-in-class analytics to deliver valuable new insights that were never before possible. By 2020, an estimated 50 billion machines will come online, boosting global GDP by as much as \$15 trillion by 2030 through accelerated productivity growth. While the Industrial Internet is predicted to lead to a revolution in manufacturing, another driving force for GE in Australia is advanced manufacturing, which links design, product engineering, manufacturing, supply chain, distribution and services into one cohesive, intelligent system.

This is leading to more agile factories and supply chains that can bring products to market in half the time – and at substantial savings.

GE Australia is already working to identify and address customers' operational challenges and drive better business outcomes through data and Predix, GE's operating system for the Industrial Internet. In 2016 GE announced the opening of its latest digital collaboration centre with launch customer Qantas, in Austin, Texas. Through the partnership, data scientists, engineers and software designers from GE and Qantas will work together to distill some of the ten billion data points produced by the aviation sector annually into practical actions to help Australia's national carrier reduce fuel costs and carbon emissions.

GE is also harnessing the power of the Industrial Internet at a coal seam gas-to-liquefied natural gas (LNG) facility run by QGC. GE has deployed a predictive maintenance solution to improve the reliability of turbomachinery equipment through remote monitoring.

As GE cements its position as a key player in every LNG project underway in Australia and Papua New Guinea, the potential for productivity gains through the latest wave of technology is massive.

With 2,000 employees across the Australia, New Zealand and Papua New Guinea region, spanning industries including aviation, healthcare, power, renewable energy, oil & gas and mining, GE also continues to innovate in countless other ways.

In late 2011, it established a \$100 million technology and learning complex in Perth to support the development of skills for the oil and gas sector and provide GE's first in-country support and maintenance centre.

Globally, GE is also embracing 3D printing, allowing the company to accelerate the cycle of design, prototyping and production.

In February 2017, GE announced an investment of US \$4.3 billion to open new factories to build next-gen jet engines with 3D-printed parts and the latest composite materials

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I AM PASSIONATE ABOUT AUSTRALIA DEVELOPING OUR OWN INTELLECTUAL CAPITAL - UNDERWATER SYSTEMS, SONARS, SECURE COMMUNICATIONS,

CYBER CAPABILITIES

ETC - FOR EXPORT. AT THE SAME TIME, WE CAN CONVINCE COMPANIES LIKE MINE THAT THIS IS A GOOD PLACE TO

INVEST.”

Ian Irving, Chief Executive, Australia Northrop Grumman



CSL LIMITED



It began as a government-owned lab, set up in 1916 in Melbourne to service the health needs of a nation isolated by war. More than 100 years later it's a global multi-billion dollar force employing more than 17,000 people.

During World War I, one of the first actions of the Commonwealth Serum Laboratories, as it was then known, was to produce three million doses of a mixed bacterial vaccine in an attempt to combat the Spanish Influenza epidemic sweeping the world.

Research and Development is integrated with CSL's subsidiaries, adapting existing products for new uses and developing novel breakthrough medicines for global commercialisation. CSL employs an R&D workforce of more than 1100 and has its global R&D headquarters in Melbourne. CSL spent more than \$US600 million in 2015-16 on R&D and has a rich and promising pipeline of new products.

After privatisation in 1994 and the acquisition of a number of companies, CSL Limited now makes more 70 different plasma-derived and recombinant products, and last financial year had global revenues of more than \$USD6 billion. Here in Australia, it is one of the country's top 10 publicly listed companies. CSL comprises two major subsidiaries: CSL Behring and Seqirus.

CSL Behring is a global leader in plasma therapeutics, with products spanning a range of therapy areas, including the treatment of bleeding disorders such as haemophilia and von Willebrand disease. Vital plasma products created by CSL Behring are also used in situations such as trauma, emergency surgery and burns.

In Australia, CSL Behring works closely with the National Blood Authority and the Australian Red Cross Blood Service to process precious plasma donated by generous volunteers into 15 different therapies for Australian patients. CSL Behring also provides this service to governments in the Asia-Pacific region.

In 2010, CSL announced a \$257 million expansion in Melbourne, with a new manufacturing facility dedicated to producing its global immunoglobulin product Privigen from commercially-sourced plasma. Privigen is used to treat a range of conditions such as primary immunodeficiency and the facility became operational and began exporting in 2016.

CSL announced it would undertake a further \$210 million expansion at CSL Behring's Broadmeadows site to meet a growing demand for its albumin therapy. The expansion will create 200 jobs during construction, and another 190 manufacturing jobs once complete. Albumin, a protein found in human plasma, is used to restore blood volume in people after trauma or major surgery, along with patients suffering burns or serious infections.

These expansions have further strengthened the role that CSL Behring's Melbourne site in the company's global manufacturing network.

CSL's second major subsidiary, Seqirus, is based in Maidenhead, UK, and is dedicated to vaccines and pharmaceuticals. Its Parkville, Victoria facility plays a very important role in biosecurity in Australia, as the nation's only onshore manufacturer of influenza vaccine, and the world's only producer of uniquely Australian antivenom and Q-fever vaccine. Seqirus exports influenza vaccine to the US, UK and Germany and provides pandemic preparedness and priority response to Australia.



AUSTAL



Austal is the Australian shipbuilder, defence prime contractor and marine technology partner of choice – designing, constructing and supporting revolutionary defence and commercial ships for the world's leading operators.

From safe, modern and efficient shipyards operating in Australia, the USA and the Philippines, Austal has successfully delivered more than 255 vessels to 100 operators in 44 countries, since 1988.

Austal's focus on design innovation, modular manufacturing and customised solutions for domestic and international clients has seen the company grow to become the world's largest aluminium shipbuilder and Australia's only ASX-listed shipbuilding company and defence prime contractor.

With over 75% of vessels produced globally for overseas clients, Austal is a successful exporter and the company continues to deliver multiple, high-value domestic and export programs from Australian, US and Philippines shipyards.

2016 was very successful year, globally, for Austal.

In Australia, Austal completed construction and delivered two 72 metre High Speed Support Vessels (HSSV's) for the Royal Navy of Oman, with a contract value of US\$124.9million. Like the 103 metre Expeditionary Fast Transport (EPF) designed and constructed by Austal for the US Navy, these military catamarans are redefining naval capability with an unrivalled capacity to transport personnel, vehicles and cargo with aviation support, quickly and economically.

The shipyard also completed a 70 metre offshore crew transfer vessel for Caspian Marine Services of Azerbaijan and construction continued on two 58 metre Cape Class Patrol Boats for the Royal Australian Navy (on schedule for delivery in the second quarter of 2017). Eight Cape Class Patrol Boats are already in service with the Australian Border Force and are being maintained by Austal through service centres in Henderson, Darwin and Cairns.

Austal Australia secured the \$305 million Pacific Patrol Boat Replacement contract in May 2016 and recently completed the detailed design review for the nineteen 40 metre steel vessels. Construction at Henderson is due to commence in April 2017, with the first vessels scheduled for delivery to 12 Pacific Island nations from late 2018.

Also awarded in 2016 was a A\$100 million contract to design and construct a 109 metre vehicle- passenger ferry for Mols Linien of Denmark. The largest passenger ferry to be built at Austal since 2011, the project will see 100 new apprentices recruited in the areas of fabrication, marine fitout and cabinet making.

In the United States, Austal USA delivered two 127 metre Littoral Combat Ships (LCS 8 and LCS10) to the US Navy, launched another (LCS14) and commenced construction on a further two LCS under an 11 vessel contract worth approximately US\$4 billion. Also in Mobile, Alabama, Austal is delivering the 12 vessel, US\$1.9 billion Expeditionary Fast Transport (EPF) program for the US Navy. In 2016, the shipyard delivered EPF6 and EPF7, and launched EPF8. The 103 metre military catamarans, designed in Australia, are

contributing to US Navy operations around the world and leading the logistics for humanitarian and disaster relief missions such as 'Continuing Promise 2017' which will bring medical services to over 15,000 people in Central and South America from January to April 2017.

In the Philippines, Austal completed a 57 metre offshore crew transfer vessel for Swire Pacific Offshore and commenced construction on 5 new commercial vessels, for operators in the Philippines, South Korea and Germany. The design work for all of these vessels will be completed in Australia, and transferred through an effective project management structure and process that develops local expertise and capability.

Today, Austal Australia is responding to the Commonwealth of Australia's A\$3 billion tender for the construction of twelve Offshore Patrol Vessels (OPV's) for the Royal Australian Navy, as part of the Federal Government's continuous naval shipbuilding plan. If successful, Austal will construct 2 OPV's in Adelaide from 2018 and then a further 10 vessels in Henderson Western Australia, securing jobs for the local workforce(s) for at least 10 to 15 years.

Well positioned with an established, skilled workforce, a reliable supply chain comprising 1000 Australian businesses and unrivalled experience in constructing naval vessels (including Australia's entire border patrol capability for the past 18 years), Austal continues to build Australia's sovereign shipbuilding capability, now and well into the future.

DOW



The rise of the fourth industrial revolution will break the mould. 'Industry 4.0' will drive changes equal to any seen during the peak of the first industrial revolution. Will Australia be able to adapt and thrive?

Louis Vega knows a lot about moulds - making them and breaking them.

The new President and Managing Director of Dow ANZ has spent almost 20 years at the company in various strategic roles, giving Mr Vega a front row seat to manufacturing's metamorphosis.

Mr Vega said Industry 4.0 brings together digital and physical technologies that will transform the material science industry, and Australia will require smart, sustainable investment in skills and technology to be a leader in advanced manufacturing.

"Our industry is seeing streamlined operations, integrated global supply chains, and changes to commercial chemistry that will produce the next generation specialty, high-value products," Mr Vega said.

"This transformation is more than just a catchy slogan, it is a globally-accepted reality affecting our industry worldwide, including Dow. Our customers want bespoke solutions for their end users' needs – and they expect them faster," Mr Vega said.

"Australia has the building blocks to be a global leader - a highly-skilled workforce building-block natural resources, solid R&D capabilities and strong commercial governance. Now it is time invest for the future," he said.

"Digitisation and automation are not just reshaping communications and commerce; they are revolutionising every industry, from mining to fashion to food".

"To keep up and get ahead of the innovation curve, we have deployed fast-cycle innovation to ensure we deliver customer solutions and cutting edge technologies

ahead of the commoditization curve. As we invest in technology and changed our culture, Dow has moved from conducting a few thousand experiments per year to tens of thousands," Mr Vega said.

"The speed of R&D is just one example of this transformation to Industry 4.0."

However, simply advocating for change is not enough. As a global leader, Dow must bring its experiences and learnings to the table, to help Australia prioritise Science, Technology, Engineering and Math (STEM) and vocational training for the economy of the future.

"These are skills for the new age. The future is not about blue collar or white collar, but as has been coined, 'new collar' - high tech manufacturing roles which require advanced vocational training. Our emerging young talent requires investment in technical education that will provide them with the knowledge – and the skills – to fuel Australia's prosperity into the future," Mr Vega said.

"STEM at all levels of education is a priority for Dow. Highly-educated and skilled people drive the innovation and innovative processes that is are needed to solve the challenges facing humanity today. This is why STEM is the centrepiece of Dow's commitment to investing in people to build the workforce of tomorrow.

Dow is committed to sustaining and growing its long-standing operations in Australia, and continuing to invest in STEM and skills.

However, none of this investment will allow Australia to reach its full potential if we continue to maintain one of the lowest numbers of researchers in business

enterprises among developed nations. Australia has the ingredients but not the recipe to add true value to advanced manufacturing.

"When we turn our attention to R&D, we believe Australia needs to be pushed out of its resources-led complacency," Mr Vega said.

"Dow's \$1.5 billion global investment in R& D allows its innovation engine to help customers find solutions to the challenges of the new age: sustainability, efficiency and building a circular economy.

"This investment allows us to develop products like smart paints that absorb microbes and formaldehyde. But we still need actual mechanisms to encourage Australian innovation within our borders.

"Changes to policy settings - such as focusing on upfront funding instead of just tax credits, and regulatory reform to match the pace of change and allow efficient approval of new product innovations – are critical in encouraging companies to invest in Australian R&D and realising the full potential of this country," he said.

Dow's commitment to advanced manufacturing is the key element to sustainable economic growth, meaningful job creation and the development of new markets. It is part of our overall business philosophy.

Industry 4.0 demands a more efficient and nimble operations – for companies and countries. If we can invest in the right education, training and R&D, for the jobs and economy of tomorrow, we can provide a sustainable future for our company, our country and our world.



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ANCA IS BUILDING

**AUSTRALIA'S SHARE OF
GLOBAL INTELLECTUAL CAPITAL
THROUGH
CONTINUOUS R&D.**”

Grant Anderson, Group CEO, The ANCA Group

COOK MEDICAL

Cook Medical Australia has become one of Queensland's largest exporters, currently exporting over 90 per cent of its locally manufactured products, specialising in IVF and endovascular repair, to 64 countries around the world at a value exceeding US \$100 million.

In 2016, the company manufactured more than 13,000 stent grafts for the treatment of aortic aneurysms, and more than 920,000 needles to assist in the reproductive health process.

Barry Thomas, Director - Asia Pacific and Vice President - Cook Incorporated, says Australia has carved out a significant global position in medical devices, with companies such as Cook Medical, ResMed and Cochlear among those leading the charge.

He says the three companies contribute almost 20 per cent of total inventions filed in the medical devices field for Australia, citing the latest Australian Medical Devices Patent Analytics Report.

Cook Medical Australia started distributing medical device products in 1979 in Victoria and moved into manufacturing in 1988 when the business shifted to Queensland. It became one of the first businesses to operate from Brisbane Technology Park where its state-of-the-art manufacturing and research and development (R&D) facility, is still based. Cook Medical's Australian operations also double as the headquarters for the Asia Pacific (APAC) region.

Despite the bulk of its customers living thousands of kilometres away, Mr Thomas says the company is committed to supporting and promoting local manufacturing, particularly because its aortic stent grafts were developed and commercialised from Australia.

"We believe in keeping R&D and manufacturing together because there are so many advantages that we can take by keeping both under the same roof," says Mr Thomas.

"We are committed to leading one of Australia's most successful, and highly advanced medical device manufacturing companies, and by doing so, to also retain local manufacturing and local research and development."

General Manager of Cook Medical Australia, Dr Samih Nabulsi says the company is dedicated to pioneering innovative medical solutions to help patients worldwide, which could in the future include Europe's ageing populations and Asia's rising middle-class.

"We are always looking in the pipeline for new ideas," he says. "We will continue to work with physicians, innovators, research centres, universities and anyone else who is willing to back themselves with an idea that fits within our company mould. If it doesn't, we will try and help find someone that can," said Dr Nabulsi.

As part of Cook Medical's commitment to provide innovative solutions in advancing patient care, the company is actively scouting for new technology throughout the APAC region. The Asia-Pacific New Technologies Team (ANTT), was formed in 2014, to discover and evaluate new concepts and technologies from this region and to channel these to appropriate divisions with Cook Medical.

In 2017, the company launched the Asia-Pacific Commercialisation and Development Centre (ACDC) in Brisbane. Collaborating with the ACDC will mean innovative, late-stage research projects can be taken to the next level so medical devices and technologies with global market potential can be developed.

Like any manufacturer, Cook Medical faces challenges, with Mr Thomas noting Australia's manufacturing environment as a key concern.

Working with other industry leaders, Cook Medical Australia spearheaded a campaign to introduce a 'patent box' style tax incentive for Australia. Under the model, termed the Australian Innovation and Manufacturing (AIM) Incentive, qualifying IP profit would be taxed at the lower rate with the standard corporate tax rate to be applied to other income. This would ensure Australia benefits from investment in any R&D by encouraging companies to locate all activity associated with the development, manufacture and exploitation of that IP within Australia. This would help to safeguard the future of manufacturing in Australia.

"Medicine and medical devices can be a complex field, but if the correct manufacturing and research environment can be created, Australia has the opportunity to become the world leader in this field and the home to a new wave of innovative and progressive companies."

In the meantime, Cook Medical takes a straightforward approach to fostering innovation.

"You back the people you work with. Pretty simple, but you must not be afraid to take a risk," says Mr Thomas.

"Innovation means that a risk was taken and it paid off."

ANCA



The best problem a business can have: a product range so popular that you're forced to pull out all stops to keep up with global demand.

That's the challenge for Melbourne-based manufacturer ANCA, whose latest innovative offering – cost-effective tool grinding technology that is easy for operators to use – is selling quicker than the company can make it.

Over the last 30 years ANCA has had an average growth of 17 per cent annually. In 2016 the company was inducted into the Australian Export Awards Hall of Fame, the eleventh company ever to achieve this honour. ANCA exports 99 percent of its products and achieves an annual revenue of approximately \$200 million.

The company was founded in 1974 by two passionate engineers, Pat McCluskey and Pat Boland. Their early focus was on developing world class Computer Numerical Controls (CNC). At the forefront of this technology, the early ANCA work involved retrofitting old machines from manual to CNC.

"Even before we started ANCA, Pat and I have always been driven simply by wanting to get machines to do things better," explains co-owner Pat McCluskey.

"The FX Linear is a perfect example of that philosophy. The significant new technology development is producing the sort of results that our customers are after.

"We developed the first cylindrical linear motors for tool grinders for this range and in conjunction with other features, such as a new control system, the resulting superior tool finish has made this a popular machine."

The company was the first to design and manufacture an Australian CNC, and found a niche in sophisticated tool grinding machines, which ANCA eventually took to Germany, a country that was considered the centre of elite tool grinding technology.

Fast-forward a few decades, and ANCA is now a world-leading designer and manufacturer of high-precision grinding machines, software and automation accessories.

The tool grinders ANCA produces are widely used by companies involved in creating components used in medical, automotive, defence, aerospace, pharmaceutical and manufacturing sectors with customers including Boeing, GE, Rolls Royce and Johnson & Johnson.

Its global headquarters in Bayswater North, Melbourne, has about 400 staff, including 100 engineers and a dedicated R&D team. ANCA has another manufacturing site in Thailand and offices in the UK, Japan, Taiwan, Brazil and India.

In 2016 ANCA opened its refurbished European headquarters in Germany and, in 2017, ANCA is expanding its US and Chinese facilities by 50 per cent to grow capacity and add a customer focus and training centre.

"When you are talking about the high impact, high technology items that are used in our machines, we produce those in Australia because they are critical to the outcomes of the machines," ANCA Chief Executive Grant Anderson says.

Aside from an ongoing push to innovate – 9 per cent of turnover is funnelled back into R&D – the company also places a heavy

emphasis on training. Facing a potential shortage in the niche skills needed to manufacture its machines, ANCA started its own apprentice training centre, in affiliation with the Australian Industry Group Training Services.

"Finding the staff with the specialist skills required to build CNC machines, or the mechatronic, software and other engineers also needed is a constant challenge", says human resources manager Wayne Young.

"The apprentice training centre has been very successful. We currently have 12 apprentices and some who have finished and are working in the factory, or overseas.

"We also hire many Industry Based Learning (IBL) students from universities and have a very multicultural workforce. This is because there is movement between the global offices and because the industry is a global one, so we look globally for the right skillsets."

Mr Boland said: "The ANCA philosophy is to push in two different directions, one being engineering excellence, with 25 PhDs working in our R&D centre and close co-operation with universities around the world.

The other crucial part of the company's success was "practical trade skills," he said. "Machine tools need to be rugged, reliable and easy to use for the tradespeople around the world that operate them. I think that push from an academic sense and a trade sense has been one of our important cultural features."

PPG INDUSTRIES



Look around you. There is something in your vicinity that PPG Industries has helped produce.

PPG Industries supplies durable, innovative and specialty coatings for everything from cars, houses, stadiums, soft drink cans, to bridges and aeroplanes.

It may not be a household name but with \$16 billion in worldwide revenue and 50,000 staff, the company is no less a major global – and Australian – success.

Represented in 60 countries, the company employs 1000 in Australia, including scientists and researchers, in a centre located in Melbourne – and is one of the leading developers of so-called “intelligent” coatings worldwide. These include construction coatings that reduce harmful airborne pollutants from building materials, carpets or fabrics, for example, by converting them into water molecules and harmless inert gas.

Vice President ANZ and General Manager Architectural Coatings ANZ, Tim Welsh, says what is critical to the company’s present global success and future growth is research, development and innovation. And Australia is home to the company’s centre of excellence for research into coatings for harsh conditions.

“Australia has some of the harshest conditions in the world,” says Mr Welsh. “We love our steel roofing here. The coatings we produce for Colorbond, for BlueScope Steel, are not only light, but durable. They have a performance that go beyond 30 years so they are capable of withstanding extreme climate conditions.

“Innovative companies are continually developing new sustainable technologies and constantly looking to a horizon 10 to 15 years out,” he said.

Tim Welsh, along with his role on the AAMC Leaders Group, is also Chair of the Chemicals and Plastics Innovation Network, a new industry-research collaboration based at Monash University and funded with support from the Victorian Government.

Many of PPG Australia’s R&D projects focus on adding value to their protective products. These are often active “smart” coatings that not only look good, but are able to reflect heat, self-sanitise, self-clean.

PPG is also bringing innovation to Australia through technological advancements in sustainable chemicals such as BPA-NI technology for use in consumer food and beverage packaging.

The company is a lead participant in a new industry initiative to keep paint out of landfill, to be known as “Paintback”. The scheme will make it easy for paint users – DIY and professional painters alike – to dispose of paint responsibly.

Predominantly a paint business, PPG is also involved in flat glass and specialty chemicals. “We believe that we can meet the needs of all markets and all customers because of our diversity and our global capabilities.”

PPG manufactures protective marine coatings for large ships, stadiums, bridges; wood coatings for kitchen cabinetry and furniture; and durable coatings for the motor vehicle industry and the aviation and aerospace industry.

The company’s motto, not surprisingly, is: “If it moves, we paint it. If it doesn’t move, we paint it.”

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AUSTAL IS THE ONLY FOREIGN
COMPANY IN THE WORLD TO

PRIME CONTRACT

SHIPS FOR THE UNITED STATES NAVY.

WHY? BECAUSE CONSTANT INNOVATION
HAS MEANT WE ARE NOW A

WORLD LEADER. //

David Singleton, CEO Austal



BOEING



Boeing's Australian roots go back 90 years, and the heritage companies that form part of its legacy manufactured some of this country's most iconic aircraft.

The vibrant history of Boeing in Australia continues to be written today. With approximately 3500 employees, the Australian operation is Boeing's largest operational footprint outside the United States.

And in recognition of its enduring contribution to the Australian economy, Boeing last year became the first international company to be acknowledged at the Australian Export Awards.

"I was honoured to accept the inaugural Investment Award on behalf of our employees in Australia and around the world," said Maureen Dougherty, President of Boeing Australia, New Zealand and South Pacific.

The Minister for Trade, Tourism and Investment, the Hon. Steven Ciobo MP, in presenting the award, acknowledged Boeing's efforts to support the expansion of Australian industry within global supply chains.

"The \$1 billion Boeing has invested in Australia ... is creating opportunities for engineering and machining companies to diversify and win new markets in the international aerospace market," said Minister Ciobo.

"In 2015 alone, more than 1,000 Australian companies were suppliers in Boeing's global supply chain. That year, Boeing spent approximately A\$400 million on its Australia suppliers," he said.

In the midst of a challenging global aerospace environment, Boeing in Australia has developed a winning formula for an advanced manufacturing ecosystem based at its Fishermans Bend, Melbourne, site.

The company continues to invest in its commercial airplane manufacturing capabilities at Boeing Aerostructures Australia (BAA). Co-located with a team of Boeing research and development engineers, BAA also works with universities including RMIT, local industry, and community organisations, in order to drive innovation and the next generation of engineering talent into the site.

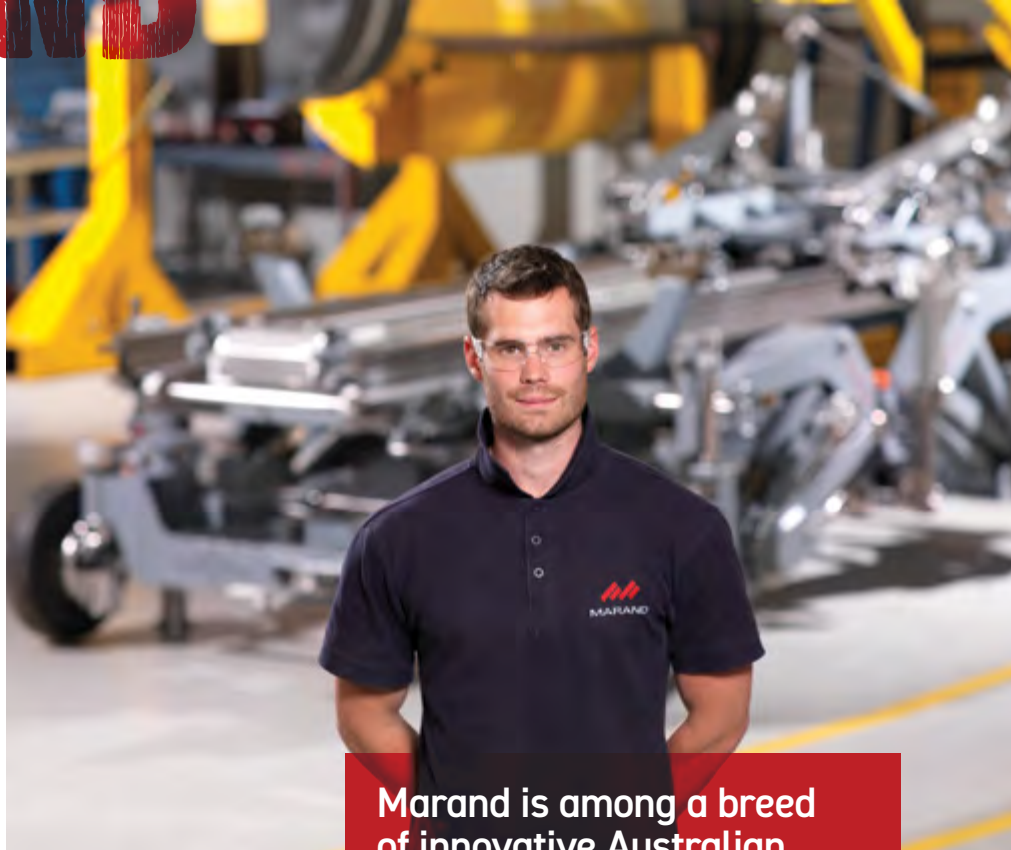
Today, BAA designs, tests, certifies and produces world class advanced structures including part of the trailing edge of the most technically advanced commercial aircraft in the world – the Boeing 787 Dreamliner. In addition to work on the 787 moveable trailing edge, BAA is also the sole source producer of 737 ailerons, 747 moveable leading edges and 777 cove lip doors, elevators and rudders.

Once complete, all parts produced at BAA are shipped to the US for final assembly at Boeing's factories in South Carolina and Washington state.

Boeing's collaboration with local industry including small and medium-sized enterprises, government and academia, help ensure it continues to stay at the forefront of Australian aerospace. Its long-term partnership with Australian research organisation CSIRO has sparked a number of significant advances.

Boeing is an integral part of the aerospace and defence fabric of Australia, offering long-term partnerships based on trust and performance. Boeing is unique in the Australian aerospace industry based on its history, presence, mix of commercial and defence business, original research and development activities, and supplier network – all with connectivity back to the largest aerospace company in the world: The Boeing Company.

MARAND



Marand is among a breed of innovative Australian manufacturers harnessing the existing talents of staff to pave a new road to success.

Ten years ago, about 90 per cent of Marand's workload revolved around the automotive industry. But while the fortunes of Australian car manufacturers have faded, Marand has managed to adapt and prosper, with one major project putting more than \$1.3 billion on the table over the next 10 to 15 years.

In fact, while the automotive industry now comprises less than half a per cent of Marand's workload, the Victorian manufacturer has shown consistent growth. CEO Rohan Stocker says the company's revenue this year is 10 times that of 2001.

The Moorabbin-based company is the major Australian player involved in the manufacture of aerostructures, ground support equipment and production tooling of the F-35A Lightning II aircraft, a fifth generation air combat jet that will be used by the Royal Australian Air Force and other military in 12 countries including the USA, UK, Italy, Netherlands, Turkey and Israel. Australia will eventually buy 100 of the aircraft.

With over \$200 million of JSF work already completed since 2002 on production tooling and ground support equipment for the planes, Stocker says the largest element is yet to come with the manufacturing of vertical tails for the F-35, which including the tooling and ground support equipment, should net the company more than \$1.3 billion.

Thanks to its involvement in the international project, Marand will build one of Australia's largest aerospace machining and component assembly workshops.

Mr Stocker said Marand had focused on diversifying over the past 15 years, and was well prepared for the drop-off in work in the automotive industry.

"It's been about distilling the underlying capabilities and transferring those skills into other industries," Mr Stocker said.

Marand has focused on its capabilities in engineering and design, and invests heavily in graduate engineers, software, engineering processes and advanced manufacturing technologies.

Its customer base is mostly blue-chip organisations in sectors including mining, rail, aerospace, defence and general manufacturing. Its rail division, Atlas Rail, is also a key part of the business, supplying and servicing automated rail maintenance equipment used to maintain rolling stock in countries around the world including USA, U.K, India and Saudi Arabia.

Marand is also an enabler for other advanced manufacturers providing them with production technology and equipment, bespoke machines and automation to assist customers delivering advanced technology to market. Boeing's advanced 787 composite production in Melbourne is one such example where Marand has provided tens of millions of dollars in automated equipment solutions.

In Australia, Atlas Rail supplies and sustains rail maintenance equipment and advanced automated turnkey maintenance facilities to major companies including BHP and Rio Tinto.

Mr Stocker believes the future success of Australian manufacturing is dependent on people with the right skills collaborating. Marand has forged strong links with several universities, CSIRO and other large companies with research and development divisions.

QUICKSTEP



Quickstep is proof of an Australian can-do attitude, and ability to solve complex problems. ASX-listed in 2005, Quickstep is at the forefront of advanced carbon composite parts manufacturing for the global aerospace, defence and automotive industries.



It counts the US Department of Defense, major car manufacturers, aerospace majors and many other institutions and commercial organisations among its customers.

Quickstep has an aerospace-grade parts manufacturing facility at Bankstown Airport, a new technology site at Deakin University, Waurin Ponds Campus, Geelong and a sales and technical operation in Munich, Germany.

The firm is successfully countering Australia's much-lamented tendency to send raw material offshore only to "buy it back at three times the price converted."

"Manufacturing in Australia is changing and repositioning from the old type of high volume manufacturing to a new high tech high automation which fundamentally means the skill types and where you are investing needs to change," says Chief Executive, David Marino (2015-2017).

"It is something we should embrace. I don't think it is something we should be afraid of. It is different but it's not less activity if done well. It is just different types of activity."

Demand for advanced composite materials is forecast to grow from 43,000 tonnes in 2010 to 340,000 tonnes by 2020, and the more tonnage demanded the faster it will need to be cured. Quickstep's unique, patented technology offers cost savings and importantly reduced manufacturing or curing times to meet these future demands.

State One Stockbroking forecasts revenue growth of 8 percent in FY17E to \$54 million, followed by accelerated sales growth of 42 percent in fiscal 2018 and 58 percent in fiscal 2019 as increasing joint strike fighter sales are augmented by a ramp-up in automotive exports and other revenues.

Quickstep's patented Qure process, formerly known as the Quickstep process, was developed by Perth's Graham family and was born out of a need for lower capital investment. The key breakthrough is the transfer of heat via fluid rather than air as done in standard technologies using autoclave.

The process is cheaper and more energy efficient, and emission-regulation friendly.

"It is not easy for someone to just come in and pick it up and replicate it tomorrow. Knowhow is difficult. Knowledge of the design, material science, and the processing approach is very, very complex. We are 15 years into the journey," Mr Marino says.

Quickstep spent around eight years on technology investment before it became a manufacturer, and it is still undertaking that technology investment.

"It takes time, you've got to be determined. You've got to stay the course and you need to find smart ways to support your investment."

Mr Marino concedes that one of the biggest challenges in Australian manufacturing is that we don't have the big global Original Equipment Manufacturers (OEMs) demand firms in the industry. But he says there are lots of global arenas where Australian innovation can be put to good use.

"The challenge for Australian manufacturers is the size of the market and the dispersed nature of it versus the likes of Europe and the US. The big challenge is the global supply chain and how to get into that global supply chain.

"Scale is fundamental. The transition from innovation to commercialization relies on this scale to support ongoing investment. It's a critical consideration.

Mr Marino says you need to have something unique, and recommends finding the right collaboration model and accepting that you can't do it all on your own.

"Global competition is hard. But innovative Australian companies have got a lot to sell in the world market,"

Quickstep is branching out into marine with work related to the government's submarine program, and anticipates demand from the energy sector, particularly wind turbines.

"Manufacturing is not for the feint hearted. But don't undervalue that we have got a lot to sell in the world market. We are extremely innovative in this country and we need to make sure that we keep manufacturing as a priority activity. It is fundamental to the value add."



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THE SUCCESSFUL TRANSITION OF MARAND
FROM AUTOMOTIVE TO AEROSPACE AND
DEFENCE CARRIES A MESSAGE OF

HOPE FOR MANUFACTURING.

IT'S BEEN ABOUT DISTILLING THE UNDERLYING
CAPABILITIES AND TRANSFERRING THOSE
SKILLS INTO OTHER INDUSTRIES. //

Rohan Stocker, CEO, Marand



AGILENT

It's half a world away from its parent company's global headquarters in California, but the Melbourne arm of Agilent Technologies is a world-beater in its own right.

In the past 40 years, Agilent's Australian team has recorded many grand achievements, including turning a single invention devised in Melbourne into six unique platform technologies, winning many Australian export awards, and generating more than \$3 billion worth of products sold around the globe.

Back in the 1950s, a team of Australian chemists led by Sir Alan Walsh at the CSIRO devised a technique to determine the concentration of elements in many substances, known as atomic absorption spectroscopy, said to be one of the most significant advances in chemical analysis in the 20th century.

Agilent Technologies has since commercialised that technology to create measurement tools that can be used to measure the quality of air, food and water, along with medicines, mining samples and countless other materials. Many of the products emanating from the Melbourne site hold leadership positions in their global markets today.

Recently the company opened a new \$25 million, state-of-the art facility in Melbourne, providing world-class research,

development and global communications infrastructure for the Australian-based team. Vice President and Managing Director of Agilent Technologies Australia, Philip Binns, says the new building has helped lay the foundations for the next 20 years of operations.

The Melbourne site – the global headquarters of Agilent's spectroscopy business – is part of a huge growth spurt for the multinational's Australian operations, which doubled in size when Agilent acquired scientific equipment maker, Varian, in 2010.

Mr Binns says the new facility has led to improvements in how Agilent teams work, and the way in which they bring products to the market. More than 10 per cent of revenue is invested back into research and development.

Global communication systems in the new building have also reduced the time to market for Agilent's products, with staff in Melbourne now connected in a live setting to project teams and collaborators in facilities around the world.

"The key for us is staying connected with our global customers whilst continually improving our ability to develop new products and services, and get them to market quickly," Mr Binns says. "Staying ahead of the competition is always a challenge. Accessing intellectual property

is becoming easier in today's connected world - the race is now all about how quickly you can commercialise it."

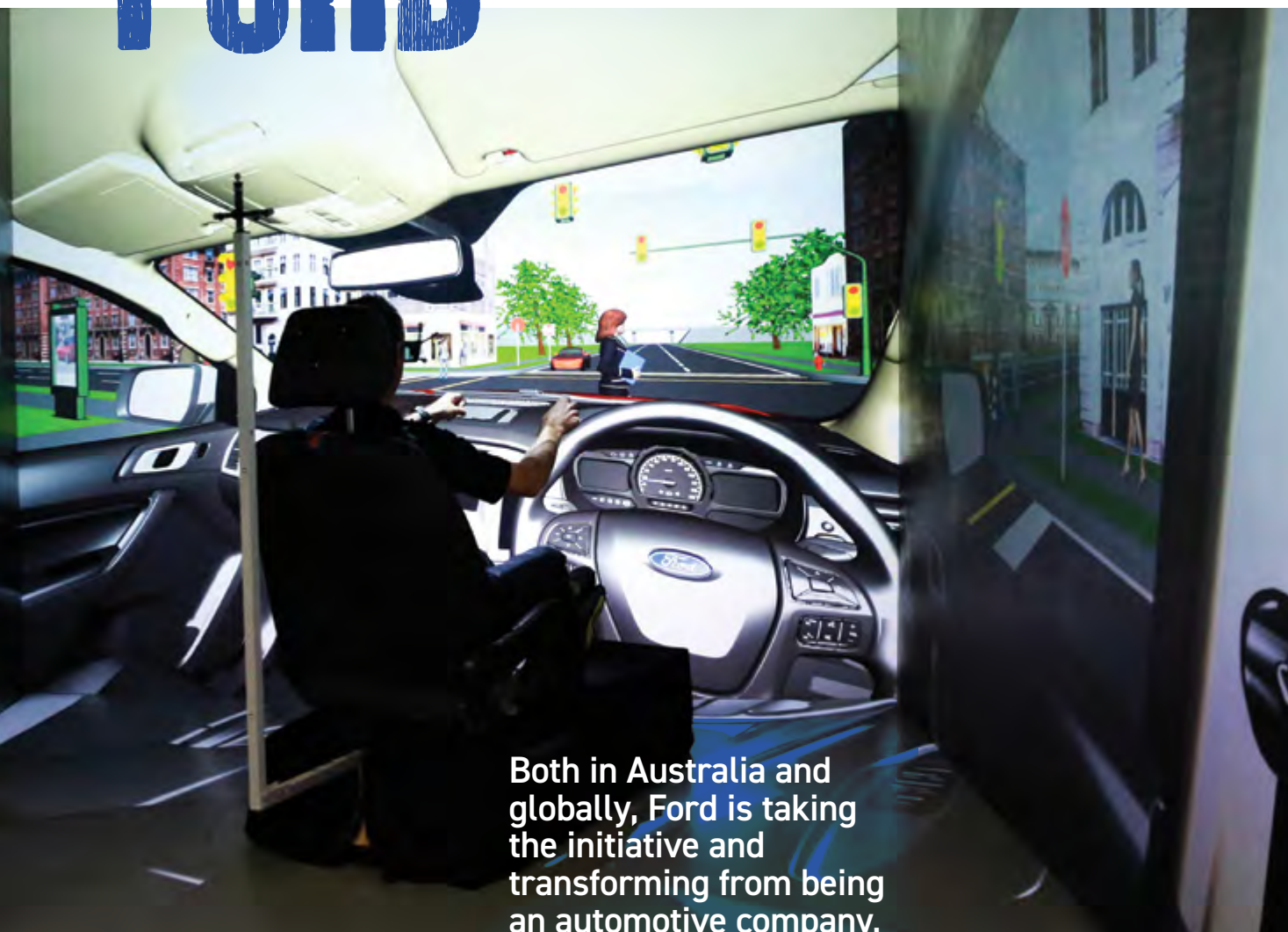
Two major products have already been developed and released to global markets from the new centre.

Mr Binns believes collaboration within and external to the company will be one of the keys to Agilent's continued success. "Providing our customers solutions to increasingly complex problems often requires expertise we do not have access to inside our own walls. Collaborating with other parts of our global organisation and with partners outside our company is becoming a critically important skill moving forward," he says.

Competition emerging from countries such as China and India will also play an increasing role in the future.

However, with double-digit growth, Agilent is continuing to march forward in a tough manufacturing environment, setting its sights on high potential growth areas for scientific measurement tools including food safety, pharmaceuticals and biotechnology, and developing global markets for advanced materials and energy related industries.

FORD



Both in Australia and globally, Ford is taking the initiative and transforming from being an automotive company, to an automotive and mobility company.

Ford's shift in thinking towards mobility solutions began more than a decade ago. From a global standpoint, the key turning point came when Bill Ford recruited Alan Mulally to become Ford's CEO in 2006. At that time, Bill and Alan confronted the situation and knew they had to prepare for an economic downturn, which turned out to be the Global Financial Crisis. To transform the company, Bill and Alan rekindled the company's innovation mindset to become a leader rather than a fast follower within the industry.

In Australia, Ford confronted the reality that auto-manufacturing was no longer viable locally, and knew as a company, they had to refocus their efforts and invest heavily in innovation.

Australia's knack for innovation, honed over the past decades, has set Ford Australia up as one of only three Product Development hubs around the Ford world.

"We're proud to be one of the top-ranking companies for patent submissions worldwide, having lodged 3,200 patents globally in 2016 alone," commented Graeme Whickman, President and CEO, Ford Australia.

So, in 2014, Ford charted a completely new course to transform into an innovation led company, with research, development and a customer focus at the core of their strategy. "This coincided with a global push to pursue opportunities, including driving for leadership in connectivity, mobility, and autonomous vehicles," Mr Whickman said. "As we look to the future, our team here in Australia will play an important role in the innovation happening across the company.

Aided by an investment of nearly \$2 billion in local research and development since 2009, our Australian team has already led the innovation of popular vehicles such as the Ranger pick-up and Everest SUV."

These vehicles are loaded with advanced driver assist technologies which help customers drive more confidently and safely. It is also those very same driver assist technologies that are the building blocks for autonomous cars in the future. This is an example of the forward-thinking mind-set underpinning Ford's vision of the future.

"We're investing in our people, as well as our facilities, by spending more on research and development than any other automotive company in the country, Mr Whickman continues.

"In 2017 alone, we'll invest \$450 million into research and development in Australia. That's a 50 per cent increase on 2016. We'll also spend an additional \$50 million on new and upgraded Product Development facilities.

"Our ongoing commitment to high-value R&D is attracting the very best minds in the business, with 1750 of the most innovative designers, engineers and technicians in the country now working at Ford Australia. Our commitment to high-value R&D means that Ford Australia will continue to pursue innovation and cutting edge technology, not only for the benefit of our customers, but for Australia more broadly."

As the world changes, so is the way we move. Ford is challenging itself to better understand how people live, work, and move in urban areas and how they will do so in the future.

"As a company renowned for democratising the car, we are excited to be playing a lead role in transforming mobility for all in the future, both through our work on autonomous vehicles globally, and some unique thinking around mobility solutions more broadly," Mr Whickman said. "Together, we will celebrate future thinking as our country realises that change is not only inevitable but critical as we head towards an innovation led economy."



SIEMENS

Engineering powerhouse Siemens says now is the time for local companies to embrace advanced technologies and carve out a place in the global supply chain.

Siemens Australia CEO Jeff Connolly says the challenge for Australia is to be ready as the world enters the fourth industrial revolution – the merging of the cyber and physical worlds.

“Also known as Industry 4.0, the fourth industrial revolution represents a world where everything imaginable is connected to a network,” says Mr Connolly, Chairman of the Prime Minister’s Industry 4.0 Taskforce. “It’s an exciting time where new production environments will emerge as information generated in the virtual world will flow into the manufacturing world.”

He says all the information from this connected world can be stored, transferred, analysed and acted upon in new and usually automated ways via network connections with everything else.

“It’s a new way of working and thinking and will make competition global rather than local. It means that people from almost anywhere can participate in the relevant global supply chain – if you’re good enough.”

Australia, with its abundance of resources, skilled workforce and talented engineers, is perfectly positioned to become a key player in the future global manufacturing system.

Siemens has a long history of connecting Australia, tracing its local roots back to 1872 and the construction of the Overland Telegraph from Darwin to Adelaide, which paved the way for communications throughout the country and with the rest of the world. In 1956, Siemens provided the hardware for the first television transmission to Australian homes.

Today, Siemens has about 2000 employees in Australia, designing and maintaining the technology that helps local business stay at the cutting edge.

Partnerships are a key element not only to Siemens’ success, but the industries it teams up with. Around Australia, Siemens’ technology helps pave the future in industries ranging from medical imaging to mining, power to processing, and electric trains to electricity transmission.

All those industries are recognising the critical role digitalisation will play in their future development and success and its potential for future efficiencies.

“For example, new rail infrastructure throughout Australia will use advanced signalling technologies to generate efficiencies and get more out of existing and new rail networks to cope with growing populations. Our wind farms are using hundreds of sensors to capture data and combine with advanced algorithms for predictive maintenance. And key manufacturing sites are using digitalisation technologies such as PLM software to

engage in global supply chains and even create digital twins to bring products to market faster and cheaper. Even the Australian Institute of Marine Sciences are using Siemens automation to simulate and help protect the Great Barrier Reef.”

He says these are just some of the examples of Siemens’ expertise in digitalisation and automation being used to create a true vision of sustainability – both in environmental and economic terms.

Mr Connolly said that companies sharing Siemens’ vision of investing in future technologies such as energy efficiencies, or enterprise strategies such as product lifecycle management, were reaping the rewards of a forward-thinking philosophy.

“There are a host of technologies available today that would allow Australian industry to find its place in the global supply chain and take advantage of massive growth opportunities,” he says.

“We need to constantly increase the level of collaboration between companies, governments, industry and educators. We consider the world to be our laboratory and regard collaborative networks as the breeding ground for innovation.”

Siemens has long-standing partnerships with leading research facilities around the globe, and invests around \$7.5 billion each year into R&D. It is also participating in ventures such as the Tonsley innovation hub being developed in Adelaide.

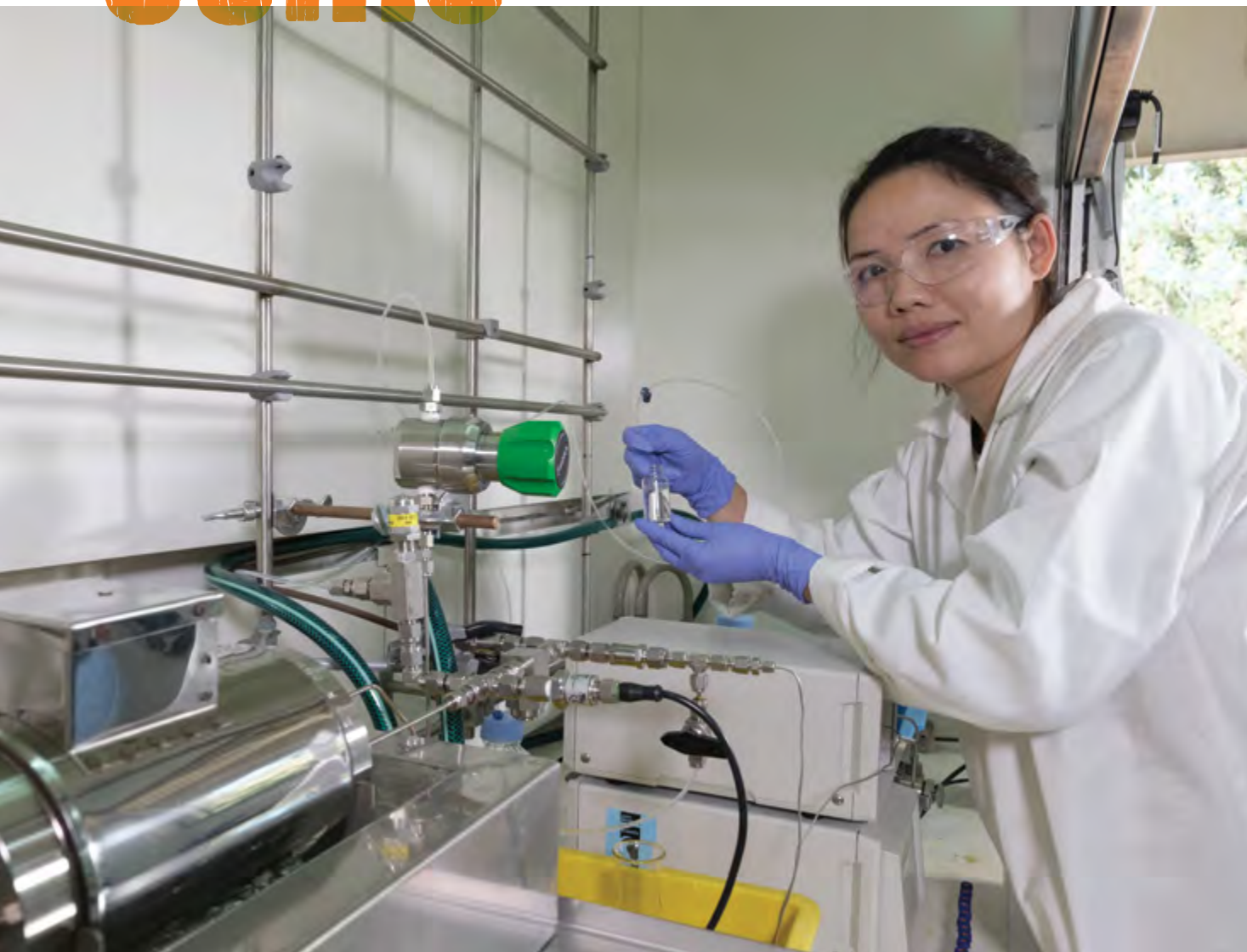
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INNOVATIVE COMPANIES ARE
CONTINUALLY DEVELOPING NEW
**SUSTAINABLE
TECHNOLOGIES**
AND LOOKING TO A **HORIZON 15 YEARS OUT.** //

Tim Welsh, Vice President ANZ and General Manager Architectural Coatings ANZ,
PPG Industries



CSIRO

WORKING WITH INDUSTRY



Picture this: a small Australian manufacturer has a promising innovation, but not enough funds to develop it. The company can't invest millions in new laboratories or build a large research team to drive a capital intensive, multi-year project.

It needs investment. It needs a proven, flexible research capacity. It also needs a partner with proven experience in business development, commercialisation strategies and IP.

That's where CSIRO Manufacturing comes in. Australia has great ideas, a strong R&D culture and lots of talented people. As part of Australia's national science agency, CSIRO Manufacturing aims to harness that innovation and help turn it into new products, companies and opportunities.

CSIRO manufacturing director Keith McLean believes the future possibilities for Australia are exciting if the right settings are in place.

"What we're really trying to do is create the jobs and the technologies of the future, and create exports for Australia," he says.

CSIRO is among Australia's top designers and inventors of Australia's ever-increasing wealth of intellectual property – a vast source of commercial opportunity – and has spun off more than 150 companies.

At the same time, the organisation collaborates with 3,000 customers each year, including Australian federal, state and local government bodies; small, medium and large businesses; the majority of Research Development Corporations, Cooperative Research Centres and Australian universities; and more than 150 international partners.

Companies gain access to world-class facilities, internationally recognised researchers, as well as business networks and a multi-disciplinary approach.

From additive manufacturing to flow chemistry, flexible electronics to cutting edge protein science, CSIRO Manufacturing has proved it has the know-how, providing world-leading expertise, ranging from molecular biologists to physicists and chemists.

Some CSIRO Manufacturing projects last for months, another has lasted 28 years and is still going strong. The enduring relationships are thanks to a very flexible approach to sharing risks and rewards with partners. It's not always about the IP; indeed, the organisation has participated in a wide range of other co-investment options.

GLOBAL NETWORK

CSIRO's network of industry and research partners covers the globe. This can attract new research or commercialisation partners, or find applications for an innovation in a field that the client company might not have considered.

PRAGMATISM

CSIRO Manufacturing's assistance doesn't end at the lab door. The organisation helps companies with growth strategies, IP development and patent applications, as well as advice around technology spinoffs. CSIRO's SME Connect can also help SMEs find researchers within and outside the organisation, define the project, find the right capability, assist with contracting and provide information on grants.

COLLABORATION

CSIRO plays an important role as a Collaboration Hub for the research sector, industry and government, and works with hundreds of businesses a year, as well as universities across the country.

"Our Lindfield site plays host to start-ups like Baraja and medical device incubator Fledge, with more on their way as part of the Lindfield Collaboration Hub," says Mr McLean. "Our Clayton site plays host to Oventus, and in Geelong we work alongside Carbon Revolution; Carbon Nexus and Quickstep."

SWINBURNE



SWINBURNE FORGES NEW FRONTIERS IN ADVANCED MANUFACTURING

Swinburne University of Technology's groundbreaking collaborations with industry have been so successful the team is now busy exporting the model offshore, starting in China's Shandong Economic Development zone.

"We are going to really push this type of approach, this type of strategy of research-engagement in the region, rather than just thinking locally," says Professor Aleksandar Subic, Swinburne's Deputy Vice-Chancellor (Research and Development.)

Swinburne's \$100 million Advanced Manufacturing and Design Centre, launched at the Hawthorn campus, is a state-of-the-art facility offering the latest manufacturing and design techniques. The "Factory of the Future" centre supports advanced manufacturing by fostering research-driven innovation and development of high value-add products and processes.

"It is a translational research program, so we are involved in taking our research to the commercialisation of new technology," says Professor Subic, who is on the Prime Minister's Industry 4.0 Taskforce.

"That is where the impact will happen — when these products get out there in the real world and hit the market, rather than just remaining in the labs."

Bronwyn Fox, Director of Swinburne's Factory of the Future, says at least one company each week approaches the team, wanting to know how to implement strategy around Industry 4.0, and what that might mean for performance and productivity.

"They see it as an opportunity but they don't know where to start. That's quite common — the companies that we speak to can see that the world is changing, the way that we manufacture products is changing, and they want to keep ahead of that and ensure that they can be competitive.

"We work with companies to identify initial small steps where research will provide immediate outcomes."

Swinburne is in partnership with Asahi Beverages to help develop and implement its Industry 4.0 strategy.

Swinburne also partnered with Imagine Intelligent Materials to develop products from graphene, a remarkable material predicted to transform advanced manufacturing.

"The work that we have been doing leading the charge in this space has been really critically important for Australia. It means that we are holding our own internationally," Professor Fox says.

"It doesn't matter if you are making a soft drink or a stem cell, the challenges are absolutely identical — creating all this data, monitoring the process, working out how to actually feed that back into the process to improve it, and how to implement the new technologies," she adds.

In achieving its success, Swinburne drew on existing partnerships with Universities in Shandong, Coventry and Stuttgart, as well as CSIRO, Siemens, Daimler, Boeing, Ford and Marand amongst others, and has been building new strategic international links.

"We are making a real impact out there by driving the development of new industries and helping transform existing companies that have the potential to integrate in the global value chain," says Professor Subic.

"Advanced manufacturing is evolving through integration of new generation automaton technologies coupled with the Internet of Things which is really pushing the frontiers."

Decades of relationship-building and demonstrated success in choice research is behind Swinburne gaining the confidence of the likes of Boeing and Siemens and majors in marine, defence and food.

"They know how to bring the new technologies and products to the world market, and we are supporting technologically and scientifically that capability so that they actually can have something that is impactful and meaningful to develop their business models," says Professor Subic.

The faculties offer research in a spectrum of advanced technologies, including automation, composites, nano fabrication and graphene, fuelling new companies and products.

Swinburne partnered with Canadian auto components and systems maker Multimatic, pulling off a world first by curing a carbon composite in just minutes.

In another project, new patent-pending technology developed by Swinburne overcomes energy density limitations with supercapacitors, achieving ten times better density than competing devices.

"That's amazing stuff," says Professor Subic, adding that the collaboration model offers "a meeting of minds, a meeting of needs, a meeting of interests. Like-minded people who can work together."

Professor Subic is also optimistic about Australia's broader manufacturing future, noting a strong foundation of exceptional research and innovation.

"The appetite and desire is there. We will see a transformation of the industry, and it will be much more rapid than we think."

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THE WORLD'S BIGGEST
CHALLENGES WILL BE FIXED BY
SCIENCE
NOT BY OPINIONS.
//

Max York, Managing Director, GE Aviation Australia, New Zealand,
Indonesia & South Pacific

Making the world a more
beautiful place is a big job.
Let's get started.



We create, invent, and formulate the amazing paints, coatings, and materials that make the world a more protected and beautiful place. For the next generation that comes along. Visit ppg.com to learn more.



We protect and beautify the world™

BRESEIGHT GROUP



A ground-breaking system that uses 3D modelling of a patient's facial bones to help guide surgeons during risky dental implant procedures has thrown a Sydney manufacturer into the world spotlight.

Breseight Group, achieving more than 90 per cent growth in its advanced manufacturing arm in 2016, has launched in Europe a flagship home grown Australian medical product, "ImplaNav", an image-guided surgery system focused on dental implantology.

Breseight managing director Kevin Cullen says the company designed the image-guided software system – which helps reduce human error, improves patient care, and dramatically reduces costs – in conjunction with surgeons.

The breakthrough is just the latest innovation from a company that has transformed itself from its 1984 beginnings as a toolmaking "job shop".

Founded by Bob Cullen and Kevin Rix, the company was bought by their sons Kevin Cullen and Tracy Rix in 1994.

By 2005, the Australian manufacturing industry had been contracting for about 25 years, and Mr Cullen said something had to give.

So he and Rix began making small, progressive changes to transform much of Breseight's focus towards advanced manufacturing, investing millions in cutting-edge 3D printing machines and staff training.

Mr Cullen says the company made a conscious decision to be in the business of development – and the positive company culture has led to major innovations across the business. Breseight in early 2017 automated their 3D printers, likely the first in Australia to do so.

"The margins are higher in the development area rather than being at the end of a mature aged product," he says.

TOMCAR



The team at Melbourne-based firm Tomcar is at the forefront of a new era in Australian vehicle manufacturing. With the first electric car to be fully produced in Australia, Tomcar is dreaming big – and succeeding.

Tomcar teamed with innovative technology developers Energetique and local manufacturer MtM to produce the prototype Tomcar LV1, being trialed at blue-chip mining firms in Australia. The car is initially intended for the underground hard rock-mining industry, with a consumer version in planning.

"We have very big dreams and ambitions in regard to the car," says Tomcar Australia's co-founder and CEO, David Brim. "It's a very robust electrical vehicle using world's best practice, and it's designed to live in a very harsh environment.

Tomcar has been manufacturing its non-electric models for just over two years and has sold largely to clients in the mining and agriculture sectors, including five of the top ten pastoral companies in Australia. Among the car's selling points is its very low centre of gravity, matching that of a Porsche.

The company is "ruthless" with its supply chain, but one of the keys to Tomcar's success has been manufacturing locally. Locating production close to the research and development has been vital for innovation, says Mr Brim.

"Yes, wages are expensive here, but you get some of the world's best engineers and employees. We can lead the world in mining, agriculture, tourism, renewable energy, renewable resources – things we are good at. These are the industries where the growth will come from," he says.

KORVEST LTD

Since 1970, Korvest Ltd has grown to become one of the Pacific’s largest manufacturers and suppliers of cable and pipe support systems, galvanising services and access systems for large mobile equipment.

Through its four specialist divisions - EzyStrut, Korvest Galvanisers, Power Step and Titan Technologies the company produces a range of standard, customised and innovative products. Korvest invests heavily in research and development, with a current focus on potential export markets such as Singapore, the Middle East, Indonesia and Malaysia.

By continuously pursuing new product development, EzyStrut has produced a number of industry firsts, such as being the first company to produce a range of AS3013:2005 compliant fire rated products, and they maintain the most extensive range to this day. Korvest understands the needs of installers for projects requiring reliability, effortless installation, options for different loads and spans, and assurance of compliance with the most stringent of standards.

Korvest’s workforce of around 175 employees is multi-skilled, and led by a central management team. Managing Director Alexander Kachellek says

employees are empowered to constantly look at improvements that can be made in the factory and throughout any of the processes. He says excellent people are one of three key factors needed to operate a successful company – together with providing a product that people need, and efficient, effective processes.

While the manufacturing plant and national distribution centre are in Adelaide, Korvest has sales offices and warehouses in Adelaide, Melbourne, Sydney, Brisbane and Perth, and distributors in Darwin, Townsville, Hobart and New Zealand.

TEXTOR

Textor Technologies grew out of the clothing and automotive industries. It was purchased in 2000 from its English parent and converted into a hygiene fabrics operation. The business is family owned and operated with its production facilities in Tullamarine. The transformation journey has now been over 16 years.

Andy Butler, now Managing Director, says that for the first few years after 2000, Textor was in a loss-making position. Seeing the decline of the automotive industry approaching, Textor was steering itself out of the sector to focus more on developing materials for the hygiene industry. The first

major investment was in 2002 when the company began supplying Kimberly-Clark Australia with fluid transfer fabrics. The success of that project led to requests from other Kimberly-Clark Asian businesses to supply into the region. The company was developing a reputation for both reliability and innovation.

In 2009 Textor was awarded a business research scholarship, which enabled Textor to employ a CSIRO scientist to help develop state-of-the-art fabrics. The transformation has been successful with Textor now exporting to 13 countries around the world.

Textor has changed its strategy from supplying a large number of companies, to supplying only a handful – including major client Kimberly-Clark, which uses Textor’s fabrics. The goal has been is to be the best in the world in a chosen field and the company has convincingly achieved this.

Andy says Textor continues to see the value of tapping into science, describing the CSIRO as “a massive intellectual database. It’s an enormous resource for Australian manufacturing.”

ANATOMICS



A pioneer of CT scan-derived surgical implant technology, **Anatomics** is not your usual manufacturer. Operating out of a dedicated manufacturing laboratory in the heart of St. Kilda in Melbourne, this global medical device company uses advanced technologies to produce life-changing surgical products that are sold to 24 countries worldwide.

Anatomics manufactures surgical implants from a variety of materials: including titanium, acrylic, and porous polyethylene, a material developed as part of an Anatomics-CSIRO collaboration. Anatomics continues to collaborate with CSIRO to create 3D printed titanium implants.

Anatomics’ highly skilled specialists produce BioModel anatomical replicas and implant prototypes working closely with surgeons and healthcare professionals, using cutting edge 3D-printing technologies and computer assisted design.

Anatomics manufactures a variety of patient specific products for medical use, including cranial, facial, chest, and orthopaedic implants and other skeletal and soft tissue parts. Anatomics has also developed a range of innovative software products to aid surgeons and healthcare professionals in planning surgery.

Founded in 1996 by neurosurgeon Paul D’Urso and healthcare expert Robert Thompson, Anatomics was born out of ground breaking research and development in the early days of 3D printing that now has real-world impacts.

The advanced manufacturer maintains global competitiveness through ardent research, development and commercial partnerships.

Anatomics has successfully carved out a niche for itself in business and medical innovations, having combined science, technology and medicine to save lives and increase Australia’s global competitiveness.



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ABOUT THE



The Australian Advanced Manufacturing Council (AAMC) is a CEO-led private sector initiative pursuing Australian success in advanced manufacturing. The AAMC brings together industry leadership to drive innovation success and resilience in the Australian economy. AAMC members represent the creative and driving energy behind successful transformations of Australian brands and companies, large and small, as well as global multinationals with a strong interest in Australia's future.

For more, go to www.aamc.org.au



The Australian Industry Group (Ai Group) is Australia's peak industry association. Acting on behalf of business for more than 140 years, we are the country's only truly national employers' organisation. Ai Group represents the interests of more than 60,000 businesses employing more than 1 million staff. Our longstanding involvement with diverse industry sectors including manufacturing, construction, transport, labour hire, mining services, defence, airlines and ICT means we are genuinely representative of Australian industry

For more, go to www.aigroup.com.au

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