DEFENCE MANUFACTURING

LEADING THE WAY WITH AI AND SMART FACTORIES

Australian defence manufacturing is advancing rapidly amid new innovations in artificial intelligence, Industry 4.0 and the digitalisation of smart factories. Australian manufacturers are using these advanced practices and succeeding in the global defence world with innovation and precision. By Carole Goldsmith.

DMTC Limited is working together with Australian defence manufacturers assisting in their capacity and technology development in digitalisation, artificial intelligence (AI), robotics, Industry 4.0 and the Internet of Things (IoT) – including smart factories. Spanning an 11-year career at DMTC, Deepak Ganga is currently Head of Program Management, where he leads the Enterprise Program Management office, responsible for business transformation and the strategic alignment of DMTC's programs.

"We have expanded a lot recently," says Ganga. "As well as traditional defence R&D projects, we are also working on technologies with applications in related areas like health sciences, AI, robotics, IoT and Industry 4.0. During the last two years, we've been working behind the scenes on our program governance framework and to standardise processes. We're now developing more software to digitalise project management tasks, as well as automating the reporting that we need to continue to do to demonstrate the value we provide to our stakeholders."

DMTC collaborates with many innovative Australian industry, research and government partners, delivering enhanced defence and national security capabilities, while strengthening the Australian industrial capacity. Formerly known as the Defence Materials Technology Centre, DMTC was set up in 2008, initially with seven years of grant funding from the Federal Government. The Melbourne-based organisation now operates as an autonomous business with income generated from competitive contracts with multiple government departments, security agencies and industry partners across Australia.

"Collaboration still underpins everything we do," says Ganga. He describes a current DMTC defence collaborative project using additive manufacturing as a repair technique for aircraft components.

"Instead of ordering a new part, it's demonstrating the schedule and cost benefits of the technology to allow for the worn part to be removed from the aircraft, repaired and built back up using 3D-printed titanium, steel and other metals. and then recertified for use on the aircraft. There are several partners involved in this project including: defence and aerospace manufacturer RUAG Australia, the Defence Science and Technology Group, the Australian Nuclear Science and Technology organisation (ANSTO), as well as Swinburne and RMIT Universities."

The Victorian Minister for Industry Support and Recovery, Martin Pakula announced on 4 October that its $1.36m Smart Enough Factory program will support small to medium-sized businesses in Victoria's defence industry to modernise design and manufacturing processes. DMTC is delivering the Smart Enough Factory program to assist participating businesses to adopt digital technologies, overcome barriers such as costs, skill shortages or security vulnerabilities, and create opportunities to enter defence supply chains.

With an aim to boost digital and Industry 4.0 capabilities, the program demonstrates that advances in data-driven production can enhance businesses' operational performance and manufacturing productivity, leading to more efficient processes and significant cost savings. The pilot program is already underway with Victorian businesses Australian Precision Technologies, APV Corporation, AW Bell, Heat Treatment Australia and Ronson Gears.

DMTC collaborates with industry, research and government partners, delivering enhanced defence and national security capabilities, while strengthening industrial capacity.

"This is an example of a technology transfer activity around digitalisation," explains Ganga. "The approach that we take is that we don't sell companies a tool, we provide them with a training tool and a training experience so they can consider their own digitisation strategy and ultimately improve their digital literacy. These manufacturers can start to learn about adopting digital technologies on their manufacturing machines and how to utilise the data coming from those technologies.

"An example of this would be putting sensors on a machine to record information about throughput, downtime and the like. The real value for a small business involved in the program is how you can utilise low-cost and low-code equipment, in a secure way, to translate that information into either a more efficient manufacturing process, or to adjust workflows and extract business value out of that information. That's key to the whole industry 4.0, AI and IoT concept."

The first pilot program started in July last year with these five Victorian defence companies, and concluded in December. The next cohort of five manufacturers will be in regional Victoria, focused around Bendigo or Ballarat.

Deepak Ganga is currently Head of Program Management at DMTC.

"Four cohorts of up to five Victorian manufacturers will be participating in the program annually," says Ganga. "So that's 60 SMEs over the three years that we can put into the program, and that's only in Victoria. Manufacturers that want to participate in this program can express interest via our website."

Continued nexdt page

AW Bell's facility in Dandenong, south-east Melbourne.

Continued from previous page

AW Bell – Award-winning casting solutions

AMTIL member AW Bell won the Manufacturing and Advanced Materials Export Award at the 2021 Australian Export and Investment Awards last November. The award takes a prime place at the entrance of the Victorian metal casting and precision engineering business.

"It is a great recognition of the innovative work that our team has been doing the past 10 years," says Sam Bell, the company's CEO. "We are also very grateful to our partners, suppliers, customers and ongoing government support."

Leading defence primes are among AW Bell's many valued customers for its precision manufacturing of components, which it supplies for defence land vehicles, submarines, F-35 fighter Jets, missiles, gun mounts and targeting systems. Northrop Grumman Corporation (NGC), BAE, Marand (ground support equipment), Levett, Raytheon, Pratt & Whitney and Lockheed Martin are its key customers for the F35 jet components. AW Bell manufactures and supplies high-strength aluminium castings for the aircraft's camera housing and decoy measure housing.

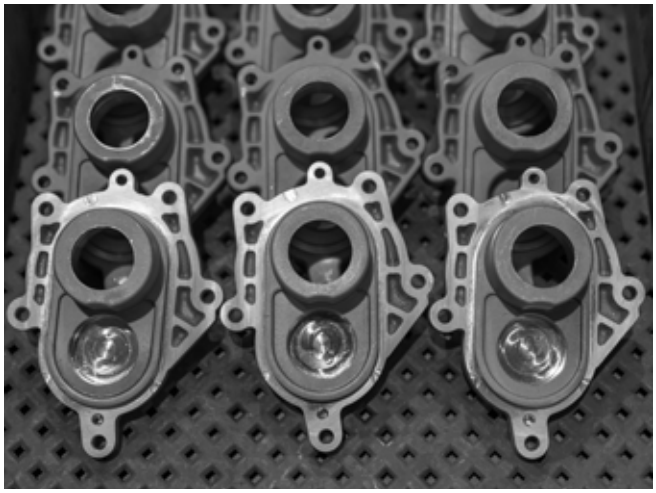
Among its many other precision defence products and global defence clients, AW Bell also supplies Thales (Bushmaster) and Rheinmetall (Boxer CRV-Australian Government Land 400 Phase 2 program) with ammunition feeds, hinges and armoured steel components. These are used on defence vehicles Bushmaster, Hawkeye, Boxer CRV and Scout.

As one of the first five Victorian defence manufacturers participating in the Victorian Government's Smart Enough Factory program, it has been a valuable learning curve on energy consumption and waste for AW Bell. The 70-year-old family-owned business has installed a 284kW solar power system on the roof of its its 10,000sqm purpose-built facility in Dandenong, in Melbourne's south-eastern suburbs. Sam advises that the solar system only provides 20% of the power needed for its manufacturing operations.

As part of its engagement with the Smart Enough Factory program, digital analysis was undertaken of the peak energy use on two of the company's essential, but older machines – the analogue autoclave and the furnace.

Sam advises: "From this analysis, we can see that we have a substantial amount of electricity waste in our use of these machines, negatively impacting our environmental footprint, our productivity and overall business performance. Utilising the data from the Smart Enough Factory, we are now working out the most effective ways of using the equipment and hope to reduce our energy consumption by over 68,000kWh per year.

AW Bell CEO Sam Bell with the Manufacturing and Advanced Materials Export Award the company won at the 2021 Australian Export and Investment Awards.



AW Bell produces a range of components for sectors including aerospace and defence.

"This project has given us a lot of valuable information that we can implement on other machines for further improvements. The Victorian Government and DMTC have upskilled our staff, teaching them how to set up visual production dashboards which has helped us further our industry 4.0 capabilities."

With a team of 94 employees, the business is going from strength to strength. As well as the defence industry, it also supplies to the space, aerospace, biomedical, mining and commercial sectors in Australia and globally.

Mounted on the canteen wall at AW Bell's plant are wooden patterns of components that Sam's grandfather Allan William Bell built after he started the business in 1952.

"We started off as a pattern shop making patterns for the automotive industry," says Sam. "Now we produce some of the strongest aluminium investment casting in the world for the aerospace and defence markets using our specialised aluminium casting process called ABE."

Today, Sam's father Geoff is the company's Chairman. After completing degrees in Mechanical Engineering and Business Management from Swinburne University in 2006, Sam worked in the USA before returning to Australia to take on a position as a Process Improvement Manager at AW Bell.

"My father wanted me to get some real-world industry experience overseas before taking on a job at the family business," he explains.

On a detailed factory tour, Sam explains about the investment casting process. He points to a wax pattern, which has the same geometry as a finished part: "From the customer's design, we create a wax pattern that is a replica of the finished part but slightly larger. We coat this wax pattern in a ceramic material, creating a ceramic mould around the pattern. We melt the wax out of the mould creating a cavity.

"Once the wax is removed from the completed shell's interior, we place the shell in the oven to preheat before casting, normally at around 1,000deg C. The metal is melted in the furnace after it passes the required metal specification and then it's poured into the hot shells, which are then left to cool down."

When the metal has solidified, the ceramic mould is removed and the part is ready for inspection. This not only includes a visual and dimensional check but also testing anomalies by dye penetrant, magnetic particle and a radiography test.

The AW Bell machinery division is another success story for the AW Bell group; it was a recipient of the US-based Investment Casting Institute's 2019 Innovator of the Year Award for designing and manufacturing seven new-to-market pieces of equipment in a two-year period. The company continues to further expand its automation and robotics range and these machines are exported throughout the world.

AW Bell's plans for the future include setting up Australia's first titanium investment casting facility over the next three years.

"That expansion in the business we hope, will support opportunities in Australian Defence through the guided weapon ordinance enterprise as well as helping our aerospace and biomedical customers," Sam explains. "We made the move across to defence manufacturing in 2007 and it took us seven years to get established. It has been very challenging but very rewarding supplying to the defence prime companies. The more Australian manufacturers work in the defence sector in this country, the stronger the Australian defence industry will be."

Continued next page

AW Bell's state-of-the-art foundry produces some of the strongest aluminium investment casting in the world.

The Australian Army has completed successful field trials of a WarpSPEE3D metal 3D printer from SPEE3D in the Northern Territory.

Army technicians using the WarpSPEE3D metal 3D printer.

Continued from previous page

SPEE3D – 3D printing on the front line

AMTIL member SPEE3D is enabling the Australian Defence Force to print vital parts and tools while stationed out in the field in remote locations.

"The challenge for defence personnel is that they are often deployed in remote locations anywhere in the world," advises Byron Kennedy, co-founder and CEO of SPEE3D. "You fly planes transporting supplies and soldiers to remote locations. You've got a limited amount of material that you can carry. Obviously, food, water and supplies take priority, and parts of things that may break are at the bottom of the list. What the Defence Department was looking for is the ability to build parts wherever they're deployed, to support shortening the supply chain."

SPEE3D was able to offer a solution, in the form of its WarpSPEE3D 3D printer, the world's first large-format metal 3D printer to use patented cold spray technology.

"We presented the technology to the Australian Defence Department a couple of years ago and they took a high level of interest in our 3D printers," says Kennedy. "SPEE3D has since deployed printers with army forces around Australia and globally."

Following a successful metal 3D printing field trial with the Australian Army, the Royal Australian Navy (RAN) installed its own WarpSPEE3D metal printer at HMAS Coonawarra Navy Port in Darwin, in November 2021. This makes the RAN the latest Australian defence service with the capability to print its own metal parts, on land or at sea, and on demand.

"Since June last year, we have sold our printers into multiple locations in the USA," Kennedy continues. "And one, a LightSPEE3D machine, was sold through Penn State University, which is directly linked to the US Department of Defence. We build all our machines in Melbourne and ship them to the US."

Kennedy co-founded SPEE3D with Steven Camilleri eight years ago. They had first met seven years previously when completing their Masters in Engineering and participating in the Charles Darwin University's World Solar Car Challenge team. As well as its Melbourne and Darwin sites, the company has sales offices in the UK, the US and Germany.

SPEE3D's founders: CEO Byron Kennedy and CTO Steven Camilleri

The Army has used the WarpSPEE3D metal 3D printer to produce various components for military equipment in the field

"The business has expanded rapidly in the past six months, employing 20 more people, bringing the SPEED3D team to 50 people. We'll continue to grow over the next year also. Our machines are sold world-wide and we have a specialist team that provides machine service and maintenance to clients across Australia and globally."

Kennedy is very positive about the future, noting that COVID-19 is impacting the business both positively and negatively. Shipping costs have increased from $8,000 a container 12 months ago and are now costing three times as much. Transport and delivery times have also increased from six to around 16 weeks to the US. These challenges are also impacting many of the company's potential customers.

"The supply chain disruption is making customers more aware of 3D printing to build their own parts," says Kennedy. "On the negative side, it makes it hard to build and ship the machines, as everything gets delayed. So, it's a blessing and a curse at the same time." AMT

www.dmtc.com.au www.awbell.com.au www.spee3d.com