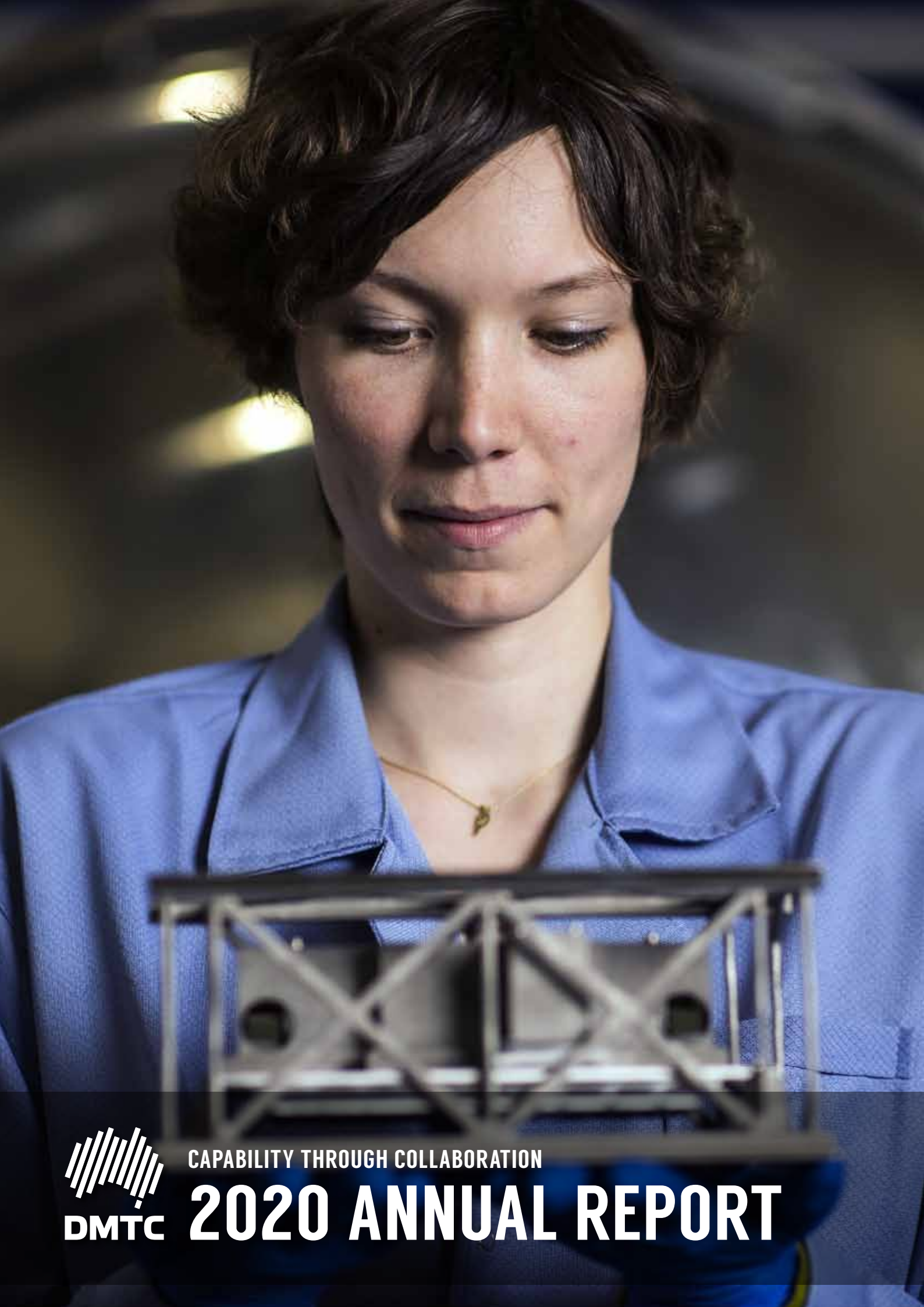

DMTC

CAPABILITY THROUGH COLLABORATION

2020 ANNUAL REPORT

CONTENTS

IMAGE Credits

All images in this Report were taken in COVID-safe settings or in the period prior to COVID-related social distancing provisions being imposed in late March 2020.

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Cover: Mrs Lena Meyer, from the School of Engineering and Information Technology at UNSW Canberra Space, with the CubeSat chassis successfully cast from Invar36 material. This chassis contains an additively manufactured optical mount which offers enhanced stability and reduces effects of thermal expansion in space. DMTC collaborated with UNSW, CSIRO and industry partner A.W. Bell for additive manufacturing and casting of the Invar36 components.

A DMTC collaboration won both the National Defence Innovation Award and the Innovation Award for Platforms and Propulsion at the prestigious Pacific 2019 Innovation Awards in Sydney. The project team included industry partners, MacTaggart Scott Australia and United Surface Technologies (UST), along with researchers from Swinburne University of Technology (SUT) and Defence Science and Technology Group (DSTG). The DMTC project achieved marked improvements in surface coatings applied to critical hydraulic components on naval vessels to prevent bio-fouling and corrosion. In addition to significant platform availability and capability benefits for the Navy customer, the novel solution also delivers superior results in environmental and occupational health and safety performance compared with traditional compounds.

Pictured above (left to right): DMTC Maritime Program Leader, Dr Stephen van Duin; First Assistant Secretary Ships in Defence, Ms Sheryl Lutz; Minister for Defence Industry, the Hon Melissa Price MP; CEO DMTC, Dr Mark Hodge; Chief Defence Scientist, Professor Tanya Monro and DSTG Marine Scientist, Dr Richard Piola. *Representatives from SUT, UST and MacTaggart Scott Australia did not attend the awards ceremony.*

KEY MESSAGE
Government

Small businesses in Australia's defence sector are among the best in the world.

As Minister for Defence Industry, my number one priority is to ensure we have the right systems in place to support Australian defence industry now and into the future to see it thrive.

Together with prime contractors and bolstered by the support of organisations like DMTC, these small businesses and their enterprising people are given the help they need to make significant contributions to projects which equip and support the women and men of the Australian Defence Force.

In 2019, I commissioned a comprehensive review of the Centre for Defence Industry Capability (CDIC) to ensure it could provide the best and most targeted support for Australian businesses looking to work in the defence sector.

In September, I released the findings of the CDIC Review and the Morrison Government's response to its recommendations. The review highlighted the achievements of the CDIC to date, but also uncovered a number of areas that needed to be tackled head-on to boost our help for industry.

One of the recommendations foreshadows an increasingly important role for DMTC within the defence innovation ecosystem. I look forward to Mark and the DMTC team contributing to the implementation of these important measures and taking on this expanded role in order to deliver stronger results for the sector.

DMTC partners with industry to build the breadth and depth of Australia's industrial capability, and works with the research sector to enhance the alignment with – and the relevance of – research outcomes to the challenges faced by Defence and national security agencies.

Working with Defence, DMTC is to be applauded for its contribution to Australia's response to the COVID-19 crisis. Defence and industry, including DMTC, have worked together in a way that again demonstrates the value of a resilient, scalable and innovative industrial sector in times of national response and recovery.

I also acknowledge the continuing partnership between DMTC and the Defence Innovation Hub for the delivery of research, development and innovation services, and the role DMTC is playing across the national Naval Shipbuilding Enterprise. These are just two examples of DMTC's highly-valued engagement with Defence as we continue to build and mobilise our capable, cutting-edge defence industrial base.

It is through strong partnerships with Australian industry that together we can maintain and grow the capability advantage provided by our world-leading defence industry.

DMTC has earned a very strong reputation as a leader in innovation and cooperation, and its work has a broad technical base and geographic reach across Australia and New Zealand.

I commend Dr Mark Hodge and his team for their efforts, working with capable partners across Australia to deliver the many successes outlined in this Report.

The Hon Melissa Price, MP
Minister for Defence Industry

An Australian Army soldier from the 1st Battalion, The Royal Australian Regiment, engages a target at Townsville Field Training Area during Exercise Long Khanh. More detail on DMTC's work on the next generation of small arms technologies is on Page 31.

KEY MESSAGE
Defence

This past year has challenged us all in many ways – in our personal and professional lives and across our communities of our great nation. Under the Whole of Government COVID-19 response and leadership of the Minister for Defence and Minister for Defence Industry, and a genuine partnership between Defence and Defence Industry, we safely sustained the Australian Defence Force and continued with Defence projects.

Most businesses in the defence sector have survived the pandemic with relative strength, and we are best postured to manage the evolving risk confronting overseas nations and the supply chain.

Some, however, are finding it exceptionally tough, including those with diversified business interests in areas that have been particularly affected. For all of those businesses – whether established in the defence sector or seeking a foothold in it – the support we can provide to help them to be more resilient and more competitive is critical. This mission takes on added importance not only for Defence but the broader Australian economy in a post-pandemic world.

Regular Ministerial level engagements have provided us the forum for much improved communications between all elements of our sector, and it is our intention to retain many of the functions of the Defence Industry Support Cell within the Australian Industry Capability Division established this year.

I am most grateful to the DMTC team including industry and research partners, for contributing to the national COVID-19 response and to the technology development across a range of disciplines, delivering our troops a competitive advantage with increased safety. DMTC is highly respected for innovation and its practical mission focus.

The Australian Government is committed to maturing a robust, resilient and internationally competitive Australian industry base as initiated under the 2016 Defence White Paper, then reinforced under the 2020 Force Structure Plan with a $270bn capital program. Collaborations such as those led by DMTC that bring diverse teams together, are critical enablers to realise the ambition and expectation of the Australian nation.

We expect DMTC to play an increasingly important role in leveraging Australia's industry and research and we look forward to our ongoing relationship to deliver the National Naval Shipbuilding Enterprise and Sustainment plan, and other programs.

Mark and the team at DMTC are valued partners in this critical journey for our troops.

Mr Tony Fraser AO, CSC

Deputy Secretary Capability Acquisition and Sustainment Group (CASG)

A Royal Australian Air Force F/A-18F Super Hornet aircraft lands while engaging the aircraft arrestor cable at RAAF Base Amberley, Queensland. The RAAF's aircraft arrestor systems are lifesaving devices utilised in fast jets in the event of an emergency. Arrestor hooks are an example of the non-structural aircraft components that can be repaired, rather than replaced, using laser additive deposition (LAD) techniques.

KEY MESSAGE
Science & Technology

I have said previously that the thing that drew me to the role of Australia's Chief Defence Scientist was the absolute focus of defence scientists and engineers on pulling ideas through to outcomes for the Australian Defence Force.

It continues to inspire me today, and I acknowledge the critical role that organisations like DMTC play in partnering with us to deliver these outcomes.

For over a decade, DMTC and DSTG have been partners in developing industrial capability to give effect to Australian science and research strategy. Across a number of domains, DMTC's status as a trusted partner has allowed us to collaborate at a level which delivers outstanding results, and lifts previously disparate activities into strategically-focused programs of work.

The speed and broad impact of technological changes present Defence with both challenges and opportunities, the first among them being to resolve how to translate these technological advances into new Defence capability, in the areas that matter most to the warfighter and that generate opportunities for developing sovereign industry capabilities.

DSTG will continue to conduct high quality research to solve those problems that can only be addressed within the Australian Government, and remains committed to supporting operations and advising on the acquisition and sustainment of Defence capability.

Moving forward, DSTG will also play a stronger role in enabling and coordinating support to Defence from a national S&T enterprise, critical elements of which include other publicly funded research agencies (PFRAs), universities, large companies, small to medium enterprises (SMEs), entrepreneurs and organisations like DMTC. DSTG's new STaR Shot missions embody this spirit of collaboration. It is through partnerships such as these that Australia's defence challenges can be addressed and sovereign industrial capability can be realised.

In translating research outcomes into industrial capabilities, at scale, our partnership with DMTC has already fostered the creation of stronger, more diverse teams who are able to tackle the broad defence and national security challenges facing Australia. I am delighted that some of that work has been recognised with national awards, including the National Defence Innovation Award and the Innovation Award for Platforms and Propulsion at the prestigious PACIFIC 2019 Innovation Awards.

I also acknowledge DMTC's proactive approach to embracing workforce diversity as a driver of innovation for Defence and Australia more broadly. Without fanfare, DMTC has put some strong runs on the board in this regard for some time and I look forward as this journey continues, to our continued partnership.

I congratulate Mark and the DMTC team, and all of the partners involved, on the collective achievements showcased in this Report.

Professor Tanya Monro
Chief Defence Scientist
Department of Defence

CHAIR'S Report

The Government has a declared long-term vision ***to build and develop a robust, resilient and internationally competitive Australian defence industrial base that is able to meet defence capability requirements***. The Board is heartened by the alignment with DMTC's mission and vision statements.

This demands an appetite for innovation and technology development and a focus on achieving shared outcomes that, in turn, become a springboard for continuing success.

The ability of the DMTC team to maintain this course and continue to achieve positive outcomes across the partner group is all the more impressive when the turmoil and upheaval of the COVID-19 pandemic is taken into account.

The Board acknowledges the efforts of all of the management team in the period covered by this Report. In particular, we commend the team for the way that they have maintained a positive mindset and pursuit of continued growth rather than adopting a survival mode.

The Board of Directors has continued to set high expectations in terms of governance, financial management and programmatic outcomes. These elements underpin the value that DMTC can realise for its partners.

I thank my fellow Directors for their respective contributions to a collegiate, consensus-driven and outcome-focused Board. In the latter part of 2019, we were delighted to welcome Air Marshal (Retd) John Harvey AM to the Board. John's experience and expertise in the sector stand him in good stead, and he is already making a valuable contribution to the DMTC Board.

The DMTC Annual Conference held in early March 2020 was a fitting showcase of DMTC collaboration with its partner group. This year's Awards for Excellence celebrated both long-time contributors to DMTC and the PhD candidates and early-career researchers who are so critical to the aspiration for future success across the industrial and research sector.

DMTC has always supported pathways for early-career researchers into the defence sector, and contributed to boosting the pipeline of young and innovative Australians who can progress from academia to applied research and on to employment in related industries. In this respect, the research provider and the industry employer and DMTC are all playing an important role in realising the Government's long-term vision for Australia's defence industrial base. It is a vision that will not be realised through short-term, transactional approaches.

In the context of discussions around national resilience and enhancing Australian industry capability, future-focused investments that Australia makes in industrially-relevant research and development have arguably never been so important. The Board is committed to DMTC playing a critical role as Australia builds new capability and self-reliance for Defence as we emerge from the shadows of the pandemic.

It is my great pleasure to present the DMTC Annual Report for 2020.

Mr Tony Quick
Chair, DMTC

CEO'S Report

DMTC's reputation and credibility in the defence and industrial sector has been hard-earned and demands constant attention. In many respects we stand on the shoulders of our capable industrial and research partners, who continue to work with us to embrace the challenge of **capability through collaboration**.

Our focus on the breadth and depth of Australia's industrial capacity to support defence capability outcomes has only been reinvigorated by the national response to the COVID-19 pandemic. Issues of resilience and capacity, which Defence has been grappling with for some time, now have a renewed urgency and national focus.

Defence has made renewed commitments to some of the key concepts in the landmark 2016 White Paper and policy suite. Significant announcements about future investment forecasts have been matched by strong support for innovation, sovereign industrial capability and industrially-focused research. In their response to the COVID-19 pandemic, Defence's leaders have also provided brilliant leadership and flexibility in engaging openly, transparently and flexibly with industry, including DMTC, which is gratefully acknowledged.

The business of innovation leadership is fluid and diverse. For organisations like DMTC, we need to carefully balance the credibility and reputation that our proven operating model enjoys with being open to new approaches. We need to be innovative about how we innovate but we need to do so in a structured and strategic way. DMTC has shown that harmonising the cultures and success drivers of the research sector, the industrial sector and government practitioners is not only possible, but delivers great benefits. Successfully integrating the different motivations, drivers and approaches creates an environment for purpose-driven collaboration. This is where the magic happens.

For me, the response to the COVID-19 pandemic has only reinforced the importance of the concept of '**line of sight**'. With it, individuals, teams, and whole organisations can confidently overcome bumps along the way because they are working towards a shared objective. Without it, trust can be lost, approaches can be fragmented and the bumps along the way can seem insurmountable.

I am enormously proud of the DMTC team and the way that everyone has responded to the challenges that this year has thrown at us. Our partners, too, have risen to the challenge and our collaborations have produced some stunning results, including breakthroughs in technology development and the pivot of existing Medical Countermeasures (MCM) activity to respond to COVID-19.

During the year covered by this Report, we have extended our engagement across government agencies, welcomed new partners to DMTC activities and added expertise and depth to our DMTC management team. All of these additions are positive signals for the future and, while this Report focuses on looking back to past achievements, in doing so it provides a line of sight to the future and a great deal of confidence for continued success.

I commend the Report to you.

Dr Mark Hodge
CEO, DMTC

ABOUT US
DMTC

OUR Vision

To develop technology solutions and provide advice enabling industry to enhance Australian Defence and national security capability.

OUR Mission

To create and enhance Australian industrial capability and skills through designing and executing collaborative technology development and innovation activities in the defence, national security and related sectors.

OUR Values

Inclusive. Committed. Inspiring. Trusted.

underpinned by **Integrity**

OUR Approach

DMTC operates through an extensive network of innovation and technology development partners, in Australia and across the world. DMTC works across multiple specialist disciplines to support the development of sovereign industrial capability for Australia's defence and national security agencies.

DMTC leads and manages collaborative efforts involving government, industry and research partners to enhance Australia's industrial capacity and capabilities. Our catchcry of **capability through collaboration** has been a mainstay of our business in over a decade of successful project management.

DMTC respects and values differences because it recognises that when people come together from different backgrounds and with different points of view, the organisation is better placed to deliver greater value to partners and customers in Defence, industry and the research sector.

In 2020, DMTC is consolidating its approach to diversity and inclusion, and creating a plan for action that the organisation will strive to implement, as we continue to develop and mature our approach.

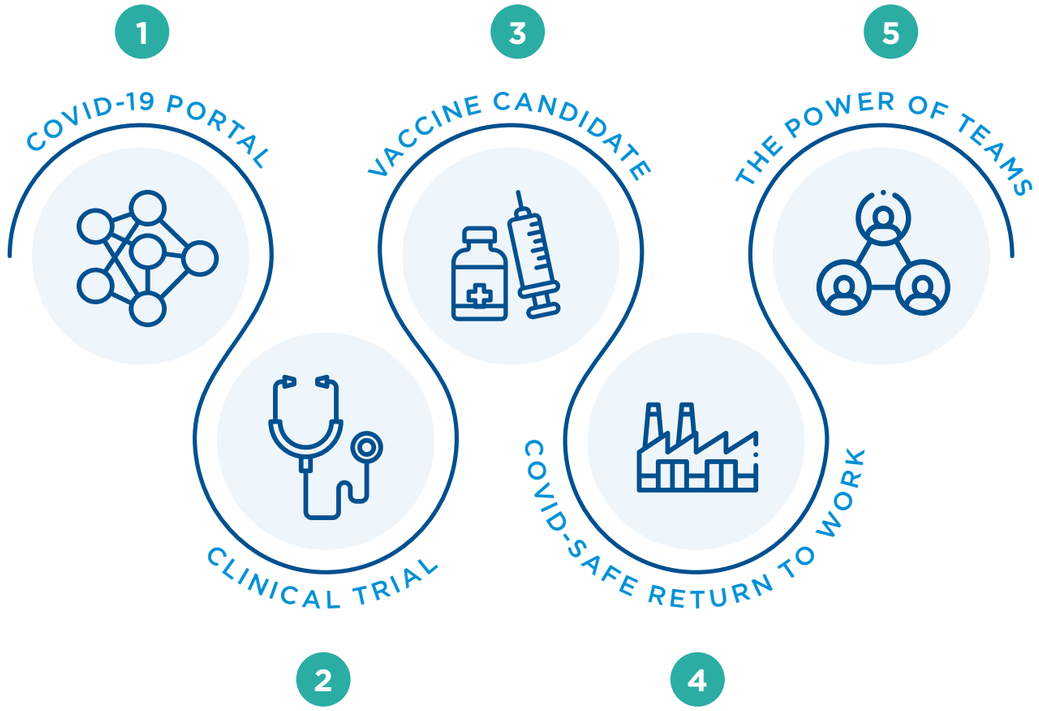
Dr Philippe Laniakea from UNSW Canberra Space holding the Imaging Payload Assembly (IPA) with the composite Ti-6Al-4V / Invar36 optical mount, which is scheduled to be launched into orbit as part of the M2 mission in February 2021.

"I'm very proud that DMTC has always had a strong focus on diversity and this will continue to be a key component of our approach to innovation. New perspectives are a vital input to our decision making and business processes and I'm absolutely convinced they make us a better organisation. "

Mark Hodge, CEO DMTC

COVID
Response

DMTC has played a key role to support Australia's response to the COVID-19 pandemic. Efforts have included establishing a national Technology Capability Portal, coordinating a clinical trial and providing expert advice on a leading vaccine candidate. DMTC has engaged intensively with government agencies, taskforces, academic institutions and industry groups to harness expertise and most effectively deploy resources.



COVID
Response

1 COVID-19 Portal

Established in May 2020, the **National COVID-19 Technology Capability Portal** provides an online collaborative platform to rapidly respond to COVID-19 technology proposals on behalf of government agencies and stakeholders. The Portal's development was supported by the Department of Defence under the guidance of the Defence COVID-19 Taskforce's Industry Support Cell.

The COVID-19 Portal connects academic and industry sectors with government and has evolved to become an effective triage mechanism for a broad range of industry-initiated COVID-19-related innovation proposals, spanning manufacturing solutions and MCM. The Portal is highly adaptable and efficient at assessing technology proposals, and has ensured that innovative ideas have contributed to growing our in-country pandemic response capacity.

2 CLINICAL Trial

In February, DMTC responded to a request from the Department of Defence to sponsor and lead a clinical trial, to determine the effectiveness of chloroquine as a pre-exposure prevention measure against COVID-19. The MCM Program Leader, Dr Felicia Pradera, rapidly coordinated a team of industrial partners together with the Australian Defence Force Malaria Institute (ADF-MIDI) to conduct the trial.

Commencing in April 2020, the trial's focus was on protecting Australian frontline healthcare professionals through the re-purposing of a known anti-malarial drug. The trial was developed for Australia but in an international context, with extensive consultation to ensure alignment with international trial activities, coordinated by the likes of the World Health Organisation and the Gates Foundation. DMTC's Investigator Brochure was shared with both organisations as reference material for other trials being conducted worldwide.

3 VACCINE Candidate

DMTC was engaged by the Queensland Government to provide independent technical evaluation, product development and risk management advice on a potential COVID-19 vaccine candidate under development at the University of Queensland (UQ). DMTC's final report included a range of expert inputs and was delivered in July 2020.

Two existing DMTC MCM projects were able to rapidly pivot to respond to COVID-19. More information on these projects can be found on page 23. Dr Felicia Pradera was appointed to the Government's Science and Industrial Technical Advisory Group for COVID-19 Vaccines and Therapeutics, led by Secretary of the Department of Health, Dr Brendan Murphy.

4 COVID-SAFE Return to Work

In the early months of the COVID-19 pandemic, DMTC teamed with the Advanced Manufacturing Growth Centre to produce a video highlighting four simple steps that Australian small businesses and manufacturers could take in ensuring a safe return to the workplace. The video reinforced the message that resilient supply chain partners can work together to get the job done, while also ensuring they followed the Government's safe work principles. (COVID-Safe Return to Work video)

5 THE POWER of Teams

In addition to looking out to enhance Australia's response to the COVID-19 pandemic, the DMTC team also responded by looking out for each other, achieving what CEO, Mark Hodge, described as "stunning results". With its head office in Victoria closed during the state's lockdown period, working from home and online meetings became the norm rather than the exception. Challenges based on regular exercise and a popular weekly gathering called 'Portrait of a Teammate' helped to ensure that, while physically distanced, team members remained socially connected.

RECONCILIATION
Actions

Relationships | Respect | Opportunities

Acknowledgement of design

DMTC would like to express thanks to Jenny Johnson for her outstanding work and immense contribution to our Reconciliation Action Plan. We acknowledge Jenny's connection to Wiradjuri Country and pay our respects to its elders past, present and emerging .

Jenny has created an original artwork that adds a very special dimension to our commitment to reconciliation. This artwork is on display in DMTC's head office and has had a unifying effect throughout the design of our Reconciliation Action Plan.

DMTC's Reconciliation Action Plan is available on request.

RECONCILIATION
Partnerships

In early 2020 DMTC began developing a Reconciliation Action Plan in support of the substantial contribution that First Nations people make and can continue to make to society, not least in the area of professional business operations. Being bold in seeking to unlock opportunities for Aboriginal and Torres Strait Islander businesses in our economy, including in the defence sector through DMTC, is an important step on Australia's reconciliation journey.

DMTC's formal efforts towards advancing reconciliation began in mid-2018 through engaging with the Indigenous Defence and Infrastructure Consortium (IDIC). The discussions resulted in the development of a Memorandum of Understanding that was signed by DMTC CEO Dr Mark Hodge and IDIC CEO Mr Adam Goodes, at DMTC's Annual Conference in March 2020 (pictured below).

Our partnership with IDIC is one way in which we seek to support the goal of creating 'defence-ready' Aboriginal and Torres Strait Islander-led and owned companies across Australia and creating opportunities for companies that wish to partner with us. To do so, we will collaborate and partner in:

- development of pathways for Aboriginal and Torres Strait Islander businesses to engage in the defence and infrastructure sectors
- development of pathways and training for Aboriginal and Torres Strait Islander people to gain employment in the defence sector
- development of networking, training and development programs, and
- pursuit of partnership and business opportunities.

In June 2020, DMTC engaged Indigenous-owned company Willyama and its team of security analysts to undertake a comprehensive cyber security audit of systems to be deployed through DMTC's Industry Capability Development (ICD) Program. This was the first significant undertaking under the MOU and work is continuing to build this broader engagement on cyber resilience into the ICD program.

DMTC sees many opportunities for highly capable Indigenous-led and owned businesses to make a significant and positive mark in the defence industry.

TECHNOLOGY
Progression

Technology Readiness Levels (TRLs) are a key component of DMTC's approach to technology development and innovation. The TRL scale provides an internationally standardised tool for planning, managing and tracking progress of technology maturity towards expected outcomes.

This table provides highlights from across DMTC's portfolio of program and project activity in 2019-20. The ICD Program is not included here as its focus is on technology transfer rather than the creation or advancement of new technologies.

DESCRIPTION	Continuation of previous DMTC work	Performance against milestones in 2019-2020	Schedule	Technology roadmap	
				TRL Journey (project life)	TRL Snapshot (as at June 2020)
MARITIME PROGRAM					
Field trial of hydraulic actuator incorporating HVOF technology	Yes	Milestones met	Complete	6-8	8
Additive manufacturing & repair of ship components	Yes	Milestones met	On track	4-6	5
Cold spray repair and additive manufacturing of submarine components	No	Milestones met	On track	2-6	2
Steel characteristics and grade selection for vulnerability reduction in Australia's future frigates	Yes	Milestones met	On track	3-5	5
Blast and shock modelling – complex numerical models to assess vulnerability	Yes	Milestones met	Extended to allow for further analysis and development	2-6	6
Develop fabrication techniques using ferroelectric ceramics	No	Milestones met	On track	2-4	3
Characterisation and development of single crystals (SSCG method)	No	Milestones met	On track	1-5	4
Technology maturation of superconducting cryocooling systems for a naval environment	No	Milestones met	On track	4-6	4
High temperature superconductors for minesweeping	No	Milestones met	On track	2-3	3
LAND PROGRAM					
Automated Offline Manufacturing – weld monitoring and defect identification system	Yes	Milestones met	Complete	5-7	6
Networked FAST Collaboration • Materials • Sensors • Modelling (digital twin)	Yes	Milestones met but with minor delays due to COVID-19 impact on lab access	Extended to allow for further plan and design work for offsite installation	3-4 3-5 4-6	3 4 5
Blast Modelling - relating soil buried blast impulse to steel pot blast impulse • Generic vehicle model • Impulse prediction model	Yes	Milestones met	Complete	3-4 5-6	4 6
AIR AND SPACE PROGRAM					
New corrosion coating technologies for light metal components (aerospace)	Yes	Milestones met	On track	2-5	4
Wire Arc Additive Manufacturing of aluminium alloy aerospace components • Path development and programming • Large material geometry	Yes No	Milestones met Milestones met	On track On track	4-5 2-4	4 3
Developing a compact, spatially agile spectral sensor (C-SASS)	No	Project has exceeded expectations	On track	3-5	6
Advanced manufacture of CubeSat components • Casting route • Additive manufacturing route	No	Additively manufactured components made, assembled and tested	Complete	3-6 3-6	8 6
Distributed LiDAR capture and process	No	Project commenced in April 2020	On track	4-6	4
MEDICAL COUNTERMEASURES PROGRAM					
Developing novel treatments to inhibit key elements of bacterial pathogens	No	Milestones achieved	On track	3-5	4
Rapid diagnosis of microbial infections without culture	No	Milestones partially met	Milestones partially met	3-5	3-4
Molecular genetics platform for rapid point of care detection	No	Milestones achieved	On track	Detection Kit: 4-5 Pathogen specific: 3-4	4
Rapid identification of bacterial and viral agents using bioinformatics approach	No	Milestones partially met	Delays due to COVID-19	3 to 7	4
Pilot flow chemistry production line and scale-up	No	Milestones achieved	On track	3-5	3
Development of non-reactogenic human Q Fever vaccine	Yes	Milestones achieved	On track	2-4	2
Development of new therapeutic against chemical threat	No	First Milestone due in 2021	On track	2-4	2-3
Universal malaria vaccine candidate	No	First Milestone due in 2021	On track	4-6	4
Development of sovereign flow chemistry manufacturing capability	No	First Milestone due in December 2020	On track	2-6	2
ENABLING TECHNOLOGIES PROGRAM					
Investigating potential applications for hybrid composites • Testing methodologies • Manufacturing processes • Properties database	Yes	Milestones met	Complete – extended to September 2020 to allow for task completions	4-7 3-4 3-6	5 4 5
Functional antenna structures • Integrated antenna system for a land-based Defence application • Cost-effective manufacturing for integrated antenna system • Modelling tools	Yes	Milestones met	On track	4-7 4-6 4-6	5 4 5

MARITIME
Overview

The Naval Shipbuilding Plan released by Government in 2017 set an ambitious agenda of establishing a continuous naval shipbuilding and sustainment program for Australia. With the Arafura Class Offshore Patrol Vessels and Guardian Class Patrol Boat build programs now in full swing and design efforts ramping up for the Hunter Class Frigate and Attack Class Submarine programs, attention is turning to how Australian Industry Capability can be enhanced to maximise Australian industry participation in current and future programs.

The Naval Shipbuilding Plan (*As at October 2020 work is underway on a substantial revision to the Plan which will be known as the Naval Shipbuilding and Sustainment Plan*) provides both an appetite, and the necessary lead-time, for Australia's industrial capacity and capability to be built up so that Australian industry is well positioned to take full advantage of supply chain opportunities in shipbuilding and sustainment.

DMTC is central to this mission, providing industrial innovation leadership alongside the science and technology strategy led by DSTG. DMTC and DSTG's efforts are coordinated, complementary and designed to evolve as shipbuilding programs progress. This has seen DMTC work with Navy, CASG and DSTG on how themes of work from different Defence programs can be managed under one umbrella.

An example is DMTC's work in the development of piezoelectric materials for sonar applications that aligns directly with DSTG's STaR Shots mission focused on Remote Undersea Surveillance. The creation of an *Advanced Piezoelectric Materials and Applications Program* will establish a strategic national capability in advanced piezoelectric materials. Such an innovation pipeline from investment in strategic sovereign scientific capabilities through to the development of specific Defence applications would not be possible if programs operated in isolation. This model has the potential to be applied in other areas of the Naval Shipbuilding Enterprise.

Pictured opposite: Collins Class submarines HMAS *Collins*, HMAS *Farncomb*, HMAS *Dechaineux* and HMAS *Sheean* in formation while transiting through Cockburn Sound, Western Australia. DMTC's work with partners ASC and CSIRO aims to advance repair technologies that will allow Australian submarines to remain at sea longer, without the need to dock for lengthy repairs. More details on Page 21.

MARITIME
Highlights

Hunting for solutions

As mine warfare countermeasure systems in modern naval platforms are upgraded to account for evolving threat environments, design constraints with power, weight and space margins are ever-present. Advances in technology that increase countermeasure capability without compromising these design constraints will play an important role in current and next generation maritime platforms. High Temperature Superconductors (HTS) and their application to minesweeping systems possess the ability to address a number of these issues concurrently.

Queensland University of Technology (QUT), Siemens Energy and DSTG Group are currently engaged with DMTC on understanding the risks of utilising cryocoolers in a naval environment. To complement this research, a scoping study was conducted, led by Systems Planning and Analysis Australia, and incorporating input from existing program partners, into the feasibility and application of HTS for minesweeping. The study concluded that HTS could provide the ADF with an effective, supportable and deployable magnetic influence minesweep solution. Phase 2 of the project is currently being defined to align with the SEA1905 Maritime Mine Countermeasures program to revolutionise the ADF's approach to mine warfare.

Each of the DMTC program partners bring unique experience and expertise to minesweep technologies; Thales Australia manufactures and sells minesweeping systems internationally; Siemens and QUT have been on the forefront on the application of HTS technology for over 15 years in the maritime domain and DSTG has undertaken studies to evaluate the trapping of magnetic flux in superconducting materials as a potential evolution in technology.

As navies embrace operations that seek to increase tempo, organic mine countermeasures will be a critical enabler, especially when deployed through autonomous systems.

Improving material grades

Australian Naval Infrastructure's development of the Osborne Shipyard in South Australia is providing ASC Shipbuilding, now a subsidiary of BAE Systems, with a world-class facility that will be an integral part of the Hunter Class Frigate Program, but also of Australia's sovereign capability in naval shipbuilding for decades to come.

The welding equipment being installed at the Osborne Shipyard is state-of-the-art and trials have shown that the twin wire systems being installed for panel construction leads to minimal panel distortion. ASC Shipbuilding continue to look for ways to maximise shipyard productivity and have identified opportunities to further improve both weld sequencing and the robotic programming required for curved panels. These are both areas in which DMTC and its partners at ANSTO and University of Wollongong (UoW) have extensive experience. DMTC is excited to be working with ASC Shipbuilding to embed this expertise in the Hunter Class Frigate Program.

DMTC is also working with ASC Shipbuilding to better understand how Statistical Process Control can be implemented into their shipyard welding processes. By utilising real-time weld data, defects may be identified at the source instead of downstream at an inspection or rework station, which has the potential to greatly increase productivity and weld quality.

DMTC is also working with BlueScope Steel, DSTG Group and UoW to improve the capability of naval platforms through development of an Australian solution for the production of DH36 or EH36 shipbuilding steel grades, with improved microstructure and inclusion characteristics. In a significant step towards a sovereign capability solution, ASC Shipbuilding has purchased a quantity of the new steel for production trials.

MARITIME
Highlights

Modernised manufacturing

Additive manufacturing (AM) in the maritime domain is naturally focused on large scale components with an emphasis on repeatability, certification, design and engineering aspects that are required for successful integration of AM products onto platforms. AM techniques that lend themselves to large components include the welding process of wire arc additive manufacturing (WAAM) and the cold spray process.

DMTC has a long history of working with partners MacTaggart Scott Australia, UoW and DSTG in the use of WAAM for the production of subsea components made from Nickel Aluminium Bronze (NAB). The team is now adapting WAAM for use in defect repair on large casted NAB components, including scanning of the defective region and automated deposition techniques to fill the void regions, with sensing systems and post process heat treatment incorporated, to ensure the repaired component can maintain their qualification against relevant standards.

DMTC is expanding its work in maritime AM with one project underway and further activities in the pipeline. DMTC is currently working with partners ASC and CSIRO to develop and specify cold spray repair methodologies for Collins Class submarine components and the AM of weld consumables, to prove that cold spray repair methods are suited to repairing components to the level required for their in-service environment. Cold spray repairs allow for the repair of components without causing distortion or microstructural changes in the base metal. Successful development of the cold spray technique for this specific application will allow Australian submarines to remain at sea longer, without the need to dock for lengthy repairs.

UNSW PhD candidate, Miss Scarlet Kong measures the electrical charge output from a textured piezoelectric ceramic sample (pictured in inset image). This work is part of a DMTC project investigating textured piezoelectric ceramics for next-generation sonar systems with enhanced performance and large-scale processing capability.

Dr Joanne Macdonald, Chief Scientific Officer at Australian diagnostic start-up BioCifer, reviews the novel amplification process for a new rapid diagnostic technology that can produce results from raw samples within 20-40 minutes, without centrifuge. More information on this collaborative DMTC project involving BioCifer, University of Sunshine Coast (USC), UQ and CSIRO can be found on Page 26.

MEDICAL COUNTERMEASURES
Overview

The MCM Program has continued to deliver successful industry-research collaborations that enhance Australia's defence and national security capabilities. Over the past five years, the program has progressed more than 20 collaborative vaccine, therapeutic and diagnostic projects against a range of Chemical, Biological and Radiological (CBR) and infectious disease threats.

Currently, the program has 10 active projects, comprising two therapeutics, two vaccine candidates, four rapid diagnostics, and two manufacturing scale-up projects. This diversity in our project portfolio enables the program to contribute to addressing military and public health capability gaps as well as developing Australia's sovereign resilience.

The MCM program has benefited from strong engagement with its Stakeholder Group, a senior whole-of-government advisory group with representatives from the Department of Defence; Department of Health; Department of Industry, Science, Energy and Resources; the Department of Foreign Affairs and Trade and most recently the Department of Home Affairs. In light of the COVID-19 pandemic, this Stakeholder Group has had an even more significant role in directing and prioritising our collective response to the pandemic.

Furthermore, consistent with the aims of the MCM Program, Defence provided funding and support for DMTC to sponsor a clinical trial to determine the effectiveness of chloroquine as a pre-exposure prevention measure against COVID-19, in collaboration with ADF-MIDI.

The MCM program is an agile and adaptive mechanism which can pivot to provide direct investment into priority areas. It has also proven itself as a credible model for product development, backed by a strong national and international network. This year, two of DMTC's rapid diagnostic projects were able to quickly respond to SARS-CoV-2, one involved in detecting the virus and the other modifying a universal buffer to inactivate the virus. Furthermore, two of DMTC's flow chemistry manufacturing projects are involved in the scale-up of two therapeutics in high global demand. These projects contribute to supply chain security and building our in-country capacity, while also enhancing workforce skills in flow chemistry manufacturing.

This year has also seen the appointment of Dr Leigh Farrell as Head of Health Security Strategy at DMTC. Dr Farrell joins Dr Pradera as co-lead for the 2020-2021 **National Health Security Resilience Assessment**, which will revisit and expand on the focus of previous National Capability Audits undertaken in 2012 and 2017.

MEDICAL COUNTERMEASURES
Highlights

Scale-up of vital manufacturing processes for in-demand therapeutics

DMTC is collaborating with academic and industrial partners across Australia to develop novel manufacturing processes which can be scaled to produce in-demand therapeutics, a key contributor to supply chain resilience.

The COVID-19 pandemic has brought to light several critical areas that Australia needs to focus on to achieve sovereign sustainability. One of these is establishing scalable manufacturing processes that can be used to rapidly produce a range of therapeutics, which may have been in higher than expected demand or at risk of interrupted supply. Diverse supply chains are important in ensuring supply chain resilience in times of crisis.

Two projects in the MCM portfolio focus on delivering novel and scalable manufacturing processes for in-demand therapeutics.

One of these projects is a collaboration between 60 Degrees Pharmaceuticals Australia (60P), the University of Melbourne (UoM), Australian strategic biopharmaceutical consulting company Biointelect and CSIRO. This project is accelerating the development of a unique flow chemistry manufacturing process, designed by experts at the UoM, for a therapeutic asset that has recently been approved for the prevention of malaria.

While malaria is not endemic to Australia, it remains both a public health threat, as well as a threat to Australian defence force personnel. Australians are susceptible to the disease when travelling in tropical regions, such as in our neighbouring South East Asian nations, and there are several hundred imported cases annually. However, there is concern that malaria could become endemic to Australia, as mosquito vectors begin to travel to far North Queensland, and local transmission could become a future issue.

This project is also important from a supply chain perspective, as the intellectual property and manufacturing will be retained in-country. If successful, this project could secure the Australian supply chain for this antimalarial drug. Furthermore, the manufacturing process could be applied to other key pharmaceuticals that are in global demand.

The second manufacturing project in the MCM portfolio is a collaboration between Australian chemical manufacturing company, Boron Molecular and CSIRO. The objective of this project is to pilot a scaled manufacturing plant using flow chemistry for an in-demand therapeutic asset. A synthetic route to produce the therapeutic asset will be established, and a scaled flow reactor will be designed to test production.

Both projects utilise flow chemistry. This process enables a chemical reaction to be run continuously and allows for a higher surface area to volume ratio, improving heat removal efficiency. It is often safer, more precise, and less expensive than traditional batch manufacturing.

Both projects aim to develop Australian capability in therapeutic manufacturing and are important in mitigating the risks associated with global supply shortages of key pharmaceuticals required in Australia. Ensuring a secure and stable local supply chain builds our in-country capacity, and enhances the skills of our workforce, contributing to sovereign resilience, which is critical in the face of current global therapeutic shortages.

MEDICAL COUNTERMEASURES
Highlights

Development of a universal malaria vaccine

DMTC is collaborating with James Cook University's Australian Institute of Tropical Health Medicine (AITHM), Townsville Hospital, Glycosyn and Pfizer Hospira to develop a universal malaria vaccine candidate that can protect against all strains, species, and life-cycle stages of malaria.

The universal vaccine candidate for malaria being developed at AITHM is the only candidate to meet the globally endorsed Target Product Profile. Led by renowned malaria expert, Professor Louis Schofield, the team is working on GPIVax, a first-in-class carbohydrate-based malaria vaccine candidate that has the ability to prevent both malaria infection and disease transmission.

Malaria remains one of the world's deadliest diseases, responsible for over 400,000 deaths a year and is a threat to Australian Defence personnel deployed in tropical regions worldwide. It is also a complex disease to vaccinate against as there is a diversity of both species and strain. There is growing resistance to certain anti-malarials, which has made treatment more difficult in some endemic areas, and made the need for an effective vaccine more critical.

GPIVax has shown strong preclinical efficacy against all species and strains of the malaria parasite, and each of these life-cycle stages, blocking sequential development of the parasite. This DMTC project is stage-gated and firstly will focus on pre-clinical vaccine toxicology work. Once pre-clinical toxicology studies are successfully completed, a Phase 1 clinical study will be conducted in Australia. In addition, this project will establish a manufacturing process for the vaccine that can be scaled, and compliant with Good Manufacturing Practice (GMP) standards, to ensure a high standard of safety in production.

If successful, this DMTC project could become the first universal malaria vaccine, produced in Australia, that could be used to vaccinate and protect both locally and globally against the malaria parasite. This project also contributes to extending Australia's vaccine development capability, and is crucial for developing self-reliance and creating new market and export opportunities for Australian industry.

LOOKING AHEAD

DMTC will continue to coordinate technology solutions as part of our national COVID-19 response. Building supply chain resilience and pursuing rapid and innovative responses to the local and global challenges posed by COVID-19 will assist in the short-term response as well as contributing to longer-term economic recovery.

In view of the pandemic, Government stakeholders requested that DMTC bring forward the next audit of MCM development to 2020-2021. Renamed the **National Health Security Resilience Assessment** (NHSRA), this assessment will guide the development of future technologies that contribute to Australia's sovereign preparedness (more information can be found on the DMTC website www.dmtc.com.au).

MEDICAL COUNTERMEASURES
Highlights

Platform diagnostic for rapid point of care detection

This DMTC collaboration between industrial partner BioCifer, the USC, the UQ and CSIRO, aims to deliver a rapid point of care platform diagnostic based on molecular genetics technology that has high sensitivity and enables the detection of multiple diseases within a single test kit.

This rapid diagnostic platform operates using a three-step “test-kit” procedure, whereby an extraction protocol is used on raw samples for 5-10 minutes (including blood, tissue and swabs), without requiring centrifuge. Following the extraction, an isothermal amplification procedure is used to rapidly amplify the nucleic acids for between 5-30 minutes, and detection occurs via lateral flow strips within five minutes.

This project focuses on Nipah virus, Dengue virus and Antimicrobial Resistance (AMR) bacteria detection. A Hendra virus test is also being developed for use in this platform diagnostic.

Carbapenemases are Beta-lactamase enzymes and work as a mechanism for resistance against many types of antibiotics. Detecting carbapenemases allows screening for multi-drug resistant bacteria, which is particularly relevant in light of growing global antimicrobial resistance AMR.

Both Nipah virus and Dengue virus are not endemic to Australia, however, both are viral infections that pose significant risks to Australians travelling overseas, particularly in South-East Asia. Nipah virus has a particularly high mortality rate, and the Dengue virus has four serotypes and can cause a particularly deadly disease called Dengue haemorrhagic fever. A rapid diagnostic will assist in obtaining a more rapid diagnosis and isolation of these viral infections.

The project team are currently conducting preclinical validation for target pathogens. They have completed the primer and probe design for their rapid Nipah test and for their various resistance enzyme tests for AMR detection.

As this project is a platform technology, the primers and probes within the amplification tube can be swapped for different genetic markers, allowing for the detection of multiple diseases. It is also low-resource and cost, as no centrifuge or equipment is required for sample processing. In addition, it can deliver a similar sensitivity to laboratory-based molecular genetic tests. Such platforms are particularly important in field deployable settings, where the ADF can be exposed to multiple pathogens at one time, especially when deployed in the Asia-Pacific region.

Success of preclinical studies will allow BioCifer to scale-up production of the rapid diagnostic platform, compliant with clinical manufacturing standards, and commercialise the outputs from this DMTC project.

Pictured opposite: Mr Joshua Boyle, a Senior Scientist with Melbourne-based industry partner Boron Molecular, adjusts the continuous flow reactor used as part of the DMTC project piloting a scaled flow chemistry manufacturing plant. This project will advance in-country pharmaceutical manufacturing and enhance supply chain capacity.

ENABLING TECHNOLOGIES
Overview

A strong and consistent focus of DMTC's work has been to advance platform-independent technologies that have broad applications across different Defence domains.

DMTC's Enabling Technologies Program uses a range of evolving technologies from leading Australian research to derive industrial outcomes, seeking to deliver both reductions in manufacturing time and cost and maintain or enhance quality and performance.

A major theme in the Program is work on advanced composites and functional materials, to characterise and assess the performance of a range of hybrid composite candidates with regard to their potential adoption in the defence sector.

Composite materials are already widely used in the aerospace industry and in other sectors including automotive and infrastructure, however the rate of adoption in the defence sector to date has been far slower.

In August 2020, Defence released an Industry Plan for the sovereign industrial capability priority related to land combat and protected vehicle production and technology upgrades. The plan highlighted the design, development and industrialisation of survivability and signature reduction material technologies and processes as one of four critical industrial capabilities for Australia, to contribute to the availability and operational effectiveness of land combat and protected vehicle platforms.

The plan also identified future trends and technology evolutions, such as the development and study of new materials intended to reduce system and platform weight, and to enhance survivability and composite armour solutions for evolving ballistic and blast threats. DMTC is well-positioned to contribute to Defence's priorities in this area through the work of partners in the Enabling Technologies Program.

ENABLING TECHNOLOGIES
Highlights

Advancing antenna design

In our special 2018 feature report on DMTC's first decade of achieving breakthroughs for Defence through collaboration, we highlighted a long-running DMTC collaboration with industry and research partners on the integration of communications system capabilities into load-bearing structures. This work was able to be progressed in 2019-20 under DMTC's services contract with the Defence Innovation Hub in a project involving DSTG, Thales Australia, Penguin Composites and UQ.

Initially designed for application to military aircraft and surface ships, this work on integration of systems is now also focused on protected mobility vehicle platforms. Conformal antennas remove or reduce the need for structures to protrude from a vehicle with benefits including lighter weight, reduced likelihood of component damage and vehicle signature.

Advances under the most recent extension of this project have included finalising a design for a cavity-backed spiral antenna structure containing both structural and functional (antenna) elements. Materials utilised include ferrite and ultra-high-molecular-weight polyethylene (UHMW-PE) selected for their electromagnetic properties, and stainless steel and glass-fibre reinforced epoxy which serve both structural and electromagnetic purposes. The radiating antenna element is made of copper foil.

Working around COVID-19 challenges including delays in access to research laboratories and manufacturing facilities, the project partners are undertaking a mix of both experimental and numerical investigations to characterise materials under representative service loads to compare and validate the hybrid antenna structures against conventional materials used in land platforms.

The team has successfully fabricated a first prototype that represents a physical scaling-up of technology previously demonstrated for aerospace applications, to a size and operational frequency required for land-based Defence applications. Because it is surface-conformal, the antenna laminate structure can be bonded to any metallic or composite component. The benefits to Defence of conformal antenna technology are more durable, serviceable communications systems, and fabricating this prototype is the first step in validating the developed antenna design.

Pictured opposite: Dr Azadeh Mirabedini from SUT, Dr Dennis Antiohos of Imagine Intelligent Materials and Dr Nishar Hameed from SUT at SUT's Factory of the Future. Novel solutions being progressed by DMTC to achieve improved functional capability for the next generations of vehicle components include both laminate structures and compounds with embedded nanoparticles. A team from SUT and industry partner, Imagine Intelligent Materials is leading research in the development of graphene nanoparticle (GnP) structures that can deliver significant advances in vehicle signature controls. The project has allowed industry partners Thales Australia and Penguin Composites to extend their knowledge of the performance characteristics of GnP materials, and the routes to achieve efficient and effective manufacturing.

LAND
Overview

The Australian Army is seeking to realise a step-change in capabilities that aligns with a vision for a protected, connected, lethal and enabled force.

Land combat vehicles as well as next-generation soldier systems and combat clothing survivability and signature reduction technologies, have been identified by Defence as sovereign industrial capability priorities.

With an extensive network of innovation and technology development partners in Australia and globally, DMTC works across multiple disciplines to support the development of key elements of these sovereign industrial capabilities.

Our collaboration model accelerates technology development and supports rapid utilisation and adoption of new technology. In Land and other domains, DMTC has identified key areas of technology forecasting and development to pursue. Among them are the application of **smart automation, robotics** and **machine-learning**, and **digital twin** technologies.

Digital twin concepts have many applications across the defence sector and benefits at each step of the manufacturing process from engineering and design through to production and asset management. Harnessing the power of computational models, digital twins allow for visualisation and analytics that can predict, detect or prevent problems and provide greater levels of quality assurance.

> “Army capability is all about people.
> The soldier is at the centre of everything we do”
>
> **Major General Simon Stuart AO, DSC,**
> **Head Land Capability - Army**

LAND
Highlights

Two projects in DMTC’s Land Program are making extensive use of digital twin and advanced computational modelling to deliver enhanced industrial outcomes.

Blast modelling

A long-term project involving researchers from ANSTO and the UoM, alongside research partner Thales Australia has developed and validated a new blast test methodology for Land combat vehicles. Full-scale blast testing of manufactured vehicles is prohibitively expensive and time-consuming.

The DMTC project team has developed and validated the methodology and parameters to translate small scale blast test data into full scale precise computational models, to accurately simulate and assess the impact of blast events on both vehicle structures, crew and passengers.

For design changes to current fleets and for future Australian vehicle procurements such as those contemplated in Defence’s LAND 4107 (Protected Vehicle Fleet) Program, this project will inform enhancements in vehicle design in a bid to improve on an already enviable safety record. It is also expected to support the export potential of Australian-designed and built protected mobility vehicles.

This result creates a lower cost pathway for keeping computational models updated with new material data, and also improves the level of confidence with which numerical simulation can be used to inform and influence the design of armoured and protected vehicles. The outcomes will be utilised in assessing issues and design changes of current Protected Mobility Vehicle’s (PMV), and in the design of future PMVs.

Next-generation soldier systems

DMTC activities in the Land domain during the reporting year also included contributions to the Networked Future Augmented Small Arms Technologies (or Networked-FAST) project that seeks to design and produce next-generation soldier systems for Australian defence personnel.

The project consists of a series of parallel technical investigations and activities led by industry partner, Thales Australia to explore and take advantage of breakthroughs in digitisation, lightweighting and advanced manufacturing. DMTC’s contribution is principally through collaboration partners at UQ and RMIT.

Investigations into new material compounds have achieved both reductions in component weight and improved thermal management of small arms systems. Candidate materials and modified manufacturing processes must pass rigorous testing to demonstrate that weight reductions do not compromise performance, reliability or safety.

Simulation and modelling to support design activities is another key area of activity. Modelling techniques being employed include computational fluid dynamics, and machine-learning architectures are being utilised to optimise the modelling outputs. Backed by earlier work on more basic models, this research effort has been accelerated and has achieved exceptional results, using multi-physics and machine-learning techniques to generate high-fidelity models which have been validated on a current platform. This is a major step toward a digital twin of the platform.

The outcomes achieved include improved speed of test procedures and more accurate results which, in turn, provides greater confidence and assurance for the industry partner and Defence.

Dr Cameron Barr of RMIT, Dr Caixian Tang, Senior Engineer in Additive Technologies at RUAG Australia and Dr Rizwan Rashid of SUT, examine the thread repair on a secondary piston component used in military aircraft. The component was repaired at RUAG using laser additive deposition (LAD), a highly efficient repair process that offers significant cost and lead-time advantages over the need to replace the part. Dr Barr and Dr Rashid were previously supported by DMTC during their PhD studies.

AIR & SPACE
Overview

The 2020 Defence Strategic Update released by Government in July 2020 signalled the Government's intentions to build Defence's air and space capabilities.

Defence needs a technologically-advanced air combat capability that is fully integrated with supporting intelligence, surveillance, reconnaissance (ISR) and supporting systems. The updates also included funding provisions to boost satellite communications and networking, develop an enhanced space control program and continue investment in space situational awareness, including sensors and tracking systems.

DMTC and its partners are working to build Australian industry capability to capitalise on new technology horizons across the air and space domains. The span of this effort covers new technology developments as well as advances in the use of existing additive manufacturing technologies and techniques.

DMTC's work is focused on building the underlying capacity and competitiveness of Australia's national industrial base, supported by key program partners including CSIRO and DSTG through their Next Generation Technologies Fund and the new STar Shot missions.

DMTC is engaging with a broader ISR and Geospatial community of practitioners that exists in Defence and across the national security and intelligence community. This broadening of the program to extend into land-based sensors and related geospatial technology is not directly linked to high altitude sensor systems but is an overlapping area of technology application.

An example of this work is a geospatial information and visualisation tool being progressively developed for defence and national security applications. Working with innovative small businesses, DMTC's project is responding to rapid cycles of technological change in this area. Project partners including Army and national intelligence community stakeholders are working together on a range of scenarios utilising LiDAR and improved information, analysis tools and situational awareness capabilities.

For Australia's sovereign aspirations to be realised in these areas, a greater industrial footprint - with a particular focus on Australian small businesses and start-ups that dominate this sector – needs to be developed to build supply chain depth and give industrial effect to the world-leading scientific and research expertise that exists in Australia.

AIR & SPACE
Highlights

Looking for a better view

Conventional spectral sensor systems enable images to be collected looking only directly down to the Earth from the unmanned manned aircraft on which the imager is mounted. This restricts the range of operating environments in which the technology can be used.

The ability to tilt the view angle of the sensor and look 'off nadir' enables the image to be acquired at a distance from the target area, such as flying above the open ocean and looking towards a beach or coastal environment. Advanced image processing and analysis techniques including Artificial Intelligence (AI) and machine-learning methods are needed to rapidly and accurately interpret these images, and to identify objects of interest from within the complex images.

In conjunction with University of Technology Sydney (UTS) and industry partner HyVista, DMTC's Compact, Spatially Agile Spectral Sensor (C-SASS) project has successfully developed and flown a prototype hyperspectral imaging system that can be pointed off-nadir, and has made other key advances including in the software used to analyse and process the images.

The project partners are now looking to finalise the development of this system towards operational readiness.

Dr Terry Cocks of HyVista Corporation with the C-SASS sensor. C-SASS can change its look angle, it has a very low signal to noise level and can be mounted on a wide range of aircraft including drones. The C-SASS sensor is part of DMTC's collaboration with HyVista Corporation, UTS and DSTG. More information on the C-SASS project can be found above.

AIR & SPACE
Highlights

New frontiers for existing technology

DMTC is continuing to build on its research expertise and extensive collaboration with leading-edge industrial partners in areas of advanced manufacturing, with a particular focus on metallic additive manufacturing methods.

While this technology is being deployed in a range of sectors and areas of interest, DMTC's involvement is ensuring that issues of quality, standards and accreditations are viewed through a defence lens and that additional concerns are duly considered, including supply chain security, the raw material's country of origin and the clearance of additively-manufactured components for use in mission critical and non-critical parts.

Detailed studies undertaken in the reporting year involved production and rigorous comparative testing of five distinct manufacturing methods.

The results of preliminary testing show significant differences in the performance of the individual designs, with some being clearly superior in terms of mechanical performance for certain applications.

Additive processes suitable for large component production – such as WAAM, cold spray deposition and new techniques including atomic-diffused additive manufacturing processes – are being commercialised by a number of capable Australian small businesses and offer a range of benefits and opportunities for adoption in defence sector supply chains.

Post processing of additively manufactured components has also been identified as an important supply chain development opportunity for Australian small businesses, including hot isostatic processing.

DMTC and its partners have also been involved in extensive R&D efforts for over a decade to advance the use of additive manufacturing in the sustainment and restoration of parts that are used, worn or damaged.

DMTC's work with RUAG Australia and DSTG has successfully demonstrated that the Laser Additive Deposition (LAD) process can restore components made from AerMet100, 300M, and 15-5PH ultra-high strength steels. The measure of effectiveness was the fatigue life of the restored components. This work is ongoing and will now assess dynamic performance measures including fatigue and damage tolerance of titanium alloys and nickel alloys in order to support the certification and acceptance of LAD repair to a wider array of materials and defence components.

ADDING UP THE BENEFITS

Some of the benefits of new additive manufacturing methods over traditional subtractive or additive methods include:

- Potential for significantly faster build or turnaround times
- 'Repair rather than replace' option for in-service parts offers significant lead-time, cost and supply chain gains
- Greater customisation
- Leveraging new design strategies including generative design
- Highly resource-efficient.

> “It is through strong partnerships with Australian industry that together we can maintain and grow the capability advantage provided by our world-leading defence industry.”
>
> **The Hon Melissa Price MP, Minister for Defence Industry**

INDUSTRY CAPABILITY
Development

DMTC’s leadership of industry capability development and technology transfer activities closely aligns with Defence’s focus on increasing opportunities for Australian industry to contribute to sovereign defence capability outcomes.

The ICD Program is one of the best examples of the way in which DMTC engages all elements of the national defence industrial sector. This extends from Defence to other Commonwealth agencies, State Governments, national advocacy groups and other government innovation programs, as well as from primes to small businesses alike.

Given the workload and workforce requirements in defence industry in Australia in the next decade – in production but also in sustainment of platforms – regionally based industrial clusters are expected to have a significant role. Issues of capability (expertise, skills, quality, traceability) and capacity (demand, throughput, reliability of supply) must be addressed early to put Australian industry in the best position for future success.

In 2019-20 the ICD Program rollout was heavily focused on enhancing Australian industry’s welding capabilities, offering hands-on experience in working with the high-strength steel alloys used in both Land and Maritime defence domains. Activities across the financial year focused on regions in Victoria (Geelong), north-west Tasmania (Burnie) and New Zealand (Auckland). The expansion of the Program to include New Zealand companies aligns with Defence policy definitions of local industry content as being inclusive of both Australian and New Zealand businesses.

Participants uniformly report a range of positive outcomes, ranging from a greater understanding of the defence industry and its exacting standards to new technical knowledge. Several participating companies have won supply chain work both within Australia and internationally as a result of participation. In one case, a participant invested in new welding equipment allowing them to keep better digital records and enhance their internal Quality Assurance systems.

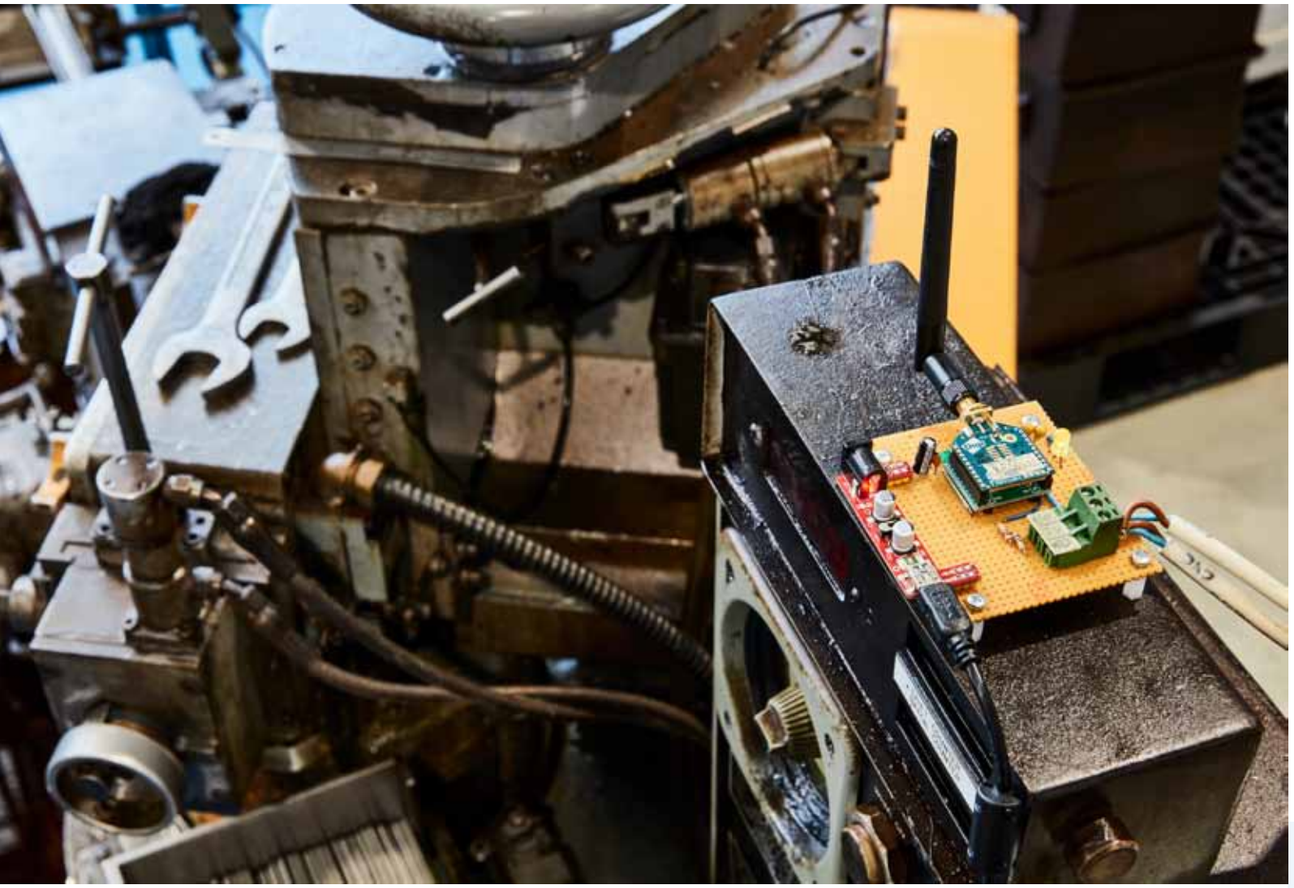
Another significant activity in the reporting year was a pilot with collaboration partner Cablex in Melbourne of a new Smart Enough™ Factory project, that seeks to introduce small businesses to new opportunities as a result of adoption of Industry 4.0 concepts. The Smart Enough™ Factory - supported by Sutton Tools, RMIT, AMGC and UQ - demonstrates that even modest process changes and advances in digital literacy can make their equipment ‘smart enough’ to collect performance data, improve traceability and inform decisions on investments in better ways of doing business.

DMTC’s ICD Program provides both process benchmarking and technological expertise to help these Australian companies to enhance ‘factory floor’ operating procedures and demonstrate their potential to compete for defence sector opportunities. It also provides an important mechanism for companies new to Defence to understand the characteristics of the sector such as market structure, project lead times, standards and accreditations and security requirements.

Adopting smart technology, even in iterative steps, can significantly enhance small business productivity. Real-time monitoring of production equipment can help address bottlenecks and data systems linked to production alerts can prevent wastage, reducing rework or reject rates and assist with Quality Assurance. Using simple cost-effective technology, companies can learn and adopt the fundamentals of Industry 4.0 in a way that is relevant to them and that improves the digital literacy of the entire company, from machinery operators through to senior management.

The DMTC team leading the workshops involves research partners from UoW, SUT, RMIT and UQ. Participants are strongly encouraged to seek assistance from the CDIC and relevant certification bodies. This broader business enterprise development advice complements the technical knowledge transfer and adoption of innovative manufacturing technologies through the DMTC program.

Experts engaged by DMTC provide mentoring and evidence-based feedback, both during the workshops and in post-activity reports, highlighting improvement opportunities for each company.



A key element of DMTC's Smart Enough™ Factory project solution is the ability to retrofit and integrate low-cost sensors across both legacy and modern manufacturing equipment. The concept is to offer a 'Factory in a Box' kit (the sensors shown on the right of the picture above, connected to legacy factory equipment at industry partner Sutton Tools) that provides a low-cost entry point to realise benefits of Industry 4.0 adoption for Australian SMEs.

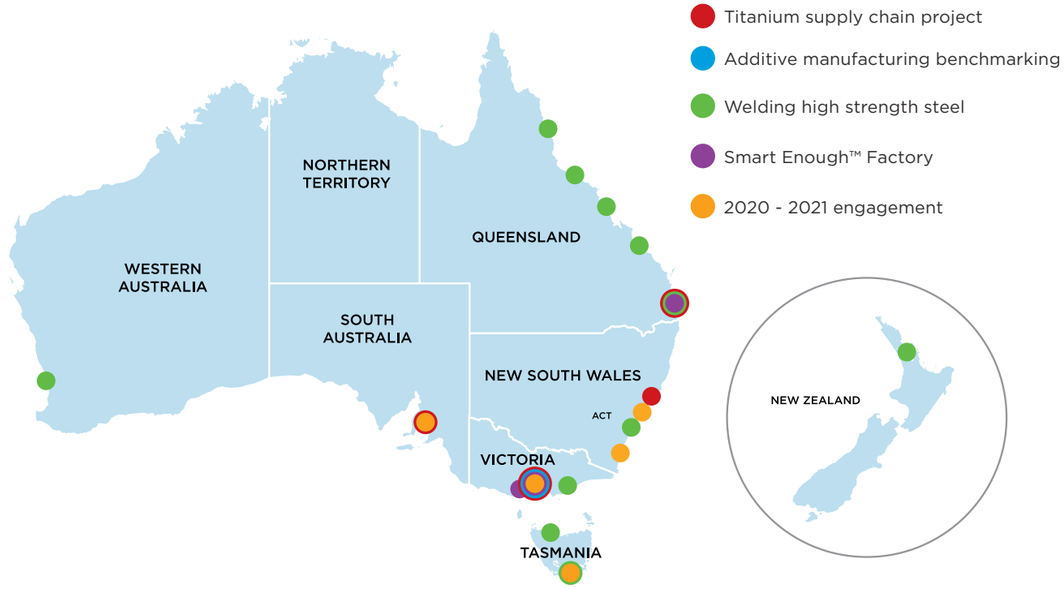
SUCCESS STORY

"The pilot project that Cablex has undertaken with the DMTC team has exceeded expectations, moving from proving the concept's merit to considering its value on the front lines of our production environment. The Smart Enough™ Factory kit provides a sensor overlay for existing machinery that benefits everyone from operators to managers and decision-makers. It builds on our company's experience with LEAN and 5S and provides a clearer picture in terms of production monitoring, visual dashboards and traceability.

Cablex is an Australian owned company servicing global customers and will continue to grow its local sovereign industrial capabilities to support Defence's needs. This project is helping Cablex to visualise future success and stay at the leading edge in providing customised Electrical Wiring Interconnect Solutions (EWIS) and electrical box build assembly solutions for our customers."

Paul Stokes
Project Director, Cablex

BUILDING SUPPLY CHAIN
Participation



LOOKING AHEAD

DMTC's investment and effort in support of industrial capacity-building continues to grow. The aggregate level of activity in this Program is on track to nearly double in 2020-2021.

Support will continue to be provided for benchmarking and technology transfer work in welding of high-strength steels, including in Western Australia. In addition, the Smart Enough™ Factory project will also be accelerated with rollout to small businesses in Brisbane and surrounds, the Shoalhaven and Geelong.

An additional area of focus in 2020-2021 and beyond will be in the area of next-generation additive manufacturing. Consultation with primes and small businesses has highlighted both opportunities and challenges in adoption of these technologies in a defence context. A critical element of DMTC's efforts is in moving past a narrow view of additive manufacturing as being 'only' about 3-D printing. In developing small businesses' capability and capacity in the production of complex parts for defence platforms, a holistic view of the production process is needed spanning 3-D printing, machine finishing, post-production processing and certification. Cost efficiency, minimising material wastage, production at scale and supply chain security are also key considerations. These projects will include trials of a range of emerging production techniques and post-production processing to verify component quality and mechanical properties.

Through the expansion of the ICD Program into new manufacturing technology areas and themes, DMTC is demonstrating its ongoing commitment to building the capacity and resilience of small businesses, many of whom have niche capability and untapped capacity to offer to defence prime contractors.

EDUCATION PROGRAM
Profiles

Dr Panneer Ponnusamy

Dr Panneer Ponnusamy has made a significant contribution to a DMTC project developing new manufacturing capability for aerospace and defence industries in Australia. He was awarded a PhD in March 2020 from SUT, titled “High Strain Rate Behaviour of Aluminium Alloy Processed by Selective Laser Melting (SLM)”. He has had over 10 years’ work experience in manufacturing design.

Dr Ponnusamy’s academic research is focused on 3-D printing of metal parts and structures involved in impact loading and high strain rate loading. These dynamic conditions are experienced in blast and ballistic events in numerous Defence applications, in particular military armoured vehicles. These conditions also exist in high-speed machining, mining shafts, and automotive impacts.

Dr Ponnusamy’s passion for harnessing new manufacturing processes and applying them to range of defence and industry settings continues in his position as a researcher at SUT in the Department of Mechanical Engineering. Dr Ponnusamy also undertook an internship under the APR.Intern program at SPEE3D.

Mr Riyan Rashid

Mr Riyan Rashid is a PhD candidate at SUT. His PhD is titled “Topology Optimisation of AM Parts using Key Materials Applied in Defence”.

The ability of additive manufacturing (AM) to develop parts with complex shapes has increased the potential design options across a range of applications for the Australian defence and industry sectors. The integration of topology optimisation techniques in product design offers huge potential for fabricating critical components for defence-based applications where weight reduction is a key limiting factor, while maintaining the required mechanical properties and performance.

Mr Rashid’s research focuses on the concept of coupling the AM process of Selective Laser Melting (SLM) with generative design techniques. His research allowed for a modified topology optimisation algorithm to be developed that incorporates constraints of the SLM process and resulting material properties to optimise design solutions.

Mr Rashid undertook an internship supported by the APR.Intern program at SPEE3D that led to him being offered employment with the company.

ANNUAL CONFERENCE
2020

In March, DMTC hosted its 2020 Annual Conference in Canberra, which enabled the DMTC community to come together and share ideas and perspectives on all aspects of the organisation’s cutting-edge research in the defence realm.

The conference was officially opened by the Minister for Defence Industry, The Hon Melissa Price MP. Minister Price confirmed DMTC’s role as a leader within Australia’s defence industry sector, working to enhance sovereign industrial capability.

Keynote speakers included Dr Peter Shoubridge, Chief of Land Division at DSTG; Mr Andrew Bowskill from MTP Connect and DMTC CEO Dr Mark Hodge. Thirty-five technical presentations were delivered across seven streams highlighting project achievements, the depth of industry partnerships and looking ahead to future challenges.

A range of project and student posters were also on display for viewing throughout the conference.

DMTC acknowledged project teams, individuals and early career researchers who have made significant technical contributions to the Defence innovation ecosystem through its 2020 Awards for Excellence.

DMTC was honoured to welcome Mr Adam Goodes, CEO of IDIC as the guest speaker for the evening. Mr Goodes joined DMTC CEO Dr Mark Hodge to present the awards.

Young researchers Dr Michael Candon, from RMIT and PhD candidate Mr Harry Veivers, from the UQ, were joint winners of the Industry Partnership Award, for their work on a DMTC project with Thales Australia to design and produce next-generation soldier systems for Australian defence personnel (more details can be found on Page 31).

A project team comprising RUAG Australia, DSTG, SUT and RMIT were also awarded for advances to additive deposition techniques to repair and restore complex aircraft components made of ultra-high strength steel.

Professor Suresh Palanisamy of SUT received a Special Commendation award for over a decade’s service to DMTC across a number of programs and projects.

All individual award winners are profiled over the page.

A highlight of the 2020 Annual Conference was the opportunity to work with BAE Systems Australia and the IDIC to facilitate the involvement of representatives from six indigenous-owned small businesses (pictured here with Ms Tamara Cardillo and Ms Esther Roberts from BAE Systems).

AWARDS FOR EXCELLENCE
2020

COLLABORATION AWARD

Dr Mitali Sarkar-Tyson

Dr Mitali Sarkar-Tyson received the Collaboration Award for her incredible commitment to developing our sovereign industrial capability in the MCM domain over several years.

Dr Sarkar-Tyson is a Le Souef Research Fellow in the School of Biomedical Sciences at University of Western Australia.

The Collaboration Award recognises an individual who embodies the spirit of collaboration, and Dr Sarkar-Tyson has truly embodied collaboration through bringing together a network of international researchers and coordinating a multidisciplinary team that can respond to bio-threat pathogens and tackle the growing threat of antimicrobial resistance.

She is currently leading a DMTC project involving her research team at the University of Western Australia in collaboration with DSTG, the Peter Doherty Institute, the University of Wurzburg, the University of Exeter, DSTL and Monash University. This project is developing novel anti-virulence compounds against a range of bio-warfare pathogens. In addition to the highly significant research she has conducted for this project, she has also contributed to 72 scientific research publications across the fields of antimicrobial resistance and molecular biology.

EARLY CAREER RESEARCH AWARD

Miss Emily Kibble

Miss Emily Kibble was the recipient of the Early Career Award for her outstanding work over the last few years in the DMTC collaboration led by the University of Western Australia. She is currently a PhD candidate in molecular biology at Murdoch University.

This project involves DSTG, the Peter Doherty Institute, the University of Wurzburg, the University of Exeter, DSTL and Monash University and focuses on the development of novel anti-virulence compounds against a range of bio-warfare pathogens.

Her PhD examines the pathogen Neisseria meningitidis, which causes meningococcal disease. Miss Kibble's research focuses on the inhibition of a protein called Mip, which appears to be key for the bacteria's development and infectivity.

Miss Kibble has also developed a novel screening mechanism to reduce the time required to test anti-virulence inhibitors against pathogens, increasing the efficiency of the testing process.

AWARDS FOR EXCELLENCE
2020

PROJECT LEADERSHIP AWARD

Professor Flavia Huygens

Professor Flavia Huygens received the Project Leadership Award for her excellent project leadership over the last year, seamlessly bringing together a multidisciplinary team from academia and industry to develop a rapid diagnostic, helping to address significant issues in the diagnosis of bio-threat pathogens.

Professor Huygens is Associate Director at the Institute of Health Biomedical Innovation (QIMR-Berghofer), Professor at the School of Biomedical Sciences at QUT and Chief Scientific Officer of Australian med-tech start-up company, Microbio.

She is the pioneer of InfectID®, which uses novel and innovative bioinformatic tools to genetically identify blood/plasma borne bacteria. This technology has been shown to distinguish between more than 10 closely related pathogens without the generation of false positives. This type of technology is critical for the military to respond to outbreaks of infection or deliberate biological attacks.

Professor Huygens has been able to manage the complexities of working across government, industry and academia to meet and exceed project objectives. During the COVID-19 pandemic, InfectID® has been able to pivot to identify SARS-CoV-2 (more details on Page 23).

THE SOLDIER ON AWARD

Dr Rizwan Rashid

Dr Rizwan Rashid received the SoldierOn Award for his invaluable contributions to DMTC projects over the past 10 years, exemplified through his strong commitment to collaboration in research and development. He has been part of multiple projects, including in laser cladding repair, additive manufacturing, surface engineering and the benchmarking of various technologies including machining and welding for various Defence platforms.

The SoliderOn Award recognises quiet achievers and those who embody DMTC's values of integrity, trust, inclusivity and commitment in their work ethic.

Dr Rashid has contributed to successful industry partnerships across nine DMTC projects, including with DMTC industry partners RUAG Australia, Sutton Tools and BAE Systems. His research achievements include being part of the development of a state-of-the-art sustainment and repair laser cladding facility at RUAG Australia, and optimising LAD repair of high strength steels for structural repairs.

Dr Rashid continues to play a key role in the successful rollout of DMTC's ICD Program, applying his expertise to benefit small businesses in regional centres across Australia.

FINANCE
Snapshot

In the reporting period, DMTC continued working closely with relevant Defence and national security agencies to successfully deliver activities across a broad and expanding portfolio of research and development activities.

DMTC secured new investment in its activities from a range of sources, including from the Defence Innovation Hub through both discrete innovation contracts and the negotiation of an extension, to June 2021, of an overarching Collaborative Research, Development and Innovation services contract. Through DMTC's co-investment model, this investment leveraged additional cash and in-kind investment from Australian industry, research agencies, State Government and other Defence Program sources.

Funding received for the financial year totalled $38.2m, including $14.3m received in relation to the COVID-19 Response Program.

Total resources applied for the financial year totalled $21.2m, including $11.4m of in-kind contributions from industry and research partners. Project activity and research activity levels were reduced in the fourth quarter of the 2020-2021 financial year as a result of the COVID-19 pandemic. This adverse impact relates primarily to scheduling rather than delivery of work packages and is expected to recover during the 2020-2021 financial year.

A surplus of $773k was recognised for the year ending 30 June 2020, which is slightly higher than 2019, driven by a reduction in program activity as a direct result of the COVID-19 pandemic and a subsequent slowdown in project activity. This surplus was added to the program opportunity reserve, increasing DMTC's ability to respond to new and emerging technologies while preserving the capacity to deliver its core objectives.

Cash reserves totaled $29.9m at 30 June 2020 and included $27m of unearned revenue from Defence, Health, DSTG and CSIRO. These funds have been committed to fulfil existing and new research activities in future periods under Defence contracts, the MCM Program and the HASS Program respectively.

Copies of the company's statutory financial report for the year ending 30 June 2020 are available on request.

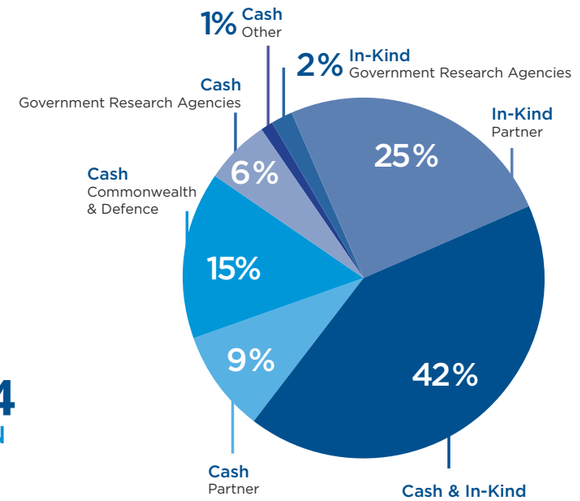
YEAR IN
Summary

RESOURCES RECEIVED

TOTAL
$38.2 MILLION

Cash
$26.8 MILLION

In-kind
$11.4 MILLION

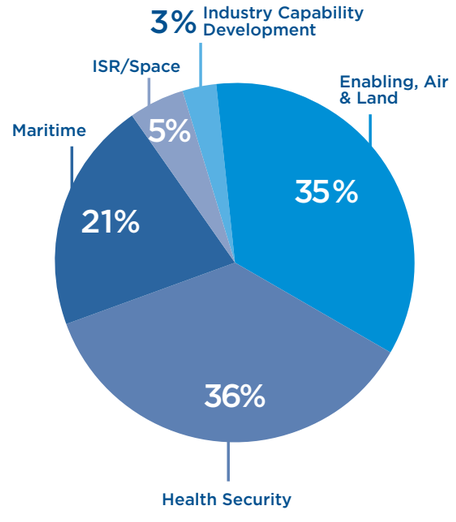


RESOURCES APPLIED

TOTAL
$21.2 MILLION

In-Kind Applied
$11.4 MILLION

Cash Applied
$9.8 MILLION



MANAGEMENT
Team

DR MARK HODGE
Chief Executive Officer

MR JIM ARTHUR
Chief Operating Officer

MR STEVE EVANS
Chief Financial Officer

DR MATT DARGUSCH
Chief Technology Officer &
Air Program Leader

MR DEEPAK GANGA
Lead Program Manager &
Land Program Leader

MS CHARLOTTE MORRIS
Industry Capability Development
Program Leader

DR FELICIA PRADERA
Medical Countermeasures
Program Leader

DR LEIGH FARRELL
Head Health Security Strategy

DR MARTIN VEIDT
Enabling Technologies
Program Leader

MS ANTHEA SILOM
Management Accountant

MR STEVE PATRICK
Head Strategic Projects

MR MILAN GANDHI
Manager Innovation Capability

DR STEPHEN VAN DUIN
Maritime Program Leader

MR JAMES SANDLIN
Program Development Manager

MS BRONWYNNE MCPHERSON
Executive Coordinator

MR MILES KENYON
Head Maritime Strategy

DR NEIL SIMS
High Altitude Sensor Systems
Program Leader

MS MADDY WALTERS
Program Support Officer -
Medical Countermeasures

DR HANA SHIRAZ
Program Support Officer -
Maritime

MS ELISA WOODLOCK
Information, Quality &
Program Support Officer

MR HARRY BAXTER
Head Government Relations

GOVERNANCE
Corporate Responsibility

The DMTC Board is responsible for overseeing the management and strategic direction of the Company. Each Director is elected for a two-year term by the Company's Members at the Annual General Meeting (AGM). As required by the company's Constitution, the Directors have a comprehensive and complementary range of skills and experience covering areas such as Defence Industry, Defence systems and policies, education and research, financial and risk management and corporate governance.

AGM and Participant Workshop

The DMTC AGM was held on 14 November 2019 and in accordance with the Company Constitution, Directors Dr John Best, Professor Valerie Linton, Dr John Harvey and Mr Tony Quick retired by rotation at the meeting, re-nominated and were subsequently re-elected to the Board of Directors.

The DMTC Partner Workshop was held on 14 November 2019. The workshop provided partners with an update on the Company's achievements for the 2018-19 financial year, ongoing and planned program activities and discussion on the Defence security environment.

Audit, Risk and Remuneration Committee

The Audit, Risk and Remuneration Committee is a formal subcommittee of the Board. The Committee assists the Board in its decisions on financial reporting, internal control structures, internal and external audit functions, compliance, governance and risk management systems and remuneration policies. The Committee is comprised solely of non-executive Directors of DMTC, the majority of whom are independent.

Environmental and Social Impacts

The DMTC Management Team continues to work towards minimising its environmental footprint and demonstrating its ongoing commitment to corporate social responsibility. During the reporting period, the Company continued to implement environmental and sustainability initiatives such as procurement of recycled office paper, eliminating avoidable business travel and purchasing carbon offsets for business air travel. More broadly, individual members of the management team are engaged in corporate volunteering programs. DMTC procures administrative supplies and corporate communications material through social enterprises where possible and is also proud to sponsor academic prizes and charities.

PROUD SUPPORTER OF SOLDIER ON

Nadrasca
Diversity in Industry

BOARD
of Directors

MR TONY QUICK
Chair
MA

MS PATRICIA KELLY
Director
BA, GAICD

MR MARC PESKETT
Director
BBus, CA (Australia), FTI (Australia), MAICD

MR MICHAEL GROGAN
Director

PROFESSOR VALERIE LINTON
Director
PhD, MBA, FIEAust

DR JOHN BEST
Director
PhD, BSc (Hons), MBA, GAICD

AIR MARSHAL (Retd) DR JOHN HARVEY AM
Director
PhD, MIS, MLitt, BSc, BA, GAICD

Dr James Gardiner, Senior Research Scientist at CSIRO, is part of a DMTC project team that successfully developed and scaled up a new process to batch-produce a novel antibiotic drug candidate developed by a Perth-based pharmaceutical company.

QUALITY
Management

Quality system accreditation remains a vital asset for DMTC in its engagement with the Department of Defence and, more broadly, in the Australian and international defence and national security sectors.

In the reporting year, DMTC was re-certified against the ISO 9001:2015 standard. The ISO benchmark represents a globally recognised endorsement of our systems and processes. A number of new or updated policies and procedures have been added to our quality management system, including new policies describing DMTC's commitment to the responsible conduct of research and to ethics and bio-risk management.

DMTC also successfully completed the first annual surveillance audit against the ISO 44001:2017 Collaborative Business Relationship Management Systems standard. This ISO certification is a further validation of the DMTC collaborative model.

The external accreditation of DMTC's quality management system and business relationship management processes complements a range of existing internal continuous improvement commitments.

Through both of these initiatives, DMTC continues to maximise the effectiveness and efficiency of its program delivery, together with its supporting corporate systems and operations.

DMTC's partners and government agencies alike can have confidence that our focus remains squarely on the delivery of practical, tangible outcomes for Australia's defence capability and support for the local defence industry sector.

Building on its long history of involvement in the internationally benchmarked Supplier Continuous Improvement Program, administered in Australia by the CDIC, DMTC conducts rigorous annual self-assessments. These are useful as a 'health-check' on the organisation and to test the strategic focus and alignment of ongoing improvement initiatives.

CERTEX ISO 44001 Collaborative Business Relationship Management System

CERTEX 9001:2015 Quality Certified

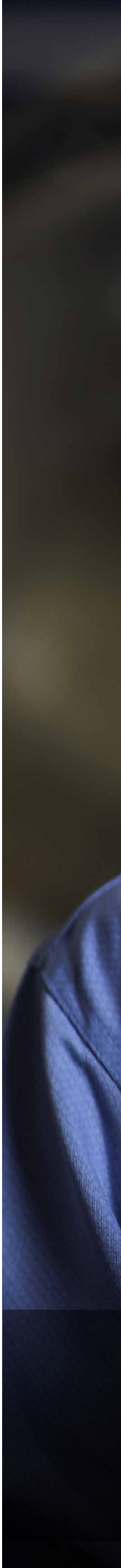
SUPPLIER CONTINUOUS IMPROVEMENT PROGRAM PARTICIPANT

SECURITY
Assurance

DMTC continued to monitor and review security requirements and maintained its Defence Industry Security Program (DISP) membership during the financial year. Security training has been provided to all staff members to inform them of emerging risks and good practices. DMTC has also undertaken a comprehensive security risk assessment. Updated practices and procedures have been introduced in accordance with DMTC's new IT system, which is fully compliant with ISO 27001 standards.

GLOSSARY

ADF	Australian Defence Force
ADF-MIDI	ADF Malaria and Infectious Diseases Institute
AGM	Annual General Meeting
AM	additive manufacturing
AMR	antimicrobial resistance
C-SASS	compact spatially agile spectral sensor
CASG	Capability Acquisition and Sustainment Group
CBR	chemical, biological or radiological
CDIC	Centre for Defence Industry Capability
COVID-19	Coronavirus pandemic resulting from SARS-CoV-2 outbreak
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Defence	Australian Defence Organisation
DMTC	Defence Materials Technology Centre
DSTG	Defence Science and Technology Group
GMP	Good Manufacturing Practice
GnP	graphene nanoparticles
HASS	high altitude sensor systems
HTS	high temperature superconductor
ICD	Industry Capability Development
IDIC	Indigenous Defence and Infrastructure Consortium
ISR	intelligence, surveillance and reconnaissance
LAD	laser additive deposition
LiDAR	light detection and ranging
MCMs	medical countermeasures
Mip	macrophage infectivity potentiator
NAB	nickel-aluminium bronze
N-FAST	Networked Future Augmented Small-arms Technologies program
NGTF	Next Generation Technologies Fund
NHSRA	National Health Security Resilience Assessment
NSE	Naval Shipbuilding Enterprise
PhD	Doctor of Philosophy
PMV	protected mobility vehicle
QUT	Queensland University of Technology
R&D	research and development
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RMIT	Royal Melbourne Institute of Technology
SLM	selective laser melting
SME	small to medium-sized enterprise
SSCG	solid-state single crystal growth
SUT	Swinburne University of Technology
TRL	Technology Readiness Level
UNSW	University of New South Wales
UoM	The University of Melbourne
UoW	The University of Wollongong
UQ	University of Queensland
WAAM	wire arc additive manufacturing



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