CREATING FUTURE DEFENCE CAPABILITY

DMTC

ANNUAL REPORT 2017

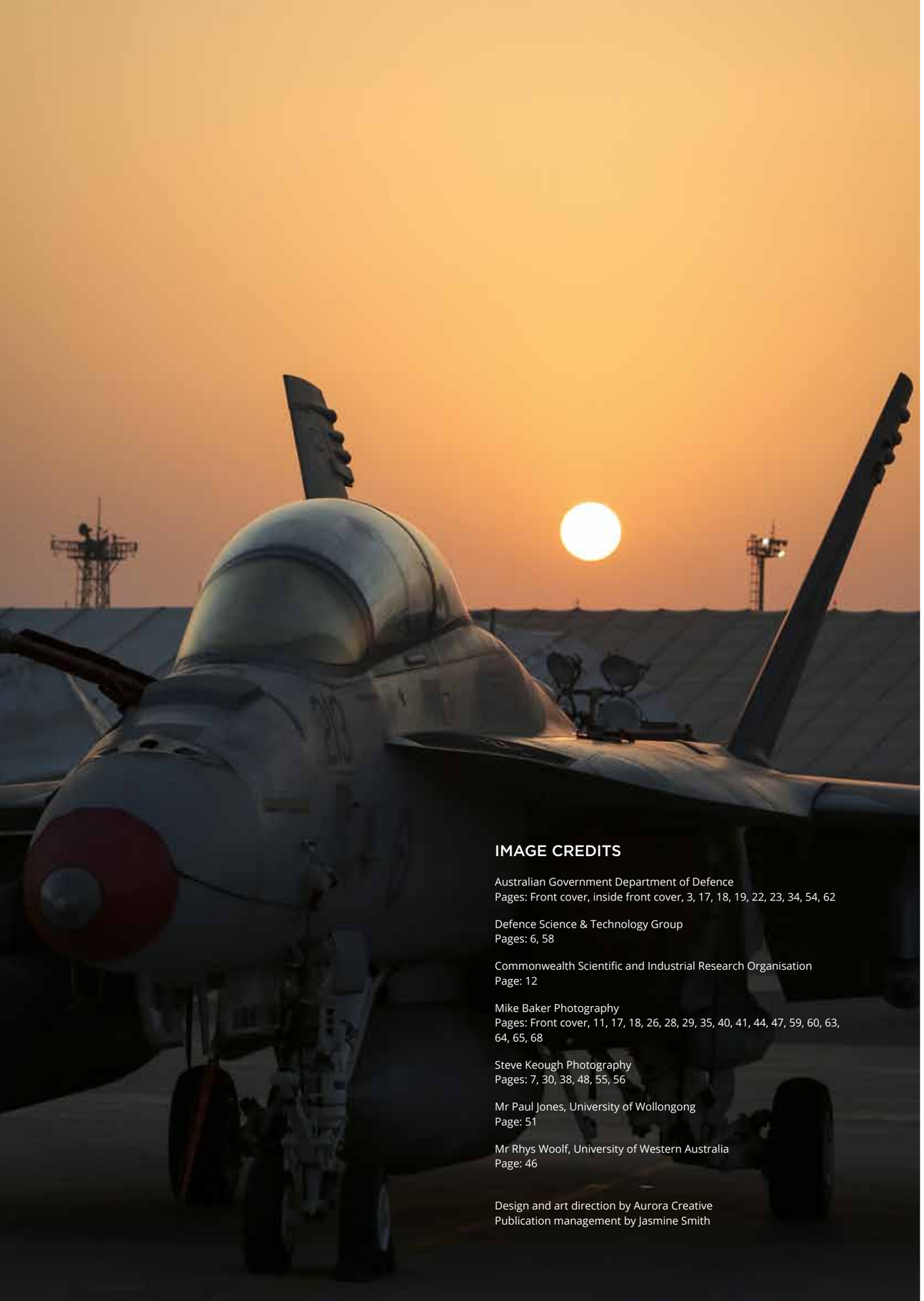

IMAGE CREDITS

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Steve Keough Photography
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Mr Paul Jones, University of Wollongong
Page: 51

Mr Rhys Woolf, University of Western Australia
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Design and art direction by Aurora Creative
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DMTC 2017

Pictured: Guided Missile Destroyer NUSHIP Hobart sits in the shiplift moments before the announcement of her floating for the first time.

MINISTERIAL Foreword

The Australian Government, in which I am privileged to serve as the Minister for Defence Industry, recognises that national prosperity depends on our national security. The two are inextricably linked.

To meet current and future challenges to our national security we need an effective and efficient sovereign defence industry. One that can deliver and sustain the capabilities our defence force needs now and into the future.

The Defence Materials Technology Centre (DMTC) has a significant role to play as a leader, a broker, and a manager of enhanced defence and industry capability outcomes, underpinned by Australian research expertise. DMTC leads collaborative efforts to develop and advance the cutting-edge technologies that the women and men of the Australian Defence Force (ADF) will deploy to protect Australia's strategic interests.

As a partner in the Defence Innovation Hub, and drawing on other funding from Defence major programs and government research agencies, DMTC is helping Australian industry to adapt and stay ahead of the technology curve. It also assists our world-class research community to ensure their work is relevant and aligned to industrial and defence priorities.

The Government's approach to defence acquisition and sustainment – and to industry policy more broadly – places a premium on the transfer of technology and industrial capability into Australia. This will grow the local industry and help to meet our current and future sovereign capability requirements.

DMTC is engaged in many of these areas of sovereign capability and capacity building. Earlier this year I announced that DMTC would work with Defence on technology development in support of Australia's key role in the international Joint Strike Fighter (JSF) program, and I am also pleased to note their involvement in the Government's unprecedented investment in a continuous naval shipbuilding program.

Australia already has some of the world's most innovative commercial and defence enterprises, but we need to continue to work hard to maintain our reputation for incubating and advancing game-changing technologies.

Research and development not only spurs innovation, but also drives business growth across Australia and along the length of supply chains.

DMTC's role here is significant, too. As a leader in applied research and development – and having achieved a significant milestone in being recently certified to the ISO 9001:2015 benchmark for its quality systems and business excellence – DMTC is translating innovation into reality and extracting maximum value from the resources applied to its activities.

I congratulate Mark Hodge and his DMTC team for their ongoing commitment to this task, and for their role in what I believe is a great national endeavour. I welcome this report on their achievements.

The Hon. Christopher Pyne, MP,
Minister for Defence Industry

KEY MESSAGE
Defence

The 2016 Defence Industry Policy Statement (DIPS) set out the Government's expectation for Defence industry policy to focus on: delivering Defence capability; a new approach to Defence innovation, including streamlining its engagement with industry and academia; driving Australian industry competitiveness and export potential; and cutting red tape and streamlining tendering and contracting procedures.

The intent of the policy is to make the best use of the resources available, guided by Defence strategy, to fulfil the dual aims of delivering Defence capability and maximising Australian industry opportunities.

As Defence invests in major equipment acquisitions and sustainment programs, our aim is to maximise Australian industry involvement without compromising capability, cost, schedule and risk.

As part of the strategic centre of Defence, the Strategic Policy and Intelligence (SP&I) Group, of which the Defence Industry Policy Division is a key element, supports the alignment of Defence strategy, capability and resources.

DMTC is an important capability partner for Defence and for Australian industry. The track record of success through DMTC programs shows that the kind of closer collaboration sought in the 2016 DIPS is both achievable and rewarding.

I am pleased that since the last DMTC Annual Report, the Defence Innovation Hub has been established and DMTC and the Hub have established a formal partnership agreement. We have acknowledged DMTC's key role in working with Australian industry, particularly small to medium enterprises (SMEs), to address technology challenges in areas identified as priorities by the Defence Innovation Hub.

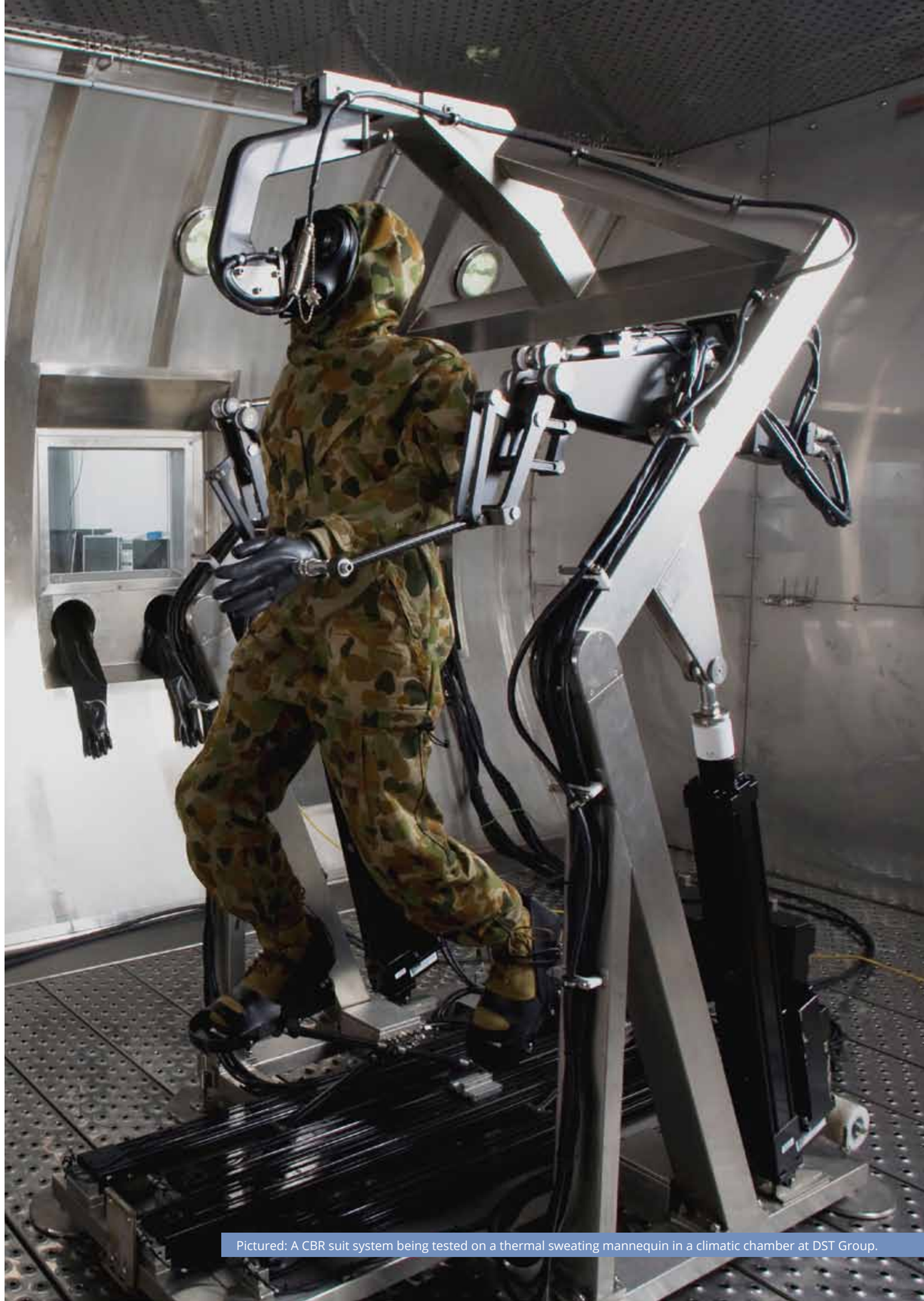
We have encouraged DMTC to continue working within the broader Defence investment program to identify and participate in areas that would benefit from collaborative research. In particular DMTC is encouraged to support access for Australian SMEs into global supply chains for major projects.

One of the most important features of the new Defence innovation system is that it is integrated across the Defence organisation. The alignment and cooperation between SP&I Group, the new Force Design organisation, the Capability Acquisition and Sustainment Group and the Defence Science & Technology (DST) Group reflects our shared understanding that the needs of the warfighter must be supported by a single innovation pipeline. The Defence Innovation Hub is the Government's signature Defence innovation development program. In this context DMTC continues to be a key partner in advancing technologies, and has a vital role to play in applied research and development.

The relationship between DMTC and Defence is important to the success of our collective endeavours. DMTC helps Defence to deliver enhanced capability outcomes through its partnerships and networks, including harnessing expertise from across the Australian research sector.

I look forward to closer collaboration with DMTC and with Australian industry in the years ahead.

Mr Marc Ablong
Acting Deputy Secretary
Strategic Policy and Intelligence Group
Department of Defence



Pictured: A CBR suit system being tested on a thermal sweating mannequin in a climatic chamber at DST Group.

Pictured: Mr Brad Yelland, BAE Systems Australia, addresses DMTC's 2017 Annual Conference audience.

> "Collaboration is vital for lifting Australia's industrial capacity and capability."

KEY MESSAGE
Industry

Defence is a long game. The development lifecycle for new capability and product is rarely shorter than a decade, and often much longer. As an example, the global F-35 JSF program commenced before we had Google or eBay, which today seem such an automatic part of our everyday life.

At BAE Systems Australia our technical observation, and our firm belief, is that Australian researchers and engineers are the equal of the best of their counterparts, anywhere in the world. If there is one thing that has held Australia back is not our capability, it is a lack of opportunity.

Creating momentum and opportunity is one of the reasons why BAE Systems has strongly supported the release and implementation of the 2016 DIPS. It's also why initiatives like DMTC and the Defence Innovation Hub are important.

Capably led by Tony Quick and Mark Hodge, DMTC has proven to be a stable and reliable innovation partner. Companies, from small enterprises even to the size of ours, find the DMTC model to be relevant and accessible, and it works.

The risks associated with the long technology development lifecycles in Defence, over and above the risks normally associated with advanced technology, make it hard enough for a global company like BAE Systems, let alone for small enterprises whose risk appetite or financial pressures are even more acute.

DMTC has proven its credentials in this field, with SMEs and prime contractors alike. It has deployed a genuinely collaborative and commercially astute business model, and provided real leadership to ensure both customer and contributor satisfaction with the outcome.

For BAE Systems, the clear route to market for technology and product development activities is a stand-out feature of DMTC's work across a range of programs. DMTC worked to establish a sovereign titanium machining supply chain capability that has resulted in opportunities for many Australian industry partners, not just for BAE Systems. DMTC's work on Corrosion Prognostic Health Management technology has facilitated successful integration of this technology into the global JSF program.

In both of these cases, the end customer was engaged prior to initiating the activities, ensuring a clear route to market and to adoption.

These are worked examples of how we – Government, Defence, industry and academia – can come together as an enterprise to ensure that our country receives full benefit from a healthy defence industry.

Collaboration is vital for lifting Australia's industrial capacity and capability.

Together, we can meet the ADF's capability requirements of today, and partner with Defence to embed innovation in its force design and planning for the future.

I look forward to the continued success of DMTC as it continues to strive to enhance defence capability through collaboration.

Mr Brad Yelland,
Director - Engineering
BAE Systems Australia

CHAIR'S Report

TONY QUICK

Following the release of landmark policy documents in early 2016, the past year was always going to present its share of challenges and opportunities across the Australian defence landscape in general, and for DMTC in particular. With policy settings and the current stage of acquisition cycles placing increased focus on innovation in the defence industry sector, the breadth and depth of Australian supply chain capacity, on harnessing expertise and on extracting best value from the innovation pipeline, DMTC's role is perhaps more important than ever.

At its core, our work is about collaborating with partners to enhance defence industrial capabilities.

The continual challenge for DMTC is to consolidate, grow and enhance activities with existing partners or along known pathways, but also to develop an understanding of where new and emerging pockets of expertise and niche research capability reside in Australia, whether that be through an existing or new research partner. In this regard, it has been pleasing to see the DMTC community grow, with consolidation of our traditional partner base and the addition of a number of new industry and research partners supporting exciting new programs. The Board welcomes new partners and looks forward to their involvement and positive contributions.

One of the hallmarks of DMTC's approach and its success, has been the effectiveness of our collaborative model and the willingness of multiple research partners to work together on DMTC projects. This is as true of our core research programs that have been running for nearly a decade now, as it is of our more recent moves into new areas such as medical countermeasures (MCMs) and space-borne sensors. Collaboration is about real, practical outcomes derived from actually working together, not just about partnership agreements with little or no activity to give effect to what might be the most polished agreement framework.

Of course, the world has changed, and the Board has been very pleased with the commitment to continuous improvement and the consistent optimisation of our business model that this important activity has supported.

I am delighted that DMTC's work continues to be publicly recognised, with awards and other formal acknowledgments. The Board views these as important validations of the value of our contribution in the sector, and of the balance we strive to maintain between the research excellence and industrial impact of the Company's programs.

As Chair, I would like to recognise the ongoing contributions of our Board members, many of whom have given many years of service. At the Board level, and with the benefit of this continuity, we have worked hard to ensure the Company is firmly focused on good governance; is on a solid financial footing; and is positioned to continue to meet the priorities articulated by our Defence customer.

It gives me great pleasure to present the DMTC Annual Report for 2017.

Mr Tony Quick
Chair, DMTC

CEO'S Report

MARK HODGE

DMTC's strong focus on enhancing capability for the ADF continues to be backed by a commitment to build Australian industrial capacity, and underpinned by best-of-breed Australian research expertise. For us, this is what achieving 'capability through collaboration' is all about, and these partnerships are central to all of the success stories in this report.

Established in 2016, the Defence Innovation Hub is a key part of the new, end-to-end pipeline for innovation and technology development in Defence. DMTC is proud to be a partner with the Innovation Hub, the core principles of which align so well to those we have developed over recent years.

DMTC's core principle is that, no matter how innovative a technology may be, its ultimate utility in a Defence context can only be fully realised by maintaining the war-fighter at the centre of considerations. In our view, there is simply no other way to approach our work. We are pleased to work with Defence to play our part in realising the objectives of the Innovation Hub, the Force Design Division and other new policy and organisational initiatives.

Through engaging with our Defence customer and understanding Defence's priorities, we can align our efforts in advancing technologies for adoption by Australian industry.

DMTC works hard on its engagement with industry and research partners, and we continue to reach out to the multinational primes who have a pivotal role in putting Australia's defence sector on the global map. The international leadership and experience injected by these major Defence primes is critical to the ongoing relevance and alignment of DMTC's activities. I have been delighted with the proactive approach taken by industry over the past year and we look forward to playing our role in delivering on the confidence placed in us.

We have demonstrated that it is possible to do commercially-relevant research, but still excellent research. Our engagement with the university sector is critical. While publication rates are far from the most useful measure of impactful research, it is pleasing to note that in 2017 our DMTC community has achieved a record number of peer-reviewed papers in professional publications.

Another highlight of 2017 was our certification against best-practice quality management standards. As an ISO 9001:2015 accredited organisation, DMTC has developed what we believe to be a unique program management and program delivery framework, in a technology development context. Our commitment to quality means optimised business processes and more value delivered to our partners.

Adding to the achievements of existing projects, our new programs in High Altitude Sensor Systems (HASS), a new round of investment in MCM technologies, expansion of our Sea Program and the imminent JSF Program bode well for our future and for defence industrial capability across all domains. We have achieved a great deal, but there is more to do. I am particularly looking forward to the expansion of our industrial benchmarking and capacity-building activities, and also to seeing the continuing progression of the future leaders who are receiving support under our successful Education Program.

I commend this Annual Report for 2017 to you.

Dr Mark Hodge
CEO, DMTC

SNAPSHOT
DMTC

Vision

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

Mission

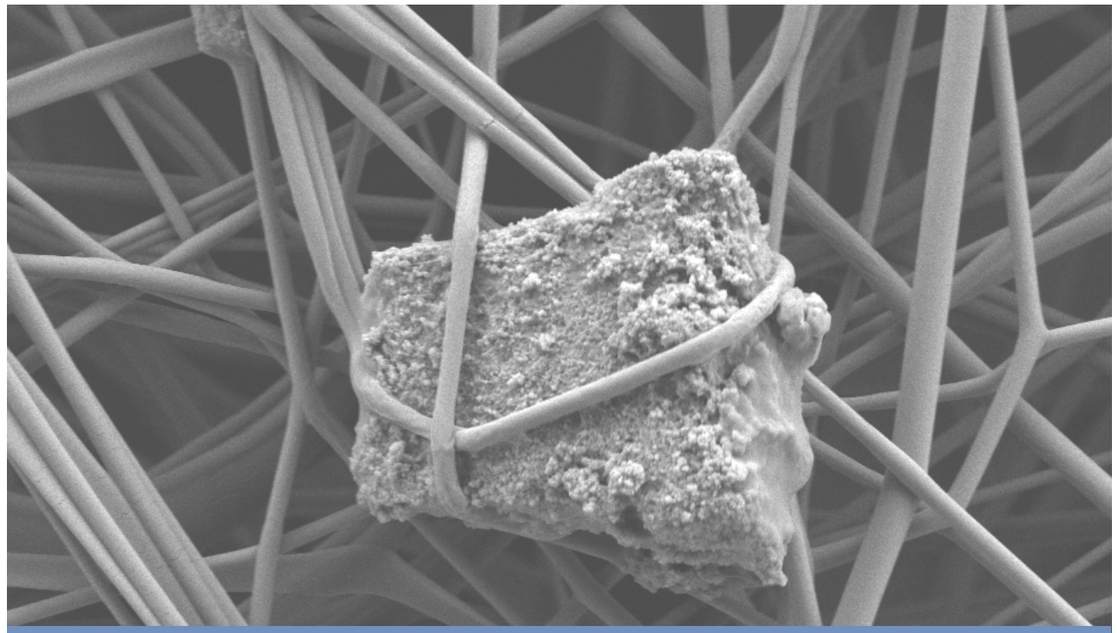
DMTC leads, facilitates and manages collaborative research and development in the defence and related sectors in manufacturing, engineering and applied science to create and enhance Australian industrial capability.

Defence and national security customers, industry and the research sector are key stakeholders.

VALUES

Inclusive
Committed
Inspiring
Trusted
Integrity

Pictured: Mr Michael Kellam of CSIRO with a melt spinner machine, which produces ingots for thermoelectric devices. These devices, developed for the Land (Mounted) Program, convert heat from an exhaust to useable energy.



Pictured: A carbon particle enveloped in nanofibres — researchers are developing textile composites (for use in combat uniforms) that have a high surface area to capture fine particles such as aerosols.

Partners

DMTC is comprised of partner organisations that contribute resources towards joint research and development activities.

By working together in a collaborative environment, our partners achieve far greater technology and performance outcomes more quickly and cost-effectively than by pursuing research and development activities independently.

Model

DMTC's collaborative model:

- fosters enduring collaborative relationships between prime defence contractors, SMEs, research organisations, industry bodies and Defence
- features an intellectual property model focused on rapid royalty-free transfer to partner organisations
- simplifies the formalisation of collaboration with standardised agreements
- leverages resources of collaboration partners providing highly cost effective outcomes
- maintains and benchmarks the balance between technology excellence and commercial outcomes
- delivers impact for the Defence customer and the research and industrial sectors.

ENGAGEMENT Model

01 PROGRAM DEVELOPMENT

CO-INVESTMENT FROM ALL PARTNERS

DMTC

DEFENCE
Articulate capability need

INDUSTRY
Australian capability footprint

RESEARCH
Expertise & credibility

CONCEPT → VIABLE PROGRAM

02 PROGRAM MANAGEMENT

RESOURCE & CAPABILITY LEVERAGE

INDEPENDENT OVERSIGHT

Applied Technology Development
(TRL RANGE ~ 3-7)

COLLABORATION

GOVERNANCE: QUALITY FRAMEWORK & INTELLECTUAL PROPERTY

03 OUTCOMES

Enhanced Defence & national security capabilities

Commercial & capability impact

Applying research & innovation to create maximum value for the Defence customer

Extensive collaboration between government, research & industry

Significant returns on investment for all partners

New technologies – potential for commercialisation or dual-use application

New market entrants – with benchmarked capabilities

Assistance to reach global competitiveness benchmarks

Education outcomes – investing in future experts & leaders

Programs and projects are undertaken only after a thorough assessment to confirm that the DMTC engagement model is appropriate and will maximise value for the Defence customer and the Australian industrical and research communities.

ABOUT US
DMTC

DMTC leads collaborative projects to advance technologies and develop industrial capabilities in the Australian defence and national security context. Our programs enhance ADF capability and operate on a co-investment model, an approach that allows each partner to leverage the expertise, investment, human resources and capabilities of the other partners. This genuinely collaborative model provides the pathway to creating industrial capability and solving complex challenges.

DMTC plays an important role in building a more capable and defence-ready industry sector. DMTC has a strong focus on engaging SMEs in its research and development activities and equipping them to participate in prime contractors' supply chains.

Collaborating through DMTC presents opportunities for our research and industry partners to access world-class expertise, contribute to collaborative projects and leverage outcomes in areas of new interest or breakthrough potential for their organisations.

Through DMTC, the research sector (including government research agencies such as CSIRO and ANSTO, the university sector and private research institutions) receives significant financial and non-financial value, including allowing students to gain practical insights and relevant industry experience. The early identification of capable industry partners ensures a clear path to adoption and commercialisation, and validates the industrial relevance of research themes.

DMTC contracts with Defence and national security customers, industry and the research sector, and applies a consistent and proven model for project definition, management and delivery. This standardised approach removes an administrative burden for our partners, allowing them to direct all resources to realising project outcomes.

The involvement of the Defence customer ensures ongoing relevance to the Defence end-user, and the company has built a strong reputation with its Defence customer for solving complex technological challenges. DMTC was initially selected through a competitive process to deliver an initiative announced in the 2007 DIPS and has since entered into additional contracts, one of which is as a key partner in the Defence Innovation Hub. This funding through the Defence Innovation Hub was confirmed in the 2016 DIPS.

In addition to its partnership with the Hub, DMTC continues to work within and across the broader Defence Integrated Investment Program to deliver beneficial outcomes to Defence's capability managers through its collaborative model. DST Group, the primary scientific adviser to Defence, is a DMTC partner and directly supports some of DMTC's research projects.

DMTC's approach to IP aligns with the Defence Innovation Hub's IP Strategy. IP is controlled at the individual project level. Ownership of all background IP remains with the relevant partner and all project partners retain automatic rights, within agreed fields of use, to practise IP that is developed (or advanced) during the project. Fields of use for IP developed through DMTC projects are negotiated with partners prior to project commencement.

TECHNOLOGY
Readiness

Technology Readiness Levels (TRLs) offer a standardised numerical indicator for the maturity of a technology. TRLs provide a common language to describe the status of a technology in development, ranging from the initial identification of an idea or opportunity through to a fully-tested product or system that is ready for market.

DMTC applies a structured methodology to conducting Technology Readiness Assessments (TRA) and documenting the TRL of the technology in question. TRA's are conducted at the outset of the project activity, at each major project review or project milestone and at project completion.

DMTC's best practice approach to program development is resulting in smarter engagement with prospective industry and research partners, faster transition from development to implementation and more strategic deployment of resources.

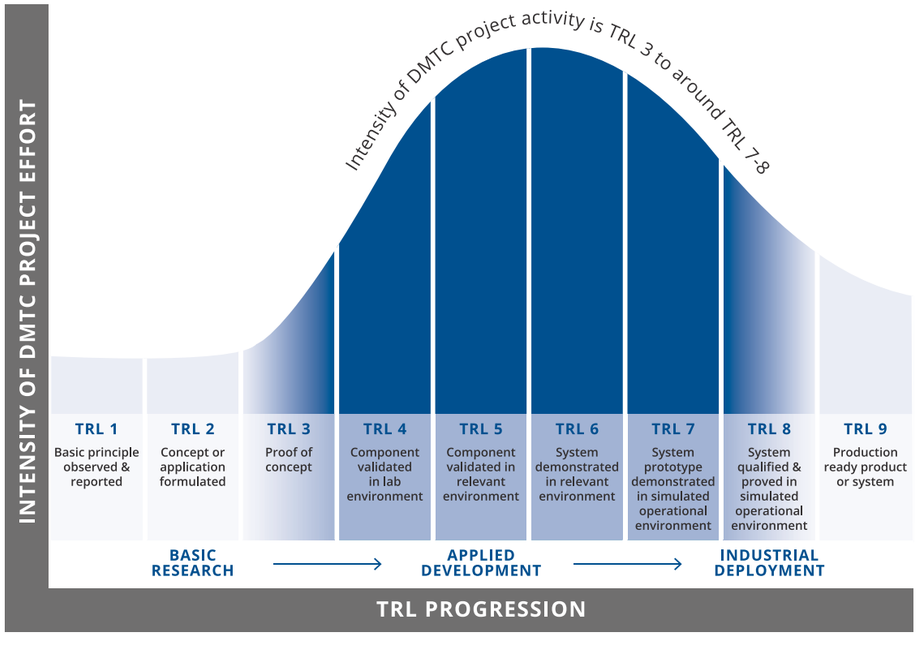
DMTC recognises that the early phases of a technology development activity are often the most critical to long-term success.

Particularly in areas where the technical risk is judged to be high, initial scoping studies are increasingly being used to better understand the technical issues and to prove assumptions before more significant investments in projects are made.

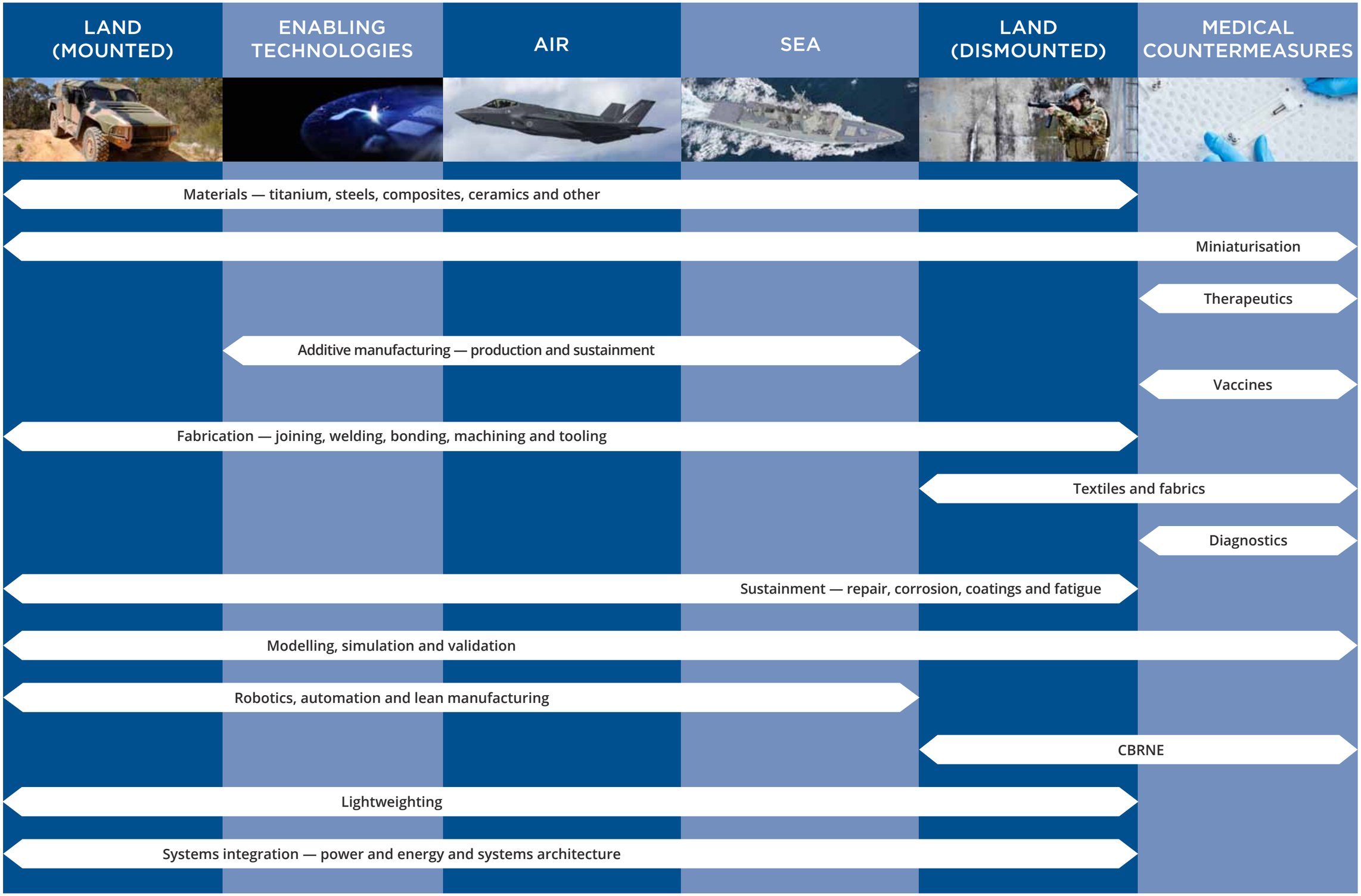
These studies are a useful way to scrutinise existing technical solutions, benchmark current Australian industry capability and identify prospective industry and research partners that can be involved in follow-on projects.

Better foresight and definition of the potential technical breakthroughs that can be made, and the attendant risks in moving along the TRL pathway, help to inform better decision-making and make higher-confidence estimates about technology development milestones.

Historical data indicates that the bulk of DMTC's project activity falls in the range from TRL 3 to TRL 7-8.



TECHNOLOGIES
Matrix



LIST OF PROJECTS
DMTC

Pictured: An ARH Tiger helicopter and an MH-60R Seahawk operate onboard HMAS Canberra during first of class flight trials.

IDENTIFIER	PROJECT NAME	STATUS
SEA PROGRAM		
9.07	Corrosion scoping study	In Progress
9.08	Corrosion prognostic health monitoring	In Progress
9.09	Biofouling and corrosion performance evaluation	In Progress
9.11	Low distortion welding processes scoping study	In Progress
9.12	Additive manufacturing of ship components	In Progress
9.14	Blast and shock modelling	In Progress
9.17	Single crystal lead zirconate titanate ceramics	In Progress
9.18	Polyurethanes	In Progress
9.45	Thermoset materials scoping study	In Progress
LAND (MOUNTED) PROGRAM		
6.04	Land vehicle alternative material characterisation	In Progress
6.05	Alternative vehicle power packages	In Progress
6.06	Advanced vehicle modelling	In Progress
6.30	Automated manufacturing	In Progress
6.35	Robotic squad support platform	In Progress
LAND (DISMOUNTED) PROGRAM		
7.1.1	Ceramic armour technology	In Progress
7.1.2	High curvature armour systems	In Progress
7.1.3	Low profile body armour	In Progress
7.2.1	Improved anti-ballistic soft armour	Complete
7.3.1	High strength fabrics for combat clothing	In Progress
7.33	Advanced nanostructured fabrics for low burden personal protection	In Progress
7.46	Polymer composite forming technology	In Progress
AIR PROGRAM		
5.01	New manufacturing capability	In Progress
5.02	Enhanced tooling solutions	In Progress
5.03	Sustainment capability development	In Progress
ENABLING TECHNOLOGIES PROGRAM		
3.19	Lightweighting	In Progress
3.20	Modelling of manufacturing processes and new coating technologies	In Progress
INDUSTRY CAPABILITY DEVELOPMENT PROGRAM		
3.21	Benchmarking for best practice	In Progress
	Welding high strength steel benchmarking study (Vic)	In Progress
	Welding high strength steel benchmarking study (NSW)	In Progress
	Welding high strength steel benchmarking study (Qld)	In Progress
MEDICAL COUNTERMEASURES PROGRAM		
10.41	Deployable high sensitivity multiplexing point-of-care diagnostic system	In Progress
10.42	Pathology lab-on-a-chip	In Progress
10.43	Rapid mobile pathogen detection and antimicrobial resistivity diagnostic	Complete
10.44	Pharmaceutical development of antivirulence compounds against bio-warfare pathogens	In Progress

> “Impactful R&D outcomes through discipline and excellent management.”

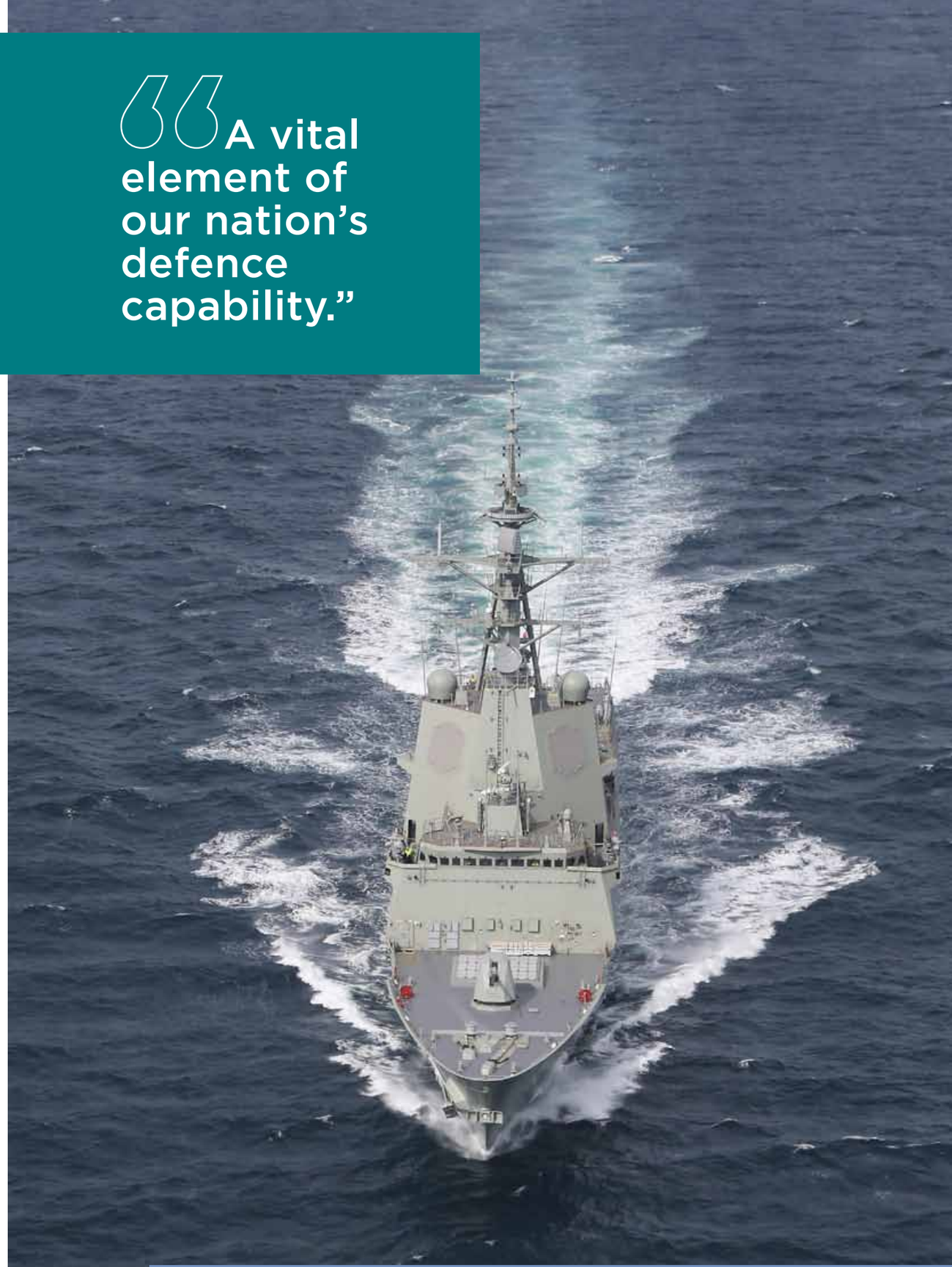
SEA
Program

SEA

The Naval Shipbuilding Plan released by the Australian Government in May 2017 outlined Australia's vision for a national shipbuilding enterprise and provided the investment required to achieve this.

The message from the Naval Shipbuilding Plan and the Chief of Navy is clear: Australia's massive shipbuilding program must become a focused, national endeavour involving Government, Defence and the industry and research sectors. A strong, viable and sustainable Australian naval shipbuilding industry must be established as a vital element of our nation's defence capability. Four key enablers for this vision have been identified as innovation, workforce development, cost competitiveness and collaboration. DMTC has demonstrated capabilities in naval shipbuilding and associated technologies and is well placed to provide significant support to a reinvigorated naval shipbuilding industry. This includes enhancing capacity and capabilities within SMEs to equip them to participate in prime contractors' supply chains.

> "A vital element of our nation's defence capability."



Pictured: NUSHIP Hobart conducts sea trials in the Gulf St Vincent off the coast of Adelaide, South Australia in February 2017.

Sand-blasting (pictured) and repainting are among the most common current methods to treat corrosion of ship components. As a key element of its Sea Program, DMTC is working to identify critical structures and materials susceptible to corrosion; and delivering a range of corrosion prognostic & monitoring tools and prediction models that will be highly relevant to Australia's submarine and surface shipbuilding programs. A detailed understanding of corrosion and its cost drivers (see inset) is vital to informing future work on mitigation strategies and methods.

SEA PROGRAM
Overview

DMTC's Sea Program, funded from within Defence's SEA 5000 Program, is developing technologies that will elevate Australia's industrial manufacturing and sustainment capabilities to a level consistent with global best practice.

DMTC is working with Defence, industry and research institutions to deliver breakthroughs and innovations in manufacturing, to develop and integrate new cost-effective technology and to enhance skills across supply chains.

With construction of offshore patrol vessels and the first of the Future Frigates expected to commence in 2018 and 2020 respectively, DMTC project teams are providing advanced material and manufacturing options to Defence that will contribute to meeting the operational performance, sustainment and technical integrity requirements of Australia's current and future naval fleets.

Five technology areas, at the core of DMTC's established expertise, are being further developed in support of the continuous surface shipbuilding program:

1. improved understanding of corrosion and corrosion mitigation by developing prognostic health monitoring tools and new surface coating technologies
2. development of advanced welding and joining for more efficient fabrication options
3. use of analytical modelling to determine ship life-of-type and and life-of-type extension (LOTE)
4. further development of sonar materials for sustained in-country manufacture of advanced sonar devices
5. advanced toughened composite and polyurethane materials for lightweighting and protection.

Each of the technologies has different drivers, including cost reduction, superior performance, or early detection tools. Some technologies, like LOTE models, are in the early stage of their development, while other technologies are more advanced and ready to be transferred from laboratory into production environments.

The need for a skilled workforce in Australia is particularly critical in delivering the enhanced naval capabilities envisaged in the 2016 Defence White Paper (DWP). In this regard, DMTC's focus on building industry capabilities is also expected to be highly relevant to the establishment of a Naval Shipbuilding College to be operational from early 2018.

> "Shipbuilding is a combination of many things... It will only work if it's a national enterprise, a national endeavour... It's the design and production capability for all of the sub-components, the education process to deliver those with the capacity to design and build in-country, the industry process and the financial process within governments – federal and state – and the research capabilities to develop what's needed."
>
> **– Vice Admiral Tim Barrett, AO, CSC, RAN, Chief of Navy**

SEA PROGRAM
Highlights

Welding options for Future Surface Ship fabrication

Naval shipbuilding currently uses a range of traditional welding processes specific to the joining of naval steels. However, a number of emerging welding technologies may provide the industry with alternative processes, offering the potential for better control of heat inputs and therefore reducing the amount of distortion in the final structure. In previous DMTC research, several gas metal arc welding processes, as well as active distortion control methods, were tested on naval grade steels. In particular, tandem gas metal arc welding parameters were successfully developed for the joining of steel plate used on Australia's Air Warfare Destroyer ship panels. The resulting weld method eliminated significant amounts of thermal rework and increased shipyard productivity.

Researchers at the University of Wollongong (UoW), ANSTO and DST Group are now working with Naval Group (formerly DCNS) to evaluate several of these processes when applied to more complex T-joint stiffener geometry further along the manufacturing process. At this point in manufacturing it becomes more difficult to predict how resulting residual stresses affect the overall ship structure with regard to distortion and operational performance. By correlating residual stress measurements with resulting distortion, researchers aim to create a more accurate weld simulation model to be used for process planning. If proven successful, advanced joining techniques may be utilised at increasing rates in the Australian shipyards of the future.

Blast modelling to help evaluate Future Frigate variants

A continuous surface shipbuilding program offers Navy and Defence planners the opportunity to consider different perspectives on replacement, refit or life extension. These decisions must be informed by expert life-of-type assessments.

Numerical modelling and experimental validation provide the most comprehensive analysis, but the lead times and technical complexity of these studies present key challenges. In response, DMTC is building on experimental work of DST Group in the area of internal blast modelling, material science and engineering design. Researchers at ANSTO are working with DST Group on a number of finite element models and machine learning algorithms to compare assessment techniques and to better understand blast phenomena and its effects on hull integrity. This will improve DST Group's capacity to rapidly assess various operational threat scenarios in order to provide advice to Defence on multiple variations of hull design.

DMTC is applying the above methodology to areas of platform fatigue and corrosion performance. Using both historical and in-service data from future platform contenders, researchers at the University of Tasmania's Australian Maritime College are developing the relevant computational algorithms to allow for a detailed assessment of a ship's 'age' based on the vessel's operational history. In combination with the blast model, this additional model may be used for scheduling of maintenance, management of future operations and ultimately predict how loading damage may determine the life and LOTE considerations for warships.

Advanced surface coatings for corrosion resistance

A series of DMTC projects have successfully demonstrated the potential for high velocity oxygen fuel (HVOF) thermal spray coatings to provide solutions for corrosion and biofouling issues experienced in hydraulic piston rod/shaft components used in seawater applications. Recent work has focused on fully immersed coated rod coupons deployed at three Australian coastal sites with the results being used to determine the optimal composition for corrosion and biofouling resistance, as well as improved coating adhesion when compared to the current plasma-sprayed ceramic coating technologies.

A collaborative project is now underway with research partners SUT and DST Group working alongside supply chain partners MacTaggart Scott Australia and UST to provide the final evaluation of the coatings necessary for engineering test certification. Prototype hydraulic actuators containing HVOF-coated piston sections will be tested in selected underwater environments. Performance data will be made available to the project's industry partners to inform final engineering and design decisions and commercial applications.

Working with industry partner Thales Australia, DMTC researchers, including Mr Tianlong Zhang and Dr Fengwei Xie at UQ (pictured), are testing polyurethane samples to understand failure rates and life expectancy. This work will enhance the stability of future sonar materials.

LAND
Program

LAND

As a major component of an integrated ADF fighting force, the Army relies heavily on the capability edge provided by a sovereign and innovative defence industry and is seeking partnerships with industry suppliers that are at the leading edge of technology and meeting global performance benchmarks.

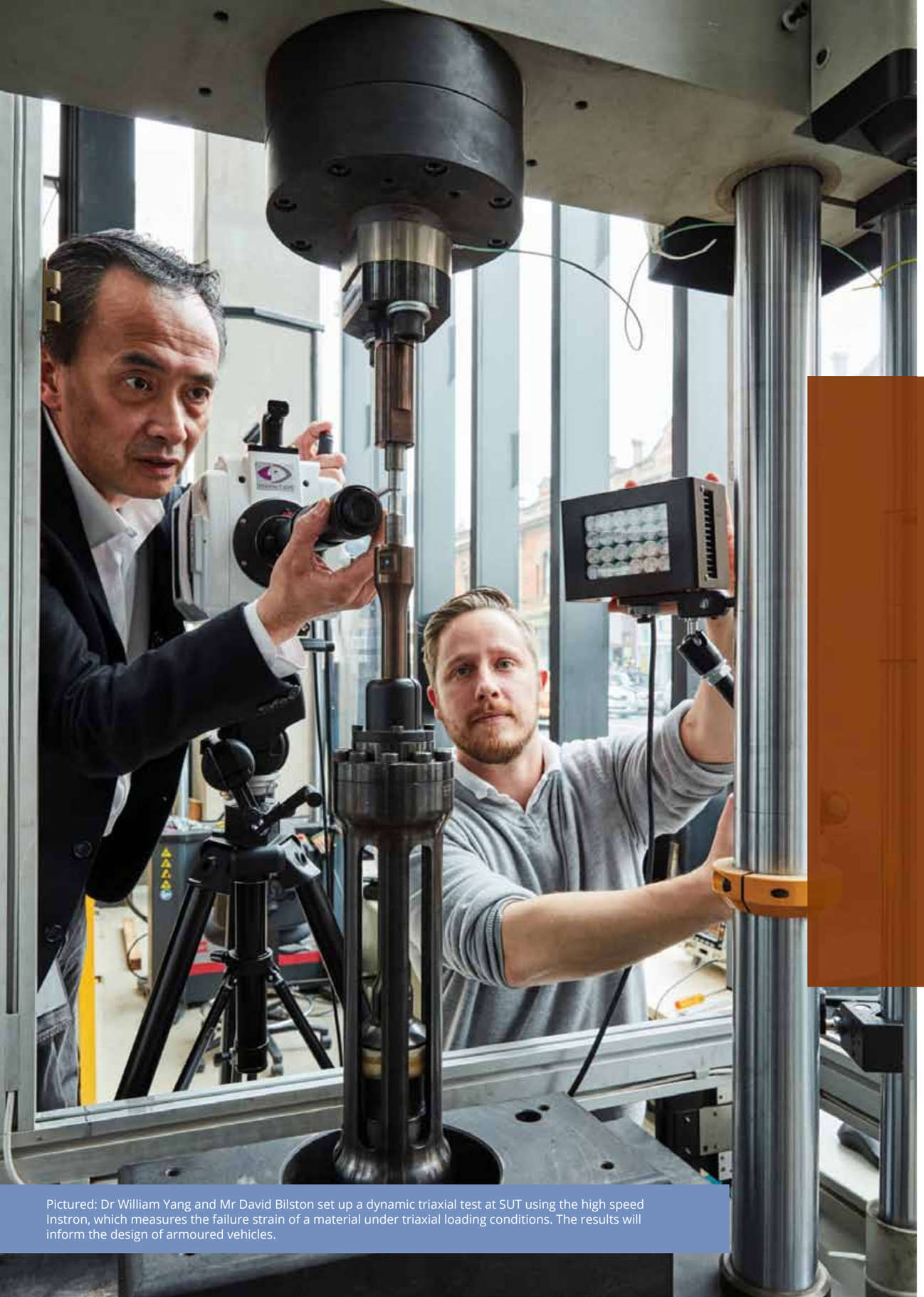
In developing a top-down design and architecture for its land combat system, Army is seeking suggestions from defence industry and the research community on ways to:

1. optimise maintenance and sustainment regimes
2. mitigate risk and reduce cost of ownership
3. introduce innovation, disruption and customisation across soldier combat systems and equipment
4. future-proof the land combat system against technological shocks and innovation challenges.

With these questions in mind, DMTC is working with industry to apply and extend research and development to deliver solutions in the Defence priority areas, identified through Defence's planning processes for force design and for capability acquisition, upgrade and sustainment.

Pictured: ADA's prototype uniform fabric is designed to better protect soldiers from blast debris. Mr Alvaro Carvajal (pictured) is ADA's International Product and Business Development Manager (Military and Tactical Range).

LAND PROGRAM
Overview



Pictured: Dr William Yang and Mr David Bilston set up a dynamic triaxial test at SUT using the high speed Instron, which measures the failure strain of a material under triaxial loading conditions. The results will inform the design of armoured vehicles.

"DMTC does important work partnering with others to enhance Defence and industrial capabilities... On behalf of the Chief of Army I have end-to-end – that is, cradle to grave – responsibility for land capability, its modernisation, and its management. You'll appreciate that this makes me pay close attention to the total cost of ownership of land capability, not just its acquisition cost."

– Major General Kathryn Toohey, AM, CSC, Head Land Capability

DMTC's Land Program focuses on improving materials used in land-based military systems by reducing weight to increase payload and mobility of soldiers and vehicles. Researchers are also investigating technologies that would increase the electricity available to soldiers to power the ever-growing array of electronics used.

The Land Mounted Program encompasses five projects focused on vehicle research: land vehicle alternative materials characterisation; alternative power packages for land vehicles; advanced vehicle modelling; automated manufacturing; and robotic squad support platform.

The scope of the Land Mounted Program has expanded over time to include optimisation of particular features of platform operation. Researchers are developing power technologies and benchmarking against existing vehicle systems to prove performance advantages.

The program is investigating the operation of small autonomous platforms (sub vehicle size) in concert with dismounted combatants – increasing their load carrying, mission configuration and lethality options.

The Land Dismounted Program research spans body armour, protective fabrics and power technology. Many of these projects are at a mature stage and the program has expanded its mandate to include fabrics that protect against chemical, biological or radiological (CBR) threats.

Under this program, several technologies have progressed to prototype stage, including a combat helmet shell, ceramic applique for helmets, portable fuel cells, lighter weight soft armour, lighter weight stab and spike armour, fragmentation resistant combat uniform fabric and quick-drying combat uniform fabric. The prototypes illustrate potential capability improvements in the areas of soldier protection and/or reduced weight.

LAND PROGRAM
Highlights

High curvature armour

A key objective in soldier combat systems, particularly protective equipment, is the balance between protection, comfort and mobility.

This project is assessing the feasibility and design of shape-specific body armour systems. It is expected to provide an industrial capability for forming of ballistic materials into more complex shapes, giving increased protection and comfort, including provisioning for frontline female combatants.

Led by industry partner DefendTex, this project is one example of the potential commercialisation opportunities from a new and innovative DMTC platform technology known as double diaphragm deep drawing or simply D4 (patent pending). DMTC expects to see commercialisation opportunities being pursued by multiple industrial partners in Australia along different proprietary pathways and technology extensions. D4 offers a range of process and performance enhancements including spliceless production, adoption of next-generation materials and reductions in manufacturing cycle times. There are likely to be opportunities to further advance these technologies in both military and civilian applications for both Australian and export customers in the future.

The project team comprising industry partner DefendTex and research partners DST Group, Deakin University and BMT has worked on the curing of laminates and modifications to tools design and materials. These extensions of the D4 technology are expected to realise higher production efficiency, trial new temperature control and quenching methods and overcome known challenges with adhesion and fabric surface treatments.

Blast models to inform future decisions

Future ADF vehicle acquisitions include smaller, lightweight vehicles for which the challenge of minimising the weight of the vehicle while meeting structural performance, protection levels and endurance requirements is critical.

Through DMTC, industry partner Thales Australia is working with research partners from the University of Melbourne (UoM), DST Group and ANSTO to develop a systems-level simulation capability that can be applied to the design and service life evaluation of military land vehicles.

Building on previous DMTC research and materials characterisation work, the project team is working to increase the fidelity of modelling; and develop a better understanding on the behaviour of vehicles, namely the structural and kinematic responses, to blast wave and impact events.

One of the objectives of the project is to develop material and numerical models to capture shock wave impacts through soil and air, in line with international standards. To date, soil blast and steel pot blast tests have been successfully undertaken, and a numerical model has been developed and validated based on experimental inputs.

On completion, vehicle and environmental models developed will be shared with industry partners and to Defence stakeholders as requested. The models will inform the development of upgraded components for mid-life upgrades of existing platforms, and future platform designs.

World-first breakthrough for vehicles and beyond

Automated off-line programming (AOLP) is a technological breakthrough developed through DMTC's collaboration with UoW and proven on Thales Australia's Bushmaster vehicle production line in Bendigo.

AOLP was created to automatically re-program the complex robot movements necessary to achieve production requirements. The research outcomes have significantly reduced the programming time for new products and increased the effectiveness of Thales' existing robot application from a utilisation rate of 36% up to 100%. Recent advances in the programming and mathematics behind the AOLP software have led to further improvements in computing and simulation speeds and further automation of downstream processing tasks.

Initially developed for long seam welds such as those found in the assembly of steel hulled platforms including ships and armoured vehicles, such as the Thales Bushmaster vehicle, the technology has now been adapted for the assembly of complex, tubular space frames such as those found on a smaller, lightweight protected military vehicle.

The successful demonstration of the robotic system for the fabrication of complex pipe structures, such as those found on Thales's Hawkei protected mobility vehicle being acquired by the Australian Army, is a world-first Australian capability and one that offers significant opportunity for the Australian manufacturing sector.

This extension of the technology is expected to open up a range of new potential applications for AOLP across the defence industry sector, including in naval shipbuilding, and in other commercial applications.

Breakthrough in fabric technology

The industry and research partners involved in DMTC's Advanced Nanostructured Fabrics project have achieved a major milestone. The team has developed and tested a composite fabric for use in protective suits, filtering harmful airborne particles while maintaining breathability and thermal comfort.

The fabric has a multi-layer textile structure, which stops hazardous CBR substances from travelling into and through the fabric while remaining fully breathable and allowing heat to travel out of the fabric.

A lack of protection from aerosolised hazards has previously been identified as a capability gap in Individual Protective Equipment. Previous systems have relied on employing multiple layers of fabric to provide protection. Studies of existing low-burden protective suits available internationally confirmed the need for Australia to develop its own solution.

In seeking to deliver enhanced protection that far exceeds the performance of current protective suit systems, the team has faced technical challenges in the structure of the fabric solution and in bonding and seam-joining methods. The DMTC solution demonstrates that the individual protective elements can now be combined into a single integrated fabric system with enhanced utility, fit and comfort.

The project is funded through the Defence Innovation Hub. Industry partners are Bruck Textiles and Revolution Fibres, with research expertise provided by the DST Group, CSIRO and the Royal Melbourne Institute of Technology (RMIT). Initial development of the composite technology underpinning Membrane Protective Absorbent Composite Technology – Aerosol-Vapour fabric was previously funded under a DST Group research fellowship that concluded in June 2013.

Having demonstrated the technical characteristics and performance of the new fabric in a laboratory setting, the DMTC team is now focused on further improving thermal comfort and moving toward prototype garment production.

AIR
Program

AIR

Guided by Plan Jericho and the elements of the 2016 DWP suite focused on the Air domain, the Royal Australian Air Force is undertaking the largest technological upgrade in its history. To match the upgrades to the capacity of its major aircraft platforms, Air Force recognises the need to transform its people, operating concepts, training, support systems, maintenance and sustainment approaches.

DMTC's Air Program is focused on delivering technological advances in line with Defence priorities, with a strong focus on building the capacity of the underpinning Australian industrial base and on manufacturing and repair technology solutions.

> "Building industry expertise and capacity."

Australian Government Department of Defence Science and Technology

RMIT UNIVERSITY

SECO

The University Of Queensland AUSTRALIA

Together ahead. RUAG

suttontools world class cutting tools

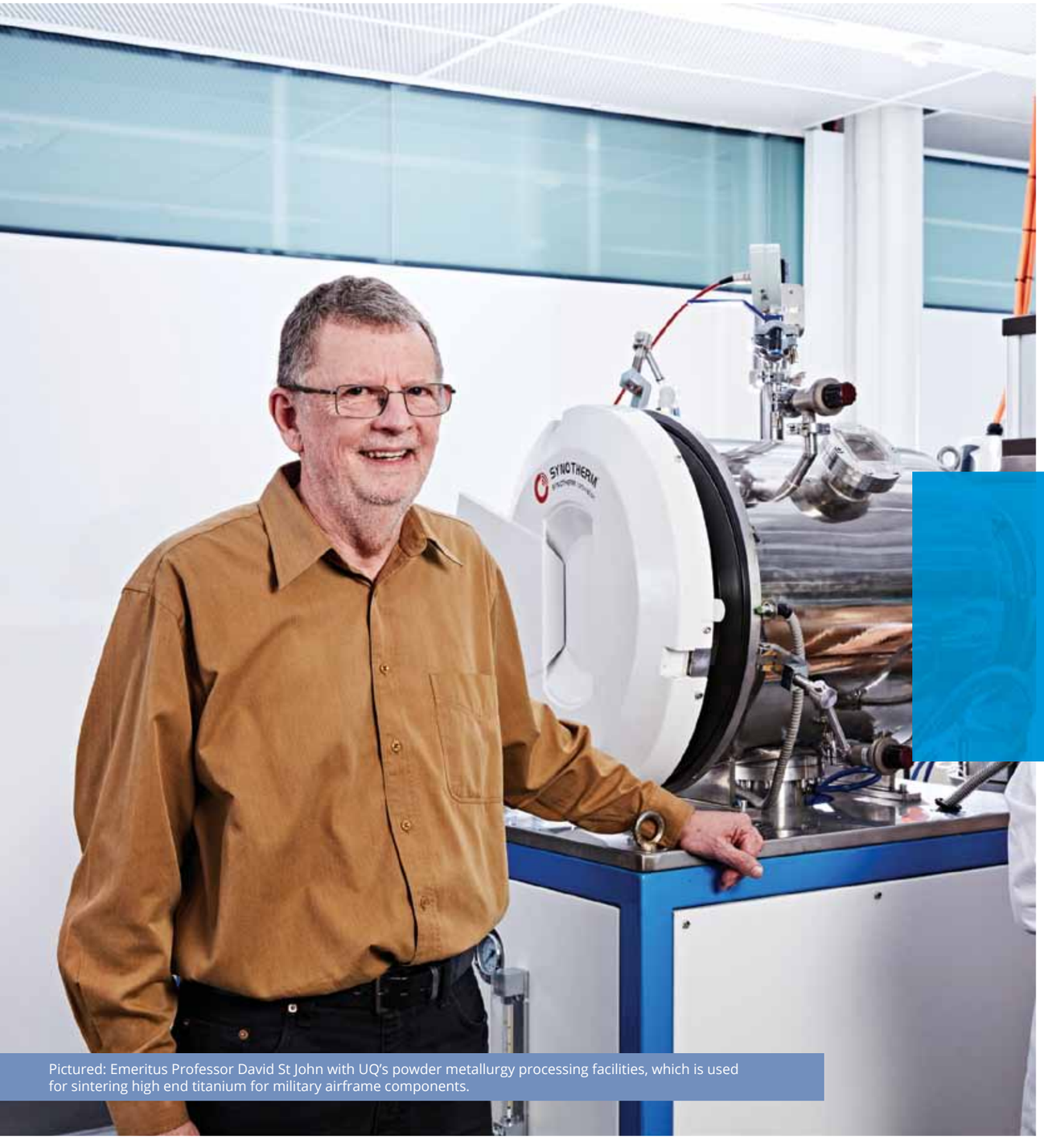
The University of Melbourne

Swinburne University of Technology

QUT

Pictured: An Australian F-35A JSF at Luke Air Force Base, Arizona (USA) with its weapons bay open.

AIR PROGRAM
Overview



Pictured: Emeritus Professor David St John with UQ's powder metallurgy processing facilities, which is used for sintering high end titanium for military airframe components.

> "There are some challenges ahead, which means Australian industry will have to stay internationally competitive by improving efficiency; driving innovation, supporting skills development and maintaining quality."
>
> **– Air Vice-Marshal, Leigh Gordon, AM, CSM, Head Joint Strike Fighter**

Research in the Air Program is currently focused on increasing the competitiveness of the manufacturing, repair and sustainment capabilities of Australia's defence industry.

The DMTC Air Program team is working with industry and research partners to enhance manufacturing and sustainment performance by developing new processing technologies and introducing world best practices. These include improving and enhancing existing additive manufacturing technologies in order to make them suitable for the production of high integrity, high value components.

This program's research activity focuses on technologies to:

- provide cost effective opportunities for aircraft component supply chains including the exploration of additive manufacturing technologies for the production of components
- improve maintenance operations such as corrosion, fatigue and structural health monitoring.

In the Air Program, DMTC research partners and BAE Systems Australia have continued to advance technologies to improve manufacturing of titanium components and deliver corrosion prognostic solutions for Defence.

Along with industry partner Sutton Tools, DMTC has made further progress towards producing a new generation of cutting tools produced using laser-based additive manufacturing techniques. These new tools have been tested and benchmarked against standard cutting tools during machining of titanium components. Additive manufacturing processes including direct metal deposition, laser cladding and supersonic particle deposition (SPD) technologies have also been applied and optimised for the repair of aircraft components in the sustainment capability project. This sustainability work has the potential to increase aircraft availability and reduce the cost of maintenance of ADF aircraft.

AIR PROGRAM
Highlights

Repair, not replace

For ageing aircraft platforms in particular, replacement components and systems can be expensive and difficult to source. Long lead times for spare parts can lead to delays in aircraft returning to the flight line.

A DMTC collaboration involving industry partner RUAG Australia and research partners DST Group, SUT and RMIT has focused on developing Laser Cladding Technology (LCT) as a potential maintenance and repair solution. LCT is one of a raft of emerging manufacturing technologies that use powder to repair machine components suffering from wear and tear.

The 'holy grail' for this work is ensuring the repaired aerospace components and structures meet the demanding technical airworthiness standards required for Defence aircraft. The hardness and surface finish of the components need to be built back up to their original dimensions.

Another technology solution in this field is SPD, which deposits powder to the substrate by ejecting it from a nozzle at high speed. SPD allows for more localised (on a particle-to-particle basis) heating of the substrate. While SPD is currently available to the market, work is underway to improve nozzle design for greater ejection speed and to develop a field-deployable solution.

The team is also continuing to work on combining cladding technology with digital manufacturing processes, in order to build up the damaged surface area in a more controlled way.

New manufacturing capabilities

Recent work has involved optimising both part design and processing parameters in a range of materials. A wide range of technologies have been reviewed and evaluated. A database is being developed to capture detailed mechanical property information for different materials, that will be critically important in the development of a design package.

Emerging modelling and simulation tools for process optimisation and prediction are also being evaluated in collaboration with industry partners.

DMTC's project team involving industry partners Seco Tools and research partners the University of Queensland (UQ), SUT and RMIT has successfully demonstrated fabrication techniques for titanium parts using selective laser melting (SLM) techniques. The team has studied the influence of various SLM process parameters on the relative densities of aluminium and stainless-steel samples. The flexural behaviour of several parts with lattice structures were studied to develop a detailed understanding of fracture patterns. The influence of solute oxygen on grain growth kinetics of titanium-based alloys has also been investigated.

A recent breakthrough in this project has been the commissioning of an actual aircraft part to manufacture. The combination of the design package – addressing limitations in design and manufacturability – and the actual part to manufacture is set to intensify work in this project.

A challenge for this team is to exploit the potential recyclability of powders used in additive manufacturing, and to investigate other sources of cost-effective powder materials for advanced manufacturing technologies such as SLM.

Precision tooling – at the cutting edge

Materials used in the manufacturing of critical military equipment are inherently difficult and costly to machine.

Australian industry must establish and demonstrate cutting-edge capability in the efficient and economical manufacture of these components in order to maintain international competitiveness within global supply chains.

This project is aimed at innovation in new tooling and manufacturing practices, and establishing local supply chain solutions for Defence.

Along with industry partner Sutton Tools and with research expertise from RMIT and SUT, DMTC has made further progress towards producing a new generation of cutting tools produced using laser-based additive manufacturing techniques. The performance of these new tools has been tested and benchmarked against standard cutting tools, demonstrating comparable outcomes to date.

More broadly, the team is developing a knowledge base in cutting processes, additive manufacturing and coatings that will enable research partners to build on their existing capability and expertise.

CUTTING EDGE CAPABILITY

Sutton Tools is Australia's largest manufacturer of engineering cutting tools and power tool accessories. The Australian-owned company employs more than 400 people and is celebrating 100 years of operation in Australia – a milestone that was celebrated at this year's DMTC Annual Conference. Sutton Tools is a founding participant of DMTC.

At this year's annual conference, Dr Mark Hodge (left) presented an award to Sutton Tools, represented by Dr Steve Dowey (right).

ENABLING TECHNOLOGIES
Program

The Enabling Technologies Program focuses on those underpinning technologies that form the basis of many materials and manufacturing capabilities required to produce an innovative and sustainable defence industry.

DMTC, Thales Australia, DST Group and CSIRO are collaborating to develop several technologies that aim to provide a military capability edge across many different technology platforms, improving performance, agility, efficiency and mechanical and environmental durability.

Program activities include:

- development of lightweight materials
- development of methodologies and tools for the evaluation of materials
- new composite manufacturing processes
- extending current testing methodologies to determine essential material characteristics for lightweight materials
- applying and validating multi-scale damage initiation and propagation simulation tools for composite materials and structures
- investigating the application of novel manufacturing methods for the cost-effective production of small batch Defence components.

Successes of this program will be transferred into new, specific platform-based programs in the future.

> “DMTC projects are not about taking investment dollars and disappearing behind the laboratory door. Our focus is on leveraging the investments and expertise of our partners to prove technologies and to pursue applications of those technologies in new contexts and domains.”
>
> **– Dr Mark Hodge,**
> **CEO DMTC**

Pictured: Dr Martin Veidt removes cured glass fibre reinforced vinyl-ester from the oven at UQ as part of DMTC’s research into lightweight composite materials. Dr Veidt is DMTC’s new Enabling Technologies Program Leader.

Pictured: UQ's Miss Kelli Thomas characterises composite materials. The digital image correlation measurement system tests materials for strength. Miss Thomas is now a Graduate Engineer at Thales.

ENABLING TECHNOLOGIES
Overview

The Enabling Technologies Program is tasked with developing the underpinning technologies that form the basis of many materials and manufacturing solutions required to produce an innovative and sustainable defence industry. This program allows DMTC to invest in strategic, underpinning technical capability that will be transferred into new, specific platform-based programs in the future.

Activities this year have focused on lightweighting technologies, corrosion assessment and protection measures along with industry engagement and benchmarking activities. The development of lightweight material solutions can provide a military capability edge across many different technology platforms to improve performance, agility, efficiency and mechanical and environmental durability.

Project partners Thales Australia, DST Group and CSIRO are developing new material solutions that provide advantages in mass and/or functionality and have comparable mechanical and environmental performance to conventional materials. As always, cost is a major consideration when assessing the feasibility of possible solutions.

New materials for land vehicle applications require the development of methodologies and tools that may also be applicable to other Defence platforms.

These methodologies and tools include:

- establishing unified material selection processes and procedures to compare stiffness, strength, weight and environmental performance, and include materials manufacturing as well as operational costs as integral parts of the evaluation process

- investigating the potential of new composite manufacturing processes such as high-pressure reactive resin transfer and injection moulding (RTM) and injection overmoulding as cost-effective alternatives for primary composite structures. In addition, established manufacturing processes such as light resin transfer moulding (L-RTM) and vacuum-assisted RTM are investigated as manufacturing techniques for secondary components

- extending current testing methodologies to determine essential material characteristics for lightweight material solutions such as interlaminar and interface strength and toughness of fibre-reinforced composite laminates and hybrid fibre metal laminates. This includes the extension of current digital image correlation (DIC) measurement techniques to determine properties such as interface toughness, which are essential input parameters for advanced numerical simulation programs to analyse and predict the mechanical performance and damage modes of composite material solutions

- applying and validating multi-scale damage initiation and propagation simulation tools for composite materials and structures. This includes the application of advanced finite element methods such as phantom node and cohesive zone modelling techniques

- investigating the application of novel manufacturing methods for the cost-effective production of small batch Defence components. This includes the development of robot machining capabilities to prepare deep moulds for fibre-reinforced structures and manufacture of 3D-printed sand casting moulds to produce near net-shaped metal moulds for lightweight aluminium castings.

ENABLING TECHNOLOGIES
Highlights

Innovative casting solutions... a step at a time

DMTC is continuing to support industry partner Thales Australia in the identification and testing of alternative metals that could be used in several components of the Hawkei light protected mobility vehicle platform. The potential benefits include reduced manufacturing costs and possible weight savings at equal strength and durability performance.

One component being investigated in detail is the side step of the Hawkei. The original component is manufactured from plate-welded steel. A casting version of the component using gravity casting as an alternative manufacturing route is being investigated as a way to reduce manufacturing costs and weight, and to improve the mechanical and environmental performance of the part.

Additive manufacturing solutions including sand-printing technology instead of traditional pattern and moulding technology have been utilised to manufacture sand moulds for making prototype gravity sand castings with short lead time and low cost. Three sets of prototype castings have passed maximal load case and fatigue testing and 3D dimensional scanning inspections. These test results verified the feasibility of the casting solution for the side step. Supply chain partner Melbourne Gravity is providing casting expertise. The team is now focused on taking the innovative casting solutions into a full-rate production environment, using near net-shape mould manufacturing for the cost-effective manufacture of associated tooling.

The project team is also developing a comprehensive material database for the dedicated aluminium alloys in order to support design and testing. This will establish a foundation for the development of efficient cast aluminium solutions for a broader range of defence applications in the future.

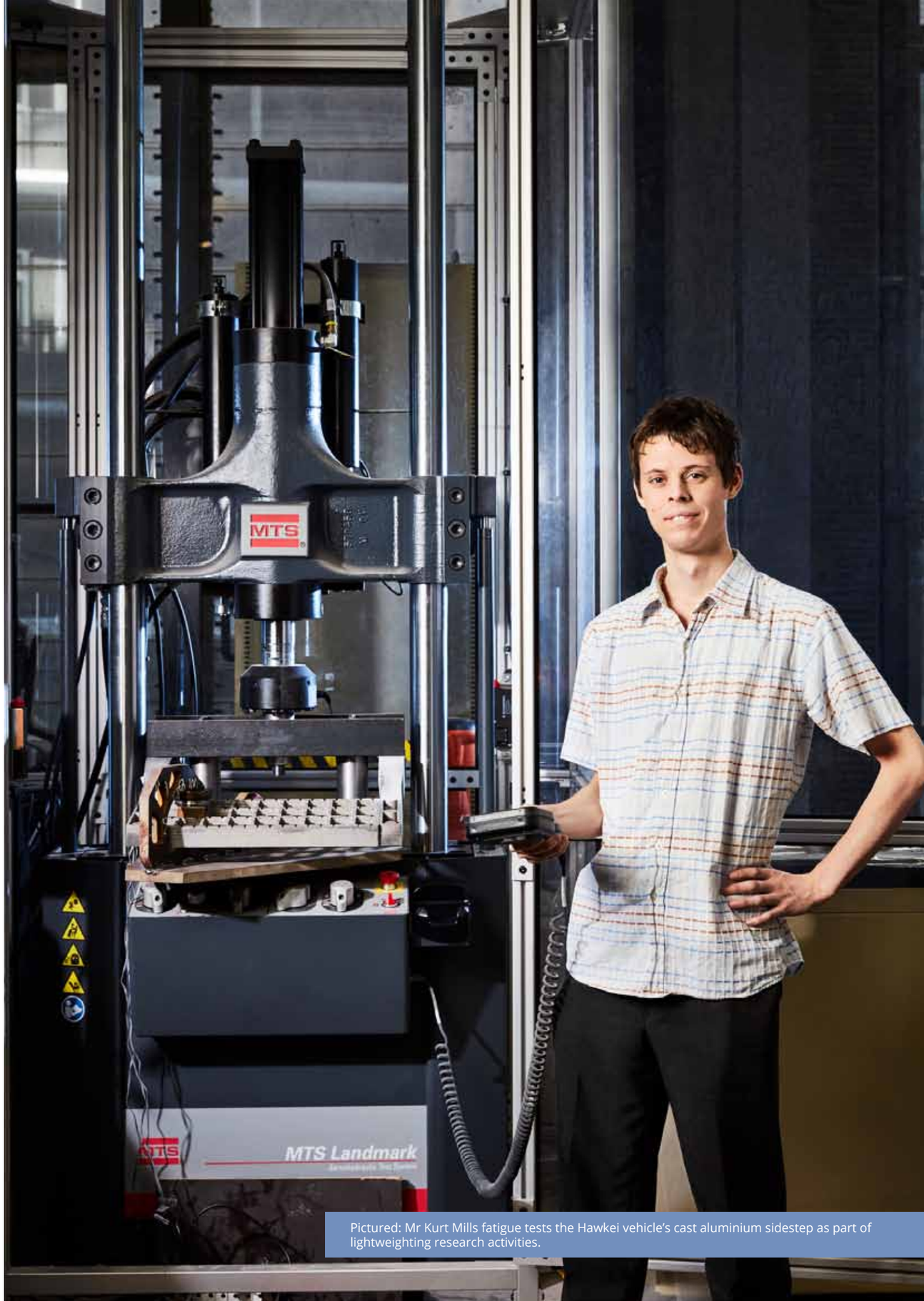
Lightweight composite materials solutions

Cost-effective manufacturing techniques are currently being developed using robot machining of deep moulds and modular design concepts. They are critical to demonstrate the possible cost efficiencies of replacing current metal solutions with fibre-reinforced composites for the small batch sizes that are common in Defence applications.

This DMTC project is identifying and assessing lightweight composite material solutions as cost-effective alternatives for armoured defence platforms in general, and for Thales Australia's Bushmaster protected mobility vehicle in particular.

A detailed materials selection study identified glass fibre reinforced vinyl-ester composites as potential candidates to produce external storage locker compartments that are currently manufactured from aluminium sheet metal. Queensland-based SME Fibreglass Design Panels support the development of modular mould systems and the manufacturing of prototype components.

An extended database of the mechanical characteristics of the selected material – including interlaminar toughness and bearing strength – was determined. Calculating interface toughness involved a novel top surface analysis method using 3D DIC displacement measurement. The material data is used in finite element simulations to develop and validate micro-mechanical damage models. They are essential foundations to the design of cost-competitive lightweight composite components.



Pictured: Mr Kurt Mills fatigue tests the Hawkei vehicle's cast aluminium sidestep as part of lightweighting research activities.

MEDICAL COUNTERMEASURES Program

MCMs is an exciting program of work for DMTC, that has facilitated the introduction to DMTC of several new industry and research partners. This critical work aligns with national and international efforts to protect against CBR threats, emerging infectious diseases and pandemics.

Trends toward increased global prevalence and transmissibility of diseases and man-made threats pose a serious risk to our national security and our healthcare systems.

To effectively prepare for existing and emerging threats, Australia must implement a strategy that builds on-shore capability and capacity to rapidly develop, produce and deploy MCM products.

A recent analysis of the national industrial and research landscape determined that Australia has the potential to meaningfully contribute to global MCM product development efforts and lead these efforts regionally. DMTC's program is part of this broader effort to position Australia to become a centre of expertise in the region, harnessing resources from across civil and military domains to develop an effective MCM capability.

Australian Government Department of Defence Science and Technology

CSIRO

miniFAB MICRO-ENGINEERING | MEDICAL | MANUFACTURING

Planet Innovation

anteo technologies

MONASH University

DEAKIN UNIVERSITY

THE UNIVERSITY OF WESTERN AUSTRALIA

[dstl]

> "An exemplar of future engagement with Australian SMEs."

Pictured: L to R: UWA's Dr Mitali Sarkar-Tyson, Dr Jua Iwasaki and Ms Emily Kibble analyse pathogen proteins in their pursuit of antivirulence compounds against bio-warfare pathogens.

MEDICAL COUNTERMEASURES
Overview

“Our role is to deliver what we term ‘force health protection’ to the women and men of the ADF, and to many other populations that we serve. For us, the opportunity to engage through DMTC with other organisations in advancing the work, towards producing the MCMs we need, we see this as vital. One of the big benefits in bringing Australian industry and Australian research capability to the fore, is to reduce our supply risks in terms of dependence on other militaries.”

– Air Commodore Mike Paterson, Director General Health Capability, ADF

Pictured: A Planet Innovation technician tests different thread membrane constructions for sensitivity and reproducibility. The Nplex POC diagnostic system will enable fast, accurate diagnosis of infectious diseases while out in the field.

With seed funding from both CSIRO and Defence (through DST Group), DMTC’s MCMs Program is in its second full year of operation.

MCMs include vaccines, therapeutics and diagnostics for the protection of military and civilian personnel against CBR threats, emerging infectious diseases and pandemics.

DMTC’s program builds on extensive work carried out by DST Group, CSIRO and various industry and academic partners. Its focus is on product development in three broad areas namely point-of-care (POC) diagnostics; antimicrobial resistance; and security sensitive biological agents.

MCMs are an important sovereign capability for Australia in a range of scenarios. Endemic tropical and mosquito-borne diseases are a key risk to Australians, military and civilian, and to international forces deployed on exercises or operations in Australia’s north.

Currently Australia relies heavily on imported products and DMTC is working to build the underpinning industrial capability for in-country production of vaccines and diagnostic devices.

Research developments

DMTC’s MCMs Program has already leveraged an additional three dollars of investment for every dollar of Government funding, with additional project activities anticipated to grow this already-successful program. DMTC’s work to support national industrial capacity for MCM production is an exemplar for future engagement with Australian SMEs in the biotech sector.

A call for Round 2 proposals was issued in March 2017. Three projects have now been selected and are expected to commence before the end of the calendar year.

MEDICAL COUNTERMEASURES
Highlights

Antivirulence compounds against bio-warfare pathogens

Bio-warfare agents cause potentially lethal infections and many species are multi-drug resistant. As a result, there is an urgent requirement for new treatment regimes and antibiotics.

DMTC's collaboration with research partners at the University of Western Australia, DST Group, the Peter Doherty Institute and the University of Wurzburg is focused on delivering novel anti-virulence compounds, which are active against potential bio-warfare agents including Burkholderia pseudomallei, the known causative agent of the disease melioidosis.

These novel inhibitors directly target the macrophage infectivity potentiator (Mip) protein, conserved in a number of bacterial species, meaning that the treatment effectively tackles the virulence factor while reducing the chance of developing resistance to the therapy.

The project team has investigated the broad-spectrum activity of these novel compounds and to begin with has demonstrated that they successfully inhibit the Mip protein from the Coxiella burnetii pathogen.

As a result of this finding, the project team has also initiated gene-based studies with the Coxiella Mip protein to investigate its role in the ability of this pathogen to cause disease.

Structural studies are also being used as a guide to improve inhibitors to achieve enhanced efficacy. These modified inhibitors have been synthesized and are now ready to screen, first against the Mip protein itself and then in in vitro infection tests against the bio-warfare pathogens.

Deployable, highly sensitive diagnostic system

This DMTC collaboration with Planet Innovation (PI) is developing mobile, high precision diagnostic tests to enable medical professionals to rapidly identify and treat life threatening diseases.

Considerable progress has been made on the first development phase of this project, involving the development of a field deployable POC diagnostic testing system that will detect and differentiate multiple infectious disease agents within a single test cartridge.

The project addresses the specific need to diagnose military and civilian personnel infected with security sensitive biological agents. Alongside PI, industry partner Anteo Technologies and research partner Deakin University have also contributed to this project.

Anteo has worked to optimise the infectious disease test chemistry in order to further improve test sensitivity and Deakin has produced and tested a novel, thread-based membrane which acts as the support material for the infectious disease tests.

PI has successfully integrated the test chemistry and test membrane, carrying out functional performance analysis and optimising of the entire test system using a camera-based reader technology to accurately assess test results. PI have also generated a number of concepts for panel cartridges which would allow multiple, simultaneous tests to be run from a single sample input.

Pathology lab-on-a-chip

Disease-causing agents or pathogens are of concern to the ADF when it deploys forces overseas, particularly in the world's developing regions. Rapid identification technologies will be critical to military personnel to ensure that appropriate and timely treatment can be delivered.

This project is seeking to demonstrate an in vitro diagnostic (IVD) that is of direct relevance to military health. DMTC industry partner MiniFAB is developing a field-deployable, in vitro diagnostic (IVD) platform that uses polymer-based capillary fluidics to quickly identify a target pathogen and communicate the test results via a low-cost and readily available instrument, for example a mobile phone or similar device.

The project is bringing together industrial and research capabilities that have previously existed in isolation in Australia. Collaborating through DMTC has enabled these partners to be brought together to address a clearly defined Defence need.

Using the chikungunya virus as a pilot pathogen, key technical challenges that are being overcome as the project progresses include:

- assay development and translation
- immobilisation and blocking
- manufacturing integration
- demonstration of detection.

Research partners Monash University and CSIRO are performing antibody production at different stages. Isolation, sequencing of antibodies and their purification has been successfully completed. Multiple surface treatments have been explored for antibody attachment to the platform device. The stability of the surface treatment has been identified as one of the major risks, which is currently being mitigated. The project team is focused on delivering a fully functional, polymer-based platform by March 2018.

MiniFAB has recognised that this platform technology has the potential to be relevant to multiple pathogen targets and therefore may have a significant civilian application.

For our research partners, successful demonstration of this capability will prove the value of Monash University's state-of-the-art facilities and infrastructure, and build on CSIRO's world-leading competency in surface treatments and biomedical devices. It also provides an opportunity to keep the technology development and manufacturing capability for the device in Australia.

INDUSTRY CAPABILITY
Development

DMTC's Industry Capability Development Program aims to create a network of 'Defence-ready' companies with benchmarked, globally competitive capabilities. It has a strong focus on engaging SMEs in its research and development activities and equipping them to participate in prime contractors' supply chains.

Participants gain exposure to innovative technologies, best practice techniques and processes and insights into quality, safety and certification standards expected by Defence. The multi-phase DMTC program involves process benchmarking and technology transfer activities with research partners and with support from the Centre for Defence Industry Capability (CDIC) and relevant certification partners.

This multi-phase program aims to build capacity and open doors to opportunities in the Defence sector. It also provides mentoring and evidence-based feedback on what SMEs need to do to improve skills. Building on previous capacity-building successes in areas such as CNC machining and additive manufacturing (3D printing), current efforts focus on enhancing welding capabilities. Selected SMEs in the Latrobe Valley, Illawarra and Mackay regions have been involved to date, with the program likely to expand into Tasmania, other Queensland regions and other states in 2017-18.

DMTC's activities focus on development of industry capability, rather than a specific product. As such, platform independent activities (such as welding productivity improvements) can be addressed independently of design or prime contractor selection, by focusing on supply chain improvements and setting context through global best practice benchmarks, standards and quality frameworks.

Future expansion of the Program may address additive manufacturing and casting techniques, and technologies critical to the digitalisation of manufacturing.

"Companies have really embraced the opportunity – some have even agreed to join forces to offer a cluster of regional capability. It's a big thing for companies that normally compete in the marketplace to agree that in the defence space they want to work together, but this kind of program led by DMTC shows it is possible."

– Dr Valerie Linton,
Executive Dean of Engineering and Information Sciences, UoW

GROWING SUPPLY CHAINS

HIGH ALTITUDE SENSOR SYSTEMS Program

In FY2017 DMTC established a new program to develop and enhance Defence capabilities in the space domain. Over the decade to 2025-26, our Defence customer plans to invest around nine percent of the total value of the Integrated Investment Program to strengthen its existing capabilities and develop new intelligence, surveillance, reconnaissance, electronic warfare (ISREW), space and cyber capabilities.

Defence has prioritised evolving threats and changes in ISREW technologies as areas for further investment, in order to develop and maintain Australia's capability edge. Enhancements in the ADF's capabilities in these areas will be critical to the delivery of a significant number of the equipment acquisition projects in the Integrated Investment Program.

DMTC's HASS Program will specifically focus on the development of miniaturised sensor components and on-board processing of sensor data for small Unmanned Aerial Systems (UAS) as well as micro-, nano-, and cube-satellites (with a payload capacity of up to 5 kilograms).

Leveraging an initial CSIRO investment of $2.7m, a total program of work valued at greater than $6m over four years is envisaged. Technical and strategic-level Advisory Groups have been established for the Program, and Dr Kimberley Clayfield, Executive Manager Space Sciences and Technology has been appointed Program Leader on secondment from CSIRO.

Projects fit within one of two theme areas:

THEME 1:

Miniaturised & ruggedised sensor components (synthetic aperture radar, chemical, thermal, hyperspectral), including:

- development of new or enhanced test/ validation techniques (e.g. unmanned aerial system testbed)
- sensor 'building block' technologies (e.g. 3D printing, low coefficient of thermal expansion materials, miniaturised optics, mass/size optimisation of existing sensors).

THEME 2:

On-board processing of sensor data including:

- enhanced data compression
- integrated data analysis (e.g. classification of thermal, electromagnetic, emissions).

The initial call for proposals for the program in December 2016 yielded an impressive 36 responses, representing collaborations involving more than 50 organisations from across the research and industry sectors. From this initial response, 11 proposals were shortlisted to move to a second stage where detailed proposals were considered. A list of projects announced for Phase 1 is available on DMTC's website: **www.dmtc.com.au/our-activities/sensor-systems/**

DMTC is actively seeking opportunities to expand the program in the near and longer term (this relates to both opportunities to build the base by attracting investment from Defence and other sources, but also to the potential to increase contributions to the program by adding new partners to existing activities as the projects mature).

JOINT STRIKE FIGHTER Program

Involvement in major Defence programs, including multinational collaborations like the F-35 JSF, provides critical context and global competitiveness benchmarks for Australian industry development. DMTC is well positioned to provide leadership, technological expertise and strategic pathways for industry to develop in-country capability in order to provide enhanced capabilities for the RAAF in the operation of the F-35 JSF, and for Defence more broadly.

In March 2017, the Minister for Defence Industry, the Hon. Christopher Pyne, MP, announced that DMTC would work with Defence's JSF Division and DST Group to identify improvement and innovation opportunities that will address key sovereign capability requirements in the operation and sustainment of the F-35 JSF.

DMTC sought expressions of interest from industry and research organisations to:

- develop and enhance Australian industry capabilities in support of the F-35 JSF program
- position Australian industry to pursue opportunities to participate in both the F-35 JSF global supply chain, and the sustainment of in-service fleets
- provide opportunities for Australia's smartest minds to contribute to the global technology development learning curve for this sophisticated new fifth-generation air platform.

Along with a letter of support from Air Vice-Marshal Leigh Gordon, the Head of Defence's JSF Division, DMTC has called on domain expertise from DST Group to assist with reviewing applications, prioritising and developing a detailed program of research and capability development activities. The proposed program is currently with Defence for consideration.

DMTC's program will assist Australian companies that have already won F-35 JSF production contracts to continue to innovate and maintain a competitive position within the global supply chain. The program will also include the development of critical in-country capabilities associated with sustainment and follow-on modification and upgrade capabilities to support the F-35 JSF platform once in service.

> "DMTC has a demonstrated track record of delivering a range of key production, fabrication, manufacturing and sustainment technologies in the aerospace sector... The JSF Division is seeking to identify improvement and innovation opportunities for development through DMTC so they can assist Australian industry..."
>
> **- Air Vice-Marshal, Leigh Gordon AM, CSM, Head JSF Division, Defence**

Pictured: The RAAF's F-35A Lightning II JSF just after leaving Luke Air Force Base, USA.

ANNUAL CONFERENCE
Canberra

A highlight of the evening was guest speaker Corporal Daniel Keighran, VC, (pictured left) who told the remarkable story of his life and the circumstances of the 2010 battle in Afghanistan for which he was awarded the Victoria Cross.

DMTC's Annual Conference at the Australian Academy of Science's Shine Dome in Canberra on 28 and 29 March featured presentations from senior Defence and industry representatives on meeting challenges facing today's ADF, as well as detailed technical presentations on the progress of DMTC projects.

Keynote speakers were Mr Benjamin Hayes, Assistant Secretary Defence Capability & Innovation, Mr Andrew Garth, General Manager of the Centre for Defence Industry Capability and Mr Brad Yelland, Head of Business Strategy, BAE Systems Australia.

DMTC'S ANNUAL CONFERENCE

Pictured top to bottom: (L to R) Mr Benjamin Hayes, Mr Andrew Garth and Dr Mark Hodge; CPL Dan Keighran, VC, with Dr Felicia Pradera; Dr Yen Truong with Mr Deepak Ganga.

AWARDS
for Excellence

The DMTC Awards for Excellence were presented at the Conference Dinner, which was held at the National Gallery. The Awards recognise significant contributions made by individuals and teams that have resulted in successful outcomes for DMTC and its partners.

The *Research Collaboration Award* was presented to Dr Felicia Pradera for embodying the spirit of collaboration that is integral to DMTC's strategic intent in her leadership of the MCMs Program. DMTC CEO Dr Mark Hodge commended Dr Pradera, who is on secondment from DST Group, on her expert oversight: "Felicia is a valued member of the DMTC team and really has exemplified our commitment to achieving the very best outcomes for the ADF, while also facilitating industry and supply chain development in this country."

The *Industry Partnership Award* is awarded to individual researchers whose efforts contribute significantly to the capability of a DMTC Industry partner. Dr Gui Wang and Dr Juan Torres from UQ were jointly awarded for their efforts in helping Thales' Protected Vehicles division transition research outcomes from DMTC Project 3.19 into their vehicle development program.

The *Project Leadership Award* recognises project leaders who have contributed significantly to achieving project outcomes. This year's award was received jointly by Dr Ali Daliri and Dr Lihong Su for their leadership of the 'Land vehicle alternative material characterisation' project, and Dr Yen Truong for her leadership of the 'Advanced nanostructured fabrics' project.

The *Early Career Award* recognises the contribution of early career technical officers, engineers and scientists to DMTC projects aged under 35. This year's award went to Mr Andrew Ang from SUT who has been a highly-valued team member and contributor to no fewer than four DMTC projects in the Sea Program.

The *Capability Improvement Award* recognises significant improvement in technical capability in the area of materials and/or manufacturing technology. This year's winner was the High Strength Fabrics project team, for developing fragmentation-resistant fabric to prototype stage. The team comprised Dr Tony Pierlot (Project Leader – CSIRO), Dr Ahmed Bhoyro, Mr Ben Eu, Dr Bin Lee, Mr Doug Dower, Mr Horace Billon, Ms Liberty Wagner, Dr Lyndon Arnold, Mr Peter Herwig, Dr Rajiv Padhye, Mr Sandip Ranjan, Mr Tim Head and Mr Vlad Libeson.

EDUCATION
Program

DMTC has an established Education Program, investing in the next generation of Defence scientists and engineers through PhD and Masters scholarships and a 12-week vacation student program for final-year engineering students. DMTC has supported more than 45 PhD and Masters students (24 completed) and 25 final-year engineering students.

Many completed PhDs and Masters students are now fully embedded in the Defence sector, making significant contributions to Defence capability. DMTC has a demonstrated track record of transitioning postgraduates into successful careers within the Defence sector, with students choosing a variety of careers across the Defence, research, industry and adjacent sectors.

Postgraduate scholarships are awarded based on alignment with future Defence capability requirements and industrial opportunities for Australian industry. This approach ensures the best and brightest can make meaningful contributions to Defence capability both through their studies and, more importantly, throughout their careers.

DMTC is also playing an important role in bringing a cohort of Defence-focused PhDs together across a range of disciplines. The DMTC Education Program now incorporates PhD students from The Research Training Centre for Naval Design and Manufacturing and the Defence Science Institute. This is a great opportunity for students and supervisors across various technical disciplines to network and collaborate on areas of common interest.

At the 2016 DMTC Annual Student Conference, 19 students presented their research to peers. Students were also involved in a professional development workshop on improving presentation skills. Further workshops are being conducted to develop skills in students that align with the needs of Defence, industry and research partners.

INVESTING IN FUTURE LEADERS

YOUNG INNOVATOR RECOGNISED

Dr Long Nguyen received the Land Defence Australia Young Innovator Scholarship prize at the 2016 Land Forces Conference in Adelaide. Supported through the DMTC scholarship program, RMIT and DST Group, Dr Nguyen's doctorate research focused on modelling and predictive analysis of ballistic protection offered by new composites used in helmets and vests.

The application of Dr Nguyen's research to Army land vehicles may provide protection against high lethality blast and ballistic threats encountered in theatre while maintaining reasonable vehicle weight.

DMTC postgraduate scholarships are awarded through our partner universities to candidates in areas of research that align with DMTC activities and future Defence capability requirements. Sponsored postgraduates receive financial assistance and access to professional development courses.

Dr Nguyen has secured full-time employment with DST Group and remains engaged with DMTC as a member of the team working on Project 6.04, which is examining alternative materials for land vehicle production.

Pictured: Dr Long Nguyen receives his Young Innovator award from the Hon. Christopher Pyne, MP, Minister for Defence Industry.

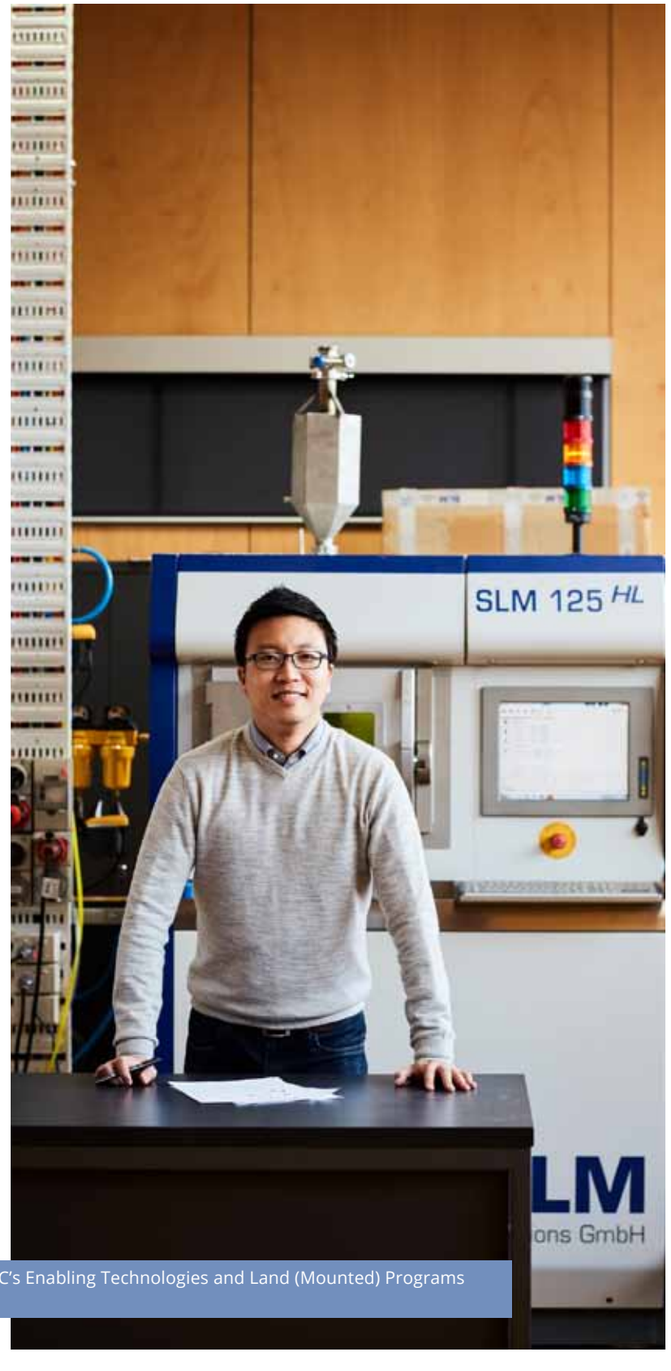
PHD & MASTERS
Candidates

DR ERIC YANG

Dr Eric Yang received his PhD in 2017 from UoM. Dr Yang's thesis focused on the meso-scale modelling of multi-layer textile composites under ballistic impact. During his time with DMTC, Dr Yang was involved with the 'High strength fabrics for combat clothing' project.

The design of traditional textile personnel armour relies heavily on an experimental approach. However, this approach has become increasingly inefficient with recent advances in multi-layer structures and high-strength/rate-dependent fibres and greater complexity in material and structural response. By combining the characterisation of high-strength fabric materials, CT scanning/processing of high-definition 3D geometry, and multi-scale finite element modelling, Dr Yang established a meso-scale modelling approach that simulates the ballistic impact response of multi-layer fabric laminates. He then conducted ballistic experiments, which validated the simulation results. His research found that the ratio between the width of the yarns and projectile diameter is a critical factor in the ballistic protection of the fabrics – valuable information for the development of future personnel armour.

Dr Yang currently works at RMIT's Centre for Additive Manufacturing, pursuing a new research area in 3D-printing of bio-compatible structures, such as titanium bone implants. Prior to this, he was a research scientist at DST Group, working on the development of blast protective systems for armoured vehicles. In the longer term, Dr Yang would like to focus more on research management and commercialisation by collaborating with academia and Australian industry to streamline the transfer of established technologies to commercial sectors.



Pictured: Dr Eric Yang was involved in DMTC's Enabling Technologies and Land (Mounted) Programs and is now employed by RMIT.

MR KURT MILLS

Mr Mills received his M Phil in 2017 from UQ. Mr Mills' area of study was the usage of external fields during the solidification of aluminium alloys to provide grain refinement. To improve the mechanical properties and downstream workability of castings, grain refinement is employed during the solidification process. However, typical methods of grain refinement such as master alloy addition are not without flaw, and it found that the application of external fields (such as ultrasonic fields) can provide significant grain refinement.

In this research, Mr Mills looked at the effects of solute content on the grain refinement achieved when an ultrasonic field was introduced during solidification. In an 'as cast' form, the amount of solute content in Al-Mg and Al-Cu alloys was found to significantly influence the grain size. However, when ultrasonic treatment is applied, it was found that a consistent grain size was achieved across a broad range of alloy compositions, along with a much finer and uniform grain structure overall.

Currently Mr Mills is a research assistant at UQ, where he continues to work on DMTC projects. His areas of interest involve materials engineering and the development processes to increase the performance of manufactured parts. He also enjoys working with light metals and composite materials, and their combined integration in various application. In the future he plans to continue research in his interest areas, potentially starting a PhD in the near future.

Pictured: Mr Kurt Mills uses the Creaform Handyscan 300 portable metrology scanner to check the dimensional accuracy of a lightweight aluminium casting component at UQ's structures laboratory.

FINANCE
Snapshot

In the reporting period, DMTC continued to focus on the successful delivery of applied research outcomes across a portfolio of new and existing programs to address critical Defence and industry capability challenges. Ongoing engagement with the Innovation Hub and other Defence program areas informed the establishment of new, industry-focused technology research and development activities.

As confirmed in the 2016 DIPS, DMTC received a portion of its income from the Defence SP&I Group. This funding was leveraged with additional cash and in-kind contributions from Australian industry, research agencies, State Government and other Defence Program sources.

Revenue for the financial year totalled $23.9m which included $12.9m in-kind contributions from industry and research partners. In-kind contributions from industry and research partners exceeded commitments by 8.0% for the year, reflecting our partners' continued support for and willingness to engage in DMTC activities.

DMTC realised a net surplus of $1.62m for the year ending 30 June 2017. This surplus has primarily resulted from the creation of a program opportunity reserve to undertake enabling research aimed at securing new program opportunities in future periods. The reserve is an accumulation of unapplied funds and increases the Company's ability to respond to new and emerging technologies while preserving its capacity to deliver its core objectives.

Cash reserves totalled $13.4m at 30 June 2017 and included $9.7m of unearned revenue from Defence, CSIRO and DST Group. These funds have been committed to fulfil existing and new research activities in future periods under the Commonwealth Agreement, Defence program contracts, the MCMs Program and the new HASS Program.

Significant effort and investment has been made throughout the year to further enhance DMTC's finance systems and to automate finance processes, delivering efficiency and productivity gains.

> "Further enhance systems and processes."

EFFICIENCY & PRODUCTIVITY

YEAR IN SUMMARY

TOTAL REVENUE*	2017 $'000	2016 $'000
Government and Defence Programs	6,955	6,050
State Government	39	15
Industry sector and other income	5,322	3,307
Research sector	11,592	10,024
	23,908	19,397

TOTAL EXPENDITURE*	2017 $'000	2016 $'000
Education	416	184
Projects	19,161	17,142
Administration	2,710	2,083
	22,286	**19,409**

*Includes cash and in-kind contributions

Pictured: Minister for Defence Industry, the Hon. Christopher Pyne MP (centre right) at the announcement of the Naval Shipbuilding Plan with Acting Chief of the Defence Force, Vice Admiral Ray Griggs, AO, CSC, RAN (left), Minister for Defence, Senator the Hon. Marise Payne, and the Prime Minister of Australia, the Hon. Malcolm Turnbull.

MANAGEMENT
Team

DR MARK HODGE
Chief Executive Officer

MR JIM ARTHUR
Chief Operating Officer

MR STEVE EVANS
Chief Financial Officer

MR DEEPAK GANGA
Lead Program Manager
Land (Dismounted) Program Leader

DR SURESH PALANISAMY
Air Program Leader

MR JAMES SANDLIN
Program Development Manager

MR HARRY BAXTER
Communications Manager

MS BRONWYNNE MCPHERSON
Executive Coordinator

DR STEPHEN VAN DUIN
Sea Program Leader

DR KIMBERLEY CLAYFIELD
High Altitude Sensor Systems Program Leader

DR MATT DARGUSCH
Chief Technology Officer
Enabling Technologies Program Leader

DR FELICIA PRADERA
Medical Countermeasures Program Leader

MR MILES KENYON
Program Development Manager
Education Program Leader

MS JANE TISDALL
Financial Controller

MS ANNE JUPP
Program Support Officer

MR GARY SAVAGE
Land (Mounted) Program Leader

MS CHARLOTTE MORRIS
Supply Chain Engagement State Government Relations

BOARD of Directors

MR TONY QUICK

Chair

MA (Cantab)

DR ROGER LOUGH AM

Deputy chair

PhD (University of Adelaide) FTSE, GAICD

MRS BRONWYN CONSTANCE

Director

FCPA (Australia), FCIS, FAICD

DR PETER JONSON

Director

BCom, MA (Melbourne), PhD (London School of Economics)

MR MICHAEL GROGAN

Director

MR JOHN NORRISH

Director

Eur Ing. C Eng Msc. FWeldI, FIIW

DR JOHN BEST

Director

PhD (University of Wollongong),BSc (Hons) (University of Queensland), MBA (University of Adelaide), GAICD

The biographies of DMTC Board members are available from www.dmtc.com.au

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 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 procurement and research, financial and risk management and corporate governance.

Annual general meeting and participant workshop

The DMTC participant workshop was held on 11 November 2016. The workshop provided participants with an update on the Company's new program activities, future contract discussions with the Commonwealth, future research activities and remaining activities under the existing Personnel Survivability program.

The DMTC AGM was also held on 11 November, immediately after the participant workshop. Members of DMTC provided unanimous endorsement of DMTC's Strategic Plan as well as new and existing and future planned research activities. In accordance with the company constitution, Directors Dr Roger Lough, Mrs Bronwyn Constance, Dr Peter Jonson and Mr Michael Grogan retired at the meeting and were subsequently re-elected to the Board of Directors.

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.

Advisory panels

The role, structure and membership of advisory panels has been comprehensively reviewed in the context of developments within the Defence innovation system.

As a result of this review, the Research Advisory Panel was disbanded and a Higher Education Advisory Panel has been established.

The Higher Education Advisory Panel will provide advice to the CEO to sharpen DMTC's focus on the national impact and value we can achieve together. The scope of the Panel's deliberations will include:

- development of an appropriate research impact framework
- updates on the rollout of the Defence Innovation System and Defence-related training initiatives
- potential and proposed new technology themes and programs for DMTC
- developing, maintaining and growing DMTC's Education Program.

Environmental and social causes

The DMTC Management Team continues to work towards minimising its environmental footprint and demonstrating its ongoing commitment to corporate social responsibility.

Actions taken in the company's head office during the reporting period, in line with the company's environmental policy include procurement of recycled office paper, eliminating avoidable business travel and purchasing carbon offsets for corporate air travel. More broadly, individual members of the management team are engaged in corporate volunteering programs. DMTC is also proud to sponsor several academic prizes and charities.

QUALITY
Management

DMTC's Quality Management System aligns with and complements our existing continuous improvement activities that focus on embedding best practice leadership and continuous improvement through benchmarked performance measures.

DMTC's recent achievement of ISO 9001:2015 accreditation is the latest step in a journey of continuous improvement that has included participation in the Supplier Continuous Improvement Program (SCIP) since 2012. Through these initiatives, DMTC continues to drive efficiency in its corporate systems and operations with a focus on stakeholder satisfaction, enhanced outcomes for our Defence customer and delivering value to our industry and research partners.

DMTC sees achievement of this accreditation as a key differentiator and an independent benchmark of the company's ongoing commitment to business excellence, and to managing collaborative technology development programs efficiently and effectively.

Under the SCIP, which is administered by the Centre for Defence Industry Capability, DMTC conducts annual Business Excellence self-assessments as a 'health-check' on the organisation and a way to strategically review the organisation and identify improvement activities. In 2017, DMTC again performed strongly, achieving its highest self-assessment score to date and confirming its commitment to embedding continuous improvement across the organisation.

SUPPLIER CONTINUOUS IMPROVEMENT PROGRAM PARTICIPANT

CERTEX 9001:2015 Quality Certified

> "Excellent research delivering capability and commercial impact."

Pictured: Ballistic & Mechanical Testing's Mr Ben Eu and RMIT's Dr Lijing Wang with a stab and spike testing rig, which tests the protective qualities of military uniform fabric for DMTC's Land (Dismounted) Program.

GLOSSARY

ADF	Australian Defence Force
AGM	annual general meeting
ANSTO	Australian Nuclear Science and Technology Organisation
AOLP	automated off-line programming
CBR	chemical, biological or radiological
CBRNE	chemical, biological, radiological, nuclear and explosive
CSIRO	Commonwealth Scientific and Industrial Research Organisation
D4	double diaphragm deep drawing
Defence	Australian Defence Organisation
DIC	Digital image correlation
DIPS	Defence Industry Policy Statement
DMTC	Defence Materials Technology Centre
DST Group	Defence Science & Technology Group
DWP	Defence White Paper
HASS	high altitude sensor systems
HVOF	high velocity oxygen fuel
JSF	Joint Strike Fighter
L-RTM	light resin transfer moulding
LCT	laser cladding technology
LOTE	life-of-type extension
MCMs	medical countermeasures
Mip	macrophage infectivity potentiator
M Phil	Master of Philosophy
PhD	Doctor of Philosophy
POC	point-of-care
R&D	research and development
RMIT	Royal Melbourne Institute of Technology
RTM	resin transfer moulding
SCIP	Supplier Continuous Improvement Program
SLM	selective laser melting
SME	small to medium-sized enterprise
SPD	supersonic particle deposition
SUT	Swinburne University of Technology
TRA	Technology Readiness Assessments
TRL	Technology Readiness Level
TUS	Thales Underwater Systems Australia
UoM	The University of Melbourne
UoW	The University of Wollongong
UQ	University of Queensland

DMTC Ltd
Level 2, 24 Wakefield Street
Hawthorn, VIC 3122, Australia

Phone +61 3 9214 4447
Email information@dmtc.com.au
Web dmtc.com.au

Or follow us on **LinkedIn** or on Twitter **@DMTCLtd**