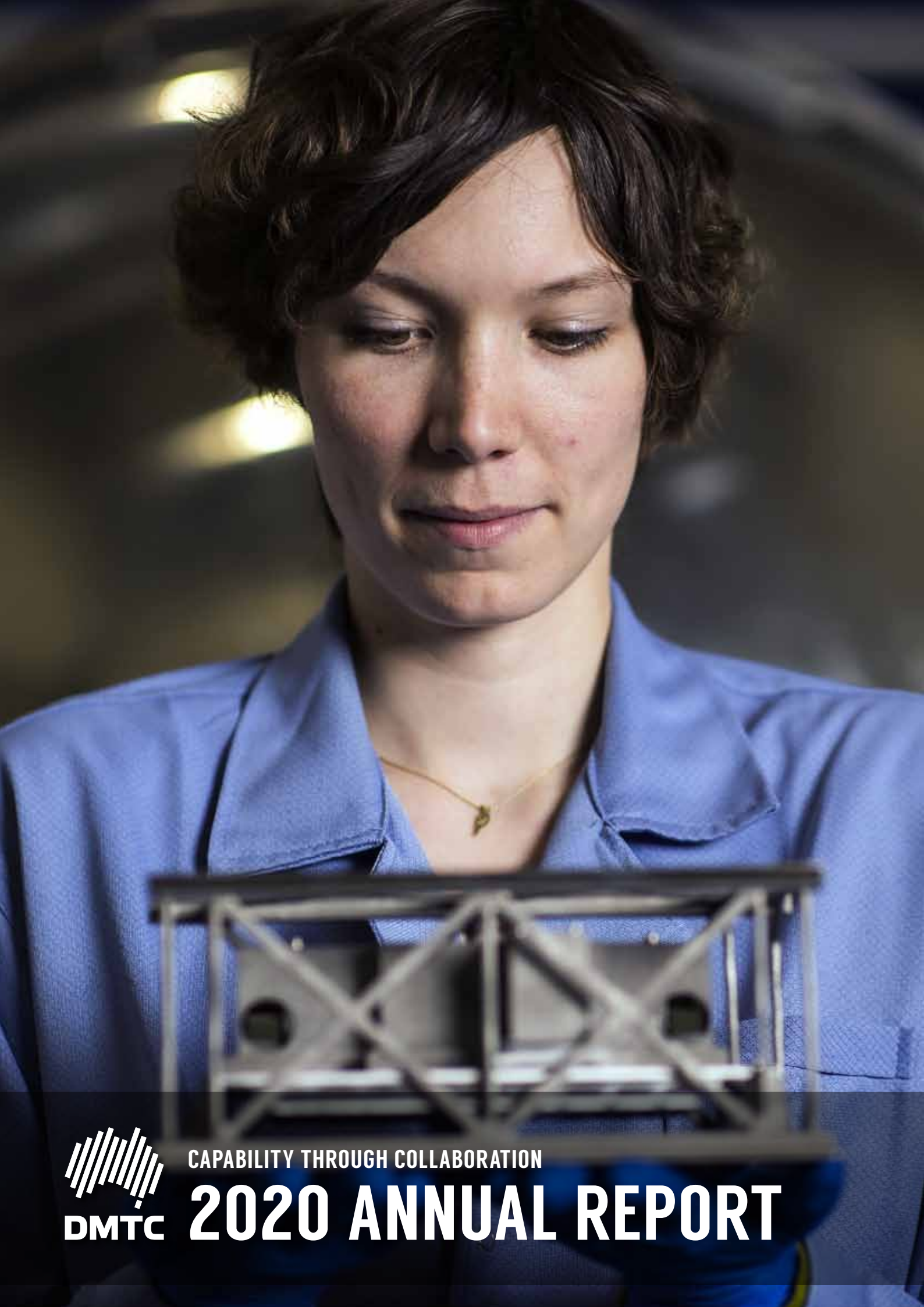

DMTC

CAPABILITY THROUGH COLLABORATION

2020 ANNUAL REPORT

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

AIR & SPACE
Overview

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

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

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

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

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

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

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

AIR & SPACE
Highlights

Looking for a better view

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

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

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

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

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

AIR & SPACE
Highlights

New frontiers for existing technology

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

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

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

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

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

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

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

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

ADDING UP THE BENEFITS

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

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