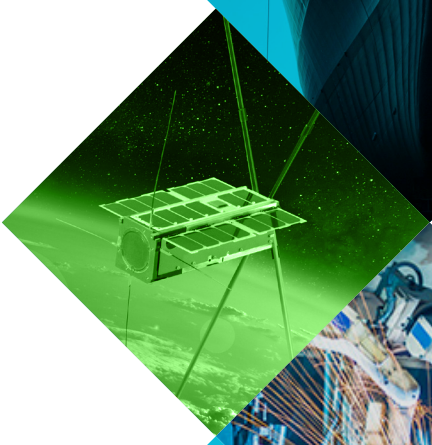
Australian Government

DEFENCE INDUSTRY & INNOVATION



2018–19 Defence Industry and Innovation Programs **Annual Report**

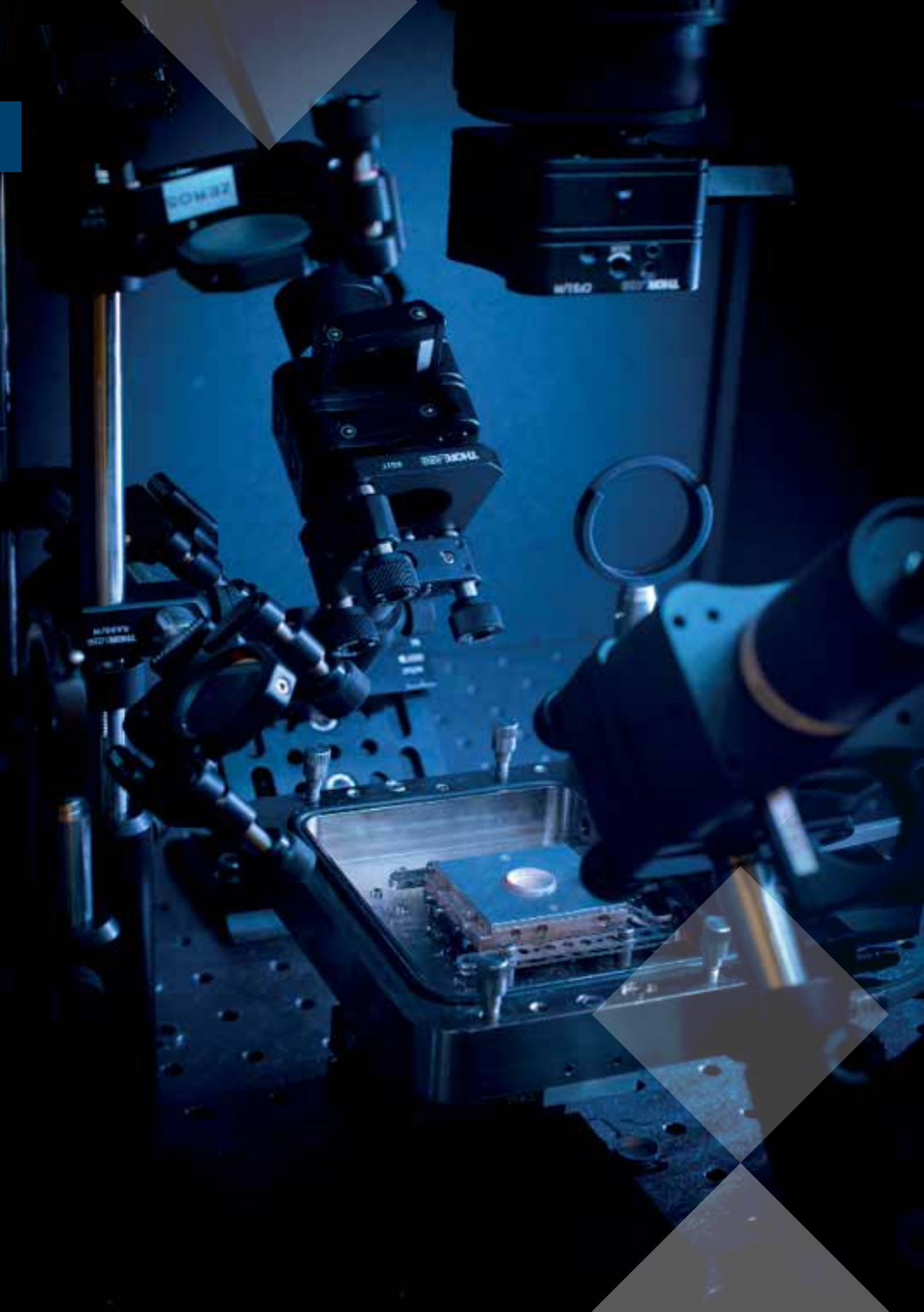
DEFENCE INNOVATION HUB

CENTRE FOR DEFENCE INDUSTRY CAPABILITY

NEXT GENERATION TECHNOLOGIES FUND

Australian Government

2018–19 Defence Industry and Innovation Programs **Annual Report**



FOREWORD

In 2018–19 the Morrison Government drove continued growth of the Australian Defence industry and enhanced Defence capability through innovation. As the Minister for Defence Industry, I am particularly encouraged to see how our Australian businesses, particularly small businesses, are thriving, innovating and delivering the state of the art technologies we need to meet emerging regional and global threats.

Three years into the Government's $1.6 billion investment in the Centre for Defence Industry Capability (CDIC), the Next Generation Technologies Fund (NGTF) and the Defence Innovation Hub, the programs are unlocking the creative potential of our local industry.

The NGTF continues to mature and work closely with industry and research organisations, including establishing new Grand Challenges and research networks. The NGTF now has over 170 agreements in place between DST, research organisations, small and medium business and primes. Our investment in research is driving development of advanced technologies for potential use by the Australian Defence Force of the future.

Since launching in 2016, the Defence Innovation Hub has invested over $150 million to support Australian businesses and research organisations develop cutting-edge technologies with Defence applications. With the overwhelming majority of that investment in small businesses, the Defence Innovation Hub has opened the industry to new entrants and created over 200 new jobs. The Hub's investment in advanced technologies over 2018–19 included more than $20 million in space-related innovations, and over $8 million in uninhabited aerial systems.

Demand from Australian industry for the CDIC's highly regarded business advisory and facilitation services has continued to grow. The CDIC awarded $2.3 million in Capability Improvement Grants in 2018-19 to help Australian businesses become more competitive in global export markets. The Government further expanded its support to Australian small businesses in the Defence industry by launching the Sovereign Industrial Capability Priority Grants and the Defence Global Competitiveness Grants in 2018–19.

These Defence industry and innovation programs are showing that Australian small businesses can match it with the best in an environment of rapid technological transformation. We're starting to see the early results of our increased investment in innovation and small business, with businesses who have received funding and support expanding and reaching new heights in the Defence industry – here and overseas.

I welcome this report on the progress of the Defence industry and innovation initiatives for the 2018–19 year and look forward to their continued success.

The Hon Melissa Price MP
Minister for Defence Industry

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OVERVIEW

In 2016 the Australian Government released the 2016 Defence Industry Policy Statement which called for a more focused, coordinated and transparent relationship between Defence and industry to maximise delivery of Defence capability.

The statement announced the establishment of three new initiatives to build Defence capability, as well as building the capability and capacity of Australian industry and the innovation sector to support Defence.

Next Generation Technologies Fund

The Next Generation Technologies Fund is a forward-looking program focused on research and development in emerging and future technologies. Launched in March 2017 and managed by Defence Science and Technology (DST), it is designed to develop innovative capabilities for Defence.

The initiative is funded at $730 million to 2025–26. It engages the Australian innovation sector—universities, research agencies and industry—to shape research programs that will turn ideas into science and technology with the potential to deliver capabilities for the 'future force after next'.

Outcomes resulting from research conducted under the Next Generation Technologies Fund can be further explored and realised into capability through multiple avenues, including the Defence Innovation Hub.

Defence Innovation Hub

The Defence Innovation Hub was launched in December 2016 and is funded at $640 million to 2025–26. It accepts proposals that are ready to enter the engineering and development stages of the innovation process, from concept exploration and technology demonstration to prototyping and integrated capability demonstration and evaluation.

The Defence Innovation Hub enables Defence, industry and research institutions to collaborate on innovative technologies that can be delivered as advanced capability for Defence.

Centre for Defence Industry Capability

The Centre for Defence Industry Capability (CDIC) is the cornerstone of the Government's strategy for building a positive, intelligent and productive Defence–industry partnership.

The CDIC is a unique organisation that combines the program delivery and industry expertise of the Department of Industry, Innovation and Science (DIIS)[1] with the strategic guidance of the Department of Defence. This allows the organisation to identify and harness the capability and capacity of Australian defence industry to meet the needs of the Australian Defence Force.

The CDIC works with Australian businesses to strengthen their ability to meet current and future Defence requirements.

The CDIC does this by offering businesses:

- tailored advisory and facilitation services through a national network
- funding for defence business development and skilling
- facilitating innovation proposals
- export and sector development initiatives.

CDIC performance is reported over the following pages. Strategic measures are reported qualitatively, supported by quantitative performance information.

For information about how to engage with Defence industry policy initiatives see page 92.

[1]following Machinery of Government changes on 5 December 2019, the department's name was changed to the Department of Industry, Science, Energy and Resources (DISER)

Facts and figures

1,900+ PROPOSALS RECEIVED FOR DEFENCE INNOVATION PROGRAMS

1,000+ ADVISORY SERVICES PROVIDED BY CDIC

280+ DEFENCE INNOVATION CONTRACTS SIGNED

1,600+ ATTENDEES AT NEXT GENERATION TECHNOLOGIES FUND AND DEFENCE INNOVATION HUB EVENTS

$3.8M CAPABILITY IMPROVEMENT GRANTS AWARDED

$15.0M SOVEREIGN INDUSTRIAL CAPABILITY PRIORITY GRANTS AWARDED

$1.2B GLOBAL SUPPLY CHAIN CONTRACTS AWARDED

Progress in 2018–19 —achieving the Government's objectives

More than three years on from the release of the *2016 Defence Industry Policy Statement*, the Defence industry and innovation system is delivering the policy objectives:

- Enhance Defence capability through innovation - by managing a portfolio of innovation investment that is coherent and aligned with strategic priorities.
- Build capability and capacity of the Australian defence industry - to support expansion and mobilisation of ADF now and into the future.

ENHANCING DEFENCE CAPABILITY THROUGH INNOVATION

The Next Generation Technologies Fund, the Defence Innovation Hub and the Centre for Defence Industry Capability have transformed the way Defence approaches innovation. Together the three programs are supporting Australia's industry and research sector to turn their innovative ideas into game-changing technologies that enhance Australia's Defence capability.

Programs under the Next Generation Technologies Fund have matured with extensive engagement from Australia's innovation community. Since the Next Generation Technology Fund's inception, more than 1,100 proposals have been received from Australia's universities, publicly funded research agencies and industrial entities, ranging from start-ups to long-established defence primes. During 2018–19, new investments totalled $44 million, bringing the total commitment of the Next Generation Technologies Fund to more than $150 million.

Partners under the Next Generation Technologies Fund include organisations from every state and the Australian Capital Territory (ACT). Research projects have been established across each of the technology priority areas identified in the *2016 Defence Industry Policy Statement*.

Building on the solid foundation established to date, the Next Generation Technologies Fund continued to expand in 2018–19 with more partnering and research projects. This includes establishing new Grand Challenges in hypersonics and multifunction apertures; creating additional research networks to address Defence's needs in quantum and integrated intelligence, surveillance and reconnaissance technologies; expanding the Human Performance Research Network; launching the SmartSat Cooperative Research Centre (CRC); and creating specific research projects within the Defence CRC for Trusted Autonomous Systems.

A key highlight of the year was the first bilateral call between Australia and the United Kingdom (through the UK's Defence Science and Technology Laboratory and Defence and Security Accelerator) on joining technologies for materials. Parallel launches were held in London and Melbourne. In all, 70 proposals were received for projects to support the development and integration of advanced materials into military platforms through the Small Business Innovation Research for Defence program. Defence is investing $900,000 across seven innovative proposals in the first phase of this program, with a second phase to be launched in 2019–20.

In 2018–19 the Defence Innovation Hub continued to support Australian industry and research organisations by backing good ideas and providing the capital needed to further develop these ideas into Defence capability. The Defence Innovation Hub achieved a record level of investment in innovation in 2018–19, awarding 39 contracts with a combined investment value of around $76 million. For the first time, all contracts awarded by the Defence Innovation Hub in 2018–19 were new contracts not linked to legacy innovation programs.

Innovators working with Defence through the Defence Innovation Hub are developing cutting-edge and world-first technologies to equip our warfighters with some of the most advanced capabilities. Over 2018–19 the Defence Innovation Hub invested more than $20 million in space-related innovations, ranging from nanosatellites to radar systems that will enhance space situational awareness, and over $8 million in uninhabited aerial systems such as the development of a low-cost and disposable uninhabited aerial vehicle that can rapidly deliver small payloads of equipment. To see how the Defence Innovation Hub's portfolio of investment is directly linked to Defence's published capability priorities, see page 46.

The Defence Innovation Hub investment portfolio continues to mature and progress, with over 30 partners successfully completing their innovation contracts during the year. The Defence Innovation Hub substantially increased its investment in innovations at more mature stages of technology development in 2018–19 investing $47 million in projects at the two highest stages of maturity.

The Defence Innovation Hub continued its Special Notice service offering in 2018–19, running two Special Notices in collaboration with Army for Army Innovation Day. Five contracts were awarded in 2018–19 to Special Notice respondents, with a total contract value of $5 million.

After a successful pilot, the Defence Innovation Hub launched its newest service offering, Rapid Assessments, in May 2019. Rapid Assessments allow Defence to quickly obtain answers from industry and academia about capability gaps and opportunities, and to understand industry's capacity to meet future capability requirements.

BUILDING THE CAPABILITY AND CAPACITY OF THE AUSTRALIAN DEFENCE INDUSTRY

Over 2018–19 the CDIC continued to strengthen the capability of Australian businesses to meet Defence requirements and support the growth of the Australian

defence industry. By combining the service delivery and industry expertise of DIIS with the strategic outlook of Defence, the CDIC maximises Australian business opportunities stemming from the Government's significant Defence capability investment, and is central to the Government's strategy for building a positive, intelligent and productive partnership between the Defence and the defence industry.

In the past year, the CDIC saw significant growth in the number of business advisory and facilitation services provided to Australian small and medium businesses, with an increase of 12 per cent from 2017–18. These advisory and facilitation services assist businesses to increase their ability to meet the demands and priorities of the defence market and have been highly regarded by industry, with a 90 per cent client satisfaction rate.

The CDIC also had significant growth in grants over 2018–19, approving 64 Capability Improvement Grants to 46 Australian businesses worth $2.3 million, almost double the value from 2017–18. In addition, the CDIC administered two new grants programs that were launched in 2018–19: the Sovereign Industrial Capability Priority Grant and the Defence Global Competitiveness Grant. These grant programs are helping Australian businesses build their capacity to deliver cutting-edge technologies, compete on the global stage, and build Australia's sovereign industrial capability.

The Defence Innovation Hub has evened the playing field for smaller organisations by providing them with the opportunity to work directly with Defence in developing their innovative technologies. Over the last financial year, around 84 per cent of Defence Innovation Hub contracts were awarded to micro, small or medium sized businesses. Since the launch of the program in December 2016, Defence Innovation Hub partners have reported the creation of over 200 new local Australian jobs, attributable to Defence Innovation Hub contracts. Around 21 per cent of Defence Innovation Hub partners are new to Defence, with many reporting that their Defence Innovation Hub contracts have allowed their business to diversify into the defence sector, attract further investment, accelerate activities, and recruit and train a specialist workforce.

DRIVING COMPETITIVENESS AND EXPORT POTENTIAL

In April 2018, the Australian Defence Export Office (ADEO) was established as a key initiative of the Defence Export Strategy. The ADEO supports Australian defence industry to achieve export success through a range of initiatives from the Defence Export Strategy.

The Australian Defence Export Advocate, the Hon. David Johnston, has provided Australian industry senior level advocacy for Australian businesses both domestically and internationally, attending trade shows and missions to five countries.

For the first time this year, Australian businesses were included in the maritime security activity Indo-Pacific Endeavour. Australian defence industry capabilities and services were showcased on board HMAS Canberra as part of engagement with seven regional partners: Indonesia, Singapore, India, Malaysia, Vietnam, Thailand, and Sri Lanka. These exhibitions have already generated several export opportunities.

MAJOR HIGHLIGHTS

28–29 August 2018: More than 900 visitors from industry, academia, government, the education sector and the scientific community attended SCINDICATE, DST's flagship partnering event.

4–6 September 2018: The Defence Industry and Innovation Programs exhibited at Land Forces 2018 and hosted an industry programs and policy settings update for industry.

10 October 2018: The Annual Defence Innovation Hub Industry Conference attracted around 400 people, taking the opportunity to learn more about the Defence Innovation Hub and hear updates from Defence senior leaders.

10–11 October 2018: Defence held the second phase of an Emerging and Disruptive Technologies Assessment Symposium (EDTAS) in Human Biotechnologies.

16 October 2018: The Next Generation Technologies Fund (NGTF) Defence Research Accelerator program hosted its first ON Prime: Defence Day in Canberra with 11 teams participating.

25 October 2018: Army and the Defence Innovation Hub collaborated to deliver Army Innovation Day 2018, with industry presenting proposals on Delivering a Next Generation Army.

31 October 2018: Explosive Protective Equipment (EPE) completed its Defence Innovation Hub contract after successfully demonstrating its prototype Portable RAMAN Improvised Explosive Detector (PRIED). PRIED can detect explosives, chemical warfare agents, narcotics and gases at a safe distance, providing increased awareness and protection through a 'stand-off' detection capability. EPE was one of over 30 companies that successfully completed their innovation contract during 2018–19.

21 November 2018: The Sovereign Industrial Capability Priority (SICP) Grant launched. SICP grants provide funding to industry to ensure that Australian small and medium businesses have the appropriate capacity and resilience to support Defence's most critical capabilities.

29 November 2018: The Defence Innovation Hub reached over $50 million of investment in its top capability priority streams—Intelligence, Surveillance, Reconnaissance, Electronic Warfare, Space and Cyber—with a $1.3 million contract with GPSat Systems Australia.

8 January 2019: The Defence Global Competitiveness Grant launched to support small and medium businesses to overcome barriers in accessing export opportunities.

11 January 2019: The Defence Innovation Hub signed a $3.29 million contract with the University of Adelaide, taking the total innovation investment by the Defence Innovation Hub past $100 million.

1 March 2019: Defence launched the Defence Industry Skilling and STEM Strategy to help Australian defence industry meet its workforce skills requirements.

5–6 March 2019: Defence partnered with Noetic Solutions, the University of Western Australia, Curtin University, Edith Cowan University and Murdoch University to hold an Emerging and Disruptive Technologies Assessment Symposium (EDTAS) in Space Technologies.

15 April 2019: $12 million investment by the NGTF in the Cooperative Research Centre for Smart Satellite Technologies and Analytics (SmartSat CRC) in South Australia was announced.

April–July 2019: The NGTF's Defence Research Accelerator program hosted the Hacking for Defence (H4D) activity, supporting the Amphibious Task Group.

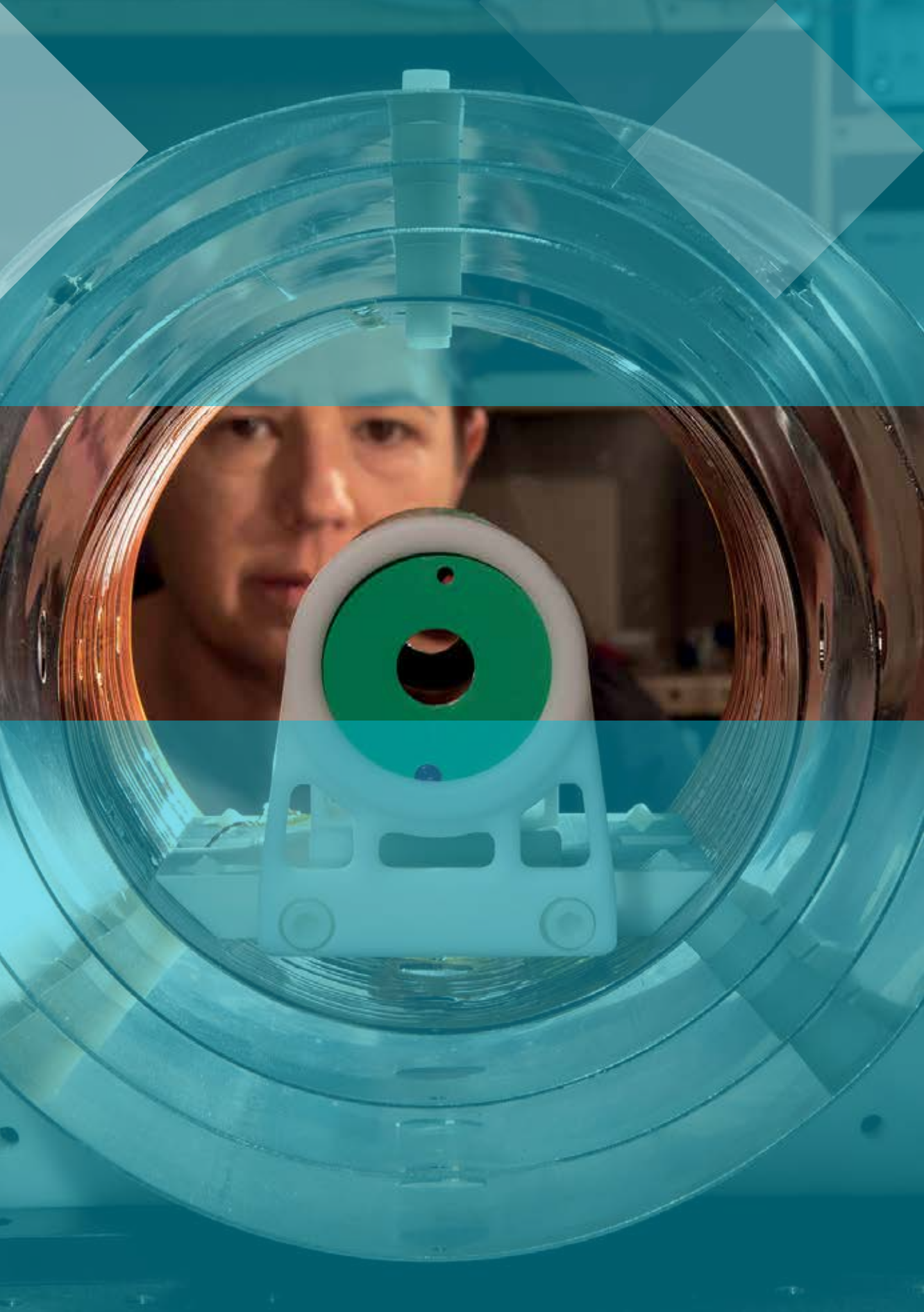
May 2019: The Defence Innovation Hub launched Rapid Assessments, a short-term procurement that answers specific questions about capability availability or maturity in the market.

11 June 2019: The NGTF's Defence Research Accelerator program hosted its second ON Prime: Defence Day in Canberra with 15 teams participating.

13 June 2019: The Defence Innovation Hub signed a $3.8 million contract with DMTC for collaborative research and development and innovation services.

25 June 2019: Ocius Technology completed sea trials off the south coast of New South Wales, successfully completing their Defence Innovation Hub contract for the development of persistent, intelligent autonomous networked uninhabited surface vehicles three months ahead of schedule. Ocius was one of over 30 companies that successfully completed their innovation contract during 2018–19.

29 June 2019: Submissions closed for the Australia–United States Multidisciplinary University Research Initiative (AUSMURI) 2019 round. This year's topic was 'active perception and knowledge exploitation in navigation and spatial awareness'.



NEXT GENERATION TECHNOLOGIES FUND

The Next Generation Technologies Fund will create a research portfolio aligned with Defence priorities to deliver world-class science and technology capabilities

Program performance for the Next Generation Technologies Fund is reported over the following pages. Strategic measures are reported qualitatively and supported by quantitative performance information.

NEXT GENERATION TECHNOLOGIES FUND

Partnering with purpose—driving change in delivering Defence strategic research

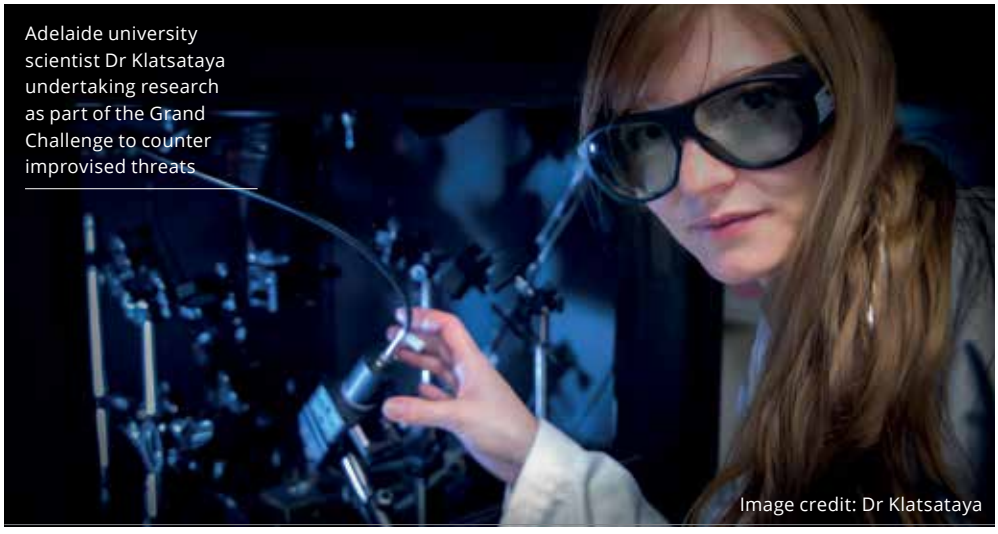
PROGRAM IMPACT STATEMENT

The Next Generation Technologies Fund is creating a national research base closely aligned with Defence priorities that will deliver capability for the 2030 Defence Force and beyond. The Next Generation Technologies Fund is addressing a wide range of Defence's science and technology challenges, from the threat of improvised devices to achieving self-reliance in space. It is facilitating unprecedented collaboration between Defence, industry and academia and attracting partners that may otherwise have remained undiscovered.

The Grand Challenge to counter improvised threats brought together 13 teams from across Australia involving nine universities, CSIRO, 12 small and medium businesses and one defence prime, all collaborating with Defence experts and scientists.

> *"Collaborating across all those organisations, breaking down the silos, the barriers, getting each other in the room looking at a problem and working together to achieve a solution in a collaborative manner is what the Grand Challenge brings to the table."*
>
> **BRIGADIER JONATHON BEESLEY, COMMANDER JOINT COUNTER IMPROVISED**

The Small Business Innovation Research for Defence (SBIRD) program provided the opportunity for MicroTau, a small Sydney-based business, to become a new Defence partner, enabling them to leverage their expertise in bio-inspired contactless microfabrication to provide an adaptive visual camouflage system.



Adelaide university scientist Dr Klatsataya undertaking research as part of the Grand Challenge to counter improvised threats

Image credit: Dr Klatsataya

> *We are excited to have the opportunity to work with DST on a problem driven by the Australian Defence Force customer. Funding through the Next Generation Technologies Fund allows us to explore an exciting new application of our technology."*
>
> **HENRY BILINSKY, CEO MICROTAU**

Initiatives such as the Human Performance Research Network (HPRnet) have attracted international attention for the way they have engaged the national research community.

> *HPRnet is exceptional in that it is connecting a network of top university researchers with defence scientist and military stakeholders who are guiding the research in a way that ensures the greatest warfighter relevance and impact. Office of Naval Research – Global's participation in HPRnet can help to extend the network to include people and institutions within the US, strengthening ties between these scientific communities and creating new opportunities for collaboration and innovative work."*
>
> **BEN KNOTT, OFFICE OF NAVAL RESEARCH—GLOBAL**

Programs such as the SmartSat CRC, Grand Challenges and the Defence CRC for Trusted Autonomous Systems demonstrate that the Next Generation Technologies Fund is delivering on its promise to invest at scale, maximising the potential of ambitious research programs to deliver on their potential.

> *With the SmartSat CRC, the world's best minds will be working together in Australia to create breathtaking technology and usher in a new satellite communications paradigm. A strength of this centre is the network of contributors including many Australian start-ups, small to medium enterprises and global leaders in space technology such as Airbus Defence and Space."*
>
> **PETER KERR, SMARTSAT CRC DEFENCE SECTOR DIRECTOR**

Collaborations under the Next Generation Technologies Fund

The Next Generation Technologies Fund expanded its collaborations significantly in 2018–19, building on foundational partnerships and bringing together industry, academia and publicly funded research organisations to work with Defence scientists.

Through an ongoing outreach program including national roadshows; DST's flagship partnering event SCINDICATE; and visits to individual institutions, Defence continues to raise awareness of the Next Generation Technologies Fund and strengthen connections with the research community.

To address the full range of its science and technology challenges, Defence has developed an operating framework including:

- large-scale collaboration vehicles such as Grand Challenges and Defence CRCs
- medium-scale partnering arrangements such as university research networks and strategic partnerships
- lightweight technology acceleration mechanisms such as Small Business Innovation Research for Defence, the Defence Research Accelerator, and technology futures and foresight.

In the reporting period, the Next Generation Technologies Fund announced new research agreements with more than 14 Australian universities, six industry partners, one Australian Defence Science University Network and one Cooperative Research Centre through the following collaborative programs:

- Grand Challenges in hypersonics and multifunction apertures
- new research networks in acoustic materials, intelligent decision superiority and quantum technologies (including advanced sensors) and expansion of HPRnet
- Australia–United States Multidisciplinary University Research Initiative projects in quantum noise cancelling and additive manufacturing
- participation in the new SmartSat CRC
- Small Business Innovation Research for Defence (SBIRD) programs in adaptive camouflage and material joining technologies
- new projects under existing strategic partnerships with DMTC and Data61.

This brings the total number of collaborative agreements to more than 170.

Hypersonics Grand Challenge

Defence established the Grand Challenge in hypersonics to advance the fundamental scientific understanding of hypersonic flight.

In October 2018 DST, through the Next Generation Technologies Fund, established several long-term agreements with the University of Queensland to facilitate a broader and deeper collaboration in hypersonic science and high-temperature composite materials research. The agreements will see the consolidation of both parties' test facilities to leverage the expertise of academic and industry researchers and international partners.

The agreement includes:

- the loan of a hypersonic ground test facility to DST and the establishment of a Hypersonic Research Precinct at DST Eagle Farm, with a collaboration space that allows students, academics, industry and Defence staff to interact more closely and provide new opportunities to broaden this relationship
- a framework for conducting innovative research in hypersonic science and high-temperature composite materials
- the creation of an academic position, Chair in Future Hypersonic Technologies, to explore potential and emerging disruptive technologies related to high-speed flight beyond the current hypersonic research activities
- significant contributions to the science, technology, engineering and mathematics (STEM) pipeline through the sponsorship of undergraduate and postgraduate scholarships, including joint supervision and regular embedding of students at DST.

There are two other Grand Challenges underway. The Grand Challenge to counter improvised threats has been operating for 18 months and had its first major review with national and international subject matter experts in March 2018. A new Grand Challenge in multifunction apertures was announced and will commence in 2019–20.

Hypersonics - Launch of rocket to test hypersonic speed at more than five times the speed of sound

CASE STUDY

Grand Challenge: dragonflies and hoverflies helping Defence counter improvised threats

The dragonfly is considered to be one of nature's most effective and efficient predators. Its an agile flier, with the ability to change direction suddenly, and capable of moving across littoral environments. It catches its prey in mid-air at speeds of 60 kilometres per hour with a success rate of 95 per cent and its bulbous, multifaceted eyes can distinguish brightness and colour far beyond what we can see.

Supported by the Next Generation Technologies Fund through the Grand Challenge to counter improvised threats, a small team of academic and industry participants is employing bio-inspired algorithms based on the physiology and neurology of the dragonfly and the hoverfly as one of the possible ways to counter airborne improvised threats.

The University of South Australia's Professor Anthony Finn is working on this insect-inspired algorithm with Adelaide-based start-up Midspar and DST.

'It starts with the fundamental research of understanding an insect's brain, and slowly but surely transitioning this through the technology chain beyond simulation, beyond biology, and applying it in the real world for a real practical application that has true value for Defence,' says Professor Finn.

'It's going well, we have the capacity to significantly enhance the range at which electro optic infrared and acoustic sensors are able to detect the energy from the improvised threats, in particular electrically powered drones. We have been able to double the range, detect objects and significantly reduce the false alarm rate, which is down from 60 per cent to 1 per cent or 0.1 per cent, an enormous reduction in false alarm rate for complex cluttered environments.'

Aaron Melville-Smith (front) and Muhammad Uzair operating the Bio-Inspired Visual (BIV) camera system during Trial Desert Owl. Imagery from these sensors will be processed using an algorithm inspired by how the insect processes imagery. The aim is to determine detection performance against a range of uninhabited aerial vehicles.

CASE STUDY

Next-generation space technologies for Defence

At the beginning of 2019, 4,987 satellites were orbiting the Earth. Only a handful were designed or built in Australia.

As space becomes more competitive, it is essential that Australia's reliance on foreign satellite systems for critical infrastructure such as communications, satellite imaging and navigation is addressed.

Defence recognises the importance of an indigenous space capability, investing $12 million over seven years in the SmartSat CRC to foster the creation of leap-ahead space technologies for Australia's national security.

The SmartSat CRC is part of the national Cooperative Research Centres Program. With $254 million, it represents the biggest research and development investment in the space industry in Australia's history. The centre will develop a globally significant space research, development and innovation program which will provide significant leverage for Defence through its contribution of $12 million.

Nick Stacy, DST's Theme Lead for Space Technologies with the Next Generation Technologies Fund, sees the SmartSat CRC as the best vehicle for serving Australia's space interests.

'Instead of forming a second dedicated Defence CRC, Defence decided the broader national interest in space was better served by leveraging off the existing CRC program. We will seek to ensure the CRC research program investment is in high risk, high pay off technologies. These tend to be less focussed on classified applications and in many cases are dual use,' he says.

The SmartSat CRC involves 84 partners, including 40 start-ups, and a number of universities and small businesses, among them the University of South Australia, Nova Systems, BAE Systems Australia, the University of New South Wales (UNSW) Canberra, the University of Queensland, Myriota, Inovor Technologies and Frontier SI.

University Research Networks

The Next Generation Technologies Fund is advancing cross-disciplinary research and building academic communities across Australia through the creation of a number of research networks.

The year 2018–19 saw the creation of new research networks in quantum technologies, acoustic materials, and intelligent decision superiority, as well as the expansion of the Human Performance Research Network, HPRNet.

The Quantum Technologies Research Network involves nine universities from around Australia, as well as researchers from Orica, the NASA Glenn Research Centre and QuintessenceLabs, an Australian company specialising in quantum cyber security. With funding of $6.5 million, the network will explore the use of quantum technologies for future Defence applications such as sensing, time-keeping, communications, cryptography, advanced materials and computation.

The Acoustic Materials Research Network, involving the University of Melbourne, RMIT University, QinetiQ Australia and Matrix Composites & Engineering, is looking at the design of advanced acoustic materials for Defence applications.

The Intelligent Decision Superiority Research Network is focused on developing automated systems to analyse, fuse and understand large volumes of data and information to support decision superiority. The pilot phase of the research network, funded at $600,000, is being led by Griffith University, the University of Technology Sydney, RMIT University, the University of Adelaide, the University of Sydney and industry partner Acacia Systems. Further expansion of the network is planned for 2019–20.

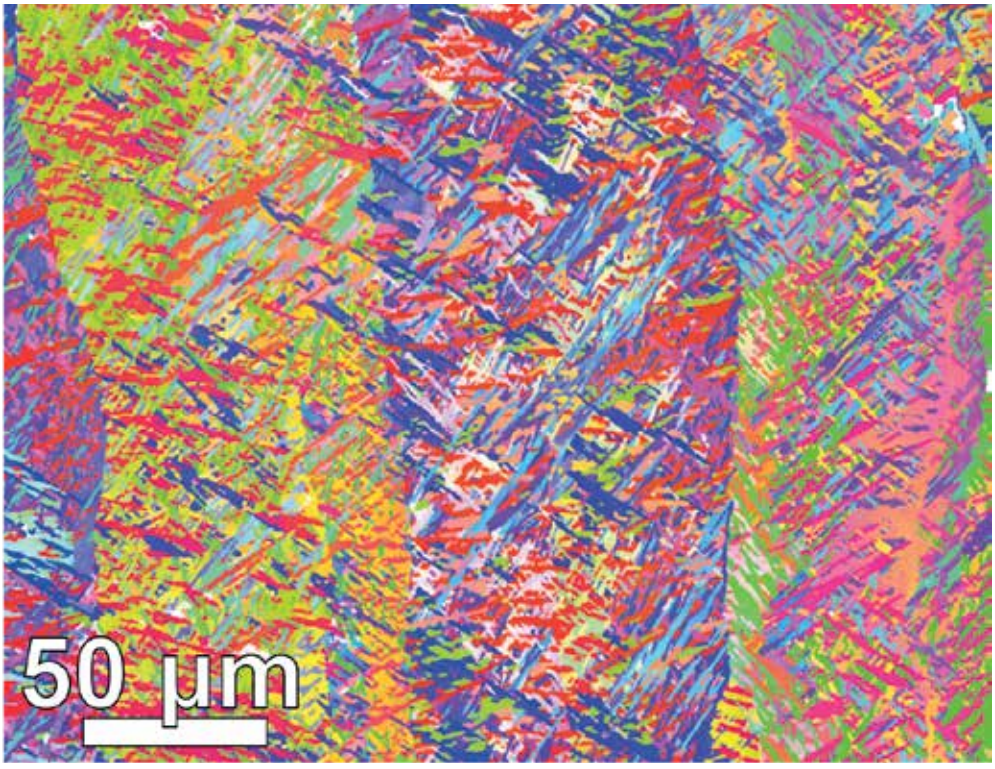
HPRnet is a growing community of leading research teams from across Australia dedicated to working together to identify and pursue the many emerging opportunities for warfighter enhancement. Initially involving seven universities focused on supporting Army's human performance requirement, the network has expanded its research to include Navy and Air Force requirements, enabling an additional seven universities to participate.

Australia–United States Multidisciplinary University Research Initiative

The Australian-United States Multidisciplinary University Research Initiative (AUSMURI) provides Australian universities with the opportunity to partner with United States (US) institutions on defence-related research.

Defence has invested a total of $9 million in three strategic research collaborations with the US under the Multidisciplinary University Research Initiative (MURI) and AUSMURI to date. As a consequence, five Australian universities are now partnering with a total of 15 US academic institutions in priority areas of research for Defence.

This funding includes a $6 million investment in this reporting period in two projects under the AUSMURI program. Griffith University, the University of New South Wales and the University of Technology Sydney are now working with US partners including Duke University, the University of Oregon and the Massachusetts Institute of Technology on integrated quantum sensing and control. The University of Sydney and the University of



AUSMURI - An electron backscatter diffraction image of an additively manufactured Ti-6Al-4V alloy, printed via electron beam melting. The different colours represent different crystallographic orientations of individual grains within the microstructure.

New South Wales are in partnership with the University of Tennessee, Ohio State University and the Virginia Polytechnic Institute to work on a project in additive material sciences.

The topic for the next AUSMURI is 'active perception and knowledge exploitation in navigation and spatial awareness'. This aligns with Next Generation Technologies Fund priority themes, including trusted autonomous systems; cyber; and integrated intelligence, surveillance and reconnaissance (ISR).

Small Business Innovation Research for Defence

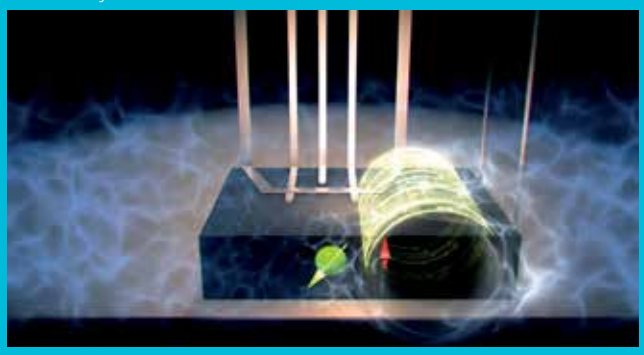
The Small Business Innovation Research for Defence (SBIRD) initiative enables small business to conduct early stage high-risk, high-payoff research with the potential to mature into Defence capability.

In 2018–19, five new project teams from industry were each awarded up to $100,000 for the first stage of their research in multidisciplinary materials. The research encompasses adaptive camouflage from both visual and noise control perspectives, as well as the first parallel call with the United Kingdom (UK) for proposals on joining technologies.

CASE STUDY

‘Noise-cancelling headphones’ for quantum computers

A consortium of leading researchers from around the world are developing a capability that could overcome one of the biggest challenges of quantum computing: its sensitivity to ‘noise’.



Supported by the Next Generation Technologies Fund through the AUSMURI program, a team of researchers from Griffith University, the University of New South Wales and the University of Technology Sydney, in partnership with seven research institutions in the US, is developing a ‘noise cancelling’ system that will enable quantum computers to work reliably.

Unlike traditional computers, where digital data is stored in bits whose ‘0’ and ‘1’ values can be stored and manipulated very robustly, quantum computers encode information in delicate superposition states of quantum bits, or qubits.

This feature, which makes quantum computers so powerful, also makes them highly susceptible to any kind of environmental noise. This noise could be in the form of vibrations, electromagnetic fields or even the presence of other quantum systems.

Professor Howard Wiseman from Griffith University explains:

‘The information processed by a quantum computer is extremely fragile. Protecting it from the noise in the environment is absolutely essential for the quantum computer to work.

‘To build a quantum computer, we must shield the quantum bits from the [sic] noise in the environment.’

The solution is a novel system which is able to cancel the noise around a data qubit using a ‘spectator’ qubit. The spectator qubit detects the noise and then advanced machine learning algorithms are used to make instantaneous decisions on how best to counteract that noise.

With quantum computing hailed as one of the most transformative technologies of the 21st century, the significance of this work is widely recognised. The outcome of this project will be a revolutionary, Australian-based quantum computing hardware, integrated with the most advanced software and theoretical models to optimise its operation.

Australia’s Chief Defence Scientist, Professor Tanya Monro, sees enormous potential for the technology:

‘This project has the potential to deliver a breakthrough in quantum technologies which will lead to important applications in Defence and beyond.’

CASE STUDY

Parallel call on joining technologies

New adhesives to improve the longevity of body armour and new methods for producing graded material are two of the technologies chosen for further research following the first bilateral call for proposals by the UK and Australia under the Small Business Innovation Research for Defence (SBIRD) program.

In November 2018, DST's SBIRD program and the UK's Defence and Security Accelerator (DASA) issued a call for proposals from small and medium businesses as well as universities to support the development and integration of advanced materials for military platforms.

Parallel launches were held in London and Melbourne and attended by over 120 delegates. In all, 70 proposals were received, 32 from Australia and 38 from the UK.

As Program Lead, Dr Craig Rogers has led the development and implementation of the SBIRD vehicle. He says working with the UK on the launch was very beneficial:

'We were able to provide a detailed message to the wider community on the total breadth of the opportunity from both regions. During the down selection process both DST and Dstl[2], alongside DASA, benefited greatly from the exposure to the total quantum of proposals, and to learn from each other in terms of assessment process.'

Defence selected seven innovative research proposals from the University of Southern Queensland, the University of New South Wales, RMIT University, Deakin University, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and QinetiQ Australia, who will receive a share of $900,000, or up to $150,000 each.

The Chief Defence Scientist, Professor Tanya Monro, says the first synchronised bilateral call between the UK and Australia was a unique approach to source science and technology solutions under the Next Generation Technologies Fund.

'The experience has given us valuable insights and a wider perspective on problems shared by our two countries and opened up the opportunity for international collaboration,' she says.

'The process could become the standard to facilitate future international calls for research innovation and increased collaboration with our allies.'

[2] The UK's Defence Science and Technology Laboratory.

Building engagement with the research community

A series of forums, symposiums and workshops are run under the Next Generation Technologies Fund to bring together Defence, small companies, defence primes, universities and government research organisations.

The goal is to exchange information and build professional networks. Participants are informed about Next Generation Technologies Fund programs and helped to explore collaboration and partnering opportunities. The Defence Innovation Portal has been an especially successful complement to these initiatives to inform universities and industry about opportunities for engagement.

SCINDICATE was held in Melbourne in August 2018

Highlights include:

- SCINDICATE, held at DST in Melbourne in August 2018
- research community engagement leading up to the parallel Australia–UK call for proposals on joining technologies in the SBIRD program
- expansion of the Human Performance Research Network, and the creation of the Quantum Technologies Research network and the Intelligent Decision Superiority Research Network
- two technology futures and foresight symposiums, which explored aspects of emerging and disruptive technologies and their value for Defence.

More than 900 visitors from industry, academia, government, the education sector and the scientific community attended SCINDICATE. Delegates participated in briefings, site tours, workshops, match-up sessions, industry pitches and networking opportunities over the course of the event. Speakers included:

- the CEO of Myriota
- the CEO of Data61, CSIRO
- the Director Space Technology and Policy, Nova Defence
- the Head of Research and Innovation, Blue Chip Vision.

Potential applicants for the Next Generation Technologies Fund attended information sessions designed to help understand the broader partner engagement processes, what Defence is looking for, and the general characteristics of both successful and unsuccessful proposals. The aim was to help every applicant maximise the possibility of funding by preparing and submitting competitive proposals.

Information sessions held around the country for the parallel Australia–UK call for joining technologies and the expansion of HPRnet were well attended, resulting in large numbers of submissions for these programs:

- The materials joining technologies parallel information session in Melbourne was attended by 120 delegates, resulting in 32 Australian proposals being submitted
- More than 200 delegates attended the HPRnet information sessions, resulting in 116 proposals.

To reach a broader audience in a more innovative way, the Intelligent Decision Superiority Research Network was marketed via video instead of a roadshow. The video had 360 views (1,996 webpage views), resulting in 36 proposals.

Accelerating research

The aim of the Defence Research Accelerator is to encourage and support start-up style activities. One of its roles is to connect the people with ideas or inventions from academia and Defence to the people who can realise those ideas within the broader Australian innovation ecosystem.

The Defence Research Accelerator works with existing accelerators, primarily CSIRO's ON Prime program, to incubate a start-up culture within Defence. The ON Prime program takes research teams through an eight-week mentorship course designed to self-identify their innovation pathway. ON Prime: Defence is a value-add to the existing ON Prime program, acting as a catalyst for select ON Prime teams to explore potential defence applications. A further introductory workshop, LaunchCamp, was introduced in 2017 as a first stage to get teams thinking about their idea strategically. Over the long term the Defence Research Accelerator aims to further explore mechanisms based on the US Hacking for Defense program and crowdsourcing solutions to Defence problems through the public domain.

In the 2018–19 reporting period, ON Prime: Defence hosted 26 teams. The upcoming iteration of ON Prime: Defence is expected to be on a larger scale. The Defence Research Accelerator also sponsored various successful Hacking for Defence sprint workshops and two GovHack challenges with the Bureau of Meteorology.

Participants at the ON Prime: Defence workshop in June 2019

Emerging and Disruptive Technology Assessment Symposium

The Emerging and Disruptive Technology Assessment Symposium (EDTAS) series is a key element of Defence's horizon-scanning activity. The symposia bring together internationally recognised thought leaders, Defence scientists and other Defence groups and services to identify and explore potential leap-ahead technologies.

Knowledge derived from the symposia helps steer the evolution of the Next Generation

Technologies Fund, ensuring the priority research being undertaken remains relevant throughout the program's full 10-year life.

Emerging science and technology areas are studied to position Defence to exploit future opportunities as well as to prevent strategic surprise. For that reason, analysis considers how advancement of these technologies could realise critical Defence and national security capabilities as well as identifying emerging threats to the nation's security.

Combining the expertise of the broader science and technology community with Defence's domain knowledge means the symposia deliver an in-depth picture of future technologies and an understanding of their relevance to future Defence needs.

Dr Taekyu Reu, Vice President, Advanced Defence Technology Research Institute, Agency for Defence Development, Republic of Korea and other international experts joined with experts from academia and industry to consider how technological developments in space technologies could be used in a 2040 timeframe

Each EDTAS theme is examined through a combination of research, interviews and symposia in a campaign of events. Following some initial research, a series of subject matter experts are identified from across DST, broader Defence, other Australian Government agencies, academia and industry to contribute to the identification of potential technology opportunities through a series of interviews and then the main technology opportunities symposium.

The symposium is held in partnership with an Australian university or group of universities, with typically over 100 delegates including international representation. The symposium is followed by a data distillation and analysis phase and then an in-house workshop during which the results are examined through a Defence and national security lens. To date, four symposia have been conducted through the Next Generation Technologies Fund: Information Knowledge & Digital Disruption, Advanced Materials & Manufacturing, Human Biotechnologies, and Space Technologies.

The Space Technologies EDTAS was held in Perth in March 2019, where delegates focused on improving and enhancing the terrestrial benefits of space technologies. At that symposium four themes were explored, looking at the 2040+ timeframe:

- Advances in space launch technologies
- Future technologies for operating in space
- Comprehensive space domain awareness
- Exploiting information and data from space capabilities.

Next Generation Technologies Fund operating framework

Defence has developed an operating framework for the Next Generation Technologies Fund, informed by analysis of successful innovation programs across the world, with the best being adapted to suit the Australian defence context.

Partnering options through the framework allow choice and flexibility in scale and time-to-delivery for research program design—from ambitious Grand Challenges to lean and focused technology acceleration. This allows Defence to engage a range of research partners, individually or in teams, from start-ups to primes and national research organisations.

The science and technology priorities and challenges addressed through these collaborative vehicles are continuously informed by investigations of emerging technology and technology futures and foresight.

Partnerships and collaboration vehicles include:

- Grand Challenges
- Defence Cooperative Research Centres
- University Research Networks
- Strategic Research Program
- Small Business Innovation Research for Defence
- Defence participation in national technology accelerator programs.

GRAND CHALLENGES

Grand Challenges provide the scale and intensity required to tackle formidable challenges which have no simple solutions. The design of the Grand Challenge program has been influenced by the US Defence Advanced Research Projects Agency (DARPA), Grand Challenges Canada, and the Bill and Melinda Gates Foundation. Participation by academic institutions, publicly funded research agencies, agile small companies, larger defence primes and Defence itself is essential to ensure optimal outcome delivery.

DEFENCE COOPERATIVE RESEARCH CENTRES

Defence Cooperative Research Centres (Defence CRCs) are Defence-focused, industry-delivered collaborative programs which draw on the leading national research capabilities of universities, industry and publicly funded research agencies. This program builds on the successful national CRC model, with some modification in that it has a mission-driven focus. Each Defence CRC has specific goals and objectives that align with Defence needs. Research projects are only supported if they have an identified pathway for adoption by Defence.

As with the other Next Generation Technologies Fund programs, Defence CRCs improve the research skills and capabilities of participants and increase small company engagement in collaborative research. The goal is to make the Australian defence industry more efficient, productive and competitively priced.

UNIVERSITY RESEARCH NETWORKS

The Next Generation Technologies Fund is shaping the national innovation enterprise into targeted university research networks. It is advancing cross-disciplinary research and building academic communities across Australia and around the world. Built on open partnerships and mutual investment in the academic domain, these networks provide a robust mechanism to bring leading research teams together to address defence priorities with a strategic focus led by Defence. Defence benefits from enhanced access to Australia's leading academic expertise, while universities gain access to Defence scientists and specialist facilities to contribute directly to future ADF capability.

Initiatives also include the Australia–United States Multidisciplinary University Research Initiative (AUSMURI) and the Australian Defence Science University Networks (ADSUN).

AUSMURI enables Australian and US universities to partner in an existing US program (the Multidisciplinary University Research Initiative (MURI)) and undertake research on focused topics of high priority for the future defence capabilities of both countries.

It helps Australian researchers to remain in Australia and develop capability in key areas of science, while at the same time benefiting from working with the best US universities. The Next Generation Technologies Fund is for Australian universities only, while the US Department of Defense provides funding to participating US research institutions, promising a valuable return on Australia's investment.

ADSUN also brings academics and Defence scientists together to collaborate on future leap-ahead technologies. The networks are co-funded by state governments and build on the success of the Defence Science Institute

(DSI) model established in Victoria. Networks have now been established in South Australia (Defence Innovation Partnership), New South Wales (Defence Innovation Network) and Western Australia (Defence Science Centre), with a similar network (Defence Science Alliance) currently being established in Queensland.

STRATEGIC RESEARCH PROGRAM

Where initial investigation of a new concept or technology shows the potential for disruption, the research activity may be scaled up and further focused to develop technology of particular importance for Defence, drawing on partners from across the innovation enterprise.

SMALL BUSINESS INNOVATION RESEARCH FOR DEFENCE

The SBIRD program is modelled on international initiatives such as the longstanding and successful Small Business Innovation Research program in the US and the Small Business Research Initiative in the UK. SBIRD is targeted at engaging small business to conduct early-stage high-risk, high payoff research with the potential to mature into Defence capability. Funded activities run in two stages:

- researching the feasibility of a potential Defence technology over a six to nine month period
- evaluating the technology in the context of the specific Defence application. Promising results are evaluated for transition through the Defence Innovation Hub.

DEFENCE ACCELERATOR PROGRAM

A new generation of innovators is developing breakthrough products without the huge capital cost traditionally required for cutting-edge research and development. This agile approach leads to technology disruption, where inventions of new processes, products or systems are rapidly developed and applied to known problems in unexpected ways. Bringing this inventive approach to the market for Defence and national security products improves capability outcomes. This program works with existing accelerators within the national innovation system, such as CSIRO's ON Prime program, which supports the start-up community with an interest in Defence.

TECHNOLOGY FUTURES AND FORESIGHT

Defence conducts ongoing horizon-scanning to inform the science and technology priorities addressed by the Next Generation Technologies Fund. The purpose is to understand emerging science and technology areas across a broad spectrum over a 10- to 20-year span.

Investment portfolio versus priority needs

Through the Next Generation Technologies Fund, Defence is continuing to build a portfolio of research with investment in all science and technology areas agreed as priorities for Defence. These priorities are shaped by:

- technology foresight as part of the annual Force Design process
- assessments of emerging threats
- the strategic directions set out by the Chiefs of Service in their long-term planning documents.

The identified priorities currently remain as stated in the *2016 Defence Industry Policy Statement.*

The cumulative investment made[3] in each priority technology area is shown below as a percentage of the total investment made to the end of the reporting period. The cost of delivering and assuring the Next Generation Technologies Fund remains within 5 per cent of overall funding.

[3] *'Investments made' captures only the initiatives where agreements are fully executed.*

Defence Investment made per priority technology area to date

Trusted Autonomous Systems	*(45.2%)*	*Hypersonics*	*(1.3%)*
Countering Improvised Threats	*(16.7%)*	*Enhanced Human Performance*	*(1.2%)*
Cyber	*(10.6%)*	*Integrated ISR*	*(0.9%)*
Quantum Technologies	*(8.6%)*	*Multifunction Aperture*	*(0.5%)*
Medical Countermeasure Products	*(5.6%)*	*Space Capabilities*	*(0.4%)*
Multidisciplinary Material Sciences	*(5.5%)*	*Directed Energy Capabilities*	*(0.3%)*
Advanced Sensors	*(3.2%)*		

FACTORS SHAPING THE INVESTMENT PROFILE

At any given time the scale of investment in a particular technology area depends on:

- the capacity of the national innovation system to undertake world-class research in that field
- the maturity of Defence's understanding of the scope and potential of a targeted research program.

Each investment is shaped through the lens of one or more of the Next Generation Technologies Fund collaboration vehicles.

Major investments have been made in the Defence CRC for Trusted Autonomous Systems and in the Grand Challenges for countering improvised threats, hypersonics and the multifunction aperture array.

Mid-scale investments have been made in:

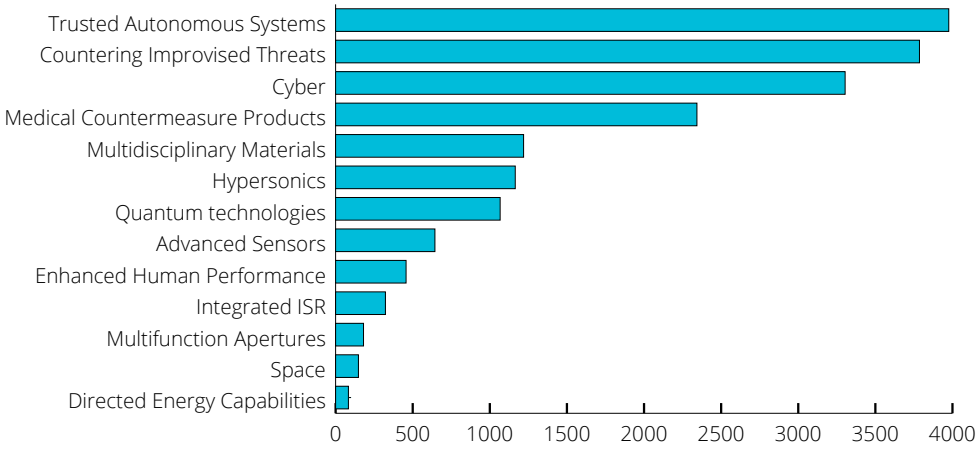
- cyber, through the Data61 partnership
- space, through investment in the SmartSat CRC
- medical countermeasure products, in partnership with the Defence Materials Technology Centre

- quantum technologies, through the Australia–United States Multidisciplinary University Research Initiative and establishment of a research network
- integrated intelligence, surveillance and reconnaissance, through the establishment of a research network for intelligent decision superiority
- advanced sensors and hydrodynamics, through a pilot Multidisciplinary University Research Initiative led by the University of Tasmania
- multidisciplinary material sciences through the Australia–United States Multidisciplinary University Research Initiative.

Smaller investments have been made in:

- enhanced human performance, developing the Fight Recorder through SBIRD
- multidisciplinary materials joining technologies (parallel call with the UK), adaptive camouflage and acoustic materials SBIRDs
- start-ups, through partnership with CSIRO to deliver defence-specific training during their ON Prime accelerator program
- EDTAS workshops for the directed energy, enhanced human performance and space capabilities priority areas.

Average Investment per year in technology priority areas ($k)



INVESTMENT IN TECHNOLOGY PRIORITY AREAS

The scale and nature of each initiative is a consequence of the investment context outlined above, taking into account, for example:

- partnering goals
- the maturity of Defence's understanding of the research needed in each area
- the research community's readiness to participate.

The Next Generation Technologies Fund initiatives underway are mapped into the Defence science and technology priority areas below.

Research theme	Summary of investment to date
Cyber	A strategic partnership with Data61 (CSIRO) and 11 universities covering the following themes: • system design for resilience • data analytics • autonomous cyber • sensing to effects This core element of the cyber portfolio is supplemented through exploratory research with five universities to assess the range of topics of interest to Defence. The Grand Challenge to counter improvised threats includes aspects of cyber research.
Space capabilities	Exploratory research collaborating with three universities and one small company in aspects of domain awareness and precision tracking. A technology futures and foresight symposium held in March 2019 addressing space capabilities. Participation and funding for the SmartSat CRC.
Advanced sensors	University of Tasmania research collaboration on hydrodynamics under a pilot Multidisciplinary University Research Initiative with US universities. Research collaborations are in place with four universities to investigate the potential of novel sensor systems, ranging from bacterial to fibre optic and radiation-sensitive sensors. The Grand Challenge to counter improvised threats includes research in advanced sensing.

Hypersonics	Collaborative research to understand the science behind hypersonic flight— including propulsion—flight dynamics, control surfaces and materials that support flight systems. Hypersonic flight trials.
Directed energy capabilities	Exploratory research collaborating with two small companies and one university in aspects of advanced laser technologies. Exploratory research collaborating with one university in aspects of advanced high-power radio frequency technologies. The Grand Challenge to counter improvised threats includes research in advanced directed effectors.
Quantum technologies	An Australian University Research Network initially involving nine Australian universities and one industry partner, QuintessenceLabs. Investment through the Australia–United States Multidisciplinary University Research Initiative at Griffith University, the University of New South Wales and the University of Technology Sydney to address Multidisciplinary University Research Initiative topic 1: integrated quantum sensing and control. Support for the Australian Research Council Centres of Excellence on Engineered Quantum Systems (EQuS) and Quantum Computing and Communications Technology (CQC2T). Exploratory research collaborations with three universities. Areas include precision sensing, navigation and timing, and communication and information. An Australian University Research Network initially involving five universities and one industry partner, QuintessenceLabs.
Integrated ISR	Exploratory research collaborations with four universities on aspects of surveillance and target recognition. New developments in integrated ISR as part of the Grand Challenge to counter improvised threats. Initial funding for the multifunction apertures Grand Challenge. Establishment of an Australian university research network in intelligent decision superiority, initially involving five universities and one industry partner, Acacia Systems.

Trusted autonomous systems	Establishing the first Defence CRC for trusted autonomous systems. Undertaking collaborative research with nine universities in machine cognition, persistent autonomy and human/autonomy integration. The Grand Challenge to counter improvised threats includes research in advanced cognitive decision-making.
Enhanced human performance	Pilot SBIRD initiative to develop the Fight Recorder concept. Two partner companies have been selected: Myriota and IMeasureU. Exploratory research collaborating with four universities to conduct research in virtual reality and operator workload. A second phase technology futures and foresight symposium was held in May 2018 on human biotechnologies.
Medical countermeasure products	Collaborating with 17 industry, academic and government organisations through DMTC to examine: • antimicrobial resistance, • point-of-care diagnostics • security-sensitive biological agents. A technology futures and foresight symposium held in May 2018 addressed human biotechnologies.
Multi-disciplinary material sciences	Investment through the Australia–United States Multidisciplinary University Research Initiative in 2017–18 in the University of Sydney and the University of New South Wales addressing Multidisciplinary University Research Initiative topic 22: Material defect identification for metallic additive manufacturing. Collaborative research with seven universities in advanced multidisciplinary material sciences such as metamaterials. This is contributing to the knowledge base for new Defence capability in areas including active camouflage, ballistic protection and power and energy sources. A technology futures and foresight symposium held in November 2017 addressed the topic of advanced manufacturing and materials.

Partner profiles

To deliver the Next Generation Technologies Fund over its 10-year lifetime, Defence is establishing a wide variety of enduring research partnerships to develop the disruptive technologies needed to provide future Defence capabilities. During the reporting period these partnerships have grown in number and profile. New research agreements have commenced with 14 Australian universities and six companies as lead partners, plus new projects through our partnerships with DMTC, the Defence Cooperative Research Centre and Data61.

Distribution of Next Generation Technologies Fund investments to date

In 2018–19 the intelligent decision superiority and quantum technologies research networks and the adaptive camouflage Small Business Innovation Research for Defence program have brought six new lead partner companies to the Next Generation Technologies Fund. These have ranged from micro enterprises such as XROTOR (UAV rotor design) and MicroTau (bio-inspired additive surface manufacture) to well-established defence partners such as Acacia Systems. QuintessenceLabs, a pioneer quantum encryption enterprise, has joined the Next Generation Technologies Fund's newly established Quantum Technologies Research Network.

The National Innovation and Science Agenda (NISA) noted that, relative to many of its OECD peers, Australia ranked poorly in terms of levels of industry–research collaboration. The Next Generation Technologies Fund is one of a raft of Government initiatives that are redressing this national performance shortfall. Teaming arrangements established under the Grand Challenge to counter improvised threats and through the medical countermeasure products initiative with DMTC are making a positive contribution to the national profile of industry–university collaboration. This will grow rapidly as other initiatives—such as the Defence CRC for Trusted Autonomous Systems, the SmartSat CRC and research networks—are launched and mature.

UNIVERSITY PARTNERS

Under the Next Generation Technologies Fund, partnerships with Australian universities vary in scale and breadth. Funding to individual universities since the launch of the Next Generation Technologies Fund ranges from $100,000 to more than $5 million. Factors which have contributed to this variation include the breadth and depth of a university's engagement with Defence and the degree of alignment of a university's research capabilities with priority Defence research themes. Working from a position of impartiality, Defence is taking steps to ensure all universities that aspire to be partners under the Next Generation Technologies Fund can be competitive bidders. Every university with Defence interests has been assigned a senior Defence scientist to provide direct support as a science and technology partnership manager. University-specific resources are also being developed to help each university apply to Next Generation Technologies Fund initiatives.

Victoria, South Australia, Western Australia and New South Wales have established institutes to encourage university-based defence research. Defence recognises the value of these state-based institutions in developing a truly national defence research enterprise, with support provided through the Next Generation Technologies Fund.

The following summary of each university's cumulative direct engagement in the Next Generation Technologies Fund portfolio includes support for state-based Defence science institutes but does not distinguish which funding went to which university by the institutes. Projects and funding are associated with lead university partners contracting directly with Defence only: in some cases, other universities are receiving a share of the funding through collaborative arrangements. Collaborations under the strategic partnerships with Data61 and DMTC are listed separately.

Partner university	Priority technology areas	Number of projects	Defence investment
Australian National University	Trusted Autonomous Systems Quantum Technologies	7	$3,252,000
Curtin University	Space Capabilities	1	$85,000
Deakin University	Enhanced Human Performance	4	$349,000
Edith Cowan University	Cyber	2	$197,000
Flinders University	Advanced Sensors Counter-Improvised Threats	2	$777,000
Griffith University	Trusted Autonomous Systems Quantum Technologies Integrated ISR	3	$3,195,000
La Trobe University	Medical Countermeasure Products	2	$211,000

Macquarie University	Directed Energy Systems Multifunction Apertures	4	$298,000
Monash University	Multidisciplinary Material Sciences	2	$255,000
Queensland University of Technology	Multidisciplinary Material Sciences Counter-Improvised Threats Integrated ISR	4	$1,052,000
RMIT	Enhanced Human Performance Multidisciplinary Material Sciences Trusted Autonomous Systems Quantum Technologies Integrated ISR Multifunction Apertures	13	$1,751,000
University of Adelaide	Integrated ISR Advanced Sensors Multidisciplinary Material Sciences Trusted Autonomous Systems Cyber Directed Energy Systems Medical Countermeasure Products Counter-Improvised Threats Quantum Technologies Multifunction Apertures	20	$4,534,000
University of Melbourne	Medical Countermeasure Products Multidisciplinary Material Sciences Trusted Autonomous Systems Enhanced Human Performance Cyber Multidisciplinary Material Sciences Multifunction Apertures	13	$2,129,000
University of New South Wales	Advanced Sensors Quantum Technologies	2	$264,000

University of New South Wales, Canberra	Quantum Technologies Trusted Autonomous Systems Cyber Directed Energy Systems	5	$387,000
University of Newcastle	Trusted Autonomous Systems	1	$100,000
University of Queensland	Quantum Technologies Counter-Improvised Threats Hypersonics	11	$5,233,000
University of South Australia	Directed Energy Systems Trusted Autonomous Systems Cyber Space Capabilities Counter-Improvised Threats Multidisciplinary Material Sciences	7	$1,441,000
University of Sydney	Cyber Trusted Autonomous Systems Multidisciplinary Material Sciences Integrated ISR	8	$3,979,000
University of Tasmania	Enhanced Human Performance Advanced Sensors	3	$3,237,000
University of Technology Sydney	Integrated ISR Multifunction Apertures	2	$218,000
University of Western Australia	Counter-Improvised Threats	1	$2,910,000
University of Wollongong	Advanced Sensors Multidisciplinary Material Sciences	2	$363,000
Western Sydney University	Space Capabilities	1	$100,000
Australian Defence Science University Networks (ADSUN)		4	$4,760,000

University partners involved in the Data61 strategic partnership

The strategic partnership with Data61 for the Cyber technology priority area was established in 2017. At the reporting date it has distributed $9.8 million amongst the following universities:

Australian National University, Macquarie University, Monash University, Swinburne University of Technology, The University of Adelaide, The University of Melbourne, The University of New South Wales, The University of Newcastle, The University of Queensland, The University of South Australia, The University of Sydney and The University of Technology Sydney.

University partners involved in the DMTC strategic partnership

The strategic partnership with DMTC for the medical countermeasures priority theme was established in 2017 and to date has distributed $5.8 million to industry and university partners. The following Australian universities have entered into funding agreements under this strategic partnership:

Deakin University, Flinders University, Monash University, The University of Adelaide, The University of Melbourne, The University of Queensland and The University of Western Australia.

International partners from The University of Exeter, Universitat Wurzburg and Dstl also participate in NGTF-funded DMTC projects.

INDUSTRY PARTNERS

The Next Generation Technologies Fund is supporting defence innovation research across the broad spectrum of industrial entities. Partners include every category of business, ranging from small businesses with fewer than five employees to the Australian branches of defence primes. In line with guidance from the 2016 Defence Industry Policy Statement, emphasis has been placed on building collaborative programs with small to medium businesses.

A summary of each industry partner's direct engagement in the Next Generation Technologies Fund is given below. Projects and funding are associated with lead partners only. Industry partners involved in the strategic partnership with DMTC are listed separately.

Small companies (one to 19 employees)

Industry partner	Priority technology areas	Number of projects	Defence investment
Acacia Systems	Integrated ISR	1	$100,000
Aether Photonics	Directed Energy Systems	1	$72,000
Dotterel Technologies	Multidisciplinary Material Sciences	1	$99,000
iMeasureU	Enhanced Human Performance	1	$298,000
L3Harris Micreo	Grand Challenge to Counter Improvised Threats	1	$1,061,000

MicroTau	Multidisciplinary Material Sciences	1	$100,000
Myriota	Enhanced Human Performance Space Capabilities	2	$580,000
Noetic Solutions	Technology Futures and Foresight	3	$1,326,000
QuintessenceLabs	Quantum Technology	1	$249,000
RFTeq	Grand Challenge to Counter Improvised Threats	1	$2,363,500
Simbiant	Multidisciplinary Material Sciences	1	$95,000
Solinnov	Trusted Autonomous Systems	1	$180,000
Teledyne Defence	Grand Challenge to Counter Improvised Threats	2	$921,000
Xrotor	Multidisciplinary Material Sciences	1	$100,000

Medium companies (20 to 199 employees)

Industry partner	Priority technology areas	Number of projects	Defence investment
DefendTex	Grand Challenge to Counter Improvised Threats	1	$2,089,000
Tectonica	Grand Challenge to Counter Improvised Threats	1	$1,848,000

Large companies (over 200 employees)

Industry partner	Priority technology areas	Number of projects	Defence investment
Lockheed Martin Australia (STELaRLab)	Grand Challenge to Counter Improvised Threats	1	$497,000

Companies Involved with the DMTC Strategic Partnership for Medical Countermeasures

The following industry partners have shared in the $5.8 million NGTF funding distributed to DMTC participants: ARASMI, Anteo Technologies, The Australian Rickettsial Reference Laboratory, BiosparQ BV, Boulos & Cooper, Certara, Hydrix, MiniFAB Australia, Neoculi, Planet Innovation, Trajan Scientific & Medical, Vaxine.

PUBLICLY FUNDED RESEARCH AGENCIES

The Next Generation Technologies Fund is leveraging the expertise of Australia's national science agency, CSIRO, in a range of science domains and a variety of programs. CSIRO is a strategic partner and co-investor in two major multi-year initiatives:

- the research program in the domain of medical countermeasure products, conducted through DMTC
- a partnership in cyber with Data61.

As a component of the Next Generation Technologies Fund technology acceleration program, Defence is collaborating with CSIRO to run a defence-oriented stream in the NISA-funded national technology accelerator ON Prime. This will give researchers a unique opportunity to fast-track their science or technology proposition with expert guidance from experienced innovators.

Working with Wollongong University, CSIRO has also been funded to deliver hyperspectral imaging technology under the Grand Challenge to counter improvised threats.

Partner	Priority technology areas	Number of projects	Defence investment
CSIRO	Medical Countermeasure Products Counter-Improvised Threats Cyber Defence Research Accelerator, ON Prime: Defence	4	$11,876,000

COOPERATIVE RESEARCH CENTRES AND STRATEGIC PARTNERSHIPS

The Next Generation Technologies Fund has entered into strategic partnerships with a number of enterprises that facilitate research projects on our behalf. These enterprises coordinate funding from multiple sources including Defence, industry and universities for research projects. Defence has agreements at the highest level with these enterprises, but is not always a party to the project arrangements. The funding provided through the Next Generation Technologies Fund is leveraged considerably in this way.

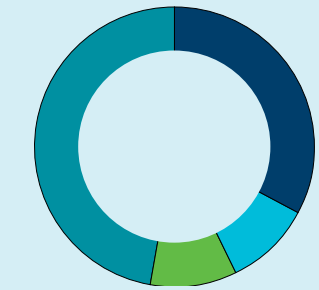
The list below contains the cumulative investment in the priority technology areas to date, excluding the investment in the strategic partnership with Data61, which is captured above.

Partner	Priority technology areas	Number of projects	Defence investment
DMTC	Medical Countermeasure Products	10	$5,800,000
Defence CRC—Trusted Autonomous Systems	Trusted Autonomous Systems	1	$50,000,000

FUNDING DISTRIBUTION BY ORGANISATION TYPE

At the conclusion of the reporting period, 10 per cent of all investments made since launch have been with industry partners, 33 per cent with universities, 10 per cent with publicly funded research agencies and 47 per cent with CRCs or strategic partnerships. These figures will continue to change significantly once additional projects under the Defence CRC in Trusted Autonomous Systems are initiated and further large-scale multi-party investments are confirmed.

FUNDING DISTRIBUTION BY ORGANISATION TYPE TO DATE



RESEARCH QUALITY PERFORMANCE ASSESSMENT

The *2016 Defence Industry Policy Statement* clearly articulates how Defence's innovation initiatives, including the Next Generation Technologies Fund, must be established. The policy states that Defence will systematically remove barriers to innovation by changing both its culture and its business processes.

In the case of the Next Generation Technologies Fund, DST was charged with delivering a program of high-quality research, featuring collaborations across the full span of Australia's innovation enterprises and with our allies. DST has delivered on that charge—the program is now fully operational with commitments as at June 30 2019 of more than $150 million to support collaborative research. This includes across every one of the inaugural priority areas identified in the 2016 Defence Industry Policy Statement.

The Next Generation Technologies Fund has been designed with a future focus, and will have a clear and measurable impact in terms of Defence's capability. While in most cases the impact will be long term, trajectories are being designed for each of the research projects.

Research activities are not confined to the academic community. A number of the program's initiatives include collaborative partners drawn from industry. While it will be possible to assess the outcomes of basic research in terms of the number of peer-reviewed publications generated for applied programs—which aim to address specific future capability needs—a different set of measures is required.

Quality assurance processes are being developed to address specific needs that arise from adopting a risk-tolerant, high-reward research model. As a consequence, it may be necessary for elements of the research to 'fail fast'. Utilising a 'fail fast' model should enable researchers to explore and experiment with concepts, learn from

mistakes and use them to create innovative final outcomes in a more efficient way.

Next Generation Technologies Fund support for engagement with Australia's allies continues to deliver results. Research engagement between Griffith University, UNSW and the University of Technology Sydney, in partnership with seven universities from the United States, is poised to develop an unprecedented capability in quantum computing: 'noise-cancelling headphones' for quantum computers. The ultimate outcome is increased stability of fragile quantum building blocks, or qubits.

Plans for 2019–20

SCIENCE AND TECHNOLOGY STRATEGY FOR DEFENCE

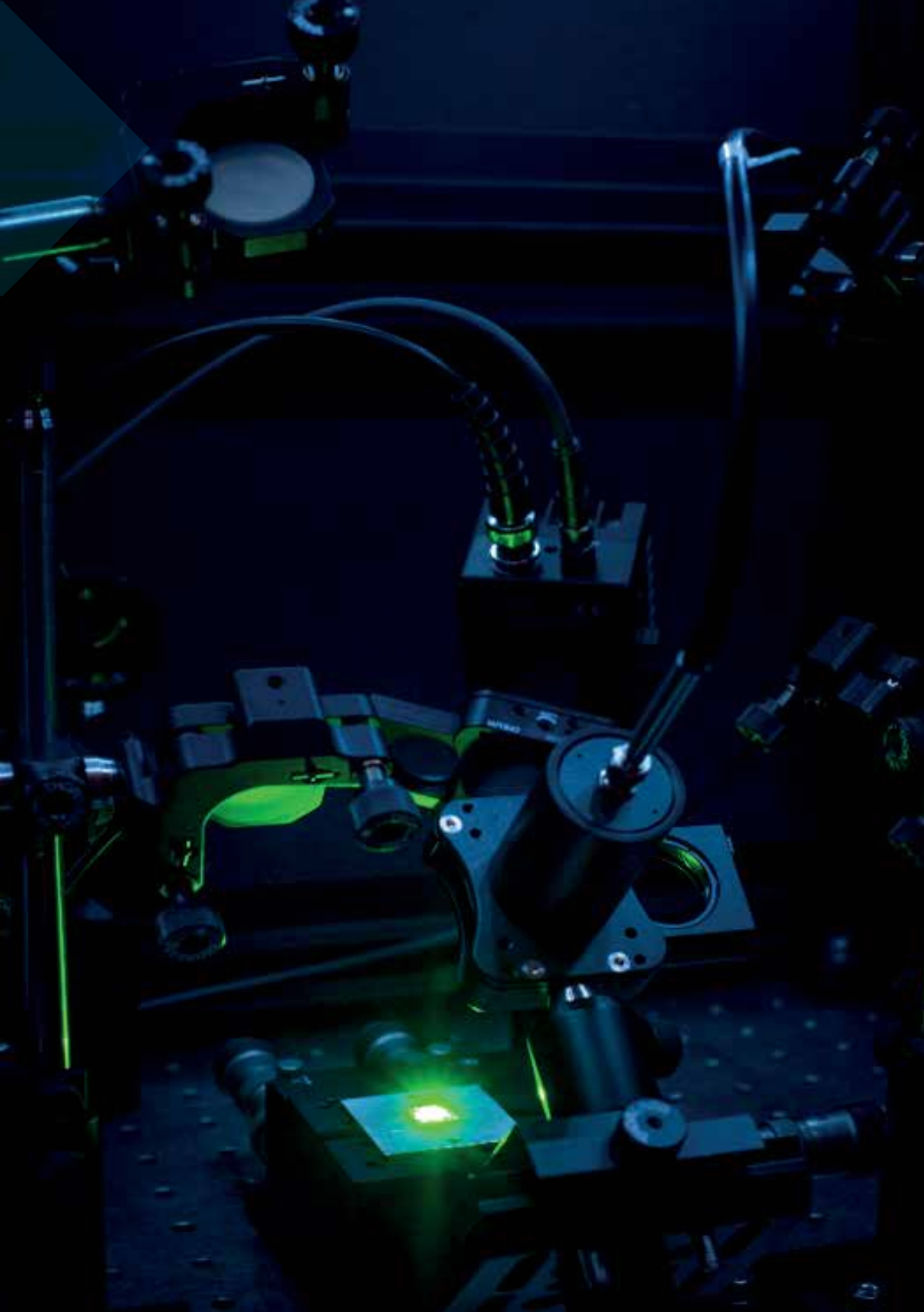
As part of the draft Science and Technology Strategy for Defence 2020–30, the Next Generation Technologies Fund is investigating the prioritisation of investments towards large Science, Technology and Research (STaR) programs termed STaRShots.

TRANSITION TO IMPACT

In 2019–20 the Defence Innovation Hub and the Next Generation Technologies Fund will work to ensure that the Defence innovation ecosystem develop projects that support creation of truly innovative and leap-ahead technologies and concepts. Our future aim is to ensure that the outputs of these projects transition to future defence capability enhancements. Both programs are continuing to build the mechanisms and strengthen the metrics to enable us to track success.

CONTINUOUS IMPROVEMENT

In 2019–20 the Next Generation Technologies Fund will continue its continuous improvement program, including exploring ways to further streamline processes to provide more timely outcomes and to strengthen communication with industry and research organisations.



DEFENCE INNOVATION HUB

The Defence Innovation Hub enables collaboration on innovation technologies that can be developed into advanced capability for Defence

Program performance of the Defence Innovation Hub is reported over the following pages. Strategic measures are reported qualitatively, supported by quantitative performance information.

DEFENCE INNOVATION HUB

PROGRAM IMPACT STATEMENT

The Defence Innovation Hub is enhancing Defence capability through innovation and, in doing so, building the capability and capacity of the Australian defence industry and innovation sector. From the launch of the Defence Innovation Hub in December 2016 to the end of 2018–19, a total of 94 innovation contracts were executed with over 70 Australian businesses and research organisations for a combined investment value of around $153 million.

Through the Defence Innovation Hub, Australian companies are developing a wide range of advanced technologies that enhance Defence capability in areas including countering cyber threats, placing uninhabited and autonomous platforms in maritime, land and air environments, improving the accuracy and range of military weapons, and building radars that can detect threats more accurately. In 2018–19 the Defence Innovation Hub made multi-million dollar investments in all six Defence capability streams, including investing $34 million in the top priority stream: Intelligence, Surveillance, Reconnaissance, Electronic Warfare, Space and Cyber.

In 2018–19 over 30 Defence Innovation Hub partners successfully completed their innovation contracts. One example is Explosive Protective Equipment, which completed its final project milestone in October 2018 when it successfully demonstrated its prototype Portable RAMAN Improvised Explosive Detector, which can detect explosives, chemical warfare agents, narcotics and gases at a safe distance.

The Defence Innovation Hub is having a strong impact on the Australian defence industry and innovation sector. Defence Innovation Hub partners are awarded Defence contracts, which provide partners with valuable recognition and access to the guidance of Defence capability managers, as well as funding to develop their innovations. Defence Innovation Hub partners have reported that their contracts with the Defence Innovation Hub have allowed them to cumulatively invest in over 200 new staff, expand their research and development capabilities, collaborate with other industry partners and research organisations, and attract new investment and customers.

Royal Australian Navy personnel with staff from EPE and the Defence Innovation Hub following the successful completion of the Maritime PRIED demonstration

> *The Defence Innovation Hub contract has supported the growth of our business by increasing our ability to attract and employ high calibre staff and enabling us to work with Australian technology partners to develop world leading innovative technology solutions which increases Australia's defence capability in Intelligence, Surveillance, and Reconnaissance, and has allowed us to attract global defence and civil customers."*
>
> **DR PAUL BOXER, CEO, SENTIENT VISION SYSTEMS**

The Defence Innovation Hub recognises that an integral part of building the capacity and capability of defence industry is attracting new entrants to the sector that have not previously done business with Defence. In 2018–19 the Defence Innovation Hub signed contracts with multiple new entrants to the Defence sector, including Carbon Revolution, a company best known for developing and manufacturing lightweight one-piece carbon fibre wheels for companies including Ford and Ferrari. In April 2019, the Defence Innovation Hub signed an innovation contract with Carbon Revolution to develop the world's first lightweight carbon fibre wheels for the CH-47 military helicopter (read more about Carbon Revolution at page 51). By the end of 2018–19, 21 per cent of partners that had entered into contracts with the Defence Innovation Hub were new to Defence.

Since launching in December 2016, the Defence Innovation Hub has focused on continuous improvement activities to drive internal improvements and implement initiatives that lead to better engagement and outcomes with industry. In 2018–19 these activities led to a reduction in the average processing timeframes, including reducing the timeframes for the first stage of the assessment process (reviewing the initial high-level proposal) to around three months, down from five to six months in 2016–17.

PROGRAM BENEFITS FOR INDUSTRY

The Defence Innovation Hub surveyed Hub partners in 2018-19 and received the following feedback on program benefits for industry

- *Bringing technology closer to commersialisation acqusition*
- *Providing close engagement with Defence capability managers, leading to a deeper understanding of Defence's capability requirements*
- *Learning from the experience of Defence project management*
- *Credibility and confidence Hub contracts provide in attracting interest from investors and other customers*
- *Upskilling and jobs growth*

Enhancing Defence capability through innovation

STRATEGIC APPROACH TO INVESTMENT

The Defence Innovation Hub invests across six capability streams, aligned with Defence's capability priorities, which are published to assist industry and research organisations to focus their innovation activities in line with Defence's capability priorities.

The response from industry to the published Defence Innovation Hub investment priorities has been strong, with more than 79 per cent of proposals received in 2018–19 aligned with the top three priority streams, enabling Defence to invest in technologies of most interest.

The total investment by the Defence Innovation Hub since its launch in 2016 in each of the six capability priority streams is outlined below.

Capability stream	Summary of investment	Total investment
Intelligence, Surveillance, Reconnaissance, Electronic Warfare (ISREW), Space and Cyber	40 contracts for innovations including artificial intelligence, space, radar, counter UAV, mapping and GPS, and encryption technologies	$73,040,000
Key Enablers	11 contracts for innovations including training and simulation platforms, software platforms and laser technologies	$12,442,000
Land Combat, Amphibious Warfare and Special Operations	31 contracts for innovations including body armour, drones, weapons systems and networking equipment	$38,338,000
Strike and Air Combat	2 contracts for innovations including air combat training solutions, and sea skimming missiles	$3,294,000
Maritime and Anti-Submarine Warfare	7 contracts for innovations including super cavitation technology, satellite communications systems and uninhabited autonomous surface vehicles	$18,338,000
Air and Sea Lift	2 contracts for innovations including lightweight armour and carbon fibre technologies	$3,294,000

CASE STUDY

Inovor Technologies—sovereign small satellite technology development and flight test

In January 2019, the Defence Innovation Hub awarded Inovor Technologies a six-month Phase 1 concept exploration contract with an investment value of $317,000. During this contract Inovor Technologies undertook a simulation study to assess mission performance and reliability of CubeSat platforms wholly developed and built within Australia, including examining the performance parameters for CubeSat missions and determining the different capability performance of different spacecraft sizes.

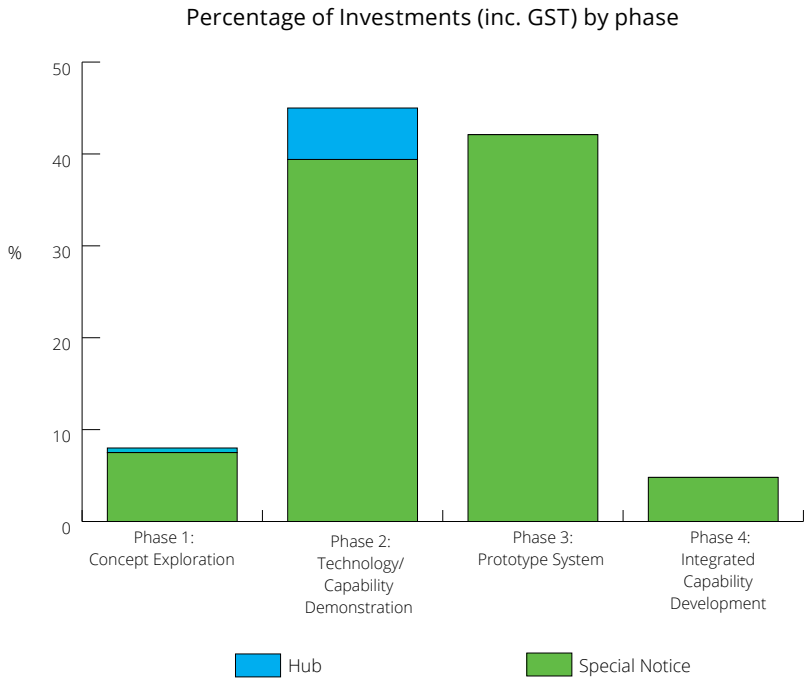
In addition to this Phase 1 contract, in April 2019 Inovor Technologies was awarded a Phase 3 innovation contract with an investment value of $6.38 million to design and develop a prototype space awareness CubeSat to test the current technical maturity and functional specifications and provide confidence in the overall system design and achievability of key performance measures. This project is building the knowledge and technology developed under the previous contract with the Defence Innovation Hub and verifying the operational life of the CubeSat, looking at factors such as radiation dose, power cycling and mechanical degradation.

> *"Our contract with the Defence Innovation Hub has allowed us to bring on extra expertise and capacity to enable us to de-risk our technology, with the objective of eventually demonstrating it in orbit and pursuing the global supply chain."*
>
> **MATTHEW TETLOW, CEO, INOVOR TECHNOLOGIES**

MATURING INNOVATION TO HIGHER STAGES OF DEVELOPMENT

The Defence Innovation Hub develops innovative technology in four phases: Phase 1, concept exploration; Phase 2, technology demonstration; Phase 3, prototype system; and Phase 4, integrated capability development. To date the majority of Defence Innovation Hub investment has been in innovations in the first two stages of development; however, in 2018–19 the Defence Innovation Hub significantly increased its investment in innovations at the more advanced stages of development. From 31 per cent at the end of 2017–18, by 30 June 2019 investment in Phase 3 and 4 innovations had increased to 47 per cent of total investment. Defence invested in an additional two Phase 4 innovations in 2018–19, taking total investment in Phase 4 innovations to 5 per cent of total investment, up from 1 per cent.

This increased level of investment is a sign the Defence Innovation Hub's investment portfolio is maturing, with a more balanced portfolio of investments. As successful innovations move through the innovation pipeline, investment in the later phases of development is expected to continue to increase.



CASE STUDY

Ocius Technology—persistent, intelligent autonomous networked uninhabited surface vehicles

In September 2018 the Defence Innovation Hub awarded Australian company Ocius Technology a Phase 3 prototype design contract, valued at $2.05 million, for the development of persistent, intelligent autonomous networked uninhabited surface vehicles, known as 'BlueBottles'. This system aims to use artificial intelligence to enhance Australia's persistent maritime surveillance capability.

Based at the University of New South Wales, Ocius Technology works in collaboration with the School of Computer Science and Mechanical Engineering to adapt intelligent robotics technology to deliver a capability edge in maritime environments. The Ocius Technology network of renewable energy powered uninhabited surface vessels could assist maritime patrols, mine clearance, environmental monitoring, and search and rescue operations, and has the potential for integrating more capabilities and performing multiple roles.

As part of its Phase 3 trials and tests, over May and June 2019 Ocius Technology successfully undertook a series of over the horizon sea trials and achieved persistent operation of up to 20 nautical miles off the south coast of New South Wales in the east Australian current for over eight days, covering 268 nautical miles. Ocius Technology successfully completed its innovation contract in June 2019, three months ahead of schedule.

Ocius Uninhabited Surface Vessel – Bluebottle

Growing the capability and capacity of the Australian industry and innovation sector

The Defence Innovation Hub is investing around $640 million to 2025–26 in order to build the innovation capabilities of Australian industry, universities and research institutions to deliver innovative solutions for Defence capability.

The Defence Innovation Hub welcomes submissions from all types of businesses and is committed to building a vibrant and globally competitive Australian industry and innovation sector.

200+ NEW JOBS

Created from Defence Innovation Hub contracts

SUPPORTING THE GROWTH OF AUSTRALIA'S DEFENCE INDUSTRY

Having an industrial base consisting of a large number of agile micro, small and medium businesses benefits Australia, and the Defence Innovation Hub is successfully supporting this goal. Since its launch in 2016, 84 per cent of investments made by the Defence Innovation Hub have been in Australia's micro, small and medium sized businesses.

The Defence Innovation Hub recognises that great ideas can come from micro, small and medium sized organisations. By providing equal opportunity for smaller businesses to put forward their great ideas and to collaborate in developing innovative technology, the Defence Innovation Hub helps to ensure that the talents and skills of Australian industry and research organisations are fully utilised.

An example of a small business achieving success with the Defence Innovation Hub is AMSL Aero, a Sydney-based small business that, in July 2018, was awarded a Phase 1 Concept Exploration contract with a total investment value of $326,000. This was AMSL Aero's first contract with Defence. Under the contract the company is developing the concept for a high-speed autonomous logistics and casualty evacuation uninhabited aircraft system. The company has reported that as a result of the contract with the Defence Innovation Hub it has been able to create an additional nine jobs.

> *"The Defence Innovation Hub contract has allowed us to demonstrate our engineering capability and showcase Intellectual Property that has a global market potential. We have been able to leverage our innovation contract to attract substantial investment to further develop our products, and have now teamed with international partners and negotiated two key Memorandum of Understandings with potential future customers."*
>
> **ANDREW MOORE, CEO, AMSL AERO**

Defence is collecting data on the number of jobs created as a direct result of investment by the Defence Innovation Hub. This measures the program's impact on building and sustaining Australia's defence industry and innovation sector. It is estimated that more than 200[4] jobs have been created as a result of investment from the Defence Innovation Hub since its launch in 2016.

PERCENTAGE OF INVESTMENT VALUE BY COMPANY SIZE

	2018–19
Micro (0–4 employees)	7%
Small and medium (5–199 employees)	77%
Large (over 200 employees)	6%
Research organisation	10%

NEW ENTRANTS TO THE SECTOR

21% NEW TO DOING BUSINESS WITH DEFENCE

Defence recognises that innovative capability solutions come from companies and research organisations whose expertise may lie beyond Defence. An important part of building the capacity and capability of defence industry is expanding the defence sector to new entrants. The Defence Innovation Hub welcomes proposals from both traditional and non-traditional organisations. The Centre for Defence Industry Capability complements the Defence Innovation Hub by helping new starters to Defence with tailored advice, support, information and guidance on doing business in the defence market.

Since the Defence Innovation Hub launched in 2016, 21 per cent of partners entering into contracts with the Defence Innovation Hub have been new to doing business with Defence.

An example is Geelong-based company Carbon Revolution, which has successfully innovated, commercialised and industrialised the supply of carbon fibre wheels to the global automotive industry. A global leader in lightweight wheel technology, Carbon Revolution signed its first Defence contract, valued at $2.58 million, to use the intellectual property, expertise and engineering tools that it has created through the development of carbon fibre automotive wheels to design, validate and supply the world's first lightweight carbon fibre wheels for the CH-47 military helicopter.

Carbon Revolution has identified that the efficiency and life cycle benefits from carbon fibre's superior fatigue, specific strength and specific stiffness properties make it perfectly suited to aerospace applications. It proposes to complete extensive engineering, modelling and simulation to provide Defence with an understanding of this technology. This project will further demonstrate how it can enhance the current CH-47 capability through enhanced lift performance and greater lift capacity.

> *"Our contract with the Defence Innovation Hub has enabled us to diversify into the defence sector. We look forward to considerable growth in this domain and are excited by the opportunity it presents."*
>
> **ASHLEY DENMEAD, ENGINEERING AND DESIGN DIRECTOR, CARBON REVOLUTION**

[4] *Data collected from Defence Innovation Hub partner questionnaires in 2018 and 2019.*

CASE STUDY

INVESTMENT WITH RESEARCH ORGANISATIONS

Australian research organisations are also developing innovative and cutting-edge Defence technology. In 2018–19 the Defence Innovation Hub invested over $9 million with research organisations, including a $6 million investment with the International Centre for Neuromorphic Systems at Western Sydney University for a three-year Phase 3 prototype system contract to develop neuromorphic vision systems for next-generation space situational awareness capabilities.

Neuromorphic sensors are inspired by biology—in this case, the neuromorphic vision system aims to create an electronic retina which works in a completely new and innovative way. Each pixel works independently, continuously observing tiny changes in light to detect events such as the movement of a vehicle. Just like human eyes, the neuromorphic sensor adapts to the overall light level, allowing it to see satellites even during the day, when regular cameras are overwhelmed by sunlight. With other advantages over regular cameras such as high-speed imaging and greatly reduced power usage and data rates, this technology shows much promise for a wide range of applications.

This innovation project will produce a prototype and full design of a neuromorphic visible-light imaging sensor for space situational awareness applications. It is an example of the unique research and development capabilities of Australian research organisations being harnessed by the Defence Innovation Hub to enhance sovereign defence capability.

COLLABORATION BETWEEN INDUSTRY AND RESEARCH ORGANISATIONS

In addition to directly contracting with research organisations, the Defence Innovation Hub is supporting collaboration between industry and research organisations through subcontracting arrangements. In 2018–19 there were multiple instances where industry and research organisations were collaborating. For example:

- Exablaze was awarded a contract in December 2018 with an investment value of $354,000 to explore the development of an automated object detection system with the capacity to operate in a range of light-based conditions. Exablaze has subcontracted with the University of Sydney and the University of South Australia.
- SiNAB was awarded a Defence Innovation Hub contract valued at $4.3 million for the development of Joint Terminal Attack Controller training solutions in May 2019. SiNAB has subcontracted with the School of Aerospace at the University of Sydney for aircraft simulator infrastructure.
- In September 2018, Ocius Technology was awarded a contract valued at $2.05 million for the development of persistent, intelligent autonomous networked uninhabited surface vehicles. Based at the University of New South Wales, Ocius Technology works in collaboration with the School of Computer Science and Mechanical Engineering to adapt intelligent robotics technology to its innovation.

RUAG Australia engineer, Nicholas Orchowski (left), and Swinburne University researcher Dr Rizwan Rashid (right) at RUAG Australia's state of the art facilities in Victoria. Image credit: DMTC Limited

The Defence Innovation Hub is also supporting collaboration through the new collaborative research and development and innovation services contract with DMTC. In June 2019 the Defence Innovation Hub signed a contract with DMTC, valued at $3.8 million, which will leverage DMTC's unique capabilities and established network with leading industrial and research partners to support and enhance Australian Defence Force capability. Their collaborative model will bring together leading industrial partners, and Australian universities and research organisations.

The contract with DMTC includes delivery of four collaborative projects that will support industrial capability underpinned by innovative technology developments to provide Defence with scientific evidence on the technical maturity of hybrid composite materials for functional enhancement of future land vehicle programs; advanced land vehicle design modelling; metallic additive manufacturing to provide higher performance components for future air platforms; and the sustainment of emerging materials for structural applications.

DEFENCE INNOVATION HUB INVESTMENTS MADE BY STATES AND TERRITORIES

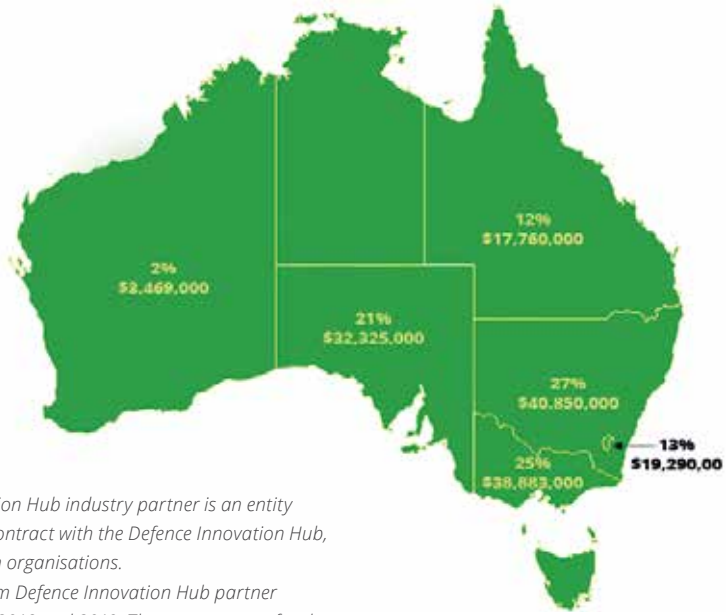
Since the launch of the Defence Innovation Hub in December 2016, the majority of investment has been with New South Wales, Victoria, South Australia, Queensland and ACT-based partners. The higher investment rate in these locations corresponds with the high number of proposals coming from those areas. For instance, between 5 December 2016 and 30 June 2019 more than 25 per cent of all proposals across the Defence Innovation Hub's program were received from New South Wales.

The map below indicates the location and value of Defence Innovation Hub investment from the launch of the program in December 2016 to 30 June 2019.

Northern Territory and Tasmanian companies accounted for less than 2 per cent of proposals received and have not been awarded Defence Innovation Hub investments. The Centre for Defence Industry Capability (CDIC) is engaged with industry in all states and territories. As part of its advisory and facilitation services, the CDIC promotes opportunities through the Defence Innovation Hub and helps companies to develop and submit proposals.

GLOBAL SUPPLY CHAIN

The success of the Global Supply Chain (GSC) Program, managed by the Centre for Defence Industry Capability (CDIC), is benefiting Defence Innovation Hub partners. Thirteen partners[5] reported that they were part of a global supply chain in 2018–19, more than double the number from the previous year.[6]



[5] A Defence Innovation Hub industry partner is an entity that has been in contract with the Defence Innovation Hub, excluding research organisations.

[6] Data collected from Defence Innovation Hub partner questionnaires in 2018 and 2019. The response rate for the 2019 questionnaire was 58 per cent.

Investment portfolio—Priority Innovation Notice

The Defence Innovation Hub accepts proposals to its open call for submissions (the Priority Innovation Notice) 365 days a year. Defence seeks proposals aligned with the priority capability streams that make up the Defence Integrated Investment Program.

The six capability streams for investment through the Defence Innovation Hub's Priority Innovation Notice remained the same in 2018–19, giving the industry and research sectors continuity to plan their activities.

More detailed information on Defence's investment priorities is available from the Defence Innovation Portal.

PROPOSALS SUBMITTED BY CAPABILITY STREAM

In 2018–19 the Defence Innovation Hub received a total of 200 proposals through its portal. This included:

ISREW, Space and Cyber	31%
Key Enablers	20%
Land Combat, Amphibious Warfare and Special Operations	31%
Maritime and Anti-Submarine Warfare	9%
Air and Sea Lift	6%
Strike and Air Combat	3%

INVESTMENTS BY CAPABILITY STREAM

Of the 200 proposals submitted, 56 respondents were invited to proceed to the second stage of assessment by preparing a more detailed proposal. These were reviewed by the Defence Innovation Hub's technical assessors, capability managers and investment advisory group, and 32 contracts were awarded as follows:

ISREW, Space and Cyber	13	$30,562,000
Key Enablers	4	$4,861,000
Land Combat, Amphibious Warfare and Special Operations	9	$14,351,000
Maritime and Anti-Submarine Warfare	4	$13,993,000
Air and Sea Lift	1	$4,692,000
Strike and Air Combat	1	$2,580,000

On 29 November 2018, the Defence Innovation Hub signed a Phase 3 prototype system contract with Victoria-based company GPSat Systems Australia, with an investment value of $1.33 million. This contract took the total Defence Innovation Hub investment in its top capability priority stream—Intelligence, Surveillance, Reconnaissance, Electronic Warfare, Space and Cyber—to over $50 million. Under the contract GPSat Systems Australia will develop GPS jamming and spoofing countermeasures delivering rapid threat detection and geo-location capabilities.

Investment portfolio—Special Notice

In this reporting period, the Defence Innovation Hub undertook two Special Notice procurements. Five contracts were awarded in 2018–19 to Special Notice respondents.

PROPOSALS SUBMITTED BY CAPABILITY STREAM

Of all the proposals received by the Defence Innovation Hub in 2018–19, 28 per cent were in response to Special Notices. The total investment made in Special Notice contracts for 2018–19 was $5 million:

ISREW, Space and Cyber	4	$3,558,000
Land Combat, Amphibious Warfare and Special Operations	1	$1,485,000

SPECIAL NOTICES

Special Notices are novel challenge-based solicitations that seek innovative solutions from industry and research organisations to meet specific Defence capability challenges.

Since the Defence Innovation Hub first supported Army Innovation Day in 2017, Special Notices have led to over $9 million in contracts being signed. This is proving an effective way for Defence's capability managers to directly approach the market in search of the best and brightest ideas to solve challenges through potentially game-changing innovation.

The response from industry to Special Notices has been strong, with over 200 responses received in response to Special Notices since the launch of the Defence Innovation Hub.

ARMY INNOVATION DAY 2018

Army Innovation Day is an important collaboration between the Australian Army, defence industry and the Defence Innovation Hub.

Held on 25 October 2018, Army Innovation Day ran a Special Notice for Delivering a Next Generation Army. The Special Notice had two themes:

- Robotics and Autonomous Systems (RAS) in the combat team
- Disruptive effects in signature management.

A total of 51 proposals were received from industry for Delivering a Next Generation Army, with 17 invited to present their proposals at Army Innovation Day 2018. Five innovation contracts were subsequently signed, with a total investment value of $5 million.

> *"Collaboration between the Australian Army, defence industry and the Defence Innovation Hub provides an opportunity for us to continuously explore new ideas, as well as build relationships with defence industry, academia and our international partners on the latest developments in technology and war-fighting capabilities."*
>
> **HEAD OF LAND CAPABILITY, MAJOR GENERAL KATHRYN TOOHEY AM, CSC**

CASE STUDY

SYPAQ Systems—Corvo precision payload delivery system

After participating in Army Innovation Day 2018, Melbourne based company SYPAQ Systems was awarded a $1.07 million Phase 2 technology demonstration contract with the Defence Innovation Hub for the Corvo Precision Payload Delivery System. This innovation consists of a low-cost disposable uninhabited aerial system that is optimised for the delivery of small-volume payloads.

The system could be used to resupply a forward-deployed soldier with small volumes of batteries, water, food, radios, ammunition or medical supplies.

Under the Defence Innovation Hub contract, SYPAQ Systems will test and demonstrate its technology to give Defence an enhanced understanding of the feasibility of, schedule for and pathway for the system's potential integration into Defence applications and systems; and demonstrate how Defence could advance the innovation into a mature capability.

SYPAQ Systems has reported that its contracts with the Defence Innovation Hub have allowed it to recruit an additional 12 employees, enhancing the company's ability to contribute to defence capability.

> *"The dedicated funding from the Defence Innovation Hub allows us to recruit and train additional specialist engineering and production workforce members who are able to contribute to the development of a sovereign industrial drone capability."*
>
> **AMANDA HOLT, CEO, SYPAQ SYSTEMS**

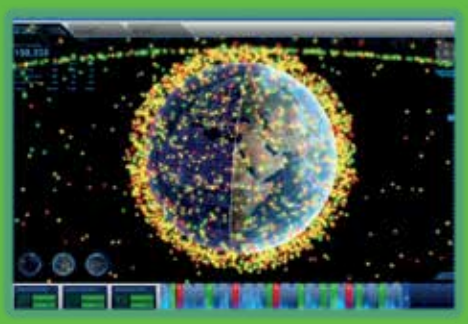
CASE STUDY

Launch of Rapid Assessments

After a successful pilot in 2018, the Defence Innovation Hub launched its newest service offering, Rapid Assessments, in May 2019.

Rapid Assessments allow Defence stakeholders to quickly obtain answers from industry and/or academia about capability gaps and opportunities, or an understanding of industry's capacity to meet future capability requirements.

A Rapid Assessment benefits both industry and Defence by identifying market options and foreshadowing the need for specific technologies through investigation and analysis of Defence capability related challenges.



As part of the Rapid Assessment pilot, in December 2018 Frazer-Nash Consultancy was awarded a Defence Innovation Hub Rapid Assessment contract as the lead collaborator to answer key questions in relation to space situational awareness mission systems.

In February 2019 Frazer-Nash hosted a one-day workshop that brought together another eight organisations to examine the questions and investigate local commercial options—specifically the differences between technologies wholly developed in Australia and those developed elsewhere and integrated in Australia.

The participants were BAE Systems Australia, EOS Space Systems, Lockheed Martin Australia, Nova Systems, Saber Astronautics Australia, Silentium Defence, Skykraft and Southern Launch Space.

Rapid Assessments often involve collaboration between multiple industry and research organisation partners to produce a report that Defence can use to inform judgements about future applications of technology to Defence capability. Rapid Assessments do not involve technology development.

In this case Frazer-Nash, as the lead collaborator, used the information gained from the workshop and the data gathered through a survey to prepare and deliver the Rapid Assessment report in April 2019, which will be used to inform Defence projects such as JP 9350.

Two Rapid Assessments valued at a total of $378,000 were run in 2018–19.

Company	Contract overview	Investment value
QinetiQ Pty Ltd	Development of Test and Evaluation Methodologies for Smart/Micro Grid Capabilities	$251,000
Frazer-Nash Consultancy Ltd	JP 9350 Space Situational Awareness Mission Systems in Australia	$127,000

Plans for 2019–20

PHASE TRANSITIONS

The Defence Innovation Hub provides a mechanism to transition successful innovation projects to the next phase of development, and this is beginning to occur. As the Defence Innovation Hub matures, projects are completing their innovation contracts. Some of these will be considered for transition to a follow-on phase of work. In 2019–20 the Defence Innovation Hub is expecting to invest in multiple projects transitioning to a follow-on stage of development.

DELIVERING OUTCOMES

In 2019–20 the Defence Innovation Hub will work with the Next Generation Technologies Fund to continue building mechanisms to transition innovative technology to Defence capability and to strengthen the metrics to enable us to track success.

CONTINUOUS IMPROVEMENT

In 2019–20 the Defence Innovation Hub will continue its continuous improvement program, including exploring ways to further streamline processes to provide more timely outcomes and to strengthen communication with industry and research organisations.

- Our timeframes for assessing proposals have fallen year on year; and the work needed to streamline assessments is a continuing focus.
- We will continue exploring agile procurement approaches to meet the needs of our customers, building on the success of our Special Notice service and launch of Rapid Assessments.
- We are starting to see successful projects transition to follow on phases of work – and we are working to streamline this process to make it easier for industry to navigate.
- We are also working to build linkages into Defence's acquisition processes, as more of our projects achieve success at the higher phases of maturity.

TIME TAKEN TO ASSESS AND PROCESS PROPOSALS

In 2017, feedback from industry highlighted that the time taken for the Defence Innovation Hub to assess proposals, notify the outcome and get into contract was a lengthy process.

The Hub listened to this feedback and over the past 12 months, focused on making service delivery improvements.

The technical assessment and governance procedures were reviewed and streamlined to allow for more timely outcomes to be notified to industry. Improvements were also made to industry guidance material to make it easier for industry to engage with, and understand, the Hub program.

Through these improvements, the time taken to assess and process proposals has reduced. For example, the processing times for proposals at the first stage of assessment decreased from over five months in 2016/17 to around three months in 2018/19.

The Hub is committed to a culture of continuous improvement and enhancements to the program for the benefit of both industry and Defence.

DEFENCE INNOVATION HUB TABLE OF INVESTMENTS 2018–19

The Defence Innovation Hub awarded 39 innovation contracts during the year, with values ranging from $192,000 to more than $6.6 million, and a total investment of more than $76 million. At 30 June 2019 the Defence Innovation Hub also managed a portfolio of 2 legacy innovation projects worth approximately $8.4 million.

The following table details the innovation contracts entered into during the reporting period.

Investment value includes Defences' total investment in the project, including direct contract costs, government-furnished materials and other project costs.

Company	Contract overview	Investment value
	ACT total	$4,560,000
Penten Services Pty Ltd	Develop a wireless decoy to mimic the appearance of active networked nodes.	$2,374,000
Penten Services Pty Ltd	Develop innovative tactical communications technology to communicate with deployed assets using highly secure encryption.	$1,088,000
Penten Services Pty Ltd	Develop a cyber-management capability to monitor network traffic and mitigate intrusions.	$1,097,000
	NSW total	$20,420,000
AMSL Aero Pty Ltd	Develop the concept for an uninhabited, high speed, autonomous logistics and casualty evacuation aircraft system.	$327,000
Anglo Pacific Import Export Pty Ltd (Amatek)	Develop a hybrid powered quad-copter drone that could transport large payloads over long distances in combat support roles and during training exercises.	$334,000
Ocius Technology	Demonstrate the concept for fleet control of low cost autonomous uninhabited service vehicles using artificial intelligence and machine learning.	$2,059,000
Thomas Global Systems (Defence) Pty Ltd	Develop a prototype digital binocular, with high resolution, full colour optical display, for armoured vehicle applications.	$3,924,000
UVS Pty Ltd trading as BlueZone Group	Demonstrate that autonomous uninhabited surface vehicles can integrate with anti-submarine warfare units to enhance underwater capability.	$329,000

Safran Electronics & Defense Australasia Pty Ltd	Enhance 'Vampir NG' infrared search and track systems, by fusing electronic chart display information system data, radar data and global positioning system feeds.	$356,000
Marathon Targets Pty Ltd	Develop an uninhabited, realistic and self-propelled vehicle target to support ADF training against improvised fighting vehicles.	$1,247,000
Western Sydney University	Develop a space surveillance optical imager using dynamic range asynchronous array imaging technologies. The asynchronous array provides very large dynamic range, enabling the same configuration to be used for day and night imaging.	$6,098,000
Clearbox Systems Pty Ltd	Develop a standalone software tool for the generation and management of crypto keys, to deliver operational efficiencies across Defence.	$1,054,000
SINAB Pty Ltd	Develop a prototype Joint Terminal Attack Controller training solution that seeks to enhance the training capability of the Royal Australian Air Force.	$4,692,000
	VIC total	$20,176,000
Textron Systems Australia Pty Ltd	Develop a small uninhabited aerial system as a potential solution for Army.	$328,000
Sentient Vision Systems Pty Ltd	Develop a visual detection and ranging multi-domain optical radar that utilises electro-optics, with a new infrared capability, for low light and night-time functionality.	$6,140,000
GPSat Systems Australia Pty Ltd	Develop GPS jamming and spoofing counter measures to deliver rapid threat detection and geo-location capabilities.	$1,329,000
Agent Oriented Software Pty Ltd	Explore the concept of an autonomous teamed intelligent software agent capability that is resilient to cyber-attacks, and which could be integrated with existing Defence systems.	$1,733,000
DMTC Ltd	In collaboration with Thales Australia, undertake research into advancing and networking equipment carried by soldiers, including small arms, to develop future battle systems.	$311,000
SYPAQ Systems Pty Ltd	Develop a low cost, disposable uninhabited aerial system that is optimised for the delivery of small volume payloads in the battlefield.	$1,072,000
DefendTex Pty Ltd	Develop and test a supercavitating fleet engagement system for use within maritime and antisubmarine warfare.	$3,699,000

Exablaze Pty Ltd	Explore the development of an automated object detection system with the capacity to operate in a range of light based conditions.	$354,000
Defendtex Pty Ltd	Develop rocket propelled grenade technology to enhance the velocity and range of grenade launchers. This technology could allow ground forces to fire directly from locations that are currently out of range.	$2,280,000
QinetiQ Pty Ltd	Develop an alternative electrical micro-grid solution for deployed forces. This technology seeks to enhance the efficiency and effectiveness of in-field power generation systems, and could be adapted to other power systems such as those on vehicles, ships and aircraft.	$350,000
Carbon Revolution Operations Pty Ltd	Develop the world's first lightweight carbon fibre wheels for the Boeing CH-47F Chinook helicopter.	$2,580,000
	SA total	$13,114,000
Consunet Pty Ltd.	Develop a software capability to enable electromagnetic battle management that integrates existing technologies.	$192,000
Inovor Technologies Pty Ltd	Develop a 3-unit and 6-unit cube satellite that provides smart earth imaging and space object detection capabilities. Additional subsystems for the satellites include altitude control, power, communications and structural elements.	$317,000
University of Adelaide	Develop an active exhaust silencer to reduce the acoustic signature of diesel engines, by reducing total noise at the engine cylinder firing frequency and harmonics.	$3,315,000
Solinnov Pty Ltd	Develop a software defined radio system with applications across electronic warfare, communications and sensing domains. This technology has the potential to replace multiple pieces of equipment with one lightweight, portable option.	$2,911,000
Inovor Technologies Pty Ltd	Deliver a prototype platform that will enhance space situational awareness. This investment will continue to expand Australia's growing space capability and has the potential to contribute to supporting the global space surveillance network.	$6,379,000

	QLD total	$12,331,000
EM Solutions Pty Ltd	Develop a low profile, flat panel antenna system to enable high capacity communication from deployable land, air and sea platforms to satellites.	$2,210,000
Explosive Protective Equipment	Develop a multipurpose capability that is capable of identifying IEDs buried underground.	$302,000
EM Solutions Pty Ltd	Continue the development of a satellite communications system for potential deployment in current and future Royal Australian Navy vessels.	$6,650,000
J3 Seven Pty Ltd	Explore the development of an uninhabited aerial system prototype capable of detecting, sampling and analysing chemical, biological, radiological and nuclear substances.	$320,000
TAE Gas Turbines Pty Ltd	Develop an autonomous software system capable of monitoring the health and performance of M1 Abrams Tank engines.	$2,849,000
	WA total	$284,000
Techventure Investments Pty Ltd	Develop an alternative small and light arm projectile system.	$284,000

* This table excludes contracts that, due to the sensitive nature of the project, cannot be reported.

CENTRE FOR DEFENCE INDUSTRY CAPABILITY

The Centre for Defence Industry Capability is a key program in the Government's agenda to build a world-class, globally competitive Australian industry as a fundamental input to Defence capability

Program performance of the Centre for Defence Industry Capability (CDIC)

CENTRE FOR DEFENCE INDUSTRY CAPABILITY

PROGRAM IMPACT STATEMENT

The Centre for Defence Industry Capability (CDIC) is successfully playing a key role in building a world-class, globally competitive Australian industry. Since launching in 2016 the CDIC has partnered with Defence and industry to maximise Australian industrial outcomes from the Government's high-level investment in Defence capability and build Australian supply chains to support Defence's major capital equipment programs.

Over 1,000 business facilitation and advisory services and more than $20 million in grants have been provided to Australian small and medium businesses through the CDIC, enabling them to build their capability and competiveness and growing the capacity of Australian defence industry to meet Defence's capability needs. In 2018–19 the CDIC increasingly provided specialist maritime industry advisory and facilitation services as naval shipbuilding activity increased under the ambitious continuous National Naval Shipbuilding Enterprise.

Through the Global Supply Chain Program, the CDIC is supporting both defence industry and Defence by facilitating Australian industry connections with Defence supply chains. Since the launch of the CDIC, Global Supply Chain contracts valued at over $350 million in total have been won by 99 Australian businesses.

The CDIC is also supporting the Defence innovation system by functioning as the front door to Defence's two flagship innovation programs: the Defence Innovation Hub and the Next Generation Technologies Fund. By connecting Australian innovators, researchers and academic institutions to these innovation programs, the CDIC is helping to turn Australian innovations into game-changing capabilities.

CASE STUDY

Skilling activities to grow RUAG's Defence capability

Working together with the CDIC, RUAG Australia identified specific areas that promised significant growth potential for their business capability. To develop this capability, RUAG followed a process to undertake a series of business improvement and skilling activities meant to improve their competitiveness.

RUAG Australia's main business is dedicated to the defence market, primarily machining hard steels in the production of hydraulic actuators. Hydraulic actuators operate using hydraulic power to enable mechanical operation and are used, for example, on the F-35 to open the payload bay doors and the landing gear.

Terry Miles, General Manager, RUAG Australia, says the results of the improvements position the company and its manufacturing business positively for future success, especially within the scope of their work in global supply chains and the F-35 program.

'Our capability for the manufacture of these multi-component systems is rare, even on a global level. These high precision systems require specialist machinery and highly accurate manufacturing know-how to make the actuator perform.'

RUAG supplies these component systems to Collins Aerospace as part of the F-35 supply chain and in support of F/A-18 fleet readiness.

RUAG became aware of the CDIC from their involvement with the Ai Group Defence Council. After accessing the CDIC's advisory services, they had a consultation with a Defence Business Adviser and went on to complete the supplier continuous improvement program.

'Engaging with the CDIC was straightforward. Many of the services offered align with building capability and capacity through up-skilling,' Mr Miles says.

'Working with the CDIC and completing the supplier continuous improvement program (SC21) provided our RUAG Australia team with the opportunity to benefit from an independent body benchmarking our business. This process clearly identified where we wanted to go and what we needed to adapt and implement in order to get there, and thus increase our capability.'

Subsequently, after cycle #1 and improvement activities, RUAG has significantly improved its position relative to the SCIP benchmark.

RUAG also accessed a Capability Improvement Grant to upskill its staff and, as a result, is now able to solve complex problems more effectively.

'We completed the Six Sigma Greenbelt project management training. Five staff received certification in 2018 and eight staff already in 2019. As a result, our teams have delivered seven contributing projects which clearly make our business more competitive.'

The 2020 Six Sigma program continues to train more staff in solving complex problems and is expected to deliver additional improvements in efficiency and competitiveness.

RUAG Australia is anticipating significant growth in its manufacturing business over the next three to five years, based on general market projections:

'Our manufacturing work in the defence global supply chain is increasing sustainably. Due to the niche nature of our work, plus our proven performance and reliability, we are focusing on continuing this uptick.'

Terry Miles encourages businesses working in the defence market to focus on their relationships with primes and original equipment manufacturers, like RUAG Australia has:

'Good, solid, and forward looking relationships are crucial to developing business opportunities, and even more so when considering positioning for Defence allocations.'

'Long-term global capability competitiveness is requisite for fulfilling our customers' and partners' expectations,' confirms Stephan Jezler, Senior Vice President Aviation International, RUAG MRO International.

'RUAG is dedicated to efficient, reliable, and sustainable performance. These criteria are quintessential for the precision manufacture of aerospace component systems for high specification programs like the F-35.'

CASE STUDY

Working to Defence standards helped Future Engineering upskill and become more competitive

Future Engineering is an advanced manufacturing company with 27 years' experience in the oil and gas sector, working to customers' technical drawings.

In 2018, Future Engineering started working in a Defence sustainment supply chain, machining components for Babcock International to support the Collins Class submarines.

Joanne Ardizzone, Business Development Manager, says the overall experience has been a good learning curve for the business.

'We started off with a lot of experience in manufacturing but not a lot of experience with sourcing different materials and meeting specific Defence standards involved with the Collins Class.

'As part of the Babcock supply chain, Defence required materials we hadn't worked with before and a 100 per cent inspection requirement (a process of inspecting of each individual unit to determine specification and quality compliance).'

Future Engineering sought advice in 2016 from AusIndustry's Entrepreneurs' Programme, which provided business evaluation and grant funding. After implementing measures based on this guidance, the business is now ready to refine its standards for Defence with the assistance of a CDIC Defence Business Adviser.

'Working with the CDIC we are keen to improve our certification standards, invest in capital equipment for tooling, and improve our cyber security and upskill staff to Defence standards—both apprentices and senior staff,' Ms Ardizzone says.

'We are also interested in the Capability Improvement Grant and the Sovereign Industrial Capability Priority Grant.'

The Capability Improvement Grant provides matched funding up to $250,000 to engage a consultant or an expert to implement business improvements based on CDIC advice.

The Sovereign Industrial Capability Priority grant provides matched funding up to $1 million to invest in projects that build capabilities aligned to one of the initial 10 Defence Sovereign Industrial Capability Priorities, such as continuous shipbuilding.

Future Engineering is planning five years ahead to meet Defence's capability requirements and better position itself to take advantage of opportunities as they arise:

'We are actively pursuing becoming part of the supply chain for all the major shipbuilding projects, and exploring providing support to the Army.

'We began working with Defence in the sustainment area—supplying parts and repairing components for existing submarines and surface ships. We would like to expand our service to supplying new-build items for all of the naval shipbuilding projects for Frigates, Offshore Patrol Vessels and Submarines and then help sustain them afterwards.'

Ms Ardizzone recommends businesses entering the defence market to engage a defence consultant, especially if their business is quite diverse.

'It takes a long time to establish your business in Defence. You've got to have the right capability and opportunity, and persistence to wait for those two things to marry up. A defence consultant can assist in ensuring your business has the right quality accreditations, connections and interest to tap into opportunities.'

Grow the capability and capacity of Australian industry

ADVISORY AND FACILITATION SERVICES

The Government is committed to maximising Australian business involvement in defence industry—particularly for innovative micro, small and medium businesses. The CDIC works closely with businesses to increase their ability to adapt to the changing demands and priorities of the defence market.

In 2018–19 the CDIC finalised 263 formal one-on-one advisory and facilitation services. These services connect businesses to Defence and provide information and advice on matters such as Defence procurement processes, security (including cyber security), commercialisation, reducing barriers to exports, business planning, financial strategies, and standards and accreditations.

A review of the CDIC's advisory and facilitation services conducted at the end of 2018 resulted in a revitalised service offering from 1 January 2019. This new service offering included a standardised but flexible approach, a single application form for clients, clear roles and responsibilities for Defence Industry Facilitators and Defence Business Advisers, systematic collection of customer feedback and outcomes data, and better connections with other Government programs for businesses.

Feedback from clients since 1 January 2019 has been overwhelmingly positive, with 60 per cent of clients indicating that they were 'very satisfied' with the services and advice provided to them by CDIC Business Advisers and Defence Facilitators, 30 per cent indicating they were 'satisfied', and the remaining 10 per cent of respondents answering 'neutral'.

To access advisory and facilitation services, visit business.gov.au/cdic.

Defence Business Advisor Steven Lakotij meeting with Air Commodore Damien Keddie and Vinesh Karan at AW Bell

PERSONAL PROFILE

Judy Denison

Defence Industry Facilitator team manager

With a long and distinguished career in the Royal Australian Air Force (RAAF) and ongoing service as a Defence civilian, Judy Denison's experience has provided her with unique insights to manage the CDIC's team of Defence Industry Facilitators.

Ms Denison says having a Defence understanding of what's required from industry makes it easier for her to empathise with some of industry's challenges when working with Defence.

'Having a unique perspective from both industry and Defence is ideal for the CDIC,' says Ms Denison.

Ms Denison's team of Defence Industry Facilitators help small and medium businesses entering or working in the defence industry understand how to navigate the defence market, the entry points, procurement processes and how to connect with relevant Defence capability areas.

'As the manager of the Defence Facilitators I am also responsible for analysing defence trends, direction and capability requirements, designing workshop content and information packages to answer industry questions, and building a comprehensive understanding of industry's future needs and barriers.'

After joining the RAAF in 1980 as a Signals Operator, Judy made history as the first female to crew in a combat aircraft in the RAAF. As an Airborne Electronics Analyst, Judy specialised in Intelligence, Surveillance, Reconnaissance and Electronic Warfare and went on to train aircrew in this speciality capability.

'Working in an operational and highly technical environment has provided me with a unique understanding of what leading edge technology actually means to the warfighter.

'Most of my team have also been in uniform which means they understand what may be appealing to Defence and understand what is required from industry.'

A high point in Ms Denison's career was being awarded the Conspicuous Service Medal (CSM) for her service in the RAAF.

'After 30 years in the RAAF, I briefly worked as a consultant to Defence before joining the Department of Defence where I worked closely with industry from a regional perspective and advised Defence on industry issues.'

Ms Denison was involved in the development of the CDIC, which was established to group different defence industry initiatives and create one strategic program.

'The most important thing SMEs need to consider when working with Defence is how unapologetically demanding Defence is as a customer. Trust in our capability is critical,' she says.

'Whether ADF personnel are flying at 35,000 feet, 100 feet below the surface of the Indian ocean or on foot patrol in an operational area, our equipment needs to work first time, every time. It is a difficult and demanding sector, but one of the most exciting and innovative sectors in which to be involved.'

OUTREACH EDUCATION ACTIVITIES

To extend the reach of the CDIC to as many businesses as possible, the CDIC coordinates and delivers outreach activities on a one-to-many basis to educate businesses.

In early 2019 the CDIC coordinated a series of 'Successful Trade Shows' workshops designed to help businesses make the most of attending these events. The delivery of these workshops was timed to support businesses attending Avalon 2019. The workshops were extremely popular and well received, with an extra Sydney session scheduled to meet demand, and post-event feedback indicating a 92 per cent participant satisfaction rate.

STRONG GROWTH IN DEMAND FOR GRANTS

In 2018–19 the CDIC administered five defence industry grants programs, compared to one in 2017–18.

During 2018–19 the CDIC approved 64 Capability Improvement Grants (CIGs), worth a total of $2.3 million, to 46 Australian businesses, most of which were for business improvement. This compares to $1.175 million worth of CIGs approved to 34 businesses in 2017–18. Through the CIGs, the CDIC helps Australian businesses deliver cutting-edge technologies, become more competitive, and gain access to international export markets.

The CIGs have helped businesses to:

- access professional management courses for senior technical and management personnel,
- hire consultants to develop the company's business and marketing skills
- pay for specialist training to develop and manufacture electronic warfare equipment.

In 2018–19 the CDIC began administering two new grants:

- The Sovereign Industrial Capability Priority (SICP) Grant was launched in November 2018, and more than $15 million in grants were approved to 30 June 2019. Grants have been awarded across all 10 Sovereign Industrial Capability Priorities, with more than half the funding supporting Collins Class submarine maintenance and upgrade projects, continuous naval shipbuilding and land combat vehicle technology.
- The Defence Global Competitiveness Grant was launched in January 2019, and a total of $1.3 million in grants were approved to 30 June 2019. These grants have assisted Australian businesses to purchase plant and equipment and increase their technical capacity, opening up export markets in the United States, Canada, the United Kingdom, Germany, France, Sweden, Norway, Singapore, Malaysia, South America and the Middle East.

In addition to these new grant programs, in 2018–19 the CDIC took on the administration of two existing Defence-related grants:

- the New Air Combat Capability—Industry Support Program, which provides grants of up to $1 million to help businesses to win work associated with the Joint Strike Fighter program
- the Australia–US Multidisciplinary University Research Initiative (AUSMURI) program, which encourages Australian universities to collaborate with US universities and complements the Multidisciplinary University Research Initiative grant program administered by the US Department of Defense.

During 2018–19 the CDIC also began working with Defence on the development of a new grant for skills and training. This grant is expected to launch in late 2019.

Australian Maritime Technologies (AMT) were awarded a Sovereign Industrial Capability Grant to improve their cyber security and meet the Defence mandated IT security standard.

CASE STUDY

Australian Maritime Technologies used a Sovereign Industrial Capability Grant to improve their cyber security

Rick Hunt, AMT's Cyber Security Manager, says the grant allowed AMT to accelerate their cyber security maturity process, improving their systems and infrastructure to enable them to exchange information associated with their projects.

'The grant sets us up for future business which relies on us being able to appropriately safeguard information,' says Mr Hunt.

AMT is a naval ship design office and works both directly with Defence and with prime contractors in technical areas including naval architectural and structural, marine mechanical, electrical and combat systems/communications integration.

'We see ourselves as a sovereign capability, unique in the market due to our independence and our 100 per cent Australian staff ownership,' Mr Hunt says.

'We're not attached to a particular ship design, shipyard or piece of equipment, so we have complete independence when providing our expert advice. We are experienced ship designers, who have produced significant ship design packages, so can advise and assist Defence based on having actually generated design packages from concepts right through to production. Defence often come to us with their "sticky" problems when they want a frank and fearless result.'

The Sovereign Industrial Capability Priority Grants Program helps SMEs by funding matched grants up to $1 million to invest in projects that build capabilities aligned to one of the initial 10 Defence Sovereign Industrial Capability Priorities, such as continuous shipbuilding.

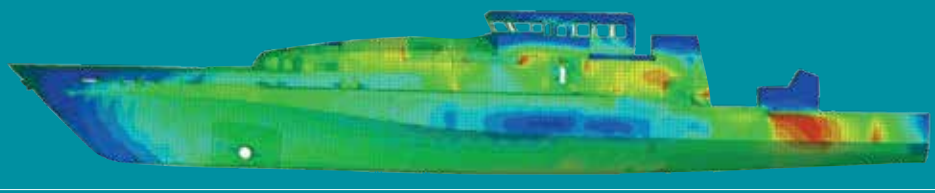
The cyber security upgrades AMT is installing are in line with the responsibilities of a Defence Industry Security Program (DISP) member

The DISP's recent change to a tiered membership structure has made joining the program and complying with security requirements easier for industry.

Mr Hunt recommends SMEs entering or working in the defence industry to join the DISP:

'The program will assist you to obtain your facility security accreditation and personnel clearances, so you are ready and have your security certifications in place, when Defence seeks to engage with you.'

AMT was established in 1987 to bid for what became the ANZAC Ship Project, in which AMT (formerly Blohm + Voss Australia) was the design subcontractor and in-country designer for the 10 ANZAC Class Frigates—eight for Australia and two for New Zealand.



ENHANCING GLOBAL COMPETITIVENESS AND INCREASING AUSTRALIAN EXPORTS

Defence industry is truly a global market, in terms of both supply and demand. The CDIC helps Australia's defence industry to:

- improve its competitiveness
- achieve economies of scale across global supply chains
- grow and sustain business across acquisition life cycles by accessing international markets.

Through its facilitation and advisory services, the CDIC supports a broad range of small and medium businesses to become globally competitive, overcome barriers to exporting and to win export contracts.

The CDIC manages the Global Supply Chain (GSC) Program on behalf of Defence, working with Defence primes to identify opportunities for Australian businesses within their international supply chains. In November 2018 CDIC successfully expanded the GSC Program to include an additional Defence prime, Leidos, increasing the number of primes in the GSC Program to eight.

At 30 June 2019, the eight primes contracted under the GSC Program were:

- BAE Systems
- Boeing
- Leidos
- Lockheed Martin
- Northrop Grumman
- Raytheon
- Rheinmetall
- Thales.

The value of the GSC Program also increased in 2018–19, with $168 million worth of contracts within defence prime contractor global supply chains awarded to Australian businesses, a 60 per cent increase in contract value on the previous year. The majority of the contract value is in the United States, United Kingdom and European markets.

Since the launch of the CDIC on 6 December 2016, the GSC has helped 99 local companies and organisations win 446 defence industry contracts worth over $350 million. The total value of contracts awarded under the GSC Program since 2007 is more than $1.2 billion.

Australian small and medium businesses are benefiting from exporting products manufactured in Australia. This includes products developed for programs such as BAE's Type 26 Frigate program and Thales Australia's Land Vehicles, Explosive Ordnance and Underwater Sonar Systems. The manufacture and export of these products enables long-term growth and development of the Australian defence industry.

The GSC Program works with the Australian Defence Export Office (ADEO) to support Team Defence Australia (TDA) events and to facilitate exports. Bringing export-ready businesses to the ADEO to participate in TDA events is an important part of the CDIC's facilitation and communications role.

The CDIC continues to help small and medium businesses prepare for export and get the most out of trade missions, leveraging relationships with Defence primes participating in the GSC Program and running workshops to help them to maximise the benefits of trade show participation.

Supporting Defence programs and priorities

The CDIC works with Defence and the Department of Industry, Innovation and Science to keep industry informed about Defence priorities and defence market opportunities, and to keep Defence abreast of changing industrial capabilities and innovative approaches to investment.

CDIC Advisers and Facilitators continue to work closely with businesses to ensure they know about Defence's Australian Industry Capability (AIC) program and to maximise opportunities for Defence prime contractors to utilise Australian businesses in their work programs.

The CDIC also continues to work closely with major Defence projects such as the Joint Strike Fighter program and the Hunter Class Future Frigate program in order to assist Australian businesses to become part of these program supply chains. The CDIC's involvement in these projects will serve as a foundation model for future engagement with other major Defence programs.

HELPING AUSTRALIAN BUSINESSES BREAK INTO DEFENCE SUPPLY CHAINS

The CDIC is instrumental in advising Australian businesses how to become part of Defence supply chains and alerting them to contract opportunities. The CDIC informs industry about Defence opportunities through its network of Defence Industry Facilitators and Defence Business Advisers, through business.gov.au/cdic and through the CDIC e-newsletter.

In 2018–19 the CDIC worked with Defence and the Industry Capability Network (ICN) to develop a new taxonomy for the Hunter Class Frigate program that provides greater Defence-specific detail than was previously available. The ICN helps Defence, primes and small and medium businesses to publicise and identify opportunities and capabilities for Australian business.

Providing leadership and partnership

During 2018–19 the CDIC undertook a research project to examine the impact of Defence spending on Australian defence industry supply chains. This project provided a proof-of-concept for how modern data analysis techniques could be used to provide insights into Australia's defence industry. The CDIC will use the results of this project to continue its work to understand the impact of Defence spending to help Australian businesses grow and create jobs.

In 2018–19 the CDIC developed a framework to assess the maturity and readiness of small and medium businesses to enter and grow in the defence market. Over 2019–20 the CDIC will test the framework and consider options for its implementation.

CASE STUDY

Micro X's unique x-ray technology opens doors to global supply chains

Micro X designs and manufactures lightweight x-ray imaging systems primarily for the medical and anti-terrorism market.

Peter Rowland, Managing Director, says their unique technology, x-ray in carbon nanotubes, means they can miniaturise an x-ray machine and broaden its capability.

'Miniaturising x-ray tubes allows products to be light-weight, mobile and do things that heavier products just can't.

'The defence industry have shown keen interest in the technology for security screening, unmanned IED detection, and temporary hospitals,' says Mr Rowland.

David Peckham, Global Supply Chain representative for Thales, became aware of Micro X while attending Land Forces in 2016.

'The technology didn't seem interesting to Thales at first as Micro X was a medical company and Thales does defence and security, but when Peter explained what his technology could do I saw his vision and how it could have a defence application,' says Mr Peckham.

The Global Supply Chain (GSC) Program, administered by the CDIC, works with defence prime contractors to identify opportunities for Australian businesses within their international supply chains.

Thales decided the best way to develop products with Micro X was to invest $10 million in them and for Micro X to remain an independent company.

'We wanted Micro X to operate as an SME, utilising the innovation you can achieve as small company.'

Mr Rowland says Micro X is now collaborating with Thales on back scanner imaging.

'When the device is in the market Micro X will sell to the five eyes and Thales will distribute products to the rest of the world.

'The particular capability of interest to Thales was the technology's multiple image capability which produces high detail images. For example, in the current airport security environment x- ray is used to screen luggage, and if there is an item of interest security will ask you to open your bag to inspect. Micro X's technology removes the need to physically inspect the item as the x-ray can be focussed to provide a far more detailed image.

'You can imagine how this technology would aid Defence to inspect potentially dangerous objects without the need to put a human in harm.'

Mr Rowland says they received a call from a taskforce in defence intelligence who needed assistance with IED detection.

'Our technology would allow armed forces to x-ray a suspected IED or weapon to see what's inside.

'Utilising our nano tube technology we developed a lightweight bedside imaging cart which only weighs 90kg compared to standard machines weighing 500–600kg. There is nothing else as competitive on the market.

'The military was suggested when we were looking for funding sources as temporary hospital set ups consider equipment weight as a key factor in their purchasing decisions.

Micro-X CEO Peter Rowland

DST were interested in the technology and awarded us $2.5 million contract to further develop the technology.'

When asked how the defence industry has assisted Micro X, Mr Rowland says working with defence has been key to broadening their reach.

'Without defence involvement Micro X would not have had the credibility to enter the security market. Winning the contract from DST has been critical for a contract with the UK's Department for Transport and the imaging trial in Defence was important to secure the Thales deal.'

COMMUNICATION AND PROMOTIONAL ACTIVITIES

The CDIC promotes its services through its day-to-day network interactions, publicising successful case studies and showcasing its service benefits to businesses through an e newsletter (with more than 3,600 subscribers), web content, social media and face-to-face delivery at major public trade shows.

In 2018–19, the CDIC's website (hosted on business.gov.au) commenced migration to a newer content management system. As part of this process, the CDIC conducted research to understand why users visited its website, using Google Analytics, heat maps and a survey. After analysis of this research the CDIC web content is being redesigned to make it easier for users to find information.

In June 2019, a series of video case studies was created showing how businesses have benefited from CDIC services. These videos were published on the business.gov.au/cdic website and broadcast on the business.gov.au social media channels (which have an audience of around 155,000). The video case studies have attracted excellent engagement and click-through rates on social media.

In 2018–19, the CDIC received almost 175,000 unique views on business.gov.au and received approximately 800 contact centre enquiries.

Throughout the year, the CDIC conducted a number of interviews with defence media outlets to communicate the mission and value of the CDIC to the defence industry. Duncan McIntyre, Head of Division, was interviewed by the Defence Teaming Centre, WA Defence Review and WA Works about the program's direction and achievements.

MAJOR EVENTS

The CDIC, together with the Defence Innovation Hub and the Next Generation Technologies Fund, sponsored a stand at Land Forces 2018 and Avalon 2019 to promote the Defence Industry and Innovation programs and increase visibility of their services. High numbers of visits to the stand and keen interest among businesses at these events has resulted in larger spaces being booked for future trade shows.

At Land Forces and Avalon the CDIC also hosted several successful business events. This included Global Supply Chain Program networking events, a panel session with the CDIC Advisory Board, and a policy settings update session.

CASE STUDY

CDIC helps Sea to Summit respond to Defence contracts

Working with the CDIC, Sea to Summit recently won a contract with the Australian Army for the supply of camping and outdoor equipment.

Sea to Summit is a 100 per cent Australian-owned company that designs innovative lightweight equipment, largely for the global adventure market.

Sea to Summit's Dale Tyson, says the Australian Army have recently shifted away from unnecessarily heavy and bulky soldier's equipment to more lightweight and compact options.

'The shift has seen an increase of interest in our products and more broadly in our capability to design, and develop and deliver world leading solutions,' he says.

Before bidding for the contract, Sea to Summit worked with a CDIC Defence Facilitator to develop their internal 'Defence Ready' capability and identify and pursue more meaningful supply opportunities. Mr Tyson says:

'We worked with our Facilitator to identify opportunities for market engagement, participation at tradeshows, and general questions of the services provided by the CDIC.

'We applied for and received a Capability Improvement Grant to develop our internal capabilities and we are now more strongly positioned to respond to future opportunities as a result of winning the contract.'

Winning the contract means defence supply will become a more prominent element of Sea to Summit's business going forward.

'It will result in more jobs in the defence industry in Western Australia and more development of local intellectual property,' says Mr Tyson.

Before engaging with the CDIC, Sea to Summit were already a recognised supplier to Defence, having grown to become world leaders in the supply of lightweight sleeping, dry storage, water storage, weather protection and cooking equipment by using innovative material and fabric developments. Mr Tyson says:

'We supplied products including Hygiene/Toiletry Cells, Adventure Training Equipment, Sleep Systems and Dry Storage solutions and have an ongoing dialogue with Diggerworks, sharing information on emerging technologies and products.

Over the years we have taken on lots of feedback from military end-users who have substituted their standard issue kit with products from our outdoor and adventure ranges. As a result we provide tailored and bespoke solutions to frequently arising issues around colour, weight, durability and style.'

Mr Tyson encourages businesses entering the defence industry to network broadly and consider additional sales channels such as oil and gas/mining to diversify their offering.

'There are numerous opportunities available to Australian businesses that want to engage with Defence. Companies should connect regularly with groups such as the CDIC, Defence West (or state Defence group) and the Australian Industry & Defence Network (AIDN).

'One of Sea to Summit's strengths is the diversity of our sales channels. This diversity both alleviates our reliance on Defence as a single purchasing entity and removes the burden on Defence to maintain consistent purchasing.'

Continuous improvement

THE CDIC IN 2019–20

The CDIC's national presence and experienced workforce are providing a solid foundation to help Australian industry meet Defence's evolving capability needs into the next decade.

In 2019–20, the CDIC will continue to work with key stakeholders to drive the development of industry capability and capacity in support of the Australian Defence Force, and continue to support defence industry to meet the challenges and embrace the opportunities linked to the complex and ambitious continuous National Naval Shipbuilding Enterprise.

The CDIC will enhance its outreach program with additional education programs, further electronic resources and new approaches such as webinars.

The CDIC will continue to work with other industry programs, such as the Cooperative Research Centres program, the Venture Capital program, the Entrepreneurs' Programme and the Research and Development Tax Incentive program to maximise Government assistance to industry.

The CDIC will proactively seek and respond to feedback as part of its commitment to continuous improvement, and will continue to promote its services and client achievements through case studies, attendance at public events and media engagement.

INDUSTRY POLICY IMPACT AND ENGAGEMENT THROUGH THE INTEGRATED INVESTMENT PROGRAM

Progress continues on implementing key initiatives of the *2016 Defence Industry Policy Statement*. Defence has sought to:

- create the long-term policy settings to shape our defence industry
- incorporate industry as a fundamental input to capability across Defence business processes
- support industry development and innovation.

The integration of Australian industry as a fundamental input to capability ensures Defence fully considers the industrial capability and capacity of Australian businesses to deliver Defence capability.

In 2018–19 Defence launched a range of policy and program initiatives to enhance Australia's defence industry to better support Defence capability. These include the following initiatives.

DEFENCE EXPORT STRATEGY

Released in January 2018, the Defence Export Strategy supports the development of a resilient, and internationally competitive Australian defence industry. A key achievement is the establishment of the Australian Defence Export Office (ADEO) in April 2018 to lead whole-of-government implementation of the Defence Export Strategy. The ADEO works closely with Austrade, Export Finance Australia and the Centre for Defence Industry Capability (CDIC) to tailor its assistance to Australian companies on a case-by-case basis.

Over the past year the ADEO continued to implement a range of initiatives in the Defence Export Strategy, including:

- the launch of the Defence Global Competitiveness Grants on 2 January 2019, with 14 grants totalling over $1.8 million awarded to date
- the first two applications for funding approved under the Defence Export Facility, granted to CEA Technologies ($90 million) and to the Government of Trinidad and Tobago to buy Austal boats to be built in Western Australia ($113 million)
- the expansion of Team Defence Australia's program of international trade shows, which continued to experience record attendance and included delegations to shows in Sweden and Malaysia and two separate shows the United States
- the appointment of Business Development Managers in the United States, the United Kingdom, Germany, France, Indonesia and Japan to further expand our international reach and engagement
- the release of the 2019 Australian Military Sales Catalogue in February 2019, showcasing 114 Australian companies from every state and territory—up from 65 the previous year.

DEFENCE INDUSTRIAL CAPABILITY PLAN

Released in April 2018, the Defence Industrial Capability Plan outlines the Government's vision for Australia's defence industry over the next decade to build an innovative domestic defence industry that is better placed to meet Defence's capability needs. It identifies:

- 10 initial Sovereign Industrial Capability Priorities
- a Sovereign Industrial Capability Assessment Framework to provide a top-down, strategy-led framework which provides a repeatable methodology to identify Sovereign Industrial Capability Priorities.

Progress has been made in implementing the initiatives announced in the plan:

- integrating consideration of the Sovereign Industrial Capability Priorities into Defence planning processes like the Force Design and the Defence Planning Guidance
- launching the Sovereign Industrial Capability Priority Grants Program for eligible small and medium businesses that contribute to one or more of the Sovereign Industrial Capability Priorities, with 28 successful applicants being awarded grants with a total value of $15 million since the program began
- beginning work on the Sovereign Industrial Capability Priority implementation plans. Three of the 10 implementation plans are scheduled to be released by the third quarter of 2019—for Combat Clothing survivability and signature reduction technologies; Collins Class maintenance and technology upgrade; and munitions and small arms research, design, development and manufacture. Other implementation plans will be released successively over the rest of 2019 and 2020.

AUSTRALIAN INDUSTRY CAPABILITY PROGRAM

The Australian Industry Capability (AIC) Program is the major lever for Australian industry involvement in supporting Defence capability and the long-term development of our defence industry. The AIC Program, which aims to maximise the involvement of Australian industry in meeting Defence's capability goals, was strengthened in late 2016 to better align with Australia's Defence capability and defence industry goals.

Defence has launched a range of policy and program initiatives to enable Australia's defence industry to better support Defence capability. This included the March 2019 release of the Defence Policy for Industry Participation, which builds on the success of the AIC Program and extends the requirement to maximise Australian industry involvement to Defence materiel and non-materiel procurements over $4 million, and Defence construction service procurements over $7.5 million. The policy will be implemented over 2019–20.

In 2018–19, 16 Australian Industry Capability Public Plans were published on the Defence AIC Program website. They set out the plans and forecast opportunities for Australian industry involvement in major Defence capability projects and sustainment activities.

They can be found at defence.gov.au/spi/industry/PublicPlans.asp.

The AIC Program was further strengthened to clarify the requirements for tenderers to explain how they intend to maximise the involvement of Australian industry in meeting Defence's capability goals. This included alignment of the AIC Program with the Defence Industrial Capability Plan. Where capability procurements include the Sovereign Industrial Capability Priorities, tenderers are required to identify the actions they will take to develop, support or enhance Australian industry's ability to deliver an enduring sovereign industrial capability.

Over the last year, Defence has focused on implementing the strengthened AIC Program throughout its procurement and contracting processes. Defence is now reviewing the dataset to understand the commitments made to Australian industry and what has been delivered by Australian industry.

DEFENCE INDUSTRY SKILLING AND STEM STRATEGY

Released on 28 February 2019, the Defence Industry Skilling and STEM Strategy supports the Government's long-term vision to build and develop a robust, resilient and internationally competitive Australian defence industrial base.

The strategy is designed around four pillars which help Australia's defence industry to develop a workforce with the knowledge and skills to meet Defence's capability needs over the coming decade:

- **Engage:** improve access to information about defence industry and career opportunities to promote growth in the volume of workers joining defence industry.
- **Attract:** support defence industry to grow and sustain a national defence industry workforce by leveraging the existing or soon-to-be workforce pool.
- **Train and Retain:** encourage investment in skills and providing support to defence industry businesses to enhance existing workforce capability.
- **Collaborate:** improve cooperation, coordination and collaboration across all stakeholders to identify trends, align objectives and optimise the use of funding.

NATIONAL DEFENCE INDUSTRY SKILLS OFFICE

The National Defence Industry Skills Office was established following the launch of the Defence Industry Skilling and STEM Strategy to streamline governance and policy for defence industry skills issues. The office engages with stakeholders individually and collectively to create a common picture of defence industry skills needs and risks. It also examines cross-sectoral collaboration and information sharing to put defence industry skills concerns in a national context.

THE WORKFORCE BEHIND THE DEFENCE FORCE

The 'Workforce behind the Defence Force' campaign ran from November 2017 to June 2018. It raised awareness across Australia of the opportunities for Australian business involvement and employment in Australia's defence industry. The campaign also highlighted growing career opportunities in defence industry to the wider public.

Defence continues to leverage the awareness created by the campaign through a 'Workforce behind the Defence Force'

presence at major state and territory careers fairs to:

- create awareness that defence industry requires a highly skilled workforce to deliver on the Government's investment in Australia's Defence capability
- inform young people and job seekers about the growing opportunities for careers in the defence industry sector as the number of major projects increases over the next few years.

DEFENCE INDUSTRY INTERNSHIP PROGRAM

Defence facilitates direct connections between individuals and prospective employers through the Defence Industry Internship Program (formerly the Defence Engineering Internship Program).

The program was established in 2012 to address leakage from tertiary education to defence industry by creating engineering pathways into the defence industry sector. The program provides third and fourth year engineering students with an opportunity to gain industry experience through a 12-week internship in a defence industry small to medium business. Defence funded 30 internships under the program in 2018–19. The program was expanded for the 2019–20 round to allow 70 aspiring engineers to enter into internships in 2019–20. The 2019–20 budget for the program is $1.9 million.

SCHOOL PATHWAYS PROGRAM

Defence continues the School Pathways Program as part of its early engagement strategy to inform young Australians about the varied pathways into and career opportunities within the defence industry sector. A total of $2.6 million per annum is funded under the program for 2018–19 and 2019–20.

NATIONAL DEFENCE INDUSTRY SKILLING AND WORKFORCE SUMMIT

In November 2019 the National Defence Industry Skills Office will hold a National Defence Industry Skilling and Workforce Summit. The summit will facilitate collective engagement on defence industry skills issues in a national context. It brings together industry and government stakeholders to better understand the skills-based workforce needs of industry and further inform development of the path to collaboration on skills issues.

INTERNATIONAL ENGAGEMENT

In 2018–19 we saw continued commitment to and progress towards strengthening Australia's international cooperation with like-minded partners on defence industry issues.

Throughout 2018–19, current and former Ministers for Defence Industry made official visits to a host of partner nations, including the United Kingdom, France and Israel to discuss our bilateral defence industry relationships. These visits reinforced the Government's commitment to support Australian industry to be export ready, helped raise awareness of Australian policies and initiatives to support defence industry, and improved government-to-government industrial cooperation with key partners.

On 10 July 2018, the annual Australia–United Kingdom Defence Industry Dialogue (AUKDID) took place in London. The inaugural AUKDID Officials Working Group met on 3 July 2018, followed by two more meetings in October

and December 2018. This initiative seeks to deepen Australia's engagement with the United Kingdom on defence industrial collaboration and to share lessons learned.

From 24 to 25 September 2018, Australia hosted the inaugural Australia–France Defence Industry Symposium in Adelaide. The symposium brought representatives from Australian and French industry, government and academia together to discuss government-to-government and industry-to-industry defence collaboration as part of, and beyond, the Future Submarine Program.

Australia's participation in the United States National Technology and Industrial Base initiative is an important opportunity to more closely integrate Australia's defence industrial base with that of our closest defence and strategic partners (United States, United Kingdom and Canada).

DEFENCE ALIGNMENT WITH THE NATIONAL INNOVATION AND SCIENCE AGENDA

The *2016 Defence Industry Policy Statement* and Defence's industry and innovation programs are aligned with, and support:

- the Innovation and Science Australia 2030 Strategic Plan
- the four pillars of the National Innovation and Science Agenda (NISA).

CULTURE AND CAPITAL, TO HELP BUSINESSES EMBRACE RISK AND INCENTIVISE EARLY STAGE INVESTMENT IN START-UPS

The Next Generation Technologies Fund portfolio includes several new ways in which businesses, especially small and medium businesses, are partnering with Defence:

- The Grand Challenges program and Defence Cooperative Research Centres are enabling major new industry–university teaming arrangements.
- The Small Business Innovation Research for Defence Program is funding small businesses in ambitious research and technology development projects.
- Defence is collaborating with CSIRO in the NISA-funded technology accelerator program to include defence themes. One defence-oriented start-up has been established as a result of this collaboration.

The Defence Innovation Hub encourages Australian businesses of all sizes and from all sectors to submit innovation proposals that are ready to enter the engineering and development stages of the innovation process. Since the launch of the program, 21 per cent of the Defence Innovation Hub's partners have been new to doing business with Defence, and 84 per cent of investment has been made in micro, small and medium sized businesses. The cornerstone of the Defence Innovation Hub program is procuring innovative technology for Defence, where Defence provides the capital needed for Australian industry to further develop bright ideas.

With Centre for Defence Industry Capability support, Australian businesses are being connected with market opportunities to grow their business ideas and commercialise emerging and future technologies.

COLLABORATION, TO INCREASE THE LEVEL OF ENGAGEMENT BETWEEN BUSINESSES, UNIVERSITIES AND THE RESEARCH SECTOR TO COMMERCIALISE IDEAS AND SOLVE PROBLEMS

Closer collaboration between Defence, state and territory governments, industry and research organisations is needed to jointly develop game-changing innovation, and to provide greater benefits to the Australian defence industry and innovation sector. Defence is working with the best of businesses, universities and the research sector to minimise risk and solve complex and challenging problems. The Centre for Defence Industry Capability helps form connections and collaboration.

The Next Generation Technologies Fund Grand Challenges program and Defence Cooperative Research Centres provide the scale and intensity needed to make a difference. The programs require small agile companies—including start-ups, larger companies and researchers—to form collaborative teams and work alongside Defence Science and Technology Group scientists. Both the Grand Challenge to

counter improvised threats and the pilot Small Business Innovation Research for Defence program brought together small companies with no awareness of each other's capabilities before their involvement in these initiatives.

In 2016 NISA identified that Australia's rate of collaboration between industry and researchers is the lowest in the OECD. Again in 2018–19 the Defence Innovation Hub identified multiple instances where industry and research organisations were collaborating organically and using subcontracting arrangements to develop innovative technology in their projects with the Defence Innovation Hub (see examples on page 53). While the majority (90 per cent) of Defence Innovation Hub investment is with industry partners, there are many examples where industry and research organisations are recognising the benefits of working collaboratively and are doing so in practice.

In 2018–19 the Defence Innovation Hub launched its new service offering, Rapid Assessments, where Defence collaborates with industry and research organisations through investigation and analysis of capability-related questions.

TALENT AND SKILLS, TRAINING STUDENTS FOR THE JOBS OF THE FUTURE AND ATTRACTING THE WORLD'S MOST INNOVATIVE TALENT TO AUSTRALIA

Defence has a comprehensive program that supports student interest in science, technology, engineering and mathematics (STEM), provides training opportunities, and aims to attract and skill students to develop careers directly in Defence or in defence industry or to undertake research of relevance to Defence in universities, CSIRO and other publicly funded research agencies.

The Defence Industry Skilling and STEM Strategy, launched on 28 February 2019, supports Australia's defence industry to develop a workforce with the knowledge and skills to meet Defence's capability needs over the coming decade.

The Next Generation Technologies Fund is supporting Defence activities to build the STEM pipeline needed to attract and retain a talented workforce. This support includes investing in PhDs through several Next Generation Technologies Fund programs, especially the hypersonics Grand Challenge, Defence Cooperative Research Centres, research networks and the Australia–United States Multidisciplinary University Research Initiative.

Defence has also established a talent pipeline under the Australian Postgraduate Research Internship program (APRI) of the Australian Mathematical Sciences Institute. Through APRI, up to 100 PhD students will be placed as interns with Defence over four years. Supported by the Department of Education and Training, APRI will post PhD students to Defence laboratories for periods of between four and six months to work on multidisciplinary projects. Paths to employment will be facilitated for high-performing interns. To date, 34 interns have been supported.

Some 70 Defence scientists are involved in the STEM Professionals in Schools Program. Managed by CSIRO, the program creates partnerships between Defence researchers and teachers to bring 'real-world STEM' into the classrooms of Australian schools.

Defence is committed to increasing the number of women in STEM careers. DST has introduced Women in Science Undergraduate Scholarships to encourage more women to take up science careers. Fifteen of these scholarships are now underway or being developed with five universities across four states and the ACT. A set of scholarships for Indigenous undergraduate STEM students has also been established and will be awarded in 2020 to three Indigenous students.

Defence is a major sponsor of the Aiming for Impactful Results (AIR4) initiative, which is opening up pathways for future generations of female leaders in STEM disciplines. In March 2019, the second AIR4 event was held at the Avalon International Airshow. AIR4 Aerospace provided a STEM experience for 1200 students across three days. AIR4 gives students a platform to discuss the careers and life choices needed in a new technological era.

DST runs a STEM cadetship program through which suitably qualified candidates are placed in key science and technology areas such as cyber and autonomous systems. There are currently 47 cadetships in place, with 30 cadets having completed the program and now working within DST.

DST has also established a partnership with the Aurora Education Foundation to build the Indigenous STEM pipeline. Aurora promotes Aboriginal and Torres Strait Islander success in education, delivering initiatives that support Indigenous students at all stages of education. Under the partnership, Defence sponsors two scholars to complete PhDs in STEM fields at Oxford University. It also supported the 2018 Aurora Indigenous Scholars International Study Tour, which exposed high-performing students to opportunities at leading universities overseas. In collaboration with Aurora, Defence is hosting five Indigenous STEM interns in 2019.

GOVERNMENT AS AN EXEMPLAR, TO LEAD BY EXAMPLE IN THE WAY GOVERNMENT INVESTS IN AND USES TECHNOLOGY AND DATA TO DELIVER BETTER QUALITY SERVICES

Defence is leading by example and delivering innovation programs with streamlined, agile processes, and is taking calculated risks to harness bright ideas. To remove barriers to innovation and deliver a streamlined and agile single innovation pipeline, the Defence innovation system has adopted:

- agile business processes and calculated risk-taking to harness bright ideas
- new contracting frameworks
- new intellectual property policies
- new governance, assessment and funding models to allow quick decision-making.

GOVERNANCE

INDUSTRY AND INNOVATION EXPERTISE

The Next Generation Technologies Fund, the Defence Innovation Hub and the CDIC are underpinned by a unified framework to ensure investment is strategy-led. Governance and operational arrangements have been established to provide strategic oversight and coordinate the Defence innovation system, ensuring visibility of funding recommendations and linking innovation investment to capability priorities.

In establishing and developing the industry and innovation programs, Defence has sought input from a range of defence industry and innovation experts. The programs are underpinned by a governance framework that incorporates private sector and Defence representation.

The Defence Innovation Steering Group includes three external representatives:

- Dr Megan Clarke, Head of the Australian Space Agency, non-executive director at Rio Tinto and former CEO of CSIRO
- Ms Sarah Earey, Managing Director of L3 Micreo
- Professor Chris Moran, Deputy Vice-Chancellor, Research, at Curtin University.

Dr Clarke, Ms Earey and Professor Moran:

- provide feedback from industry and research organisations on the performance of the Defence innovation system
- advise the Defence Innovation Steering Group on innovation practices in organisations outside Defence
- provide feedback on the implications for industry and research organisations on proposed changes to the Defence innovation system.

The Next Generation Technologies Fund also uses independent experts from industry, academia and international defence science and technology organisations to review and validate the selection processes to identify research partners. These experts engage in areas where they have an acknowledged reputation.

The CDIC Advisory Board provides advice and strategic guidance to the CDIC. The board includes representatives from Defence, defence industry, and industry groups. As at 30 June 2019, its members were:

- Mr Tony Fraser (ex-officio Defence co-chair)—Deputy Secretary Capability Acquisition and Sustainment Group
- Ms Kate Carnell (industry co-chair)—Australian Small Business and Family Enterprise Ombudsman (Ms Carnell replaced Mr Paul Johnson and commenced on 20 June 2019)
- The Hon David Johnston—Defence Export Advocate (ex officio)
- Mr James Fitzgerald—Executive Chairman, Civmec (Mr Fitzgerald replaced Mr Meryn Davis and commenced on 3 July 2019)
- Ms Amanda Holt—CEO and Chief Engineer Defence and Aerospace, SYPAQ Systems
- Mr Chris Jenkins—CEO, Thales Australia
- Ms Karen Stanton—Director Corporate Strategy, Heat Treatment Group

- Mr Chris Williams—Managing Director, H.I. Fraser Pty Ltd
- Ms Sharon Wilson—Head of Industrial Strategy, BAE Systems Australia
- Ms Christine Zeitz—Managing Director and Senior Vice President, Leidos Australia.

ANNUAL REPORTING TO GOVERNMENT

This is the third Defence Industry and Innovation Programs Update Report, and the second by financial year. The reporting framework reflects the Department of Finance Commonwealth Performance Framework Guidance, with strategic measures reported qualitatively, supported by quantitative performance information.

In addition, the Next Generation Technology Fund is part of the strategic research stream of the Defence Science and Technology (DST) portfolio and is assured by DST through the First Principles Review approved DST Investment Process. The process was also designed in response to ANAO audit recommendations.

HOW TO ENGAGE WITH DEFENCE INDUSTRY POLICY INITIATIVES

The Defence Industrial Capability Plan outlines the Government's vision to develop a robust, sustainable and internationally competitive Australian defence industry base.

For more information, visit: *www.defence.gov.au/SPI/Industry/CapabilityPlan*

THE CENTRE FOR DEFENCE INDUSTRY CAPABILITY

The CDIC is helping to build the capability and capacity of Australian small businesses to meet Defence's requirements by helping businesses navigate, prepare for and enter the defence market. We can also help with matched grants for businesses to implement improvements, access export opportunities and invest in Defence's priority capabilities.

- For more information, visit: *https://www.business.gov.au/cdic*
- To apply for advisory and facilitation services, visit: *https://www.business.gov.au/Centre-for-Defence-Industry-Capability/Advisory-and-facilitation-services*
- To apply for a grant, visit *https://www.business.gov.au/Centre-for-Defence-Industry-Capability/Grants-for-defence-industry*
- To speak to the CDIC team, call 13 28 46 or email *cdic@industry.gov.au*

DEFENCE POLICY FOR INDUSTRY PARTICIPATION AND THE AUSTRALIAN INDUSTRY CAPABILITY PROGRAM

The Defence Policy for Industry Participation, launched in March 2019, extends the AIC Program to include Australian and local industry requirements to most Defence procurements of $4 million and above and to procurements of $7.5 million and above for construction services.

It aims to strengthen Australia's industrial base through maximising Australian industry involvement. The policy will provide opportunities for greater Australian industry involvement in a wider range of Defence projects in more locations.

For more information, visit: *http://www.defence.gov.au/SPI/Industry/AIC.asp*

DEFENCE INNOVATION HUB

The Government is investing $640 million by the end of 2025–26 on innovative technologies that can be developed into advanced capabilities through the Defence Innovation Hub. Companies can submit proposals to the Defence Innovation Hub at any time.

For more information, visit: *https://www.innovationhub.defence.gov.au/*

NEXT GENERATION TECHNOLOGIES FUND

The Government is investing $730 million by the end of 2025–26 through the Next Generation Technologies Fund to deliver high-impact future capabilities for Defence. The Next Generation Technologies Fund supports research projects through a range of collaboration vehicles, including Grand Challenges, research programs and Defence Cooperative Centres.

For more information, visit: *https://www.dst.defence.gov.au/NextGenTechFund*

AUSTRALIAN DEFENCE EXPORT OFFICE

The Australian Defence Export Office coordinates whole-of-government export support for Australian defence industry. This support includes:

- attendance at international trade shows with Team Defence Australia
- targeted international trade missions
- inclusion in the Australian Military Sales Catalogue
- Government-to-Government transfers of defence related materiel
- high-level advocacy through the Australian Defence Export Advocate
- the US$3 billion Defence Export Facility

For more information, visit: *http://www.defence.gov.au/Export/Office/*

SKILLING AND WORKFORCE

The Government launched the Defence Industry Skilling and STEM Strategy on 28 February 2019. The Strategy outlines the vision and investment to assist Australian defence industry to meet its workforce skills requirements over the next decade.

For more information, visit: *http://www.defence.gov.au/SPI/Industry/IndustrySkillingSupport.asp*

DEFENCE EXPORT CONTROLS

Defence is responsible for regulating the export of defence and strategic goods and technologies, including granting export permits. Australia's export control policies are in place to enable the export of defence and strategic goods where this is consistent with Australia's national interests and international obligations.

For more information, visit: *http://www.defence.gov.au/ExportControls/*

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