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Innovation Catalysis: ASCA

Accelerating technology development and capability delivery through superior process and reduced barrier partnerships.

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Executive Summary

The Commonwealth of Australia has acknowledged the challenges of Australian innovation in the recently released Defence Strategic Review (DSR). The outcome of the review intending to serve as a framework to bolster the capabilities of the Australian warfighters in response to the acknowledged instability within Australia's strategic and geopolitical region. The DSR makes clear that the existing Australia innovation frameworks, the Defence Innovation Hub (DIH) and the Next Generation Technologies Fund (NGTF), for catalysis and bridging the delivery gap is insufficient to meet the defence needs.

The DSR recommended the establishment of Advanced Strategic Capabilities Accelerator (ASCA) to address the rapid capability development gap. ASCA officially replaced the DIH and NGTF. A priority problem for ASCA to address during its establishment is to enable a rigorous framework and process to resolve the challenges faced in previous innovation frameworks within an unstable strategic and geopolitical environment.

The paper details the research conducted of current Australian innovation frameworks via interviews of stakeholders across the spectrum of the defence ecosystem, including government, academia, warfighters and industry. Other non-defence innovation frameworks were examined, including understanding the lessons that may be learnt from overseas innovation models. Other research conducted were extensive literature reviews and analysis of Australia defence innovation case studies.

This paper identifies the following key themes from the research conducted with supporting analysis of the impact of these problem findings on the state of innovation and disruptive technology delivery via ASCA to meet the defence capabilities shortfall gap:

1. Culture and Collaboration
2. Contracts
3. Execution Process
4. Urgency

Recommendations applicable to the establishing strategy of ASCA and its role in overcoming legacy innovation challenges, while fulfilling the priority outcomes of its vision from the DSR were detailed as follows:

1. Culture & Collaboration
    - Embed the End User
        - Form innovation alliances between stakeholders
            - Integration of ADF Service Members within ASCA mission
    - Reduce Risk Averse Culture
        - Address risk-averse culture by establishing clear risk management processes
        - Simplify risk management for innovation programs to prevent excessive exposure for innovators
    - Transparency and Communication
        - Regularly communicate problems, missions, and capability needs while remaining open to new ideas
        - Engaging stakeholders in transparent communication to foster a collaborative environment

2. Contracts
    - Well-Defined Contracts & Award Setup Process
        - Develop a streamlined contract award process to reduce distractions from innovation
        - Limit upfront costs to innovation companies with a focus on lean contracts
        - Develop and share ASCA's suite of recommended contracting processes and templates.

- Practical Contracts, Suited to Innovation
    - Create fit-for-purpose contracts balancing speed and testing rigor
    - Tailor contract development on a mission-by-mission basis, considering Minimum Viable Capability (MVC).
    - Streamline contract deliverables, only selectively tying CDRLs to milestones

3. Execution Process
    - Scale-up Pathway Mapping
        - Publish a comprehensive scale-up pathway map for stakeholders in the defence innovation ecosystem
            - Illustrate routes DIOs, grants, and ASCAs three pillars
            - Include interfaces to CASG and other potential comercialisation methods
    - Rapid Procurement Process
        - Establish a rapid procurement process in collaboration with other agencies
            - Include rapid Capability Technology Demonstrator phases to bypass stifling processes
        - Enhance effectiveness by procuring innovative solutions through non-traditional agencies
    - Early-Stage R&D Capture
        - Ensure attention to early-stage R&D by defining a mechanism for academia engagement
        - Clearly identify how ASCA will interface with and fund academia through its EDT pillar
        - Prevent academia funding gaps to sustain the defence innovation ecosystem

4. Sense of Urgency
    - Define Minimum Viable Capability
        - Adequately define the Minimum Viable Capability for each mission
        - Focus on capability-centric expectations, promoting an engineering design philosophy
        - Encourage innovation by prescribing detailed requirements sparingly, based on mission context
    - Delegated Authority and Empowerment
        - Grant ASCA Program Managers delegated authority for rapid and effective decision-making
        - Ensure reduction to waiting times for ministerial decisions
    - Clear Vision and Focus
        - Develop a clear vision for each ASCA pillar, ensuring focused programs
        - Evaluate ASCA's effectiveness in delivering its vision and expedite innovations to the warfighter
        - Avoid spreading funds too thin and prioritise programs with a strategic focus

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Authors’ Backgrounds

Sam Davis
Currently specialised in driving business improvement programs at scale and overseeing build-to-print manufacturing projects. Brings worldwide experience across manufacturing, aerospace propulsion, PNT, quantum and mechanical engineering sectors. Previously led mechanical design, manufacture, and Integrated Logistics Support (ILS) development for systems integrated into AIR2025 PH6 JORN. Holds a Bachelor's degree in Mechanical and Aerospace Engineering.

David Jucha
Over 25 years’ experience performing complex program management and systems engineering within the Australian Defence industry for each of the services. With a diverse project delivery experience from a working at an Australian small-to-medium (SME) company and more recently at an Australian subsidiary Prime. Technically qualified with a Bachelor of Engineering supported by several business qualifications with the most recent being a Masters of Business Administration (MBA).

Levin Lian
Electrical and electronics engineer with extensive expertise in the field of radar and electronic warfare. Held design and delivery roles across Primes and SMEs for complex radar solutions, including High Frequency Over-the-Horizon-Radar, as well as lead design roles on R&D programs, with firsthand experience developing technology through mid-to-late-stage Technological Readiness Levels in conjunction with the DoD Defence Innovation Hub. Holds a Masters Degree in Electrical and Electronic Engineering and a Bachelor of Commerce from the University of Western Australia.

Alvaro Rosales
ICT and Electronics professional with over 30 years of experience delivering ICT projects for the private sector and the defence industry. Currently working to deliver capability to the RAN and previously participated in the acquisition phases of SEA4000 Hobart Class, SEA1654 Supply Class programs and currently in the Hobart Class Destroyer Guided Missile (DDG) Enterprise as a sustainment Project Manager. Qualifications include a MBA and a Postgraduate Diploma of Project Management.

John Ruddy
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Chapter 1. Introduction

1.1 Research Context

Innovation is the lifeblood of a nation's defence industry, underpinning its ability to deliver strategic capabilities and maintain competitiveness in a continuously evolving global landscape. For countries like Australia, the ability to innovate is paramount when equipping its armed forces with a regionally superior force-multiplier capability, and crucial to responding effectively and decisively in the face of emerging security threats. Traditionally, defence innovation in Australia has been the effort of partnerships between Defence Innovation Organisations (DIOs), government, academic institutions, and industry. Many of Australia's crowning innovation achievements have been birthed from leading research conducted at the Defence Science and Technology Group (DSTG) (formerly Organisation). These achievements also stem from commercial research and development carried out by private industry. Subsequently, they are supported to delivery by the Capability Acquisition and Sustainment Group (CASG), formerly Defence Materiel Organisation, in conjunction with robust industry consortiums. Exemplars of cooperative Australian sovereign technology accomplishments range from the world-renowned Jindalee Operational Radar Network (JORN) utilising state of the art Over-the-Horizon-Radar (OTHR) technology to the Nulka Active-Missile Decoy, and recent advancements in unmanned aerial systems such as the naval Autonomous Warrior program (Australian Government 2021).

Australia has an established legacy of successful defence innovation, however, despite its strong history in this domain, the country faces several hurdles in the modern era. Recurrent issues with long lead times to delivery of technological solutions within the defence industry, a sluggish acquisition and procurement process, challenges with research and development funding models, and inefficiencies in coordinating large groups of program stakeholders. Many of these stem from the innovation mechanisms of both government and industry.

In April 2023 the Defence Strategic Review (DSR) (Houston and Smith 2023) was released by the Commonwealth government of Australia, intending to serve as a framework to bolster the capabilities of the Australian armed forces in response to the acknowledged instability within Australia's strategic and geopolitical region. The report represents one of the most significant posture adjustments in the Australian Defence Force (ADF) capability self-assessment inside recent decades. One pressing conclusion was the ADF's present lack of fitness-for-purpose in dealing with modern threats and threat actors. In particular, the report highlighted an urgent need for increased schedules for force generation across the ADF, with emphasis placed on accelerating the pipeline for delivering disruptive capabilities from industry into the hands of the ADF. Key technologies called out by the review include areas where the ADF traditionally has demonstrated only nascent capability or none at all, such as long-range strike and integrated air-defence, hypersonic missiles, autonomous systems, and advanced undersea warfare. Many of these technologies were poised to emerge within the scope of the AUKUS Pillar II program (PM&C 2022), but they nevertheless represent a stark innovation challenge to today's state of the Australian defence industry. The DSR makes clear that the existing processes for driving innovation and bridging the delivery gap is insufficient to meet Australia's immediate defence needs.

Head of CASG, Chris Deeble, stated during discussion at the Chief of Air Force Symposium 2023 that, "urgent change in the culture within Defence," was required (Deeble 2023):

- "There needs to be an urgent reduction of the current Defence policy requirements that stifles innovation and collaboration" (Contracts and Execution Process)
- "'Fail-fast' concepts required for rapid innovation needs to be incorporated within Defence culture immediately" (Execution Process)
- "'Top-heavy' approach of decision-making prevents Defence from being innovative" (Contracts and Collaboration)
- "...better exposure to SMEs and businesses ... to understand difficulties faced by SMEs" (Culture and Collaborations)

This reflects a long-standing prevalent need to improve expediting innovation to the war fighter. The launch of ASCA on 1st July 2023 could be seen as the first step in satisfying this need.

One of the pivotal recommendations in the DSR that aimed to address the rapid capability development gap with a priority focussed approach is the Advanced Strategic Capabilities Accelerator (ASCA). On July 1, 2023, ASCA officially replaced the Defence Innovation Hub (DIH) and Next Generation Technologies Fund (NGTF), which previously served as the incumbent Department of Defence (DoD) mechanisms for supporting maturation of mid-TRL (Technological Readiness Level) technologies through to commercialisation in the case of the DIH, and provision of funding for cutting-edge research in the case of the NGTF. The Australian government has pledged $3.4billion (CoA 2023a) to secure the key priority defence needs of the country over the next decade. According to the DSR, the main goal of ASCA is to prioritise in the shortest time frame possible the advancement of specific critical technology domains under the AUKUS Pillar II Advanced Capabilities (Houston and Smith 2023, p. 73).

ASCA seeks to drive innovation via three streams, consisting of a Missions stream, an Emerging Disruptive Technology (EDT) stream, and an Incubator stream (Hilder 2023). Of these, the Missions stream is intended to address the core issues outlined in the DSR. The bulk of research and funding focus will be on expediting the development and translation of solutions fulfilling existing imperative needs within the ADF; these designated “missions” are to be endorsed by Force Design Division within the Vice Chief of Defence Force (VCDF) Group, shaping the priorities for a “whole of nation” approach to targeted innovation with the swiftest impact on the effectiveness of the function of the ADF. It is expected that the smaller EDT and Incubator streams will provide alternative funding frameworks through challenge statements, partnerships, and co-investment for research and development in early-stage technologies, with the potential to offer groundbreaking or significant advancements to current capabilities that are also aligned with the DSR priorities (ASCA 2023).

The scope of ASCA is still in its incipient stages, and its ability to resolve some of the longstanding challenges afflicting the Australian defence innovation ecosystem is still yet to be assessed. However, the importance of this endeavour will not only underscore Australia's future in remaining at the forefront of defence innovation, but also the potential question of its fundamental survival as a security leader in the face of changing hostilities in a global environment. As ASCA continues to evolve and mature, it presents a means of not only addressing issues that have hampered past progress, but also propelling the nation towards a more agile, responsive, and technology-driven future in all areas of defence. With the right strategic execution, ASCA has the potential to reshape the country’s defence innovation by making it more resilient and adaptable to the fluid global security landscape.

1.2 Problem Statement

A study conducted of current innovation models in Australian defence identified several recurring limitations present in these models which ASCA should aim to resolve to present a stronger, more successful capability development and delivery program with the requisite effectiveness to meet the critical missions needs of the ADF. While ASCA was founded to address the recognised challenges faced in previous innovation frameworks, the question of how this can best be accomplished remains a crucial one as the accelerator is established during its initial stages.

1.3 Definitions

Term	Definition
Capability	Capacity, ability, or readiness of the ADF to perform specific tasks, missions, or functions effectively. It encompasses a wide range of elements, including personnel, equipment, technology, training, logistics, and organisational structure.
Defence Innovation Ecosystem	The collection of organisations, tasks, functions, and procedures responsible for creating, manufacturing, and deploying new or enhanced technologies and capabilities for military purposes.
Dual Use	Refers to technology, equipment, or knowledge that can serve both civilian and military purposes, often with the potential for applications in both peaceful and defence-related contexts. Dual-use technologies can present both opportunities for innovation and challenges related to export controls and security.
Innovation	The process of creating, developing, and implementing new ideas, methods, products, or services that bring about positive change or solve existing problems. It involves the application of creativity and the conversion of novel concepts into practical and valuable solutions.
Prime	Contractors within the Australia Defence industry that deliver capability to the Department of Defence, normally working with small-to-medium companies to maintain a supply chain.
Sovereign	The concept and practice of Australia having the capability and capacity to independently defend its own national security interests and sovereignty without relying heavily on external dependent on foreign nations for assistance.
Technology Readiness Level	A systematic metric for assessing the maturity of a technology or innovation during its development and prior to integration into a product or system. The TRL scale typically ranges from TRL 1 to TRL 9. Each level represents a specific stage of technology development.
TRL 1	Basic Principles Observed: Lowest level representing early conceptual stage of technology development. Scientific research may be conducted; basic principles underlying the technology are observed however there is no practical application at this point.
TRL 2	Technology Concept Formulated: Researchers begin to formulate the technology concept through theoretical studies, experiments in a laboratory setting, or developing mathematical models.
TRL 3	Proof of Concept Validated: The proof of concept is validated. Researchers typically work on benchtop experiments or small-scale prototypes to demonstrate the feasibility of the technology. However, the technology is not yet ready for practical application.
TRL 4	Technology Validated in Laboratory: Involves testing and validating the

	technology in a laboratory environment to further demonstrate its functionality. The technology is still not ready for real-world applications.
TRL 5	Technology Validated in Relevant Environment: The technology is tested in a relevant environment that simulates real-world conditions. Researchers work on a larger scale, and the technology begins to show potential for practical application.
TRL 6	Technology Demonstrated in Relevant Environment: Represents a significant milestone where the technology is demonstrated in a relevant operational environment. The prototype is typically a near-final version, and it is tested in conditions that closely mimic its intended use.
TRL 7	System Prototype Demonstration in Operational Environment: A prototype is demonstrated in an operational environment. The technology is integrated into a system and tested to assess its performance.
TRL 8	Actual System Completed and Qualified Through Test and Demonstration: Involves the completion and qualification of the actual system or technology. It undergoes extensive testing and evaluation to ensure it meets all requirements and specifications.
TRL 9	Full-Scale System Proven Through Successful Operations: The highest level and indicates that the technology or system has been proven through successful operations in its intended environment. It is fully operational and ready for deployment and use.
Valley of Death	A development gap emerging when a technology, having reached TRL 5 or higher and being poised for integration into a system design or program, is ready to move from the development phase to production, fielding, and ongoing operational, maintenance, and support activities. This period also includes the duration during which a business aims to transition a prototype or commercially available product into a contract with the Department of Defence (DoD).
Warfighter	A term commonly used in Australian defence contexts to refer to an individual who is directly involved in warfare, particularly as a member of the Australian Defence Force (ADF). Warfighters train to prepare and may engage in armed conflict, either in direct combat or in supporting roles that contribute to operations.

1.4 Abbreviations

ADF	Australian Defence Force
ASCA	Advanced Strategic Capabilities Accelerator
AUKUS	Australia, United Kingdom, United States of America
CASG	Capability Acquisition and Sustainment Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CoA	Commonwealth of Australia
CTD	Capability and Technology Demonstration
DARPA	Defence Advanced Research Projects Agency
DDG	Destroyer Guided Missile
DIH	Defence Innovation Hub
DIO	Defence Innovation Organisation
DoD	Department of Defence
DSR	Defence Strategic Review
DSTG	Defence Science and Technology Group
EDT	Emerging Disruptive Technology
NGTF	Next Generation Technologies Fund
MVC	Minimum Viable Capability
SME	Small-to-Medium Enterprise
VCDF	Vice Chief of Defence Force

1.5 Methodology and Scope

This paper presents the findings and analysis resulting from extensive literature review, case studies, and interviews. The literature review focused on the Australian defence innovation ecosystem, key organisations including ASCAs predecessors and the Office of Defence Industry Support and other Australian innovation organisations. Furthermore, it included review of international innovation ecosystems and organisations including DARPA and DIU. This synthesis of research, in combination with case studies on the Jindalee Operational Radar Network and passive radar, was employed to establish the necessary context for evaluating and providing recommendations to ASCA. The research employed semi-structured interviews with experts in industry, federal and state government departments, academia, DST Group, ex-ADF, and ASCA. This approach allowed for a flexible yet focused exploration of key themes and insights from diverse stakeholders in the defence innovation ecosystem. The concepts and recommendations have been put together from leveraging the combined professional experiences of the authors.

This paper seeks to identify the most prevalent themes from research findings on existing defence innovation mechanisms, particularly the shortcomings of ASCA's predecessors, the DIH and the NGTF. An impact analysis of the of these problems on the state of innovation and disruptive technology delivery is presented. Solutions were collated through stakeholder interviews, case studies, and drawn from evidence of relevant empirical models outside of Australia and in other sectors. These were analysed and provided as recommendations applicable to the emerging strategy of ASCA and its role in overcoming legacy innovation challenges, while fulfilling the priority outcomes of its missions from the DSR.

This report is structured into three main parts. First, a literature review and background comparison of the contemporary defence innovation ecosystems in Australia and overseas is presented. This is contrasted against innovation models outside the defence sector, and a summary of the existing status of innovation in Australia's defence industry is provided. The second section of this paper investigates a selection of case studies in Australian defence innovation. The obstacles, strengths, successes, and failures encountered by each program and analysis the critical factors behind them. This section then explores the data gathered from views and opinions of experts interviewed across a broad spectrum of defence stakeholders. The final section of the report details an analysis of the research findings and extracts the most common themes identified as predominant innovation challenges across reference sources. These themes are framed in relation to the formation of ASCA and its integral role in driving the future of innovation and capability delivery to the ADF. The paper concludes with recommendations to address these issues and provides suggestions for ways in which they may be implemented as part of the groundwork strategy and policies of ASCA.

1.6 Assumptions and Limitations

Noted assumptions or limitations to the research conducted were:

- The study was constrained to the ASCA innovation phase and not focused on the interface mechanism to CASG or their contracting model
- The report does not detail any other international innovation ecosystem except for U.S. The focal international ecosystem was chosen to be the U.S., due to much past commentary explicitly calling for the setup of an 'Australian DARPA'
- The study references redacted reports, potentially limiting the accuracy of those findings
- Primarily, the study concentrated on more recent innovation in Australia, potentially overlooking significant DIOs or innovation initiatives from earlier periods due to the timeframe
- Opaque visibility into ASCA: the study was undertaken in parallel with ASCA developing its concept

Chapter 2. Current Innovation Status

Countries, companies, organisations, and individuals innovate for a variety of reasons. Innovation may be driven by a desire for solving problems, economic incentives, curiosity or fear, social and environmental concerns, and global conditions or strategic competitiveness.

As China and other countries continue to innovate and make significant technological advances based upon significant investment in emerging technologies, AUKUS countries, especially Australia who is lagging in emerging technologies, cannot afford to delay consideration of AUKUS Pillar II (PM&C 2022) and Defence IS&T priorities which promise wide-ranging effects on national security. ASPI's Critical Technology Tracker released in March 2023, revealed that China has laid the research foundations to position itself as the world's leading science and technology superpower. It has established a large lead in high-impact research across 36 out of 44 critical technologies in defence, robotics, energy, biotechnology, advanced materials and other key fields (Gaida et al. 2023). R&D for AUKUS critical technology fields are a two-horse race between China and the USA, with various other nations—most often India—a distant third. China holds a lead in 19 of the 23 technologies evaluated. It dominates R&D in hyper-sonics, electronic warfare and autonomous underwater vehicles, as well as in research into sonar and acoustic sensors. In each of these technologies, China's output of high-impact research is at least three times greater than that of the USA. It holds a comfortable lead when compared to all three AUKUS countries combined. The DSR states that "China is engaged in strategic competition" with Australia (Houston and Smith 2023).

Table 2-1: ASPI's Critical Technology Tracker (Gaida et al. 2023)

Technology	Lead country	Technology monopoly risk
Advanced materials and manufacturing		
1. Nanoscale materials and manufacturing	China	high
2. Coatings	China	high
3. Smart materials	China	medium
4. Advanced composite materials	China	medium
5. Novel metamaterials	China	medium
6. High-specification machining processes	China	medium
7. Advanced explosives and energetic materials	China	medium
8. Critical minerals extraction and processing	China	low
9. Advanced magnets and superconductors	China	low
10. Advanced protection	China	low
11. Continuous flow chemical synthesis	China	low
12 Additive manufacturing (incl. 3D printing)	China	low
Artificial intelligence, computing and communications		
13. Advanced radiofrequency communications (incl. 5G and 6G)	China	high
14. Advanced optical communications	China	medium
15. Artificial intelligence (AI) algorithms and hardware accelerators	China	medium
16. Distributed ledgers	China	medium
17. Advanced data analytics	China	medium
18. Machine learning (incl. neural networks and deep learning)	China	low
19. Protective cybersecurity technologies	China	low
20. High performance computing	USA	low
21. Advanced integrated circuit design and fabrication	USA	low

22. Natural language processing (incl. speech and text recognition and analysis)	USA	low
Energy and environment		
23. Hydrogen and ammonia for power	China	high
24. Supercapacitors	China	high
25. Electric batteries	China	high
26 Photovoltaics	China	medium
27. Nuclear waste management and recycling	China	medium
28. Directed energy technologies	China	medium
29. Biofuels	China	low
30. Nuclear energy	China	low
Quantum		
31. Quantum computing	USA	medium
32. Post-quantum cryptography	China	low
33. Quantum communications (incl. quantum key distribution)	China	low
34. Quantum sensors	China	low
Biotechnology, gene technology and vaccines		
35. Synthetic biology	China	high
36. Biological manufacturing	China	medium
37. Vaccines and medical countermeasures	USA	medium
Sensing, timing and navigation		
38. Photonic sensors	China	high
Defence, space, robotics and transportation		
39. Advanced aircraft engines (incl. hypersonics)	China	medium
40. Drones, swarming and collaborative robots	China	medium
41. Small satellites	USA	low
42. Autonomous systems operation technology	China	low
43. Advanced robotics	China	low
44. Space launch systems	USA	low

Chapter 3. Innovation Ecosystems Review

3.1 Australian Defence Innovation Ecosystem

The evolution of the innovation ecosystem in Australian defence has been colourful and dynamic at numerous levels in the past. Many programs currently exist both inside and outside of Defence, aiming to provide support for the development of novel and cutting-edge technologies at all maturity stages, using different angles of approach. In the last few decades, some of the key Commonwealth programs to target innovation via a collaborative approach with industry and academia have been funded through DSTG, which, until the establishment of ASCA, most recently included the Defence Innovation Hub (DIH) and the Next Generation Technologies Fund (NGTF). Other DoD arms include the Office of Defence Industry and Support (ODIS). While the Australian defence innovation ecosystem encompasses a vast range of institutions and programs, this chapter provides an overview of those currently used by Defence, and which are closely linked to the formation of ASCA.

3.1.1 Defence Innovation Hub

The Defence Innovation Hub was created in 2016 as the successor to the defence Capability and Technology Demonstrator (CTD) program. Between its inception to 2020, more than $240 million was invested into projects in collaboration with Australian businesses, academia, and research organisations (Defence Innovation Hub 2020). A total of $1 billion in planned funding had been allocated to it until 2030. Prior to the DIH, the CTD ran from 1997–2016, with at least $155 million over 132 projects. Also, following its creation, the DIH absorbed the functions of the former Rapid Prototyping, Development, and Evaluation (RPDE) program which was founded in 2005 to address capability shortfalls in the ADF through rapid evaluation and integration of new and emerging technologies (Ferguson 2008).

One of the ways the DIH operated was through open innovation Calls for Submission (CFS), which led to Request for Proposal (RFP) from industry and subsequent evaluation of their alignment with ADF capability priorities (Defence Innovation Hub 2020). Proposals of interest to Defence were invested in and developed using a phased approach over four stages of maturity, spanning from TRL 1 – 7, although projects could enter the program at any TRL.

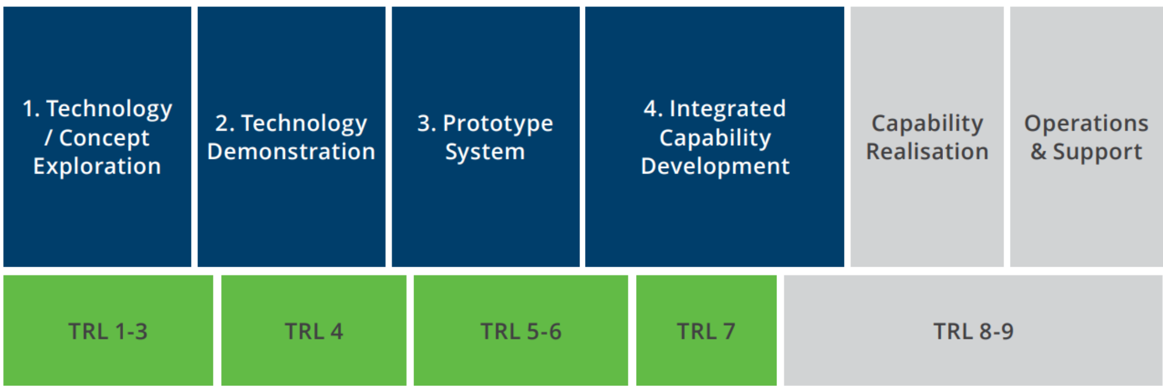

Figure 3.1.1-1: DIH development phases (Defence Innovation Hub 2020)

Each DIH phase could be funded under separate contracts, each with their own milestones and targeted technical performance measures (TPM). Although the DIH was intended to foster development of innovative technology at advanced stage TRLs, one identified shortcoming was its lack of mechanisms to facilitate actual translation of late-stage projects into realised capabilities. The 2023 UPSCALE report by the University of Sydney's United States Studies Centre observed that the DIH was not a successful program for generating new military capability or technology exports (Channer and Kunkel, 2023). It noted that out of 233 projects over 2016 to 2023, only ten resulted in acquisition contracts for new capability. The report also gave some hypotheses about the reason for this low rate of conversion, including industry perception that DIH tended to distribute funds across many Australian companies in a diluted manner.

The challenges of the DIH were one focal area of this research. A question asked to all interviewees who were closely embedded in the innovation space was to suggest factors that may have contributed to (lack of) effectiveness of the program and its predecessor, the CTD, in progressing mature TRL innovations through to ADF capabilities. These findings are presented in Chapter Five.

3.1.2 Next Generation Technologies Fund

Similar to the DIH, the Australian government has incorporated the Next Generation Technologies Fund into ASCA's responsibility, leading to the discontinuation of the fund in the first half of 2023. The NGTF was started in 2016 with the objectives of developing critical emerging technologies alongside building a national Australian research base for defence science and national security. In 2021, the fund had invested over $164 million across 275 projects at the disruptive research and low TRL level (Defence Science and Technology Group 2021).

Through the NGTF, DSTG formed a network of partnerships across state-based academia and industry, with a focus on driving research in key Defence challenges. This network, known as the Australian Defence Science and University Network (ADSUN), comprises the Defence Innovation Partnership (SA), the Queensland Defence Science Alliance, the Defence Science Institute (VIC), the Defence Innovation Network (NSW), and the Defence Science Centre (WA) (Defence Innovation Hub 2020). In conjunction with Defence and the NGTF, the role of ADSUN was to connect SMEs and research institutions, e.g. universities, to relevant and current Defence problems.

Since the fiscal year 2019, the introduction of the DSTG Science, Technology, and Research (STaR) Shots strategy has presented a framework of eight key priorities for critical mission technologies . These priorities are in alignment with NGTF funding. (Australian Government 2021) The NGTF also sought open proposals from industry and academia, however out of the 345 projects it had funded to date in 2023, none had led to acquisition contracts translating into ADF capability (Channer and Kunkel, 2023). In contrast to the DIH, the intention of the NGTF was to cultivate research at early stages of innovation which had a much higher chance of failure, or no immediate capability application. As such, failure was deemed an acceptable outcome from its projects.

The functions of the NGTF have now been incorporated into one of the two secondary domains of ASCA, i.e. the EDT stream. The research conducted for this report investigated the views of academic researchers around the effectiveness and potential issues facing ASCA as a critical disruptive technologies government funded program; these findings are presented within Chapter Five.

3.1.3 Office of Defence Industry Support

The Office of Defence Industry Support (ODIS) was established in November 2021, replacing the Centre for Defence Industry Capability (CDIC). It functions to provide advisory, guidance and mentoring services to SMEs who aim to work with the ADF, or to existing SMEs looking to expand their operations within defence. One key focus is the direct linkages to Defence end users to support innovative industry initiatives. ODIS provides tailored grants to upskill SMEs in diverse aspects related to the Defence business environment including supply chain, export controls, and readiness to initiate business with Defence. ODIS has a presence in all Australian states and territories and provides regular events to engage SMEs across the country.

As illustrated by Figure 3.1.3-1, from the Australian Government Department of Finance, ODIS' Defence portfolio is its largest. This portfolio comprises the largest share of Commonwealth contracts with SMEs. ODIS will not be replaced by ASCA and will continue its role as an enabler to provide links between SMEs, ADF end users, and the existing processes that enable successful business operations between Defence and SMEs.

Figure 3.1.3-1: Commonwealth contracts with SMEs. Estimated value of SME contracts by top 10 portfolios. Value in Million AUD. (Department of Finance 2023)

3.1.4 Other Defence Innovation Organisations (AU)

Outside of direct Defence funding, Australia also has several initiatives aimed at supporting innovation within the wider defence ecosystem. These models vary from grant funding to incubator and seed investment programs. One example, Defence Trailblazer Program (DTB), was launched on 21 July 2023. DTB forms one arm of the wider Department of Education's Trailblazer Program, which is a portfolio of university partnerships investing in innovation across industries in Australia.

The DTB is a $240 million strategic partnership between UNSW Sydney and the University of Adelaide, with support from CSIRO, the Department of Education, and over 30 industry partners (Department of Education 2023). The program provides seed funding to groundbreaking research companies, usually in the form of convertible safe notes, with the goal of helping translate novel technologies into successful commercialisation. In this way, companies are able to retain IP rights while securing funds to mature their technologies. The DTB and other similar programs play an important role as alternative drivers of innovation outside the institution and culture of Defence, but now have the potential to work in strong synergy ASCA.

3.1.5 CASG and the Pathway to Acquisition

Despite several DIOs, grants and incentives, once innovative solutions have advanced through the various stages of development, they often fail to be acquired or deployed as functioning capabilities to the ADF. The DoD Capability Acquisition and Sustainment Group (CASG) are the primary entity responsible for meeting ADF military equipment and supply requirements. Idealistically, this has included acting as the bridge across the gap for translating mature, verified concept test demonstrators from late-stage programs, like DIH, into operational capability.

Since its establishment in 2015, CASG has facilitated the acquisition and transition of numerous innovations to the warfighter in the Land, Air, Maritime and Joint Systems domains. Three examples of acquisitions include Hawkei (LAND 121), RQ-4A Triton (AIR 7000), and Pacific Patrol Boat Replacement Project (SEA 3036). While it was intended that the organisation would function as a more agile and efficient entity than its predecessor, the Defence Materiel Organisation (DMO), this has not been the prevailing reality. In the 2022 DILP Research Paper, Developing the Agile Defence Force (Summer et al. 2022), a reflection on CASG states:

> *"Innovations developed by SMEs must find a pathway into the CLC process through the complicated and lengthy process used by CASG to ensure that the IIP programs and projects are targeted at gaps in Defence's capability. The different parts of the innovations system are effectively performing their task of developing innovations and SMEs, however, there is a poor connection between these elements. In particular there are no clear pathways for SME's innovations into CASG. It is critical to secure a pathway into CASG through any of the innovation streams required by the Capability Manager and Project Sponsor to strongly champion the local innovation for its inclusion in the program strategy of an IIP project."*

At the 2023 Chief of Air Force Symposium, the Deputy Secretary CASG, Mr Chris Deeble, referred to a refreshed vision for CASG, termed CASG 2.0, which recognised the need to shift the organisation's focus towards speed to capability, minimal viable capability, new risk appetite across agencies, partnerships, and the ability to pull through innovation far more rapidly. This paradigm would be based on a two-speed model: first, a robust structure for large acquisitions where design, manufacture and test may be protracted; and second, a simpler structure for smaller acquisitions where greater risk can be taken for essential innovations to rapidly reach the war fighter. They stated:

> *"The legacy will always be there and how that is adapted to keep this clock running will be really important. I'll be working very closely with Professor Tanya Monro, heading up the DST organisation, the Australian Science Capability Accelerator Program to work out how we can actually bring innovation through to capability outcomes into the future." (Deeble 2023).*

To complete the streamlining of the full innovation path from research lab to operational end user environment, the relationship interface mechanisms between ASCA and CASG cannot be ignored. As the custodians of critical disruptive technologies for the warfighter, CASG must collaborate effectively with ASCA to swiftly deliver innovations, gaining a superior advantage in the face of current threats.

3.2 Non-Defence Innovation Organisations (AU)

This section takes a brief look at a selection of effective innovation initiatives outside of the defence sector, in Australia. An outline of each is provided as well as a discussion of some of their unique mechanisms and features that enable their success. This report lists mechanisms and impact from several influential programs by commercial value.

3.2.1 Cooperative Research Centres Program

Established in 1990, the Cooperative Research Centres (CRC) Program fosters partnerships between industry and the research sector, and is run by the Department of Industry, Science, Energy, and Resources. The program holds a strategic role in the government's agenda with over $5.1 billion invested to date in 2021, $4.8 billion of which has been dedicated solely to the CRCs. A further $14.9 billion in cash and in-kind contributions from CRC partners has also been received since its inception (ACIL Allen 2021, p. vii). The program is structured around two arms: CRC collaborations between industry and researchers, lasting for up to ten years with no predetermined limits on funding, and CRC Projects (CRC-Ps), which provide short term matched grants of up to $3 million over three years of industry-led research ventures. Of the two arms, the CRC-P places prerequisites on programs to include at least two businesses (and at least one SME) alongside a research institution. Further requirements are for the CRC-P to be an accelerated *industry-led* effort to develop a commercial product or service for addressing real business problems. Milestone payments of grant funding is conditional on quarterly progress reporting submissions.

To date the CRC program has had a net economic impact assessed in the tens of billions of dollars (ACIL Allen 2021, p. 20), with positive innovation outcomes. Programs have contributed to a wide range of Australian sectors including, defence and security, health and medical, information and communication technologies, renewable energy, advanced manufacturing, agriculture and food, and transport and infrastructure. Examples of successfully commercialised technology emerging from both the CRC and CRC-P pipelines include the Air Optix Aqua multifocals (currently the top-selling soft multifocal contacts lens in the USA), RamSelect Plus, the RoXplorer, the Oventus O2Vent sleep apnoea device, and BT Imaging LIS-M1 Solar Module Inspection System, to name a few (ACIL Allen 2021).

3.2.2 Medical Research Futures Fund

The Medical Research Futures Fund (MRFF) is a $20 billion (Department of Health and Aged Care 2023) fund aimed at supporting medical research and innovation to improve healthcare outcomes in Australia. It is administered by the National Health and Medical Research Council (NHMRC), which has overseen past funding for extremely successful biotechnology commercialisations, such as the Nucleus cochlear implant (Cochlear Ltd). MRFF is targeted towards the Australian Medical Research and Innovation Priorities set by the Australian Medical Research Advisory Board (AMRAB) (Medical Research Future Fund 2022). Funding is split across four themes: Patients, Missions, Researchers, and Translation, each of which focuses on a different avenue of tackling problems across healthcare. For example, the Patients theme focuses on grants that most directly benefit patients, including clinical trials and treatments, while the Missions theme provides funding for a consortium of researchers, health professionals, industry, and patients, to address specific health challenges. The Translation theme seeks to materialise the transition of research outcomes into industry best practice adoption. Grants are awarded on an application basis to registered MRFF eligible organisations and are subject to regular progress reporting.

The MRFF also incorporates the Medical Research Commercialisation (MRC) Initiative, which aims to support early-stage medical technology research to proof of concept and product commercialisation (Allen + Clarke 2020). The impact and success of the MRFF is assessed in accordance with the MRFF Monitoring, Evaluation and Learning Strategy, which outlines not only the objective Key Performance Indicators (KPI) used to measure achievement of the MRFF goals in line with AMRAB priorities, but also the methodology for monitoring these KPIs, e.g., through governance, communications, and reporting, as examples (Department of Health 2020).

3.2.3 Australian Research Council

The Australian Research Council (ARC) is an independent body formed under the Australian Research Council Act 2001, and currently reports to the Australian Government Minister for Education. It provides funding for a vast range of pinnacle applied research and innovation through the National Competitive Grants Program (NCGP), with an average value of around $800 million a year (Australian Research Council 2022). While the NCGP comprises a funding branch targeting research commercialisation through its Linkage Program, ARC supports a much wider field of strategic research areas, including investment in researcher skills. Nevertheless, its overarching strategy remains guided a set of defined priorities, designed to support the foremost challenges Australia is facing (Australian Research Council 2022). An upfront requirement of an NCGP application is the submission of a National Interest Test (NIT) statement, which includes an assessment of the long-term pathway for research, including how it will transition into a societal benefit, or further research commercialisation.

3.3 The United States Defence Innovation Ecosystem

In this section, the intricacies of the U.S. Defence innovation ecosystem are explored, including an examination of its structure, operations, and the critical function performed by the Commercial Technology Pipeline (CTP).

The US Defence innovation ecosystem is a multifaceted network comprising various stakeholders, including government agencies, private sector partners, research institutions, and DIOs. These entities collectively represent a dynamic and collaborative framework that enables the integration of cutting-edge commercial technologies into military applications for enhancing national security capabilities.

The defence innovation ecosystem in the United States dwarfs that of Australia. It is much larger in both monetary value and number of programs and participants. The US ecosystem is also much more mature than Australia's, and analysing its gaps and the problems it faces will give important clues about the challenges that Australia may also encounter as it grows its own capabilities. The 2023 RAND research report, *Strengthening the Defense Innovation Ecosystem* (Kotila et al. 2023), conducts a thorough critical analysis of the US defence innovation scene, and provides key improvement areas to target and address its existing shortfalls. A summary of these recommendations was detailed in Appendix 1.

3.3.1 DARPA

At the forefront of US defence innovation is the Defense Advanced Research Projects Agency (DARPA), which was founded in 1958 in response to the Soviet Union's successful Sputnik launch. DARPA's primary mission is to maintain technological superiority for the US military, which is carried out through funding high-risk, high-reward research projects that often have breakthrough impacts on far-reaching industries beyond defence (U.S. Congress 2007).

When the concept of ASCA was introduced, there were many comparisons between its model and that of DARPA (Hamilton & Brangwin 2022). In 2023 the Congressional budget for DARPA was just over $4 billion USD (DARPA 2023, p.4), which was spread across several hundred projects. However, DARPA has historically aimed to fund cutting-edge projects that solve radical warfighting problems of the future, rather than current needs (GAO 2015, p.7). The US Government Accountability Office (GAO)(2015) found that DARPA had completed 150 programs between fiscal years 2010 and 2014. Nevertheless, the translation rate of DARPA projects is stated to be relatively low, with Ranka (2020) providing estimates of five or ten out of every one hundred projects successfully transitioning to an end user operational case. This represents a translation rate of around 5 – 10%. This means that many of the agency's high-risk projects are largely experimental and exhibit a non-insignificant likelihood of failure. In contrast to the Missions Stream of ASCA, under DARPA's model, transition to end user capability is desirable but not always expected.

Structure and mechanisms of DARPA

DARPA is made up of several business units, including the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, which offer funding contracts to SMEs to work on R&D projects aligned with DARPA's mission (DARPA 2021). In addition, a dedicated Transition & Commercialization Support Program (TCSP) is available to aid SBIR/STTR awardees in translating their technologies from the laboratory to the marketplace. The TCSP serves as the key link in DARPA to help SBIR/STTR companies transition into various R&D programs for further advancement, or transform their matured solutions into products suitable for acquisition by the US DoD. Importantly, the TCSP assists SBIR/STTR companies at no cost, making it extremely easy for these entities to convert their technologies into operational capability (DARPA 2021).

DARPA's focus on strategically important areas such as artificial intelligence, quantum technology, and cybersecurity (DARPA 2019), aligning its research projects with national security needs. Such targeted prioritised approaches are part of the agency's larger strategy to help bridge the gap between disruptive research and real-world military and civilian applications. One example of how it drives innovation towards these priorities is through DARPA Grand Challenges, which are open cash-prize competitions around a technology theme, such as autonomous vehicle research and application (DARPA 2016).

The 'DARPA Model'

DARPA is characterised by four key features to which it attributes its history of creative culture and innovation. This is often referred to as the 'DARPA Model' by Congress and US industry, in the context of improving other innovation programs (DARPA 2016, p.2). The key features are:

1. Limited tenure and the urgency it promotes
2. A sense of mission (shared vision)
3. Trust and autonomy
4. Risk-taking and tolerance of failure

Limited tenure

DARPA's distinctive culture thrives on short tenures and frequent rotations of program managers and office directors. With an average tenure of four to five years, employees are driven by a sense of urgency to strive for results during their terms. The aim of limited tenure is to encourage new hires to bring fresh ideas and innovation, with approximately 25 percent annual turnover (DARPA 2016, p.2). DARPA intentionally values this rapid turnover as it keeps individuals focussed on accomplishing goals rather than building long-term careers. Short tenures also promote a willingness to take risks and embrace the possibility of failure in pursuit of ambitious objectives, as well as eliminating candidates who might introduce caution and bureaucracy.

A sense of mission (shared vision)

DARPA's stated mission is to "prevent and create technological surprise," which is reflected in its drive to advance innovation for national security and military success. The agency aims to attract individuals who resonate with its purpose and are driven by the knowledge that their work has a direct impact on the state of innovation and disruptive technology extending beyond the realm of commercial products, both domestically and on a global scale. This mission-driven approach also adds urgency, particularly when addressing imminent threats.

Trust and autonomy

Another vital component within DARPA's unique culture is the empowerment of individuals to make important decisions without continual oversight. DARPA provides its capability managers freedom to make decisions without requiring constant approval from superiors in a "bottoms-up" structure, where topical research primarily originate from program managers, instead of top-down mandates (DARPA 2016, p.5). Project proposals are then submitted to an approval process to determine which programs receive funding. This level of trust and autonomy for program managers sets DARPA apart from other federal R&D agencies, where program managers often inherit existing programs, rely on peer review panels, and select projects based on panel rankings.

Risk taking and failure tolerance

Perhaps the most unusual, and yet integral, aspect of DARPA's methodology is its tolerance for risk and failure in supporting groundbreaking and revolutionary R&D. To mitigate the financial impacts of failed ventures, DARPA allocates funds to projects for a limited time and is willing to redistribute resources from underperforming ones (DARPA 2016, p.8). This culture of failure tolerance is endorsed by Congress and is central to DARPA's innovation success. Proposals undergo rigorous scrutiny, but no idea is dismissed solely due to risk, so long as the potential payoff is sufficiently transformative.

DARPA's willingness, if necessary, to fail in pursuit of major breakthroughs, recognises the valuable knowledge that can be accumulated even from unsuccessful ventures and how that can also contribute to the growth of the larger innovation ecosystem. Occasionally, the agency's tolerance for risk leads it to diverge from expert recommendations, as exemplified by a case where DARPA ignored experts' scepticism and funded a project that achieved a tenfold increase in military vehicle armour survivability against Improvised Explosive Devices (IED), despite contradicting expert opinions (DARPA 2016, p.7). Actively recognising and rewarding work that falls short of ambitious goals is one way that DARPA demonstrates its broad risk-taking culture, in exchange for the potential of substantial rewards. This contrasts organisations that accept failure, but do not actively celebrate or reward it.

3.3.2 Defence Innovation Unit

Complementing DARPA's efforts is the Defence Innovation Unit (DIU), a Department of Defence entity committed to accelerating commercial innovation to address national defence challenges. While DARPA is primarily focused on long-term, high-risk research with the potential for transformative breakthroughs, DIU is more focused on the rapid adoption of existing commercial technologies to address current and near-term defence needs. DIU works to identify and prototype solutions that address specific defence challenges, leveraging innovations from the commercial sector. Unlike DARPA's long-term and often blue-sky research focus, DIU is more oriented toward finding existing, commercially available technologies that can be rapidly integrated into military systems. DIU collaborates extensively with startups, technology companies, and academic institutions, fostering the development of cutting-edge solutions for military applications.

In its 2022 fiscal year annual report, DIU reported awarding a total of $204.8 million USD in Other Transaction Authority (OTA) prototype contracts to commercial companies (DIU 2022). DIU displays a rapid, in comparison to common defence industry practices, 143 business-day average to award prototype contracts. Furthermore, DIU has translated 17 programs into end user capability for the US DoD, adding to a 47% cumulative successful translation rate since 2016. For a comparatively smaller innovation program, DIU acts as an extremely effective capability translation arm of the U.S. DoD. This paper investigates some of the key mechanisms it uses to operate and achieve its results.

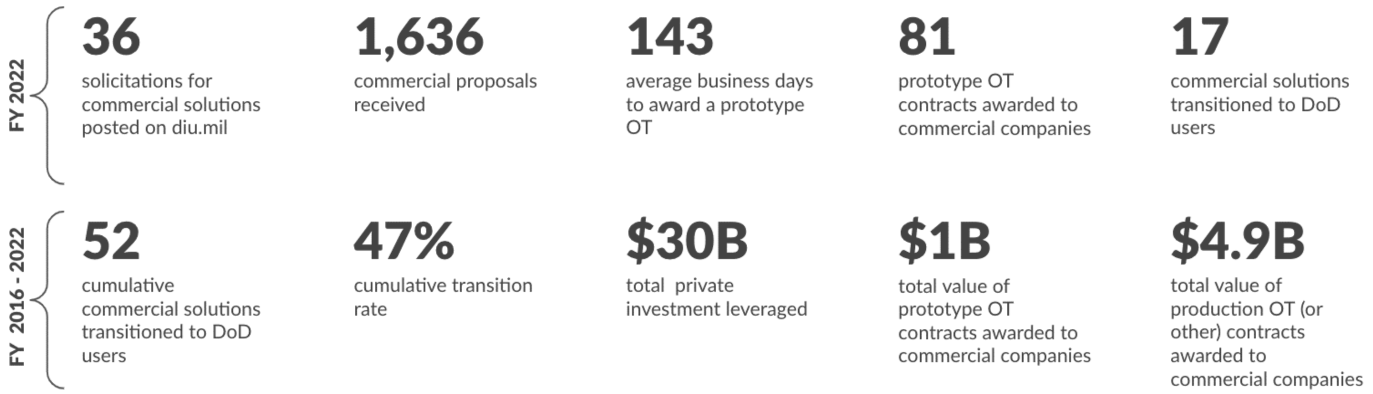

Figure 3.3.2-1: DIU's budget statistics (DIU 2022)

Leveraging fast and flexible contracts

DIU leverages fast and flexible contracts as a cornerstone of its approach to innovation. An example of this is the DIU's use of Other Transaction Authority agreements, which enable the organisation to engage with non-traditional defence contractors, startups, and technology firms more rapidly and with fewer bureaucratic hurdles than traditional procurement processes (U.S. Department of Defense 2023). OTAs enable the DIU to expedite the awarding of prototype agreements within much shorter timeframes, typically ranging from 60 to 90 days (DIU 2021). Most notably, following the successful development of a prototype, both the involved company and any DoD entity can seamlessly progress into a follow-on production contract or agreement, further streamlining the transition of innovative solutions into practical implementation. The OTAs provide a flexible framework for contracting, allowing for iterative development and frequent adjustments as projects progress. By using this approach, DIU can swiftly initiate and adapt contracts to align with emerging technologies and evolving military needs, ensuring that innovative solutions can be deployed in 12 to 24 months (DIU 2021).

Commercial solutions opening process

The Commercial Solutions Opening (CSO) process is a flexible and collaborative mechanism employed by DIU for sourcing innovative solutions that cater to DoD requirements. The CSO process satisfies the competitive requirements for OTs while providing maximum flexibility in making award selections. The CSO process intentionally mirrors commercial acquisition methods, as opposed to traditional regulatory approaches, to quickly vet and select technologies that provide value to DoD.

The 'how' of the CSO process involves several key steps. Firstly, DIU identifies specific problem areas within the DoD that could benefit from technological innovation. These problem areas are often rooted in immediate operational challenges or long-term strategic needs. Once the problem areas are identified, DIU issues solicitations, effectively inviting commercial entities, including defence companies, startups and non-traditional defence contractors to submit proposals that address these challenges (U.S. Department of Defense 2023, p.34). The competitive aspect is maintained by carefully evaluating and selecting the most promising proposals based on technical feasibility, cost-effectiveness, and alignment with DoD's mission. DIU employs a rigorous review process, often involving subject matter experts and technical evaluators. Successful proposals are then awarded prototype contracts, where the chosen companies work closely with DIU to develop and demonstrate their innovative solutions within a relatively short time frame.

The CSO process not only encourages innovation from a wide array of sources but also leverages commercial best practices, such as agile development and rapid iteration. This process is designed to be more streamlined and responsive than traditional procurement methods, by limiting the tender process to only 3 phases before the awarding of a contract (U.S. Department of Defense 2023, p.34). This allows the DoD to swiftly access and adopt innovative technologies. Also, by doing so, DIU bridges the gap between government needs and commercial solutions, fostering a culture of open collaboration and competition that leads to faster and more effective technology integration into defence operations.

3.3.3 Other Defence Innovation Organisations

Similarly to Australia, a host of other players exist within the US defence ecosystem that support the development and delivery of disruptive innovative capability in different ways. A non-exhaustive list of such entities include:

- The National Security Innovation Network (NSIN) is a program formed in 2019 under the DIU, and successor to the MD5 National Security Technology Accelerator. This alliance serves as a facilitator to bring together the DoD, startups, and academia to collectively tackle national security issues. This is achieved through direct funding of a portfolio of projects, hosting of innovation events such as hackathons, educational programs, and support for defence innovation projects.

- Military research branches such as the Office of Naval Research (ONR), the Army Futures Command (AFC), and the Air Force Research Laboratory (AFRL) are entities under the US military that focus on supporting R&D efforts in their respective organisations. Research areas spans topics such as autonomous systems, materials science, energy innovation, aircraft technology, space systems, and cybersecurity research.

- Other examples are the U.S. Air Force's Spark Tank initiative, which hosts annual competitions encouraging airmen to propose inventive solutions to military challenges, and Air Force’s Chief Digital Artificial Intelligence Office (CDAO), established in 2022 by succeeding the former Joint Artificial Intelligence Center (JAIC). This institute champions the advancement of artificial intelligence (AI) and machine learning (ML) capabilities throughout the DoD, with a specific focus on applications in predictive maintenance, warfighting, and decision support.

- Various military installations, contractors, innovation hubs and accelerators, and partnerships with industry giants such as Lockheed Martin, Boeing, and Northrop Grumman, who collaborate closely with the U.S. military to develop and integrate advanced technologies.

Together, these DIOs and range of initiatives comprise a multifaceted innovation ecosystem that drives technological advancement for the benefit of the United States’ defence capabilities. A comprehensive breakdown of areas where several key DoD affiliated DIOs specialise was detailed in Appendix 2. DIOs serve as key actors within the ecosystem, specialising in early CTP functions, such as technology identification and solution concept development. However, challenges that are commonly faced tend to arise in their ability to facilitate technology adoption in the later stages, primarily due to misaligned incentive structures with traditional requirements and acquisition communities.

3.3.4 Commercial Technology Pipeline Model Overview (US)

According to Kotila et al. (2023), researchers have created a model for the overall US defence Commercial Technology Pipeline (CTP) model, which forms the linchpin of the innovation ecosystem. The CTP acts as the conduit through which commercial technologies are identified, developed, and adopted for military use. Unlike a rigid pipeline, the CTP offers a flexible approach, featuring multiple entry and exit points, feedback loops, and diverse pathways, ensuring adaptability to technology characteristics, financial considerations, and alignment with DoD processes.

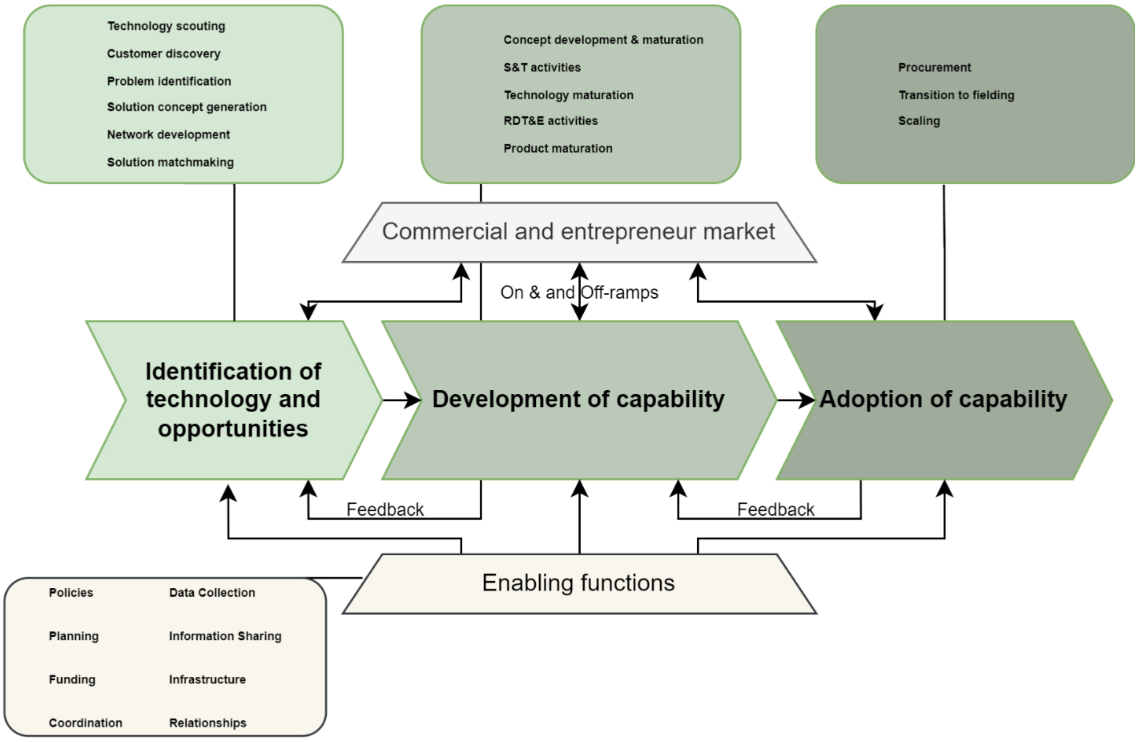

Figure 3.2.4-1: Flow diagram of the US defence innovation CTP (Kotila et al. 2023).

Illustrated by the flow diagram, collaboration is fundamental to the mechanisms of the CTP. Effective coordination and handoffs among various stakeholders are essential to provide rewarding offramps to innovators, which incentivises them to continue developing technology even if it does not lead to adoption of capability for the military. This collaborative approach spans the spectrum of CTP activities.

3.4 Non-Defence Innovation Organisations (US)

3.4.1 In-Q-Tel

In-Q-Tel (IQT) is a U.S. venture capital firm founded in 1999 that invests in startups providing innovative, short-turnaround solutions for the defence and intelligence community. The unique method by which IQT operates is to partner with their customers, chiefly government agencies like the CIA, NSA, and DoD, to define existing capability needs. They then typically invest between $500,000 and $3 million in startup companies who can develop MVC solutions to meet these needs within a rapid timeframe of 1 to 3 years. IQT supports these startup companies during the MVC development phase, much like standard venture capital firms, and retains equity in the event of successful CTD prototypes that are then translated into acquired capability. A further background overview and detailed discussion of the IQT model is provided in Appendix 3 of this paper.

3.5 Implications for ASCA

The research conducted on a range of innovation organisations and initiatives including with US and Australian Defence sectors shows some parallels between ASCA's proposed structure and their models. ASCA can draw from many of the positive aspects across the organisations described, but more importantly, to employ potential solutions from these programs to address and overcome many of the existing problems that were present in its predecessors.

Despite challenges, including limited translation of late-stage projects into realised capabilities, DIH's experience highlights the importance of effective mechanisms for technology transition. ASCA can leverage DIH's legacy to refine pathways for more seamless integration of disruptive technologies into the defence ecosystem. While ASCA aims to continue support for research at early stages, challenges may arise around the division of funding priority between the primary Missions stream (subsuming the DIH late-stage programs) and both the EDT and Incubator streams. ASCA can build on DIH and NGTF's experience to strike a balance between supporting cutting-edge research and ensuring the practical application of emerging technologies in Defence. ODIS, continues to play a crucial role in supporting SMEs engaging with Defence. Its advisory and mentoring services align with ASCA's mission of enabling collaboration within the defence innovation ecosystem. ASCA can draw on ODIS's expertise to enhance its efforts in fostering industry initiatives, ensuring a seamless connection between SMEs, ADF end users, and ASCA's funding streams. If innovations are to be successful in rapidly reaching the warfighter in a timely manner, then ASCA and CASG must be focussed on the same objective timeframes. Both CASG and VCDF group are represented at the 3-star level in ASCA governance, but the relationship could be seen as a failure if ASCA are successful in rapidly advancing innovations to the point of production readiness, only to be stagnated through the CASG acquisition process, which might typically consume years.

Although ASCA is not a venture capital firm like IQT, it can be structured to work in tandem with similar VCs in the defence innovation ecosystem, such as the DTB, to boost small scale startup and research efforts. Internally, resources for ASCA will be split into tripartite streams of Missions, Incubator, and EDT, echoing the approach of the MRFF in categorizing its funding into distinct themes, each with different goals. Additionally, ASCA's alignment with the DSR mirrors the strategy in many of the above models of targeting investment into a focused subset of key, specific priorities. Furthermore, ASCA will increase emphasis on research and industry collaboration, akin to programs like the CRC-Ps.

DARPA, with its 'DARPA Model' emphasising limited tenure, shared vision, trust, and risk-taking, serves as an inspiration for ASCA. Similar to ASCA's approach, DARPA's strategic focus on vital areas aligns with the need for targeted innovation to address national security challenges. Similarly, DIU's rapid adoption of commercial technologies and its collaborative approach with non-traditional defence contractors showcase an effective strategy. The use of Other Transaction Authority agreements and the Commercial Solutions Opening process offers ASCA valuable insights into expediting innovation contracting and pathway to acquisition by encouraging collaboration with diverse entities in the commercial sector.

Chapter 4. Innovation Case Studies

Case studies are an effective way of extracting applications from past learnings to future endeavours. In this chapter, two case studies are presented as examples of sovereign Australian defence innovation transitioning into operational ADF capabilities. These cases were selected for their different era contexts (one historical and one recent) and breadth of development scope. The program factors contributing to their success, as well as their failings as lessons to draw from were analysed.

4.1 Jindalee Operational Radar Network

The Jindalee Operational Radar Network (JORN) is one of the best recognised triumphs of Australian defence innovation, renowned for its world-leading over-the-horizon radar (OTHR) surveillance capabilities. It serves as an early warning system covering Australia's northern and western maritime approaches, detecting and monitoring aircrafts and ships beyond the range of conventional radars (Defence Science and Technology Group 2023). As a sovereign defence capability, JORN exemplifies Australia's independent technological prowess in designing complex systems, as well as the nation's potential for homegrown ingenuity.

The origins of JORN can be traced back to the 1970s, stemming from early developments in OTHR made by the US (Colegrove 2000, p. 825). Moreover, the desire for sovereign control over surveillance and early warning systems, rather than reliance on allies, became a motivation for the project. The journey of JORN began as concept demonstrators in Project Jindalee, occurring over 2 phases between 1971 to 1987. These phases were conducted by the then Radar Division of the Defence Science and Technology Organisation (DSTO). Phase 1 consisted of an ionospheric study to support the feasibility of an OTHR platform, followed by the construction of two concept demonstrators in Phase 2 over separate stages A, B, and C (Defence Science and Technology Group 2023). At the conclusion of Phase 2, the platform had been proven over several years of operational trials with the Royal Australian Air Force (RAAF), culminating in the stage C upgrade and handover of the radar to the newly formed No. 1 Radar Surveillance Unit (1RSU). The full Phase 3 OTHR network acquisition commenced in 1986, with the promised surveillance capability placing high on the priorities of the Australian government's defence policy of 1987 (Parliament of Australia 1987). However, the development of a system as sophisticated as JORN was not without its challenges.

By the mid 1990s, JORN had experienced significant cost and schedule overruns into Phase 3. Further, the Australian National Audit Office (ANAO) released a highly critical report in 1995 over inefficiencies in the program's contracting practices, for example, the tendency for payments in advance of actual work being performed, driven by the desire to 'maintain Defence's expenditure' prior to 30 June each financial year (Australian National Audit Office 1996). As a result, 100% of senior management in the Jindalee Project Office was replaced (Colegrove 2000, p. 830) and RLM, a joint venture between Lockheed Martin and Tenix, took over from Telstra as the Prime contractor. The Surveillance Systems Division (SSD) of DSTO, which had evolved from the early Radar Division, was brought on to participate in the Integrated Product Teams (IPT) for requirements validation moving forward. This difference was the catalyst for a significant change in the way that RLM dealt with design issues and interacted with the JORN end customer (Colegrove 2000, p. 830). A final operational OTHR system was delivered in the early 2000s, marking the fulfilment of the original vision of an integrated multiple site radar network.

Throughout its decades-long history, the case of JORN's innovation success is annotated with clear strengths of the program, as well as salient lessons in areas of challenges that needed to be overcome. One of its notable merits was the close early collaboration between the Project Jindalee team and the RAAF, a partnership that strengthened customer awareness and support for the technology in its alignment with Defence's operational needs. Having a long-term proponent for the project within DSTO also facilitated support for the program in levels of government, especially when driven by an identified missions priority as in the 1987 Policy Information Paper (Parliament of Australia 1987). Similarly, the evidence could point to the failings in execution and the contracting model of Phase 3, leading to cost blowouts and substantial extensions in time to delivery. Following the re-evaluation of the program's management and execution model in Phase 4, the restructuring of the project team to work in closer tandem with the SSD and end customer played an important role in correcting many of the program's earlier weaknesses. The combination of technical expertise, cooperation, and effective project management undoubtedly contributed to the achievement of JORN being the best of type OTH radar in the world today.

4.2 Passive Radar

The history of passive radar dates to the early days of radar in 1935 when the Daventry experiment was conducted in the United Kingdom (Kuschel, O'Hagan, 2010). In 1935 the end user and use-cases for passive radar was not obvious however in the modern time where the spectrum is flooded, the potential applications are clearer. Passive radar, as the name suggests, is "quiet". Unlike traditional radar which sends out a burst of radio activity and seeing what bounces back, passive radar technology picks up disturbances in existing radio activity. Passive radar technology has evolved to modern times and its development has been supported in Australia via deep-technology research at the Defence Science and Technology Group (DSTG). In the early 2000s the ADF identified Passive Radar as one of its most critical Sovereign Industrial Capability Priorities (SICP) (DoD, 2020).

In 2017, the technology was transitioned from the DSTG to two private companies for development separately via the DIH to two separate and unrelated Adelaide based Australian SMEs, namely Daronmont Technologies (Daronmont) and Silentium Defence. The development progress of these two companies on the same technologies is intriguing and the question may be asked could the outcome have been different, and advantageous, if Defence innovation frameworks could encourage companies to collaboration of the same technology for faster and better outcomes.

In 2017 Daronmont won a three-year $8.6m investment from the DIH to develop and deliver a portable version of the passive radar system for the Australian Army (Defence Innovation Hub, 2018). This product was successfully demonstrated during military trials in 2020. The ADF is not known to have procured Daronmont's portable version of the passive radar system even though Australian Army trials were successful. This resulted in Daronmont to examine different markets, such as the USA, and in 2020 Daronmont signed an agreement with Ascent Vision Technologies (AVT) for manufacturing and marketing the man-potable system in the United States (Daronmont 2023).

The ADFs decision to not procure the Daronmont passive radar may be the result of a risk adverse culture and not considering the potential applicability of products where a domestic non-threat environment is prevalent. The decision to manufacture the product overseas also points to the learning for Defence to encourage streamlined procurement and contracting processes to incentivise SMEs. Similarly, the development of the SYPAQ Cardboard drones which were also not procured locally, rather, supplied to Ukarine (SYPAQ, 2023).

Silentium Defence received the first of a series of DIH contracts in 2017 when it was awarded $1.5M to develop their passive radar product, now known as Maverick M-Series (Defence Innovation Hub, 2018). In 2020 Silentium Defence was awarded a further $2M contract to continue development of its MAVERICK M-Series passive radar for land tactical situational awareness (Defence Innovation Hub, 2020). Unlike Daronmont's passive radar product, in 2021 Silentium Defence signed a $7.4 million contract to deliver its Maverick M-series passive radar system to the Australian Army and it has also been included as part of Lockheed Martin successful AIR6500 solution offering for the ADF (AFR, 2023). Similar to Daronmont, in 2023 Silentium Defence has announced its first US sales of the Maverick M8 passive radar system, and establishment of a US entity.

Daronmont focused on Defence application for passive radar using the DIH funding, while Silentium Defence applied this dual-use technology (independent of the DIH) to commercial applications such as drone surveillance and space surveillance and advance their Defence offering. A learning may be, that Defence innovation frameworks should be flexible enough to open-up dual-use opportunities, so products have wider commercial appeal and capital funding.

Chapter 5. Industry Research & Response Themes

5.1 Themes Arising from Interviews

A component of the research was shaped through structured interviews with diverse stakeholders, including representatives from Defence, the defence industry, academia, SMEs, and DIOs. The data recorded during each interview was categorized. Analysis revealed several themes to be common amongst the interview responses. The strength of these themes amongst the interview responses is illustrated by Figure 5.1-1.

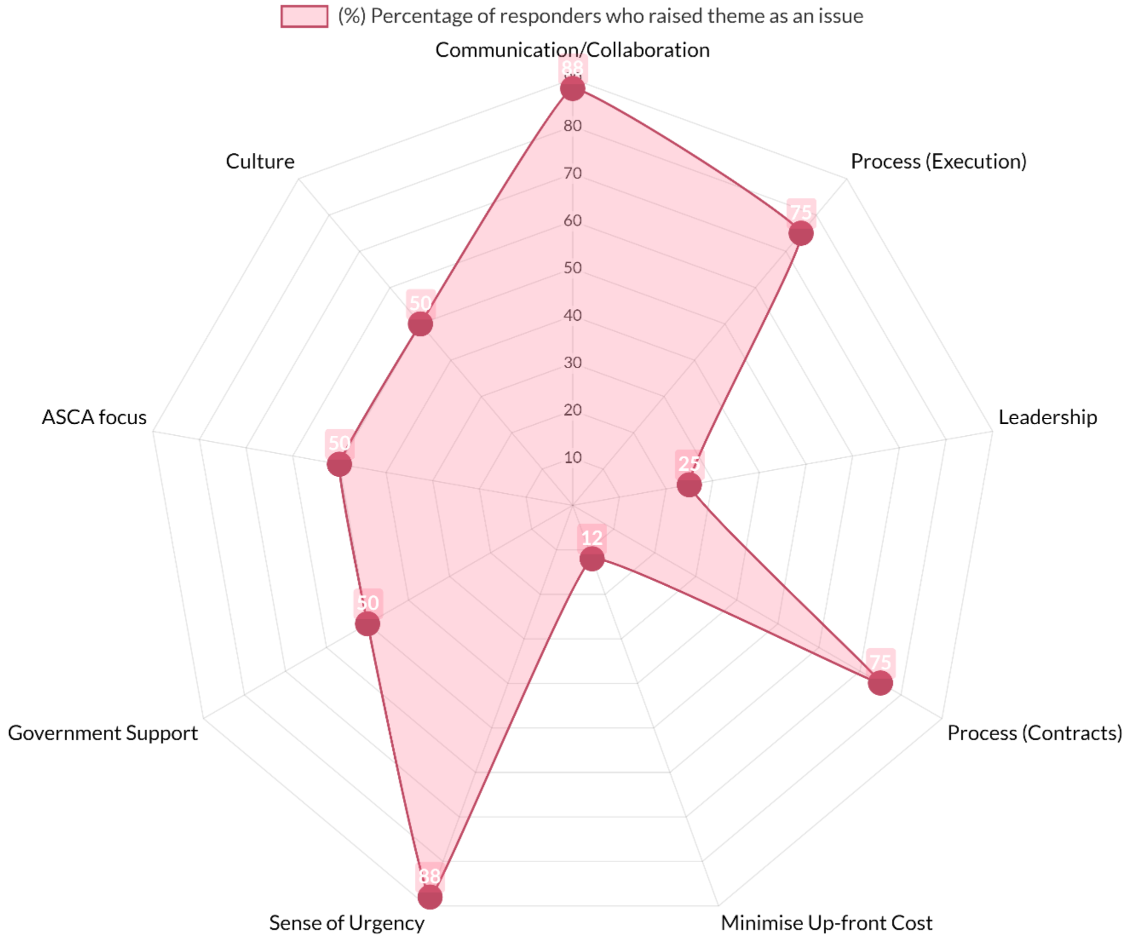

Figure 5.1-1: Interview Response Themes

Analysis revealed the prevailing themes to be:

1. Culture and Collaboration
2. Contracts
3. Execution Process
4. Sense of Urgency

It was noted that the culture and collaboration were the foundation of the effective contracting and execution of a program. Sense of urgency is a sub element which features in all three aforementioned themes.
The following sections in this chapter explore each of the prevailing themes in relation to ASCA and rapidly bringing innovations to the war fighter.

5.1.1 Theme One: Culture and Collaboration

From the interviews conducted, the following findings were noted in relation to culture and collaboration within the innovation ecosystem:

- The innovation ecosystem and DIOs were noted to be stifled by risk-averse culture within broader defence industry
- Risk management process / assignment of risk was cited as being often unclear
- End user participation during early stages of the projects was identified as a key success factor for programs
- End user collaboration was cited as being often poorly implemented, leading to challenges with:
    - Design iteration process
    - Solution relevance / demand
- Proactive engagement of innovative non-defence companies was identified as lacking
- Transparency about the key missions, clarity of capability needs and challenges were associated with program success
- Open and regular communication channels between DIOs and defence industry were connected to perception of successful innovation
- Peripheral consideration of, and alignment with, other innovation grants and initiatives was noted as an area of concern for existing DIOs and ASCA
- The influence and guidance of a role-model organisation was noted for non-defence innovators, government, industry and academia was noted as a factor to the sustained success of the broader innovation ecosystem going forward
- Alignment amongst DIOs and grants with regards to industry vision and focus areas, such as the DSR, was noted as an ongoing challenge
- It was noted different ecosystem stakeholders had different definitions of "innovation" – leading to misaligned expectations and intentions
- Transparency with missions and scenarios to drive direction was highly regarded for innovation programs
- Regarding stakeholder confidence in the ecosystem: it was suggested that ASCA needs to be successful in expediting innovations to the warfighter in order to demonstrate that it offers something tangible over and above previous DIOs and becomes enduring
- Connection of SMEs with private investors to secure capital and resources was noted as an area of the ecosystem lacking focus

5.1.2 Theme Two: Contracts

From the interviews conducted, the following findings were noted in relation to contracting within the innovation ecosystem:

- Prompt contract award was defined as requisite for successful innovation programs
- Limiting upfront costs to innovation companies was cited as a key factor for nurturing innovation, however, was more often undone by the rigid or overburdening contracting requirements
- A well-defined and streamlined contract award setup process was identified as a key factor for successful programs. Specifically, effort setting up contracts was a shortfall noted to cause distraction from innovation
- Clear guidance regarding IP handling and the right of first refusal was cited as required to attract innovators, however, at times poorly defined
- Innovation challenges with prompt prototype agreements were cited as exemplar elements of successful innovation programs
- The shortage of practical contracts which deliberately balance the trade-off for get solutions to end user faster against testing rigour against was identified
- The streamlining of contract deliverables with selectivity regarding tying CDRLs to milestones was noted as requisite for successful innovation programs

5.1.3 Theme Three: Execution Process

From the interviews conducted, the following findings were noted in relation to execution process within the innovation ecosystem:

- Lack of product focus and leadership was identified as a limiting factor for innovation programs
- A phased, complete scale up pathway map was cited as a gap for the broader ecosystem
  - Specifically, it was noted that the ecosystem was too convoluted with many options and unclear program interfacing or handover
  - Companies have little visibility or security for a complete pathway in scaling-up a new product to commercialisation
- It was noted that projects lost support when ADF sponsor changed, or working relationships were revolving
- The lack of acquisition pathway guidance in earlier stages of programs was noted to be a reason for low attainment acquisition contract through DIOs
  - The lack of clarity for interface with CASG was cited to have detriment to the effectivity of programs delivering of solutions to the warfighter
- The absence of a rapid procurement process for urgent innovation solutions was identified as a problem area in the current innovation environment.
- Lack of attention to academia in early-stage R&D was identified as a high risk of an evolving ecosystem
  - Noting that NGTF as funding of $1.2B is being absorbed by ASCA, academia funding for defence innovation is rapidly approaching a cliff such that future funding to support the defence innovation ecosystem is unclear
- It was noted transparency regarding sovereign requirements (or absence of) for any program was requisite for effectivity

5.1.4 Theme Four: Sense of Urgency

From the interviews conducted, the following findings were noted in relation to sense of urgency within the innovation ecosystem:

- Time-to-award across the ecosystem noted to be a lengthy process which was lacking a sense of urgency
- Time lost due to waiting on minister decisions and announcement was cited as a cause for delays to previous DIO programs
- Unclear scale-up pathways were noted as one factor limiting the pace at which innovation developments could establish and progress from early-stage R&D to acquisition
- Long waiting times were cited for outcomes related to innovation challenges including prototype agreements
- Lack of a Minimum Viable Capability centric environment was claimed as contributing factor limiting the pace of innovation
- Lack of delegated authority was noted to be a challenge which was limiting the agility of DIOs and programs
- It was claimed that "making everyone happy" had held back developing capabilities but "picking winners" had expedited

Chapter 6. Recommendations

The research presented in this paper on revealed four prevailing themes of Culture and Collaboration, Contracts, Execution Process and Urgency. Through research and industry interviews, understanding of the themes led to establishing recommendations for the Australian Strategic Capability Accelerator (ASCA), to be successful in bringing rapid innovations to the war fighter. The following sections in this chapter describe the recommendations resulting from the themes detailed in Chapter 5.

6.1 Culture & Collaboration

6.1.1 Recommendation One: Embed the End User

End user participation during early stages of the projects was identified as a key success factor for programs.

End user collaboration was cited as being often poorly implemented, leading to challenges with:

- *Design iteration process*
- *Solution relevance / demand*

The recommendation is for ASCA to form innovation alliances between stakeholders, specifically, including the integration of ADF Service Members within ASCA missions. This might look like targeted innovation partnerships with different brigades according to specialty area suitability.

Collaboration with the end user will cut out unnecessary complexity in the iteration process.
And, as the end user will share their ideas through the development cycles, it guarantees the correct product solution gets to the end user in the quickest development time.

An example of this is demonstrated in Section 4.1 Jindalee Operational Radar Network, where close collaboration between DSTG and RAAF spurred rapid development of prototype radar in early Phase 2. Similarly, the lack of end user communication led to project delivery issues in Phase 3.

6.1.2 Recommendation Two: Reduce Risk Averse Culture

Risk-adverse culture within the broader defence industry by having clear risk management processes and clear assignment of risk was identified as a key success factor.

Unclear risk management processes and assignment of risk was cited as stifling the innovation ecosystem and DIOs.

The recommendation is for ASCA to help stakeholders within and interfacing to the innovation ecosystem with understanding, allocating and owning risk through a simple risk management process, targeted at innovation programs. It should be considered such that innovators are not overly exposed to risk, and that other stakeholders share in the risk.
In addition, reinforcing the tolerance for failure as a consequence for transformative innovation should be a focus.

This could be explored by defining the ways in which failures can be turned into learnings incorporated into other endeavours. This recommendation is exercised by DARPA culture which actively recognises and rewords work that fails in pursuit of major breakthroughs (see 3.3.1 DARPA**).**

6.1.3 Recommendation Three: Transparency and Communication

Transparency, clarification of needs and open communication was identified as a key success factor.

Transparency about the key missions, clarity of capability needs and challenges were associated with mission success. Open and regular communication channels between DIOs and defence industry were connected to the perception of successful innovation.

The recommendation is for ASCA to regularly and clearly communicate the problem, mission, and capability need, yet still be open minded to new ideas from stakeholders. Specifically, engaging in transparent communication will enable ASCA to foster a collaborative environment

The importance of transparent communication culture was exampled by the Passive Radar DIH program which was led in parallel by two companies and may have achieved faster more effective outcomes if the innovation program framework facilitated transparency and communication between stakeholders (refer 4.2 Passive Radar)

6.2 Contracts

6.2.1 Recommendation Four: Well-Defined Contracts & Award Setup Process

Prompt contract award was defined as requisite for successful innovation programs

A well-defined and streamlined contract award setup process was identified as a key factor for successful programs. Specifically, effort setting up contracts was a shortfall noted to cause distraction from innovation.

Limiting upfront costs to innovation companies was cited as a key factor for nurturing innovation, however, was more often undone by the rigid or overburdening contracting requirements.

The recommendation is for ASCA to define a clear process on how to set up fit-for-purpose contracts for their missions. Specifically, to develop a streamlined contracting approach which will enable stakeholders to rapidly achieve lean contracts for their missions. In addition, ASCA could develop and share with the ecosystem their own suite of "recommended contracting processes and templates for innovative developments". It is noted that this approach must guide and encouraging flexibility, not stifle it.

Post implementation of this recommendation could see adoption of a new approach to both innovation and capability development contracting across the broader ecosystem and industry. Beyond the focus of their own missions, ASCA could provide all stakeholders with examples on how to rapidly achieve lean contracts. Guidelines for lean innovation development-oriented contracting could increase cohesion and standardisation of approaches across the broader industry, leading to more rapid innovation delivery to the war fighter. A specific advantage of this recommendation would be decreased barriers to entry for non-traditional defence innovators.

The success of streamlined innovation-focused contracting, particularly in rapid contracting processes, is demonstrated by the DIU's effective utilisation of their OTA framework (refer 3.3.2 Defence Innovation Unit).

6.2.2 Recommendation Five: Practical Contracts, Suited to Innovation

The shortage of practical contracts which deliberately balance the trade-off for get solutions to end user faster against testing rigour against was identified.

The streamlining of contract deliverables with selectivity regarding tying CDRLs to milestones was noted as requisite for successful innovation programs.

The recommendation is for ASCA to employ fit-for-purpose innovation contracts which balance the speed and testing rigor factors against the MVC requirement. These practical contracts are to be based on the nature of MVC context factors and the relevant stages of the commercial technology pipeline. To enable streamlined contract deliverables, CDRLs are to be tied to contracts sparingly, consistent with the flexible approach detailed in 6.2.1.

This contracting approach will result in tailoring on a mission-by-mission basis with a focus on MVC capability requirements and should be available for review during or prior to RFT phase. This allows SMEs to understand the contracting requirements in advance of the mission RFT, allowing them to focus on MVC solutions and rather than contract negotiation and administration which can be prohibitively costly and shift the

6.3 Execution Process

6.3.1 Recommendation Six: Scale-up Pathway Mapping

A phased, complete scale up pathway map was cited as a gap for the broader ecosystem. Specifically, it was noted that the ecosystem was too convoluted with many options and unclear program interfacing or handover. Companies have little visibility or security for a complete pathway in scaling-up a new product to commercialisation.

The recommendation is for ASCA to publish a pathway-to-acquisition map, illustrating to stakeholders the scale-up routes within the defence innovation ecosystem and boundaries of DIOs, grants and other initiatives. It should address its own presence including inputs and connections within the space regarding its own three pillars. ASCA should illustrate any interfaces to CASG and other potential commercialisation methods.

With a clear pathway mapped out for all stakeholders to consider, the ecosystem may have a better chance at focusing on ensuring continuity and understanding how innovation development can avoid stagnating between steps. Furthermore, providing clarity on pathways, interfaces, and scope for stakeholders within the ecosystem will aid in managing expectations effectively.

The importance of scale-up pathway mapping is exampled through the definition of, and execution against, a CTP framework by other international ecosystems (refer 3.3.4 Commercial Technology Pipeline Model Overview (US)). The requirement for clear ecosystem mapping including any commercial offramps is further evidenced by synthesis described in Section A.1 Study of US Defence Innovation Ecosystem Challenges from the 2023 RAND Report.

6.3.2 Recommendation Seven: Rapid Procurement Process

A rapid procurement process was identified as a key success factor for programs

The absence of a rapid procurement process for urgent innovation solutions was identified as a problem area in the current innovation environment.

The recommendation is for ASCA to establish a rapid procurement process with other agencies and stakeholders in the innovation lifecycle as part of an effective execution which may include procurement via non-traditional agencies. Specifically, the ability for employing rapid Capability Technology Demonstrator phases which bypass any stifling processes. The qualifiers, if any, for engaging such fast-tracked processes should be defined.

6.3.1 Recommendation Eight: Early-Stage R&D Capture

Lack of attention to academia in early-stage R&D was identified as a high risk of an evolving ecosystem

- *Noting that NGTF as funding of $1.2B is being absorbed by ASCA, academia funding for defence innovation is rapidly approaching a cliff such that future funding to support the defence innovation ecosystem is unclear*

The recommendation is for ASCA to clearly identify the mechanism for Academia engagement and research input to ensure early-stage R&D is not left out. Particularly, ASCA's EDT pillar will need to consider how it will effectively fund and leverage early stages of innovation research and concepts.

6.4 Sense of Urgency

6.4.1 Recommendation Nine: Define Minimum Viable Capability

Adequately defining a Minimum Viable Capability was identified as a key success factor for programs

It was noted that the MWV Defence Directive should drive faster innovation and combat ready prototypes, but lack of a Minimum Viable Capability centric environment is a contributing factor limiting the pace of innovation.

The recommendation is for ASCA to define the MVC clearly for each mission in the context of problems rather than the product specifications. Specifically, detail expectations for capability requirements and definition of how a solution's effectiveness will be quantified and validated against the MVC.

This focus will encourage an 'engineering design' philosophy founded on understanding the problem. The research has indicated that this capability-centric rather than solution-centric approach best facilitates raw innovations which 'solve the right problem'.

Furthermore, detailed requirements for form-fit-function, compliance and development time and other product specification should be prescribed sparingly – only when justified by the mission context.

ASCA will have a much greater chance of expediting meaningful capabilities to the end user with this clear yet non-prescriptive approach.

6.4.2 Recommendation Ten: Delegated Authority and Empowerment

Delegated authority was identified as a key success factor for programs.

Lack of delegated authority was noted to be a challenge which was limiting the agility of DIOs and programs, particularly in instances of where DIH went to the Defence Minister for approval which slowed the whole process.

Time lost due to waiting on minister decisions and announcement was cited as a cause for delays to previous DIO programs

The recommendation is for ASCA Program Managers to be delegated authority to be able to make rapid and effective decisions without the need of the Defence Minister.

DARPA has demonstrated value through their distinctive program manager philosophy which empowers decision making at lower levels of delegated authority (refer 3.3.1 DARPA).

6.4.3 Recommendation Eleven: Clear Vision and Focus

A clear vision and focus for programs within all three pillars were identified as key success factor for ASCA.

It was claimed that "making everyone happy" had held back developing capabilities but "picking winners" had expedited innovation. ASCA Missions shows clear focus, however, a strategy to ensure funds are not spread too thin is unclear. There needs to be a clear vision for each program they back.

The recommendation is for ASCA to provide a vision of their three pillars. This could include developing a method of evaluating the effectivity of the organisation against delivering on its vision. Furthermore, to ensure that their focus is on expediting innovations to the war fighter rather than simply attempting to keep all stakeholders pleased and funded. With a vivid vision set, ASCA could define KPIs to be assigned to self-assess their innovation impact and success against. Assessment criteria should be developed in line with Defence's priorities.

Defining a clear vision has demonstrated value in many organisations, one exemplar is the Medical Research Futures Fund's clear intention relating to each of its four themes. (refer 3.2.2 Medical Research Futures Fund)

Chapter 7. Future Work

The following topics provide opportunity for further research on this subject:

- Explore alternative CASG contracting model and the worked applicable of CASG 2.0 to procurement examples?
- Could ASCA type framework be implemented outside of the Australian government, potentially by private industry?
- How can Primes better support SME to have better innovation capability delivery outcomes?
- What objective Key Performance Indicators (KPI) could ASCA use to assess their innovation impact and success in line with Defence's priorities?
- How could learnings from innovation frameworks, DIOs or grants in Europe, Singapore, China or Russia be applied to ASCA?
- How will ASCA make clear its preference for 'sovereign footprint'?
- A deeper study may find it useful to contrast international defence innovation ecosystems against Australia's for a broader empirical case study

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Appendices

A.1 Study of US Defence Innovation Ecosystem Challenges from the 2023 RAND Report

This appendix provides a summary of the recommendations from the 2023 RAND Report, *Strengthening the Defense Innovation Ecosystem* (Kotila et al. 2023), for targeting the critical shortfalls of the US defence innovation ecosystem.

Cultivate Desired Ecosystem Characteristics

- Foster a Shared Sense of Mission
  A well-functioning Defence Innovation Ecosystem is marked by stakeholders who share a common mission—advancing promising technology throughout the innovation life cycle, from ideation to fielding. This shared mission aligns the ecosystem's efforts toward a common goal.

- Clear Goals and Objectives while Supporting Flexibility in Execution
  Establishing and widely communicating clear goals, objectives, and desired outcomes are paramount. When all stakeholders understand these objectives, they can collectively work toward achieving them. Simultaneously, the DoD must uphold its commitment to maintaining adaptability and nimbleness when implementing department-level strategies, policies, plans, and directives.

- Defined Roles and Responsibilities
  Effective functioning relies on each organisation comprehending its roles and responsibilities while maintaining an awareness of others' contributions. Clarity in roles enhances efficiency and minimizes gaps.

- Information Sharing and Collaboration
  Facilitating information sharing, including promising technologies, resources, priorities, and collaboration opportunities, fosters effective coordination and collaboration among stakeholders. Feedback mechanisms enhance the iterative nature of innovation.

- Implement Incentive Structures with Metrics and Accountability Mechanisms
  Align incentive structures with the ecosystem's goals and outcomes. Develop metrics and accountability mechanisms that encourage collaboration and innovation across all stakeholders.

- Comprehensive Functions
  All essential functions within the ecosystem must be performed comprehensively, leaving no gaps in individual responsibilities. Smooth transitions of technologies between functions ensure a streamlined process

Strengthen Ecosystem Identification, Development, and Adoption Functions

- Strengthen Technology Scouting:
  Develop more rigorous and coordinated approaches to technology scouting. Engage in outreach efforts, publish requests for information, and encourage sharing of the resulting business developed on emerging technologies across the DoD enterprise.

- Encourage Problem Sharing:
  Encourage CTP stakeholders at all levels to share DoD problems across the enterprise. Establish a repository for DoD problems and promote its use among innovation organizations, services, and combatant commands.

- Establish a Comprehensive Portal:
  Create a comprehensive, integrated, and searchable portal for new entrants to access DoD opportunities. This portal should provide information on pathways, opportunities, and guidance for commercial technology integration.

- Navigation Support Services:
  Offer navigation support services to help early-stage ventures understand and navigate the DoD bureaucracy, policies, and technology development processes. This will address challenges faced by businesses once they complete accelerator programs.

A.2 Categorisation of Market Spaces for prominent US DoD DIOs

Table A2 1: Categorisation of market spaces for prominent DoD DIOs

Category	Description	Organisation
Accelerator	An accelerator is a dedicated program designed to accelerate the growth of an established company. They usually offer financial support in the form of seed funding and access to a network of experienced mentors. Accelerator programs typically span a few months, during which participants receive structured guidance and mentorship. The culmination of the program often involves an opportunity for participants to present their business ideas to potential investors.	Allied Space Accelerator, Catalyst Accelerator, Starburst Accelerator, T3 Accelerator
Challenge	A challenge refers to a single or recurring event, such as a contest or competition, designed to tackle problems for which emerging technologies could offer innovative solutions. It can serve to widen the range of individuals or entities addressing crucial issues. Challenges may include cash incentives as prizes, or may be integral components of a broader Challenge-Based Acquisition (ChBA) strategy, which could lead to the potential award of government contracts.	AFWERX, Challenge.gov, DreamPort, ERDCWERX, Hyperspace Challenge, MGMWERX, NSIN, SOFWERX, STRIKEWERX, xTechsearch
Connector	Connector organisations have a clear mission: to establish networks and foster relationships among government entities, industry players, private equity firms, and academic institutions. Their primary goal is to facilitate partnerships aimed at solving complex problems by generating innovative and fresh solutions through collaboration and mutual engagement.	AFWERX, Defense Innovation Marketplace, DEFENSEWERX,| Doolittle Institute, ERDCWERX, MGMWERX, NSIN, NavalX, RRTO, SOFWERX, STRIKEWERX
Funding Opportunity	Funding opportunities are made available by organisations with the intention of investing in and increasing the likelihood of success for entities, often including start-ups or small businesses, that are actively pursuing technological advancements. It's important to note that these funding opportunities differ from government contracts or agreements.	Allied Space Accelerator Catalyst Accelerator, In-Q-Tel, RRTO, Starburst Accelerator, T3 Accelerator
Government Contracting Authority	An organisation possessing government contracting authority has the capability to initiate contract awards or agreements for government projects. Such organisations employ Contracting Officers who hold the necessary authority and authorisation to execute these awards and agreements on behalf of the government.	AFRL, AFWERX, Army Applications Lab, ARL, Army SBIR/STTR, DARPA, DIU, DoD Labs, DreamPort, NSIC, NRL, Navy SBIR/STTR, OT Consortia, RIF

Incubator	Incubators primarily concentrate on nurturing start-up and entrepreneurial ventures that bring innovative ideas to the forefront. They often offer initial funding and a shared physical workspace to foster the development of ideas, establish brand identity, and formulate comprehensive business plans. Incubators can be operated by not-for-profit organisations, government bodies, or universities, with the common goal of contributing to economic growth and advancing the state of technology within the U.S. industrial sector, particularly for the benefit of government stakeholders.	IQT, SOFWERX

A.3 History and Overview of US Non-Defence Organisation In-Q-Tel

In-Q-Tel (IQT) came into existence in 1999 during a period of significant global technological advancement. This era saw widespread internet accessibility, the emergence of mobile applications, and the arrival of the digital revolution. Government agencies like the CIA, which had been pioneers in innovation, realized they were falling behind in adopting cutting-edge and impactful technologies originating from Silicon Valley and other tech hubs. To bridge this gap, IQT was established, bringing together the security expertise of the government with the entrepreneurial spirit and innovation of Silicon Valley.

IQT invests in commercially-oriented startups backed by venture capital to discover and customize "ready-soon" technology—off-the-shelf products that can be adjusted, tested, and provided for use within the intelligence and defence community within a 6 to 36-month timeframe. IQT collaborates with key partners such as the Central Intelligence Agency, National Security Agency, Department of Defense, and others in the intelligence and defence sectors. The organisation collaborates closely with the venture capital community to identify innovative technology with the potential for both commercial success and significant national security impact.

- IQT seeks out startups with the potential to make a substantial contribution to national security and works in close partnership with them to deliver new capabilities required by customers, enhancing their technological advantage.

- IQT typically invests between $500,000 and $3 million, forging a development agreement that involves a cooperative effort between IQT and the startup to tailor the technology to meet the specific needs of government customers. Should the technology pilot prove successful, government customers have the option to procure the product directly from the company.

- IQT's technology team thoroughly assesses each technology in line with the mission capability requirements of its partner agencies. They also explore alternative approaches and rigorously validate technical claims. Concurrently, the investments team evaluates the potential for sustained success by examining each company's commercial viability, business plan, and management team.

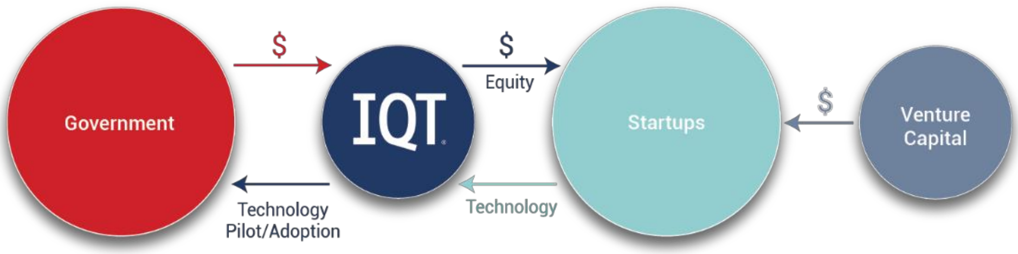

Figure A3 2: IQT Funding Interfaces

- Upon making an investment, IQT collaborates with the company and partner agencies to establish a comprehensive work program and facilitate the delivery of solutions. The process is designed to ensure that portfolio companies not only fulfill their technical potential but also commit to supporting and improving their products over the long term. IQT's model offers several significant advantages, including:

1. Accelerated product development
2. Valuable product enhancements
3. Reduced initial and ongoing costs for the national security community

IQT Labs identifies specific aspects of these challenges that can be promptly addressed and made available as open-source solutions through agile and streamlined approaches.

- By engaging in collaboration with a diverse network of experts from government, academia, and industry, IQT Labs conducts experiments with emerging tools and creates prototype solutions. This proactive approach enables IQT Labs to share valuable technological insights ahead of startup initiatives.

IQT Emerge acts as a bridge, linking the U.S. government's innovation pipeline with entrepreneurial efforts to advance technology development in the national interest.

- Through IQT Emerge, government agencies collaborate to pinpoint early-stage technologies with substantial commercial potential. This initiative facilitates interactions and connections between the creators of these early-stage technologies and entrepreneurs positioned earlier in the innovation pipeline. It also offers guidance and support for the commercialization process, with the overarching objective of enhancing the prospects for successful commercialization in support of U.S. national security endeavours.