Australian Government

Department of Defence

National Intelligence and Security Discovery Research Grants Program

Round 1 (2021): National Security Challenges

Science and technology plays a crucial and at times, dichotomous role in both strengthening and threatening a prosperous, secure and cohesive Australia. Australia's national security agencies, including those within the Defence and Home Affairs portfolios, operate within increasingly complex and rapidly shifting environments driven by multiple threat and opportunity vectors, including science and technology. Outcomes from our collective strategic outlook and scenario forecasting for the future out to 2040, including the Defence Strategic Update (DSU), signal that we are entering an era of significant change, unprecedented in scale and pace – both geo-strategically and technologically. In order to enable rapid responses to these challenges, we need to ensure that our national security capabilities are supported by science and technology that enhances strategic advantage.

The National Security Science and Technology Centre, within the Defence Science and Technology Group, coordinates whole-of-Government science and technology for national security in order to support Australia's economic prosperity, national security and social cohesion.

Below are research topics focused on science and technology challenges for national security. The target time horizon is 2040. Proposals are invited that will significantly advance the sciences pertaining to these challenge topics. We are seeking research with game-changing potential.

Serial	NSST Priority	Topic	Description	Security Layers[1]
1	P3IR	**Influence in the Pacific**	The Indo-Pacific is described as Australia's area of most direct strategic interest, within which, Australia must be capable of building and exercising influence in support of shared regional security objectives. Commentators have noted that the Pacific, in particular, is becoming more strategically crowded and contested, and that despite maintaining strong aid and defence relations, Australia's influence may be declining relative to other actors. This challenge invites proposals that will explore and empirically verify the means by which influence is acquired and exercised in the Pacific. The research objective is to provide a rigorous theoretical and empirical basis to inform development of Australian policy on the security of strategic interests within the region.	Shape
2	P3IR	**Resilient Supply Chains**	As a result of globalisation, Australia is strongly connected into the international network of physical flows (in the forms of physical trade and the movement of people) and information flows (in the form of financial and social exchanges). This has generated much prosperity in Australia over the last few decades, but has also introduced new vulnerabilities, which the current COVID-19 pandemic, and rising international tensions, have highlighted (e.g. PPE and fuel stocks). Research is sought that explores Australia's resilience to global and regional shocks, by ensuring our critical supply chains, infrastructure and systems are identified, protected and managed.	Prepare Prevent Protect Contain Recover
3	P3IR	**Disinformation Detection and Counter Narratives**	Disinformation has the potential to challenge social cohesion, undermine trust in institutions of government and disrupt a range of domestic and national security initiatives, such as the government's response to public health crises. This challenge invites multidisciplinary proposals that will identify and measure the impact of disinformation on Australia's social cohesion, develop disinformation detection and counter-narrative response technologies. Proposals may also examine how we could share capabilities with likeminded countries to strengthen their resilience to disinformation. The objective is for research that will improve how Australia prepares for, protects from, prevents and responds to malign disinformation.	Prepare Shape Prevent Contain Recover

[1] Nunes-Vaz, R; Lord, S, "Designing physical security for complex infrastructures," *International Journal of Critical Infrastructure Protection*, 7(2014), pp178–192.

Serial	NSST Priority	Topic	Description	Security Layers[1]
4	P3IR BS&IM IS&FS	**Detection for 2040**	This challenge invites research proposals in detection science and technologies relevant to national security. Detection technologies are required for many national security applications. Examples are the detection of contraband within imports; threats in air cargo and freight; chemical, biological, radiological and nuclear hazards or threats; forensic evidence (DNA, finger prints, chemical signatures); and the positive identification of person(s) crossing a border. Performance in sensitivity and stand-off range for many of these detection capabilities will be important. Field portability, in some applications, is also critical.	Prevent Investigate
5	BS&IM IS&FS	**Human Identification and Vulnerability Assessments**	Managing physical identity is becoming increasingly important for the security of citizens. While citizens seek to cross international borders, and transact freely and with confidence, criminal and other elements may exploit this movement through identity fraud. Governments invest in technologies to identify people, from paper-based Passports to the facial recognition abilities in Smart Gate. Criminal investigators seek positive identification capabilities; and agencies seek also to understand the weaknesses and vulnerabilities of these technologies, because an adversary could exploit these to deceive. Vulnerability Assessment ('White-Hat' ethical hacking) that is efficient and scalable is an emergent R&D need that is currently underdeveloped. Proposals under this topic are specifically sought in: • approaches for strong human identity technologies • scalable vulnerability technologies for existing human identification solutions.	Prepare Prevent Investigate
6	P3IR BS&IM IS&FS	**Analysis and decision support for 2040**	This challenge invites research proposals in data analytics using AI/ML for classification and decision-making technologies relevant to national security. Situational awareness and understanding are important in national security, because accurate and timely mastery of the facts, evidence and context supports superior decision-making outcomes. Applications range from strategic (e.g., crisis management, strategic geo-political policy development) to operational (e.g., criminal investigation, forensic evidence sense-making) to tactical activities on the ground. Aspects for such capability include data muster and staging; fusing high volumes of heterogeneous data; data analytics; scenario-based planning; vulnerability assessment; hypothesis testing; machine (supported) cognition and inferencing; classification; decision-making; explainable decision support, and scenario predictive modelling.	Prepare Shape Deter Prevent Protect Contain Recover Investigate

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7	IS&FS	**Artificial Intelligence (AI)/Machine Learning (ML) for Investigative Support and Forensics Science**	With the increase in electronic storage of information and the use of digital devices, the utilisation of electronic information for intelligence and investigative activities is becoming complex and difficult, particularly for mustering disparate heterogeneous data for sense-making (e.g., extracting facts, associations, links). This challenge seeks research to automate the processing capabilities of forensic and investigative specialists, in the tasks of rapid interrogation, exploitation and evaluation of case data derived from dissimilar data sets. The goal is the adaptation by machines of existing human practices, to directly increase capacity, productivity and situational awareness capabilities from data fusion. To achieve this, enhanced data analytics and engineering will be required to accommodate numbers of disparate data sets. The improved productivity from AI/ML automation of these cognitive tasks will reducing processing times, which is critical during national security operations. Additionally, potential benefits of AI/ML may include contribution to risk mitigation, threat identification, and predictive modelling. Practical deployment of this capability to decision makers is critical.	Investigate Prevent
8	P3IR	**Robust Consequence management improving Australia's responses to, and recovery from, disasters and emergencies**	Whether anthropogenic or natural, events that can cause mass harm or mass damage have immediate and long-term effects on the economic prosperity, security and social cohesion of the Australian people. Recent events such as the Salisbury poisoning in the UK, the COVID-19 pandemic world-wide, and the bushfires in Australia, have highlighted the need for robust systems for the immediate containment of events and effective recovery once the immediate crisis is over. This topic seeks to generate research insights that ultimately improve the capabilities of Australian government, industry and society to respond to, and recover from, these types of events.	Prepare Protect Contain Recover Investigate