

**1. What is your occupation?**

- Researcher
- University Staff
- Business / Industry
- Government
- Higher Education Peak Body
- Industry Peak Body
- **None of the Above**

**2. Are you responding as an individual or an organisation?**

- Individual
- **Organisation**
- None of the above

**3. What organisation do you work for?**

National Committee for Space and Radio Science

**4. Are the recommendations appropriate to the current NRI environment?**

See response to Q8 below regarding recommendation 8.

**5. Do the principles articulate the vision and key elements required of NRI, including investment?**

Yes.

**6. The NRI Roadmap has a clear focus on identifying the NRI investments required to support Australian research over the next 5 to 10 years. Are there any national research infrastructure needs missing in the draft Roadmap?**

Section 3.6 focuses on space but misses important aspects. The space sector is being transformed by massive increases in space-based instrumentation and capabilities including satellite mega-constellations and long duration human space missions. This presents new scientific, economic and strategic opportunities listed below, which also support priorities in other sections.

- **Space communication infrastructure.** Australia has expertise in providing communications support to international space programs, in radio and optical astronomy and associated data processing, and in quantum technology. The burgeoning growth of space activity will drive vast increases in data volumes. Research infrastructure to develop and demonstrate next generation networked satellite-to ground communication capability (e.g. free space optical to fibre networks) can position Australia as a key hub for secure, high bandwidth data distribution, analysis and applications.
- **Space monitoring infrastructure.** Strategic and sustainable use of space requires new capability in space situational awareness, while space weather threatens all space-reliant services. Various

Australian organisations operate a diverse suite of sensors across our extended territories. Consolidation of this infrastructure to support a coordinated research program can help protect Australian assets and position Australia as a major actor in protecting the global commons of space.

- **Space life sciences infrastructure.** The physiological and psychological challenges of long duration crewed space missions have many analogues with the provision health care for remote, ageing and sedentary populations, and provide opportunities for development of new biotechnology and agricultural products. Research infrastructure is required to enable engagement of Australia's world standard medical, life and agricultural sciences with emerging opportunities.

**7. A key priority for Australia is to enhance research translation. The 2021 NRI Roadmap identifies some reforms and investments to achieve this. What other reforms would help deliver this priority?**

See also the response to Q8 below. Many government initiatives focus on industry-driven outcomes and pre-commercial or commercial TRL-level measures. However, the underpinning basic research is at TRL1-2. There is a gap in incentives and grant programs targeting translational research at the concept and proof-of-concept levels, and in schemes encouraging developments across the TRL scale. The idea of applied engineering infrastructure is applicable to the space sector but also requires streamlined and standardised IP agreements and other arrangements between state and federal governments and funding entities to reduce inefficiency and promote engagement, a national framework to protect domestic IP, and measures to ensure research groups are readily able to develop IP to sustain and grow their activities.

**8. The Roadmap proposes that Australia could make landmark investments to drive step changes in research and innovation over the next 10 to 15 years. Do you agree with the assessment of potential areas for investment in the report? What other areas do you consider might fit the definition of landmark investment?**

Australia has critical dependencies on space-derived services and capabilities. The Federal Government has therefore identified space capability priorities in the Modern Manufacturing Initiative, in Defence's Sovereign Industry Capability Priorities, and in the Security Legislation Amendment (Critical Infrastructure) Bill 2021, and has tasked the Australian Space Agency to grow the space economy. These schemes mostly focus on discrete strategies with rapid user-driven outcomes. A sustainable space sector requires a foundation of excellence in space science research. A more coherent, whole of system approach is required to engage the many diverse elements of the space sector with the research community in order to grow a sustainable ecosystem.

One means to achieve this is through commitment to an ongoing, national mission-oriented space program. Our partner space agencies recognise this and have made science-focused space programs and missions core elements in their overall strategies. Such missions stimulate innovation from conception to delivery, bringing interdisciplinary collaborators together to solve challenging problems, driving

growth of the industry sector, and promoting translation to practical outcomes across a broad range of sectors. International experience shows that the lag between investments and spillover impacts for space projects is around 3-5 years, a timeframe challenged by *ad hoc* and short duration funding schemes but within NRI timeframes.

A structured program founded upon small, cheap, science- and technology-based space missions can provide the platform for iteratively developing Australian space capability to realise missions of national importance within a decade, and a vigorous, sustainable space ecosystem including sovereign capability beyond that. Such a program would map to national priorities and provide confidence to overseas partners, funding agencies, industry and investors making long-term decisions. The program would also inspire students to pursue STEM and space-related careers, and provide the high-level training needed to embark on those careers.

**9. Please add any other comments you would like to provide to the Expert Working Group.**

**10. If you have a PDF (.pdf) or Word document (.doc or .docx) to share as part of your feedback, you can upload your file here. Please keep documents brief.**

See following page.

# NATIONAL COMMITTEE FOR SPACE AND RADIO SCIENCE



## Submission on National Research Infrastructure Roadmap

**We propose a national research priority in space science** to align with and complement civil and defence sovereign industry capability requirements, to drive innovation and collaboration and build capacity for national benefit and international impact. This may manifest as a consortium or network including key research institutions and civil, government and commercial stakeholders, with jointly articulated priorities. Our rationale is outlined below.

1. Australia has critical dependencies on space-derived capability and services, mostly delivered via global supply chains and strategic alliances. These enable economic, environmental, societal and national security priorities.
2. The Federal Government has identified space capability priorities in the Modern Manufacturing Initiative, in Defence's Sovereign Industry Capability Priorities, and in the Security Legislation Amendment (Critical Infrastructure) Bill 2021. Industry growth is targeted through the SmartSat CRC and the Moon to Mars initiative, but there is a significant workforce skills gap.<sup>1</sup>
3. A sustainable space industry sector requires a foundation of excellence in space science and technology. This is because space science R&D generates new knowledge, products and processes, stimulating the economy and providing benefits across the broader community<sup>2</sup>. However, space science is not currently recognised in the National Science and Research Priorities or in the National Collaborative Research Infrastructure Strategy.
4. Australia's space research activities contribute to new knowledge at world standard<sup>3</sup> but have developed largely through disconnected activities within an *ad hoc* funding environment and do not provide the basis for a sustainable and resilient national space capability. For that to occur, space research needs to be better resourced and funded.
5. A more coherent approach is needed to ensure Australia's research sector is enabled and effectively engaged to support Australia's space priorities. This requires an environment that favours coordination and collaboration across the diverse elements of the space ecosystem, enabling long-term planning and investment in R&D by industry, and facilitating enduring relationships between government, industry and research providers.<sup>4,5</sup>
6. Defence's innovation capabilities, including ways to improve links with academia and industry, are subject of a current review for the Minister for Defence Industry/Minister for Science and Technology. A national priority in space science research would be an important strategy.
7. A program of challenging, small, low cost science-driven space missions will stimulate innovation and can provide an effective pathway to the development of more high value missions which address grand national challenges and deliver sovereign capability.

<sup>1</sup> *Space Industry skills gap analysis*, Technical report no. 5, SmartSat CRC, March 2021

<sup>2</sup> *New Zealand space sector: its value, scope and structure*, Deloitte Access Economics, 2019

<sup>3</sup> Australian space and planetary science is ranked 8<sup>th</sup> globally. Source: *Measuring the economic impact of the space sector*, OECD, October 2020

<sup>4</sup> *Position statement – Australian space industry*, Australian Academy of Science, October 2018

<sup>5</sup> *Investment in the Australian space sector*, KPMG, January 2020