Please note: the substantive content of the 2026 NRI Roadmap Survey begins at Question 20 (w
prior questions dealing with administrative and other information).

As such all submissions that are published include the responses submitted from Question 20 on
only.

Q20.

Part 2: Research themes

2.1 NRI comprises the assets, facilities and associated expertise to support leading-edge research and innovation in Australia and is accessible to publicly and privately funded users across Australia and internationally. We are seeking your input on possible directions for future national-level investment - i.e., where the requirements are of such scale and importance that national-level collaboration and coordination are essential.

The 2021 Roadmap used a challenge framework to support NRI planning and investment. With this in mind, consider likely future research trends in the next 5 - 10 years, and with respect to one or more of the 8 challenge areas identified in the 2021 Roadmap as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or not at sufficient scale and
- describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities.

Q21.

Resources Technology and Critical Minerals Processing

n/a

Q22.

Food and Beverage

n/a

Q23.
Medical Products

n/a

Q24.
Defence

Australia has world-class expertise in astronomical instrumentation, particularly in high-precision optics, adaptive optics, signal processing, and advanced imaging. These technologies, originally developed for space observation and astronomical research, are increasingly relevant to defence applications such as missile tracking, secure communications, and autonomous surveillance systems. However, the transition of astronomy-driven technologies into defence remains unstructured and underfunded, limiting their potential to strengthen sovereign capabilities. An engagement framework similar to the US DARPA/IARPA initiatives is missing in Australia and would provide a dedicated pathway to accelerate the translation of astronomical technologies into defence solutions, ensuring that breakthroughs are not lost due to funding gaps or slow adoption. This model would: Support high-risk, high-reward research translation, adapting astronomy innovations for defence applications such as space-based surveillance, secure quantum communication, and directed energy systems. Bridge the gap between proof-of-concept and deployment, creating structured pathways for astronomy-driven technologies to become operational defence solutions. Ensure sovereign capability by investing in critical technologies locally, reducing reliance on foreign defence technology suppliers. Foster collaboration between astronomical research institutions, industry, and defence agencies, ensuring alignment with national security needs. A DARPA/IARPA-like model would enable long-term, mission-driven investment, ensuring that Australia's leadership in astronomical instrumentation continues to drive national security advancements. By aligning national research infrastructure with defence innovation, Australia can secure its position as a leader in space-based defence technologies, reinforcing both economic strength and national security resilience.

Q25.
Recycling and Clean Energy

n/a

Q26.
Space

Australia excels in ground-based optical and infrared (IR) astronomical instrumentation, led by the Astralis Instrumentation Consortium, securing multiple major contracts (four active, AUD10-40M) with the European Southern Observatory and the US-led Giant Magellan Telescope. These achievements place Australia at the global forefront of astronomical instrumentation, ensuring access to the world's most powerful research telescopes and positioning the nation as a leader in precision optical and sensing technologies. Astronomical instrumentation technologies are directly applicable to space research and exploration, making them a strategic enabler of Australia's sovereign space capability. The SPIRIT satellite, Australia's first orbital mission sponsored by the Australian Space Agency, was an astronomical observatory, demonstrating the deep connection between astronomy and space technology. Key contributions include: • High-Precision Optics and Imaging – Essential for space telescopes, satellite imaging, and planetary exploration. • Adaptive Optics (AO) for Space Observations – Originally developed for correcting atmospheric distortions in astronomy, now critical for laser communications (including quantum communication), space debris tracking, and surveillance. • Infrared and Multi-Wavelength Sensing – Astronomy-driven advances improve Earth observation, weather forecasting, and planetary surface mapping. • Ultra-Sensitive Detectors – High-efficiency, low-noise detectors enable deep-space exploration, exoplanet detection, and low-light space applications. • Precision Metrology and Optical Coatings – Techniques used in telescope mirrors and spectrographs are essential for space-based optical systems, remote sensing payloads, and navigation technologies. *Action: Establish a Baseline Investment in Astronomical Instrumentation* To fully leverage Australia's strengths in astronomical instrumentation for space applications, a dedicated national investment strategy is needed to: • Secure Australia's long-term role in global space and astronomy programs, ensuring access to leading observatories and international missions. • Support research translation pathways, enabling astronomy-derived technologies to advance satellites, deep-space missions, and space-based infrastructure. • Strengthen Australia's space industry, driving high-tech innovation, workforce development, and sovereign capability in space technology. This investment could take the form of direct baseline funding for Astralis institutes, covering recurrent engineering costs, or a rolling grant program to ensure continued participation in critical national and international projects. By making astronomical instrumentation a national research priority, Australia can lead the global space sector, ensuring long-term leadership in optical and sensing technologies that will define the future of Earth observation, planetary exploration, and space-based communication.

Q27.

Environment and Climate

n/a

Q28.

Frontier Technologies and Modern Manufacturing

The astronomical instrumentation workforce in Australia is a critical research infrastructure. These highly skilled professionals—engineers, optical scientists, detector/electronics specialists, and precision manufacturing experts—form the foundation of cutting-edge technology development. Their expertise, originally developed for astronomy research, now drives innovation in space technology, quantum sciences, advanced manufacturing, and autonomous systems. A baseline investment in this workforce will ensure that this essential infrastructure remains strong, adaptable, and connected to industry needs. With sustained support, these specialists can continue to pioneer breakthroughs not just in astronomy but across a broad range of high-tech sectors, keeping Australia globally competitive in precision technology and innovation. The technical capabilities developed in astronomical instrumentation directly align with Australia's high-tech sectors, including: •Precision Optics and Photonics – High-resolution spectroscopy, optical coatings, and mirror fabrication drive quantum computing, satellite payloads, and AI-driven imaging systems. •Ultra-Sensitive Sensors and Detectors – Originally designed for low-light astronomical observations, these advanced sensors now support biomedical imaging, environmental monitoring, and space exploration. •Adaptive Optics (AO) and Autonomous Systems – AO, developed to correct atmospheric distortions in telescopes, enhances laser communication networks, robotics, and AI-assisted manufacturing. •High-Precision Metrology and Fabrication – Techniques from telescope alignment and wavefront sensing are now critical to semiconductor manufacturing, nanoscale fabrication, and ultra-precise positioning systems. To fully leverage astronomical instrumentation expertise, a baseline National Research Infrastructure investment strategy would: •Retain and grow Australia's highly skilled workforce, ensuring long-term access to expertise in optical systems, sensors, and precision engineering. •Expand R&D service capabilities, ensuring critical staff are in place to directly support industry partners in space technology, quantum innovation, and advanced manufacturing. •Strengthen long-term industry connections, fostering structured collaboration between research institutions, space programs, and high-tech manufacturers. •Create structured pathways for knowledge transfer, enabling astronomy-driven innovations to advance satellite systems, autonomous technologies, and high-performance imaging applications. Position Australia as a leader in high-tech innovation, reinforcing its role in precision optics, photonics, and instrumentation development. Astronomical instrumentation is not just a foundation for science—it is a driver of technological leadership. By investing in this workforce as a national infrastructure, Australia will secure its place at the forefront of space exploration, sovereign industry capability, and high-tech innovation.

Q29.

2.2 The 2024 statement of National Science and Research Priorities (NSRPs) includes outcomes linked to each priority to assist in identifying critical research needed in the next 5 to 10 years.
Consider the priority statements and, with respect to one or more of the 5 priority areas as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or
- not at sufficient scale and describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities, and where relevant, refer to the underpinning outcomes and research identified in the NSRPs document.

Q30.

Transitioning to a net zero future

n/a

Q31.

Supporting healthy and thriving communities

n/a

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

n/a

Q33.

Protecting and restoring Australia's environment

n/a

Q34.

Building a secure and resilient nation

Australia's national security and resilience depend on its ability to translate research excellence into sovereign capability. A highly skilled, agile, and technically capable workforce is critical to this effort. The astronomical instrumentation community—led by the Astralis Instrumentation Consortium—represents an irreplaceable national asset, delivering precision technologies across space, defence, environment, and advanced manufacturing. Decades of investment in astronomy have cultivated a uniquely skilled, co-located, and multidisciplinary workforce—spanning optics, detectors, cryogenics, electronics, precision mechanics, and software. These teams design and deliver complex systems for some of the world's most demanding scientific environments. Today, they are applying this expertise to deliver mission-ready systems across priority national sectors. Astronomy-driven technologies are already enabling: • Defence: Quantum-secure communication, ISR platforms, advanced imaging, and autonomous systems • Space: Optical payloads, deep-space sensing, and mission readiness • Environment: Hyperspectral systems for bushfire risk, water monitoring, and land analysis • Manufacturing: Precision metrology, adaptive optics, and robotic vision systems As Australia expands its need for high-performance sensing and analytics systems, this workforce becomes essential. Their capabilities are directly transferable, and their quality systems are recognised by global partners including ESO. Crucially, astronomical instrumentation also plays a powerful inspirational role. The challenge of exploring the universe sparks curiosity and ambition, making this field one of the most effective gateways into STEM careers. Supporting this workforce supports not only innovation today but the talent pipeline for tomorrow. Australia now has a ready-made, globally proven capability, aligned with national needs—but it remains under-leveraged due to short-term funding, limited translation pathways, and few mechanisms to retain and grow this critical workforce. Opportunities • Establish stage-gated, medium-term investment (5–10 years) to sustain and grow the astronomical instrumentation workforce • Create structured pathways from research to deployment, modelled on DARPA/IARPA-style translational frameworks • Embed this expertise in national platforms to deliver sovereign sensing, surveillance, and communications systems • Enable closer industry–research collaboration by embedding technical expertise within national platforms Recommendation NCRIS should formally recognise astronomical instrumentation—and Astralis —as critical national research infrastructure. Strategic investment will enable sovereign capability, build national resilience, and inspire the next generation of STEM talent.

Q35.

2.3 The case for a new NRI capability, or enhancements to existing capabilities, typically emerges through advocacy from research communities clustering around rigorously identified needs and goals. Such a concept could respond to a requirement for novel or expanded capacity within a domain, or across domains, and must be such that it could only be made available with national-level investment.

If you have identified such a requirement, briefly describe the need, the proposed infrastructure capability, the medium-term goals, impacted research communities, and the timeframe over which you advocate its establishment. Your response can include links to relevant existing reports.

n/a

Q36.

Part 3: Industry perspectives

This section is seeking input specifically from industry-based respondents. Other respondents can skip this section.

Recommendation 6 of the 2021 Roadmap related to improvements in industry engagement with NRI. To complement work on this topic that has occurred since then, we are seeking additional advice on NRI requirements as perceived by current or potential industry-based users.

Q37.

3.1 Have you (or your organisation) interreacted with or used Australia's NRI?

- (●) Yes
- ( ) No

Q38.

3.2 If so, please briefly outline the NRI capabilities you (or your organisation) have interacted with or used. Do not limit your response to NCRIS capabilities.

ANFF, HIAF, and AAL

Q39.
3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

- [x] For expertise or advice
- [ ] Access to research resources or products
- [x] Access to equipment for research
- [ ] Access to equipment for operational reasons
- [ ] Help in translating research
- [ ] Access to data
- [ ] Support for clinical trials
- [ ] Other (please specify)

Q40.
3.4 If you answered no, please indicate your (one or more) primary reasons:

This question was not displayed to the respondent.

Q41.
Part 4: Other comments
4.1 Please elaborate on any of your above responses or add any other comments relevant to the development of the 2026 Roadmap. Your response can include reference or links to existing reports that you recommend be considered during the 2026 Roadmap development process.

n/a

Q49.
4.2 Optional Document Attachment.
Note: Our strong preference is that answers are provided against the relevant questions in the survey. However, this file upload option is available for submissions in file format, where needed. Please ensure the document includes your name or organisation.