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

As such all submissions that are published include the responses submitted from Question 20 onwards 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

1- Natural hydrogen is the molecular hydrogen (H2) produced naturally by chemical reactions within rocks and escaping from the earth surface. In contrast to other types of hydrogen, referred to as green or blue, natural hydrogen production does not necessitate costly or energy-consuming processes. In its Net Zero Plan, Australia's government endeavours to enable the development of innovative technologies supporting decarbonisation, amongst which hydrogen. Raman spectroscopy is critical to identify H2 preserved as fluid inclusions in rocks to identify potential migraption pathways and reservoir sources. Raman spectroscopy has otherwise a wide range of applications across many disciplines. 2- Critical minerals are key enablers of decarbonisation and energy transition but also essential for defence system and advanced technologies. Their exploration and advanced processing are, therefore, one of the cornerstones of Australia economic development framework. One important step in the exploration and processing of ores is charatcersitation: ore mineral charatcerisation and also any deleterious elements associated to them. Their geometric association in 3D in rocks is also important. Mineral charatcerisaiton techniques are evolving fast with a stronger input of AI support in the data acquisition and processing. It is important that instrumentations based in Unis are following this fast progression and have the finantial support to upgrade their facilities. Some systems can integrate 3D and 2D charaterisation (Zeiss), optimising the whole workflow of mineral charaterisaiton from rock to micro-scale observations. 3- Critical mienral research and fundamental research in Earth science is critically supported by large geometry SIMS instruments such as the SHRIMP or CAMECA1280 or 1300. These instrument are the only ones to be able to analyse O and S isotopes in-situ in minerals with a high enough precision. These instruments are also still heavily used for geochronology studies. However, the CAMECA IMS1280 at UWA will be obsolete beyond 2028 and will no longer be supported by the manufacturer and will need to be replaced to meet the demand from projects. This is a large investment that will require co-funding from different organisation and institutions.

Q22.
Food and Beverage

Q23.
Medical Products

Q24.
Defence

The International Atomic Energy Agency (IAEA) assists States in organising the analysis of environmental samples taken across the world to detect nuclear and radioactive materials and determine their origin and history. The LG-SIMS laboratory at CMCA-UWA is the only university-based laboratory to run such analyses and has been providing this service for the last 12 years. In 2024, nuclear forensic specialist Aleshin (CMCA, UWA) and his team, including CI's Suvorova and Martin, have been allocated a $2M research grant to develop a Nuclear Security Centre, focusing on nuclear forensics research by the Department of Foreign Affairs and Trade (DFAT). This work cannot be done without a LG-SIMS such as the CAMECA1280 at UWA. However, this in strument will become obsolete in 2028 and will need to be replaced for this research, unique in Australia, to be pursued.

Q25.
Recycling and Clean Energy

Q26.
Space

Q27.

Environment and Climate

Q28.

Frontier Technologies and Modern Manufacturing

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

Raman spectroscopy is a strategic analytical tool for mineral, gas and fluid characterisation in rocks and will support critical mineral research from exploration to processing, and clean energy research (natural hydorgen). AI powered, multidimensional characterisation of rocks and minerals will be key for critical mineral research, exploration and processing.

Q31.

Supporting healthy and thriving communities

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia's environment

LG-SIMS (CAMECA IMS1280) is a strategic and necessary tool in the characterisation of nuclear and radioactive materials for nuclear forensics research and applications. Raman spectroscopy is a developping tool, allowing to idetify different compounds composing these materials, without sample preparation and destruction.

Q34.

Building a secure and resilient nation

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.

The IMS1280 large geometry-SIMS (LG-SIMS) was commissioned in 2010 as a "flagship" instrument, led by the NCRIS funded Australian Microscopy and Microanalysis Research Facility (now Microscopy Australia). This $7M investment received funding from federal (AuScope and Microscopy Australia – $3M), state ($2.5M) and institutional ($1.5M) sources. This cutting-edge mass spectrometer is designed for the in-situ analysis of isotope concentrations in solid samples with high precision and has a fundamental role in geosciences (geochronology and stable isotope geochemistry) and nuclear forensic research. LG-SIMS analyses come at the end of a complex characterisation workflow involving optical and electron microscopy, X-ray technologies and others depending on the scientific problem. LG-SIMS results often lead to new scientific questions necessitating further nano-scale characterisation using Transmitted Electron Microscopy (TEM) or nanoSIMS. This correlative, multimodal approach can transform the research landscape in many scientific disciplines, offering opportunities for innovation and new discovery. However, the instrument hosted at UWA will be obsolete in 2028, as annouced by its manufacturer CAMECA. Given the excellent reputation of the laboratory worldwide, the current emergence of a new stream of research at UWA, and Australia-wide, on nuclear forensic research and the vibrant geoscience research communities at UWA, CSIRO, GSWA, and in Australia, there is a real need in the continuation and upgrade of the LG-SIMS facility at UWA. Between the vast number of geoscience applications and UWA's specialisation in nuclear forensics, there is a real demand for replacing the LG-SIMS at UWA. The loss or retention of LG-SIMS at UWA has several ramifications that are outlined below. • Loss of highly sought-after experts in geochemistry, nuclear forensics, and the SIMS technique. • Loss of the impactful UWA research outcomes and programs in geosciences and critical mineral research from an unparalleled technology for isotope analyses. Loss of an essential component in many geoscience research workflows (ICP-MS, EM, microprobe). • Loss of an important and unique Australian contribution to global nuclear safety and its ability to support research in nuclear safeguards.

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.

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

- [ ] For expertise or advice
- [ ] Access to research resources or products
- [ ] 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.

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.