



Australian Government



Australian  
Space Agency

# Australian sustainability of space activities policy

*Discussion paper*

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## Overview of consultation

The Australian Space Agency (the Agency) is seeking input on a potential Australian sustainability of space activities policy which aims to support the long-term viability of the space sector, inclusive of industry, academia and government, so Australians can continue to benefit from space services for current and future generations.

This consultation paper has been published to inform the development of future advice on the policy. The Agency invites comment on the proposed vision of the policy, the policy themes being considered, including views on the priority of each, and the role of the Australian Government and other stakeholders in supporting them.

The paper outlines eight themes that an Australian sustainability of space activities policy could include – see **Appendix A**. The themes are informed by Australia’s unique characteristics and competitive advantages as well as recent space sustainability policies released by Australia’s international partners, namely the United States, New Zealand, the United Kingdom, Canada, European Union, Japan, and India.

This consultation paper considers feedback received from previous sector consultations the Agency conducted in 2022 where sustainability was a key topic of discussion.

## Policy vision, scope and objectives

*A resilient space sector with stable access to space services and capabilities which draws on Australia’s rich history of First Nations knowledge and provides benefits to current and future generations of Australians.*

**- The proposed vision of an Australian sustainability of space activities policy**

In terms of scope, the policy would consider the economic, environmental, and social issues for the sustainability of civil space activities in Australia, and the role of Government and other stakeholders in addressing them. While the policy would focus on civil space activities, defence capability would remain important for some elements of the policy and the Agency encourages the defence sector to provide comment on this paper.

The economic, environmental, and social considerations of the policy would align with the Australian Government’s policy agenda. Economic sustainability would consider the growth and resilience of the sector through the adoption of sustainable business practices and processes. Environmental sustainability would consider how civil space activities could support the transition to net zero and a more circular economy, and social sustainability would consider how civil space activities could support the cohesiveness and fairness of society.

The overall objective of the policy would be to enable the economic resilience of the sector by building capability around the adoption of sustainability principles in operations, which extends to using technology to enhance operations. This supports international efforts toward a rules-based multilateral system, including in space, ensuring Australia continues to have access to space services and capabilities that contribute to our economic prosperity, social cohesion and environmental sustainability.

The benefits and impacts of the policy affect the Australian space sector, inclusive of industry, academia and government. Industry will play a critical role in achieving the vision and objectives of the policy.

## Policy considerations

Alignment with the Australian Government's broader sustainability policy agenda will be considered when developing the Australian sustainability of space activities policy. This includes alignment with the National Science and Research Priorities published by the Department of Industry, Science and Resources in August 2024, and the Nature Positive Plan published by the Department of Climate Change, Energy, Environment and Water in December 2022.

The knowledge of First Nations people could enrich and complement the systems-thinking and transdisciplinary approaches to space sustainability, and First Nations Australians are a key stakeholder in developing this policy. The policy will align with existing Australian Government policies involving Aboriginal and Torres Strait Islander people, such as the National Agreement on Closing the Gap and economic empowerment.

Consideration of enhancements to domestic space legislation including the *Space (Launches and Returns) Act 2018* will be evaluated through separate consultation on the regulation of new and emerging space activities in due course.

Management of the radio frequency spectrum is an important consideration for the sustainability of many critical space services, however it is not expected to feature prominently in this policy. The International Telecommunication Union (ITU) and the Australian Communications and Media Authority (ACMA) are responsible for long-standing international and domestic regulation respectively to manage the radio frequency spectrum including its use for communications and radio astronomy. These existing regulatory frameworks provide a mechanism to manage competing demands for spectrum and facilitate equitable access and rational use of this limited natural resource.

Cost of compliance is a consideration in developing any policy. This policy will consider how the Australian space sector can build and sustain competitive advantage, conscious of potential compliance costs and targeting cost neutrality.

## The sustainability of space activities in the Australian context

Space is integral to Australian life more than ever before. We rely on space-enabled technologies to deliver essential services such as telecommunications, financial management and transactions, emergency response and recovery, environmental monitoring, air and maritime surveillance, and air traffic management. Space capabilities also strengthen our national security and protect our national interest.

The utilisation of space is increasing as both governments and private entities undertake space-related activities. With the increase in space activities comes congestion and risks within outer space, such as collisions between satellites which can result in a loss of critical services that support life on Earth, and a heightened risk of 'Kessler Syndrome'<sup>1</sup>, where certain orbits could become unsuitable for use thereby limiting future access to space services and capabilities.

The sustainable use of space and assuring access to space is a global problem requiring a global response. Australia's international partners are responding to the rising environmental and economic risks by releasing policies and initiatives that identify ways for their national sectors to pivot to more sustainable practices.

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<sup>1</sup> <https://www.nasa.gov/centers-and-facilities/white-sands/micrometeoroids-and-orbital-debris-mmod>

As a founding member of the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS), and a State Party to the five UN treaties on outer space, Australia is committed to its international obligations. Australia is also committed to the development and implementation of rules and norms that seek to support the safety, stability, and sustainability of outer space.

*The conduct of space activities in a manner that considers environmental, social and economic impacts across their lifecycle and preserves the space environment for current and future generations, while providing ongoing access to downstream benefits from space activity.*

**- The sustainability of space activities defined in the Australian context<sup>2</sup>**

In the context of this policy, space activities include both the products and services the sector provides, and the business practices used to provide them, and encapsulates all activities along the space economy value chain except end user or downstream services<sup>3</sup>. This includes spacecraft manufacturing, spaceflight activities, lunar exploration, and ground infrastructure and operations.

There are several key policy themes and opportunities that the Australian Government considers relevant to the sustainability of space activities in the Australian context, including:

- Encouraging best business practice and building an economically resilient sector through the adoption of sustainable business processes.
- Supporting the development and implementation of rules and norms that seek to support the safety, stability and sustainability of outer space, including through international engagement.
- Reducing risks to space assets that provide essential services to Australia through space debris mitigation and related activities.
- Embedding First Nations cultural and scientific knowledge to complement and harness Australia's scientific and economic potential.
- Building social license around space activities including fostering positive relationships with impacted communities.
- Supporting astronomy and space science by advocating for the protection of dark and quiet skies.
- Ensuring the supply of critical enablers for space activities, such as the global geodesy supply chain, through building international partnerships and other initiatives.
- Remediating space debris<sup>4</sup> to protect the space assets that provide essential services to Australia.

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<sup>2</sup> This definition is informed by the definition of the 'long-term sustainability of outer space activities' as outlined in paragraph 5 of the UN [Guidelines for the Long-term Sustainability of Outer Space Activities](#).

<sup>3</sup> Note that the term 'space activities' is used differently in the regulatory context of the *Space (Launches and Returns) Act 2018*.

<sup>4</sup> Space debris remediation refers to any action taken to reduce the risks posed by orbital debris by moving, removing, or reusing it. This definition is taken from [NASA's Cost and Benefit Analysis of Orbital Debris Remediation](#) (2023).

## Key issues for Australia's space sector

Two of the key issues for Australia's space sector regarding the sustainability of space activities are:

- The global space economy is moving to more sustainable practices – and we must adapt or risk becoming uncompetitive, and
- We need to protect the space assets Australia relies on that deliver essential services such as communications, positioning, navigation and timing, and Earth observation.

### **Economic resilience and market competitiveness**

Sustainable business practices can help Australian space businesses build and sustain competitive advantage. For example, sustainable procurement strategies can improve supply chain resilience. Similarly, sustainability practices promote cost savings through sustainability-related operational efficiencies. Sustainability initiatives also build customer and employee loyalty. Research shows that sustainability initiatives improve HR statistics with one study finding that morale was 55 per cent better in companies with strong sustainability programs<sup>5</sup>. Investing in sustainability fosters innovation which in turn will contribute to building the resilience of the Australian economy.

In the last two years, the governments of many of Australia's international partners such as New Zealand, the United Kingdom, the United States, Japan and India have released policies and initiatives that seek to address key space sustainability issues relative to their policy landscape and sovereign capabilities. Without relevant sustainability policy frameworks in place to drive best practice, the Australian sector may not be able to adapt to increasing sustainability requirements from international partners and therefore miss out on commercial opportunities. The Australian sector is nascent and unlikely to achieve holistic capability uplift around the adoption of sustainability principles and practices purely through market forces.

### **Unsustainable use of outer space**

Australia's economy is today more dependent on space services than ever before. Australia is a consumer of space services provided by other nations. The consequences of the unsustainable use of outer space, such as increasing space debris<sup>6</sup>, may pose risks to space assets operated by international partners that Australia relies on to deliver essential services now and into the future.

The unsustainable use of outer space also puts Australia's own civil space services at risk. This includes the Southern Positioning Augmentation Network (SouthPAN), which will ensure safety and efficiency in the transport, aviation, maritime, mining and construction sectors; the Landsat and Copernicus programs, including Landsat Next, which assure Australian access to critical satellite data; and the nbn Sky Muster satellites, which provide broadband connections to approximately 100,000 regional and remote households and businesses across Australia<sup>7</sup>. It also makes it increasingly complex and expensive for Australian sectors to access outer space to deploy advanced technologies and nascent capabilities such as advanced manufacturing and spaceflight.

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<sup>5</sup> <https://www.shrm.org/topics-tools/news/hr-magazine/promoting-sustainability>

<sup>6</sup> Space debris includes any object left in orbit from human activity and can cause issues for spacecraft it collides with and the services the spacecraft provides for Earth.

<sup>7</sup> Media release, Hon Michelle Rowland MP, Boosting data for SkyMuster NBN users in regional and rural Australia, 8 July 2022.

There are social risks to the Australian community arising from the unsustainable use of space. At least 27 Australian Government agencies currently use space services and technology<sup>8</sup> to improve the lives of Australians or keep them safe. Space technologies enable connectivity and access to the digital economy for even the most remote communities and increase levels of digital inclusion including among Aboriginal and Torres Strait Islander people, in line with Closing the Gap socio-economic target 17. While the prevalence of these technologies is on the rise as more satellite constellations are deployed, the unsustainable use of outer space poses risks to these services and the benefits they provide to the Australian community.

### How the Government supports the sustainability of space activities

The Australian Government is currently undertaking a range of initiatives that support the sustainability of space activities including:

- Supporting the development and implementation of rules and norms that seek to support the safety, stability and sustainability of outer space, through international engagement,
- Maintaining an effective domestic regulatory framework that encourages entrepreneurship and sector growth while assuring safety and other national interests are managed appropriately,
- Exploring how to incorporate sustainability outcomes in grant programs and studies to increase sector capability,
- Monitoring and tracking of civil space objects to ensure the resilience of space services,
- Considering the broader community impacts of space activities to build social license,
- Partnering with international space agencies to develop understanding of sustainable approaches,
- Partnering under international initiatives to support the sustainability of critical enablers for space activities such as the global geodesy supply chain, and
- Undertaking research and development in space sustainability and related technologies.

#### Consultation prompts

- Are there other key issues an Australian sustainability of space activities policy should address?
- To what extent is the proposed vision of this policy fit for purpose? Refer to page 3 for the proposed vision.
- Are there any policy themes missing? I.e., environmental considerations such as ablation of satellites in the atmosphere<sup>9</sup>, ground infrastructure, R&D.
- What is the priority order of the themes?

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<sup>8</sup> This relates to the networks of ground stations, and the Earth observation, position, navigation and timing, and communications satellites that provide information about and across the Earth and outer space, and the associated analysis and dissemination.

<sup>9</sup> The ablation of satellites in the atmosphere refers to the wearing away or destruction of satellites re-entering Earth's upper atmosphere.



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# Appendix A – Proposed sustainability of space activities policy themes





## Sustainability of space activities policy themes

Australia has unique characteristics and competitive advantages that inform how the Australian Government could address risks and opportunities for the sector regarding the sustainability of space activities, such as rich First Nations cultural and scientific heritage and connection to astronomy, active role in international forums, and growing technological expertise. The Australian Government has drawn on these elements to identify eight themes which could feature in an Australian sustainability of space activities policy:

- Encouraging best business practice and building an economically resilient sector through the adoption of sustainable business processes.
- Supporting the development and implementation of rules and norms that seek to support the safety, stability and sustainability of outer space, including through international engagement.
- Reducing risks to space assets that provide essential services to Australia through space debris mitigation and related activities.
- Embedding First Nations cultural and scientific knowledge to complement and harness Australia's scientific and economic potential.
- Building social license around space activities including fostering positive relationships with impacted communities.
- Supporting astronomy and space science by advocating for the protection of dark and quiet skies.
- Ensuring the supply of critical enablers for space activities, such as the global geodesy supply chain, through building international partnerships and other initiatives.
- Remediating space debris to protect the space assets that provide essential services to Australia.

### Encouraging best business practice

**Objective:** To encourage best business practice and build an economically resilient sector through the adoption of sustainable business processes.

Sustainability is a key consideration for many businesses in Australia as an innovation driver to improve efficiencies and remain competitive in the current economic climate – space is no different.

Australia can leverage existing and emerging capabilities to grow a sustainable presence with a competitive advantage, using the sustainability of space activities as a core principle. There is also increasing sustainability requirements from international partners. For example, the European Commission is looking to introduce a European Union (EU) Space Law<sup>10</sup> this year which includes sustainability measures and may see an EU Space Label used to designate companies that adhere to the new rules, much like the way eco-labels are used to certify white-goods.

The Australian space sector positively contributes to our Gross Domestic Product and in 2021 saw a \$4.5 billion turnover<sup>11</sup>. The continued growth and productivity of the sector could be bolstered by the Government encouraging the adoption of sustainability principles and practices, which extends to using technology to enhance business operations. For example, encouraging the use of low

<sup>10</sup> [https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13971-EU-Space-Law-new-rules-for-safe-resilient-and-sustainable-space-activities\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13971-EU-Space-Law-new-rules-for-safe-resilient-and-sustainable-space-activities_en)

<sup>11</sup> Australian Space Agency modelling

emissions and sustainable technology could enable the sector to reduce costs, develop innovative products, create competitive advantage and attract investment opportunities across our region<sup>12</sup>.

Embedding circular economy principles is a key component of sustainable business as it can boost resource productivity, reduce production costs, and generate cost savings. Early integration of circular economy principles into business processes can future proof a sector by allowing businesses to get ahead of the curve and gain a competitive advantage. First movers in the circular economy will also be rewarded by rising global demand for goods and services that are required to meet agreed circular economy standards<sup>13</sup>.

Australia's international partners have demonstrated interest in the sustainable products and capability Australia offers in other industries. For example, Australia has partnerships in place with nine countries to advance practical action on climate change and build clean energy industries<sup>14</sup>.

### **What Australia is currently doing**

Some companies in the Australian space sector demonstrate sustainable business practices. For example, Southern Launch has several initiatives promoting sustainable business outcomes such as education programs for local students, tourism opportunities, and investment in conservation to generate net environmental benefit<sup>15</sup>.

Support for Australian SMEs to commercialise their innovations and grow their businesses is currently offered through the Australian Government's Industry Growth Program, which provides an advisory service and opportunity for matched grants for SMEs in seven priority areas across the economy. Two of the priority areas, 'defence capability' and 'enabling capabilities', are directly applicable to the space sector, with others leveraging space-based services such as 'value-add in resources' and 'value-add in agriculture, forestry and fisheries'. More established SMEs may also be eligible for funding from the National Reconstruction Fund (NRF) through these priority areas.

### **What Australia's international partners are currently doing**

Limited guidance has been released by Australia's international partners to encourage their space sectors to adopt sustainable business practices and processes. The United Kingdom, through His Majesty King Charles III, has released some guidance in the King's Astra Carta initiative (2023) which provides a roadmap for the private sector to align space-related activities with sustainability. The roadmap includes a section on creating sustainable markets in space which includes, for example, actions on reducing costs related to sustainable space exploration. The UK Government committed to supporting the intent of Astra Carta in the Space Industrial Plan (2024).

#### **Consultation prompts**

- To what extent would the adoption of sustainable business processes drive the transformation, growth and competitiveness of Australia's industries?
- In what ways would your organisation benefit from guidance material on how to adopt sustainable business processes and practices?
- What type of guidance material would provide the most benefit? You can consider options such as a voluntary code of conduct with high-level principles, professional standards, or an industry framework with objectives, metrics, targets, and actions.

<sup>12</sup> <https://www.ibm.com/topics/business-sustainability>

<sup>13</sup> <https://www.dceew.gov.au/sites/default/files/documents/circular-economy-ministerial-advisory-group-interim-report.pdf>

<sup>14</sup> <https://www.dceew.gov.au/climate-change/international-climate-action/international-partnerships>

<sup>15</sup> <https://www.southernlaunch.space/community>

## Supporting the development and implementation of rules and norms

**Objective:** To support the development and implementation of rules and norms that seek to support the safety, stability and sustainability of outer space, including through international engagement.

There are a number of international forums that consider issues relating to the peaceful exploration and use of outer space. Participation in these forums aims to:

- support the development and implementation of rules and norms that support the safety, stability and sustainability of outer space,
- reduce space threats through norms, rules and principles of responsible behaviours,
- advocate for existing space international legal and normative frameworks,
- increase understanding of the scope of the existing legal regimes, and
- facilitate bilateral engagements with like-minded nations.

### What Australia is currently doing

The Australian Government leverages bilateral partnerships and multilateral forums to pursue its international civil space agenda. Australia has joined over 15 international space and space-related bilateral agreements and engages in international discussions on space sustainability.

Australia is committed to the development and implementation of rules and norms that seek to support the safety, stability and sustainability of outer space, including implementing the UN Guidelines for the Long-term Sustainability of Outer Space Activities (LTS Guidelines) and the Space2030 Agenda, while affirming the existing space international legal and normative framework.

The LTS Guidelines are a compendium of internationally recognised measures for, and commitments to, ensuring the long-term sustainability of outer space activities and enhancing the safety of space operations. Australia has committed to taking practical steps to implement the LTS Guidelines, noting our national regulatory framework for civil space activities includes requirements for the space sector to consider the safety and sustainability of their space activities.

The Space2030 Agenda reaffirms and strengthens the contribution of space activities and space tools to the achievement of global agendas addressing long-term sustainable development concerns of humankind. Australia is working to meet the overarching objectives of this forward-looking strategy as part of its commitment to achieving the Sustainable Development Goals and to bringing the benefits of space to Earth.

Australia supports lines of effort for safe and sustainable lunar activities. Australia is a State Party to the Moon Agreement and a founding signatory to the Artemis Accords. Australia anticipates the first Australian rover to operate on the Moon as part of the US Artemis program.

Australia participates in the Quad Space Working Group, which consists of India, Japan, and the United States. The Quad Space Working Group is identifying ways to share satellite data to monitor and adapt to climate change, enhance weather services for better disaster preparedness, and respond to threats in shared domains.

Australia is in negotiations with the United States on a space framework agreement that will facilitate cooperation on civil space activities, including further cooperation on the Artemis program. The agreement also includes provisions on the sustainability of space activities.

The Australian Government maintains an active presence and leadership role on key international Earth observation coordination and data sharing bodies such as the Committee on Earth Observation Satellites (CEOS), the Group on Earth Observations (GEO), and the World Meteorological Organisation (WMO). These bodies enable the optimised collection of essential Earth observation data to avoid duplication and orbital congestion and ensure the sustainability of national space programs while supporting more powerful usage.

The Australian Government also actively engages with the International Committee on Global Navigation Satellite Systems (ICG) to promote service interoperability between global and regional navigation satellite systems, manage issues such as orbital congestion, and promote the usage of Positioning, Navigation and Timing (PNT) applications.

### **What Australia's international partners are currently doing**

Australia's international partners have indicated a commitment to developing and implementing rules and norms that contribute to the safety, stability and sustainability of outer space activities:

- The United States, through NASA, committed to taking a 'strong leadership role internationally' to 'improve coordination and collaboration outside NASA' in the first volume of NASA's Space Sustainability Strategy (2024).
- The United Kingdom committed to 'leading the development of international norms for a safe and sustainable space environment' in its Space Industrial Plan (2024).
- New Zealand's recently released space policies, namely the Active Debris Removal and On-Orbit Servicing Missions Operational Policy (2023) and the Orbital Debris Mitigation Operational Policy (2023), were based around international guidelines.
- Japan released a revised Basic Plan on Space Policy in 2023 which includes plans to 'promote international rule-making' and 'enhance international space cooperation'.

#### **Consultation prompt**

- To what extent does Australia's participation in international forums on space contribute to a more resilient economy and strengthen national resilience?

## Reducing risks to space assets

**Objective:** To reduce risks to space assets that provide essential services to Australia through space debris mitigation, Space Traffic Management (STM), Space Situational Awareness (SSA), and space weather services.

The number of space assets in Low Earth Orbit (LEO) has increased more than three-fold since 2016, rising from around 2,700 operational objects to 8,700 in 2023<sup>16</sup>. As space activity increases so does the amount of space debris. As more debris populates LEO, existing and future Australian space operations, and those of our partners on which we rely, will become less safe and more expensive as a greater portion of mission expense goes towards mitigating the debris threat.

Geostationary Earth Orbits (GEO) are also impacted by increased space activity and space debris. The geostationary ring is one of the most congested regions in space as the only orbit in which satellites can move synchronously with Earth, making it the ideal choice for meteorological and telecommunication satellites.

Being able to monitor and track objects and their operational environment, known as Space Situational Awareness (SSA), is among the responses used to address risks to space assets and make space more sustainable.

The International Organisation for Standardisation (ISO) has developed a standard for the mitigation of space debris, ISO 24113:2023 “Space Systems – Space Debris Mitigation Requirements”<sup>17</sup> which prescribes high-level debris mitigation measures that were derived largely from internationally-agreed guidelines such as those established by the Inter-Agency Space Debris Coordination Committee (IADC). Work is underway through the Standards Australia ISO Mirror Committee on Space Standards to make relevant recommendations.

There are existing internationally recognised frameworks that seek to mitigate risks to space assets such as the Space Sustainability Rating (SSR)<sup>18</sup>. The SSR assesses the design, operation, and end of life of space missions based on their sustainability and provides advice for mitigating impacts such as the risk to other objects in space.

Space weather events can also disrupt many of Australia’s critical space-based services. These events are primarily caused by the sun and include geomagnetic storms, solar radiation, and solar flares. In the worst-case scenario space weather can potentially destroy some satellites, cause increased drag on certain satellites reducing lifespans, and disrupt satellite operations. For example, NovaSAR-1<sup>19</sup> was out of operation for 13 days in June 2023 following a radiation event that affected a number of other satellites. Effective monitoring of space weather allows relevant parties to implement space weather mitigation plans and is necessary to protect Australia’s critical space-based services from these events.

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<sup>16</sup> United States Space Force (2023) – processed by Our World in Data, <https://ourworldindata.org/grapher/low-earth-orbits-objects>

<sup>17</sup> <https://www.iso.org/standard/83494.html>

<sup>18</sup> <https://spacesustainabilityrating.org/>

<sup>19</sup> <https://www.eoportal.org/satellite-missions/novasars-1>

## What Australia is currently doing

In an ongoing effort to combat risks to space assets and ensure the Australian community and economy continues to benefit from space-based services, the Australian Government:

- Engages in international forums, such as UN COPUOS, on topics related to space sustainability including space debris and has committed to implementing the LTS Guidelines.
- Maintains an effective domestic regulatory framework. For example, applicants for Australian launch permits and overseas payload permits are required to provide a debris mitigation strategy to mitigate the risk of collision with space debris and support the preservation of the space environment.
- Monitors space weather and, through the Bureau of Meteorology, forecasts large disturbances in advance to allow relevant parties to implement space weather mitigation plans.
- Partners with international space agencies to develop understanding of sustainable approaches to space missions. For example, the Agency collaborated with the French Space Agency (CNES) on a study considering the end-to-end sustainability of a nanosatellite space mission with a focus on debris mitigation, spacecraft resilience and collision avoidance.
- Defines the space technology sector as one of eleven critical infrastructure sectors under the *Security of Critical Infrastructure Act 2018* (SOCI Act). The SOCI Act defines the space technology sector as the sector of the Australian economy that involves the commercial provision of space-related services.
- Maintains an Australian Plan for Space Debris Re-Entry and is developing an Interim Australian Space Weather Plan through the National Emergency Management Agency.

Several Australian companies are currently developing technologies and capabilities for space debris mitigation and SSA, including:

- HEO is developing space object tracking technologies which help avoid collisions between space objects.
- Silentium Defence provides Space Situational Awareness (SSA) solutions with passive ultra-wide field-of-view detection and ranging of objects.
- Electro Optic Systems provide optical surveillance capabilities to enable SSA.
- Valiant Space is designing engines to move satellites in space, then back to Earth. Their design will enable satellite owners to prolong the life of spacecraft in LEO and avoid the creation of space debris.
- Neumann Space is working on thruster systems that could potentially use captured debris as thruster fuel.
- Saber Astronautics' Responsive Space Operations Center provides real-time mission support which includes space traffic management for a safe and secure operation from launch to end-of-life.
- LeoLabs Australia specialises in SSA in LEO through its global network of sensors which provides commercial satellite operators and launch organisations with tracking and monitoring data, collision avoidance, and launch support services.
- Industrial Sciences Group's Manoeuvre Decision Support System warns satellite operators of approaching collisions and gives them avoidance options in real time.

## What Australia's international partners are currently doing

Many of Australia's international partners have initiatives supporting space debris mitigation, STM, SSA, and/or space weather. For example:

- The European Space Agency's Zero Debris Approach (2023) aims to achieve zero debris production by 2030.
- The Japanese Space Agency (JAXA) published guidelines for companies to prevent space debris from space missions in 2024.
- India launched its 'Debris-Free Space Missions' initiative in April 2024, to be implemented starting 2025, which focuses on space debris and SSA.
- The first volume of NASA's Space Sustainability Strategy focuses on topics such as space debris management, space weather, and STM.
- The United Kingdom officially launched its National Space Operations Centre (NSpOC) in May 2024 to develop and operate the UK's space surveillance and protection capabilities. The NSpOC combines and coordinates civil and military space situational awareness capabilities to enable UK space operations and to protect their interests in space and on Earth from space related threats, risks, and hazards.
- The European Space Agency (ESA) maintains a Space Weather Service Network to provide timely and reliable space weather information to end users. ESA will be developing a new satellite, Vigil, to feed into their Space Weather Service Network. Vigil will monitor solar activity to give advance warning of oncoming solar storms and is planned for launch in 2031.
- In the United States, the National Oceanic and Atmospheric Administration (NOAA) monitor space weather through satellites and ground services and are upgrading their technology as part of the Space Weather Follow-On (SWFO) program. This program includes the Space Weather Follow On-Lagrange 1 (SWFO-L1) spacecraft planned for launch in 2025.

### Consultation prompts

- How would reducing risks to space assets support the resilience of Australia's supply chains and strengthen our national resilience?
- Would your organisation benefit from best practice guidance material on how to minimise the risk of creating space debris and manage the risks associated with existing space debris? If so, what type of guidance material would provide the most benefit?
- How would your organisation benefit from an Australian civil space object monitoring capability that tracks space debris and alerts organisations of potential risks?
- Why/why not should an Australian civil space object monitoring capability be industry-led?
- Is your organisation impacted by the adverse effects of space weather? If so, what would help your organisation mitigate these effects?

## Embedding First Nations cultural and scientific knowledge

**Objective:** To embed First Nations cultural and scientific knowledge to complement and harness Australia's scientific and economic potential.

First Nations astronomers are experts who have been observing the stars of Australia since time immemorial and through First Nations empirical methods made connections from the sky to the land and sea. The knowledge and practices of First Nations people can enrich and complement the systems-thinking and transdisciplinary approaches to space sustainability. For example, circular economy principles around regenerating nature which feature in approaches to space sustainability are consistent with a First Nations approach to caring for Country.

### What Australia is currently doing

The Australian Government, through the Agency, is establishing a First Nations engagement capability to connect First Nations scientific and cultural knowledge to the work of the Agency, and to develop space policy that considers impact on or benefits to First Nations people, communities, and businesses.

The Agency supported Aboriginal and Torres Strait Islander university students to intern at NASA's Jet Propulsion Laboratory through the National Indigenous Space Academy (NISA) which was launched in 2023. The interns bring their First Nations lens to western science and provide a window into the opportunity for collaboration and innovation.

Several companies in the sector engage with First Nations communities as a core part of their business. For example, Equatorial Launch Australia is developing the Arnhem Space Centre in partnership with local traditional owner business Gumatj Corporation<sup>20</sup>. This aligns with Priority Reform One of the National Agreement on Closing the Gap to empower Aboriginal and Torres Strait Islander people to share decision making through formal partnership agreements.

### What Australia's international partners are currently doing

Embedding First Nations cultural and scientific knowledge is a focus for New Zealand's approach to space sustainability. New Zealand's National Space Policy (2023) has a focus on First Nations engagement, including a commitment to ongoing engagement with First Nations in the development and implementation of space policies, especially those working towards sustainable outcomes.

#### Consultation prompts

- How does your organisation benefit from First Nations knowledge and/or engage with First Nations peoples?
- How could your organisation benefit from First Nations knowledge and/or support First Nations peoples?
- What are the barriers for your organisation in engaging with First Nations peoples and what strategies could be employed to remove these obstacles?

<sup>20</sup> <https://www.developingeastarnhem.com.au/blog/project/arnhem-space-centre/>



## Building social license around space activities

**Objective:** To build social license around space activities including fostering positive relationships with impacted communities.

Growing Australia's space sector requires social license, including considerations relating to increased environmental impacts, and perceptions of the public, local communities and First Nations peoples regarding increased space activities. In this context, space activities include both the products and services the sector provides, and the business practices used to provide them, and encapsulates all activities along the space economy value chain except end user or downstream services<sup>21</sup>. This includes spacecraft manufacturing, spaceflight activities, lunar exploration, and ground infrastructure and operations.

Spaceflight activities will become increasingly topical given the potential for increased spaceflight activity resulting from agreements such as the US-AUS Technology Safeguards Agreement (TSA). The TSA is a treaty-level agreement that enables US companies, government organisations and universities to undertake commercial spaceflight activities from spaceports (launch facilities) in Australia. Spaceflight activities include both the launch of rockets and spacecraft, and the return (landing) of rockets and spacecraft within Australia.

Lunar activities will also become increasingly topical with the first Australian lunar rover operating on the Moon later this decade as part of the US Artemis program. This program will grow global interest in lunar activities raising the question of social license around these activities.

Encouraging the space industry to adopt sustainable business principles and practices could help enhance social license around space activities and foster positive relationships with impacted communities. For example, sustainable spaceflight activities may seek to reduce potential impacts on local communities and First Nations people during launch, or to reduce environmental impacts from the return of rocket bodies.

### What Australia is currently doing

The Australian Government, through the Agency, is considering perceptions of local communities and First Nations people regarding increased spaceflight activities as Australia's spaceflight sector grows with the TSA.

The Australian Government also supports several space literacy and workforce programs which foster positive perceptions around space activities in Australia and contribute to building social license, including:

- The Australian Space Discovery Centre, which inspires Australians with stories of innovation, curiosity, and technology from the space sector.
- The Kids in Space program, which engages students in space-themed STEM learning and design thinking.
- Qwestacon, which engages with all Australians on science, technology, and innovation, including space.

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<sup>21</sup> Note that the term 'space activities' is used differently in the regulatory context of the *Space (Launches and Returns) Act 2018*.

- CSIRO Visitor and Discovery Centres, which offer interactive journeys through CSIRO and Australian science history, such as the Canberra Deep Space Communication Complex and Parkes Visitors Centres.
- The Geoscience Australia Education Centre which fosters understanding and interest in the applications of satellite data to benefit society, business, and the environment.

### **What Australia's international partners are currently doing**

The topic of social license around space activities, especially around spaceflight activities, is gaining traction internationally:

- The UK's Astra Carta initiative provides a roadmap for the private sector to align space-related activities with sustainability and includes a consideration of the environmental impacts of space launches.
- In the United States, advice on spaceflight including launch and returns will be coming in later volumes of NASA's Space Sustainability Strategy.

#### **Consultation prompt**

- How could the Australian Government build and maintain social license for space activities in Australia? Consider best practice guidance material, an advisory service, or support with community engagement.

## Supporting astronomy and space science

**Objective:** To support astronomy and space science by advocating for the protection of dark and quiet skies.

Radio frequency emissions and light pollution from increased space activity has unintended impacts on the benefits Australia derives from astronomy and space science. Radio frequency emissions from satellite constellations reduce the efficacy of radio telescopes, such as the SKA Observatory. Recent studies have identified unintended emissions from satellite constellations and shown that these emissions may be detrimental to the science goals of the international SKA project without mitigation<sup>22,23</sup>.

Light pollution from increasing space activity and the rise of satellite constellations could also have cultural impacts on First Nations people to whom astronomy constitutes a central practice in their way of life and sense of being<sup>24</sup>. Astronomy and space science are areas that could benefit from greater connections with First Nations scientific knowledge.

### What Australia is currently doing

Australia is home to some of the most important telescopes in the world, such as:

- CSIRO's Australian Square Kilometre Array Pathfinder (WA)
- Murchison Widefield Array (WA)
- Murriyang, CSIRO's Parkes radio telescope (NSW)
- CSIRO's Australia Telescope Compact Array (NSW)
- Anglo-Australian Telescope (NSW)

Australia is also home to the SKA-Low telescope through an Indigenous Land Use Agreement with the Wajarri Yamaji, the Traditional Owners and Native Title Holders of the Australian observatory site. The SKA-Low telescope is one of two telescopes that make up the international SKA Observatory that has support from 16 member countries.

Australia is a prime location for dark sky tourism due to its clear dark skies. Dark sky tourism is a form of eco-tourism that capitalises on the opportunity to experience natural night skies free from light pollution and encourages overnight stays which contributes to local economies<sup>25</sup> and can boost visitor numbers, especially during off-peak seasons.

Australia continues to support multi-stakeholder discussions on dark and quiet skies, including at UN COPUOS, and efforts to develop practical solutions to address the unintended impacts of satellite constellations on radio and optical astronomy.

Domestically, Australia has federal legislation to protect the Australian Radio Quiet Zone Western Australia (ARQZWA) through Radio Licensing Instruction (RALI) MS 32<sup>26</sup>, and coordination zones around all other radio astronomy facilities through RALI MS 31<sup>27</sup>. The ARQZWA hosts several

<sup>22</sup> <https://doi.org/10.1051/0004-6361/202451856>

<sup>23</sup> <https://arxiv.org/abs/2309.15672>

<sup>24</sup> Ciara Finnegan, 2022, <https://doi.org/10.3390/laws11020026>

<sup>25</sup> Moss, G., McGeorge, P., & Rubner, O. (2014). Design, marketing and financing of services in tourism and related fields. *Tourism Management*, 40, 194-210.

<sup>26</sup> <https://www.legislation.gov.au/F2023L00286/asmade/text>

<sup>27</sup> <https://www.acma.gov.au/publications/2019-09/instruction/rali-ms31-notification-zones-around-radio-astronomy-facilities>

astronomical research facilities of global importance such as ASKAP, MWA, and the SKA-Low telescope.

Legislation also protects the Mingenew Space Precinct in Western Australia, a designated satellite park by the Australian Communications and Media Authority (ACMA) that supports ground segment services and is situated in a radio quiet zone.

The Australian Academy of Science outlined a ten-year plan for Australian space science in their Decadal Plan for Australian Space Science 2021-2030 which was released in 2022<sup>28</sup>. The plan includes recommendations and strategies to advance national interests and priorities in space; driving innovation and cutting-edge science, building domestic capability, and improving the lives of all Australians.

### **What Australia’s international partners are currently doing**

The topic of dark and quiet skies in the context of astronomy is gaining traction with Australia’s international partners:

- The European Space Agency’s Zero Debris Approach (2023) sets out eight recommendations including one on guaranteeing dark and quiet skies.
- The United Kingdom released guidance in its Plan for Space Sustainability (2022) which includes measures covering many aspects of space sustainability including dark and quiet skies.
- In the United States, advice on dark and quiet skies will be coming in later volumes of NASA’s Space Sustainability Strategy.
- The International Astronomical Union (IAU) launched a Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (CPS) in 2022. CPS is co-hosted by the US National Science Foundation’s NOIRLab and the SKA Observatory.

#### **Consultation prompt**

- Should Australian satellites contain technological solutions to reduce their impact on radio and optical astronomy? If so, what solutions would be most effective?

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<sup>28</sup> <https://www.science.org.au/supporting-science/science-policy-and-analysis/decadal-plans-science/australiainspace>

## Ensuring the supply of critical enablers for space activities

**Objective:** To ensure the supply of critical enablers for space activities, such as the global geodesy supply chain, through building international partnerships and other initiatives.

Space activities such as spaceflight, spacecraft manufacturing, satellite operations including ground infrastructure, and lunar exploration depend on an array of critical enabling services. The continuity of these services is a requirement for a sustainable space sector and includes:

- The global geodesy supply chain which includes ground observatories, data centres, and analysis centres. Satellites rely on geodetic product generated by the global geodesy supply chain for constant updates on their orbits and Earth's position. These updates are essential due to the continuous movement of both Earth and satellites, influenced by solar radiation and Earth's varying gravitational pull.
- Calibration and validation services which assure the quality of Earth Observation data. These services allow the traceability of satellite sensor data to physical standards and provide a routine check on instrument performance.
- Space testing and qualification facilities and services. This enables the development of major space missions through severe space environmental testing of satellites, payloads, sub systems, and components to provide mission assurance prior to launch.

International studies have highlighted the fragility of these services. For example, in 2024, the UN Global Geodetic Centre of Excellence released a report drawing attention to major weaknesses in the global geodesy supply chain<sup>29</sup>. The result could see satellite operations and their dependent services at risk of sudden or more gradual but irreversible degradation.

Because of its unique location and strong capabilities, Australia can play an active role in international approaches to improving the supply of critical enablers for space activities, making it a partner of choice for international space collaboration and protecting its own critical infrastructure.

### What Australia is currently doing

The Australian Government maintains an active presence and leadership role on key international bodies related to Positioning, Navigation and Timing (PNT) such as the International Association for Geodesy (IAG) and the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). These bodies enable global access to services routinely relied on for satellite operations and downstream applications, such as the International Celestial Reference Frame and satellite orbit parameters.

No country can generate geodetic products alone and the geodesy supply chain can only operate under international coordination and partnership. The Australian Government plays a vital role by operating a network of geodetic observatories, including for Very Long Baseline Interferometry (VLBI), Satellite Laser Ranging (SLR), and GNSS reference stations. Yarragadee Observatory in Western Australia is operated as a collaboration between the Australian Government and NASA and is one of the world's highest performing geodetic supersites, combining all observatories on the same site. The Australian Government also undertakes governance, coordination and analytical functions generating authoritative operational geodetic parameter products for the international space and PNT communities based on international data.

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<sup>29</sup> [20240620-Hidden Risk Report.pdf \(un.org\)](#)

The National Space Qualification Network (NSQN) is a national network of space testing and qualification facilities in Australia. The NSQN is a consortium led by the Australian National University (ANU) with a total of \$1 billion in space qualification infrastructure across the country including the National Space Test Facility and the Heavy Ion Accelerator Facility hosted by ANU. The NSQN provides immediate, cost-effective testing and accelerated space mission design and delivery.

### **What Australia’s international partners are currently doing**

The criticality of enablers for space activities such as the global geodesy supply chain and space testing facilities is a topic of keen interest among Australia’s international partners:

- The European Space Agency’s Navigation Innovation and Support Program Advisory Committee (NAVAC) has released a new white paper outlining its vision for the evolution of PNT technology, applications, and services until 2035.
- The United Nations Global Geodetic Centre of Excellence recently produced a Hidden Risk Report and Policy Brief following the publication of a Global Needs Assessment highlighting how weaknesses in the global geodesy supply chain could have catastrophic impacts on critical infrastructure and national economies. A Joint Development Plan for Global Geodesy is currently under consultation.
- NASA’s Space Geodesy Program is implementing NASA’s response to the US National Research Council (NRC) Committee on Earth Science and Applications from Space recommendation by sustaining and operating NASA’s legacy Space Geodesy Networks while executing the construction, deployment, and operation of the next generation Space Geodesy stations that will be part of a new National network.
- NASA’s Space Environments Test Management Office (SETMO) is responsible for the oversight of key test and simulation assets across NASA’s field centres nationwide. These assets support NASA research, science and technology development and include facilities at the Ames Research Centre, Langley Research Centre, and the Glenn Research Centre.

#### **Consultation prompts**

- What background services are critical for Australian space activities? Consider services broadly, such as the global geodesy supply chain.
- What opportunities does Australia have to support the global geodesy supply chain through the Joint Development Plan for Global Geodesy or otherwise?

## Remediating space debris

**Objective:** To remediate space debris to protect the space assets that provide essential services to Australia.

Even with full compliance to international guidelines on space debris mitigation<sup>30</sup> the long-term proliferation of space debris is still expected, highlighting the eventual need for remediation of the existing debris population<sup>31</sup>. In fact, the number of debris objects is likely to continue growing even in a future scenario where no further objects are added to outer space<sup>32</sup>.

Global investment in space debris remediation missions and technologies is increasing. For example, Astroscale, a private orbital debris removal company, reported last year that they had raised a total of US\$376 million since inception with staff numbers growing 63 per cent since 2021<sup>33</sup>. With the relevant framework in place for space debris remediation, Australia could have access to global space market opportunities. In the interim, as the majority of debris remediation missions are led by space agencies, such as the European Space Agency's (ESA) ClearSpace-1 mission, the Australian sector's opportunity regarding space debris remediation could include partnering with international partners on missions.

Space debris remediation also contributes to a circular space economy. Active debris removal can include: removing current collision risks to existing assets; refuelling, maintenance, and life extension services to repair defunct assets that have become space debris; and future part salvaging that recycles space debris and other materials for new uses.

### What Australia is currently doing

There are a number of Australian companies that are currently developing the technologies and capabilities required for space debris remediation. For example, Space Machines Company design and build orbital servicing vehicles that can monitor and repair ageing satellites and decommission old ones. The company are planning to launch their second Optimus spacecraft in 2026.

### What Australia's international partners are currently doing

A number of Australia's international partners have missions, policies, and other initiatives supporting the remediation of space debris:

- In 2023, New Zealand published an operational policy on active debris removal and on-orbit servicing.
- Japan is running a 'Commercial Removal of Debris Demonstration (CRD2)' initiative which aims to demonstrate and commercialise active debris removal technology with Astroscale as its main partner.
- ESA is developing a space debris remediation mission, ClearSpace-1, which is planned to launch in 2026.
- The United Kingdom is running a national Active Debris Removal (ADR) mission.

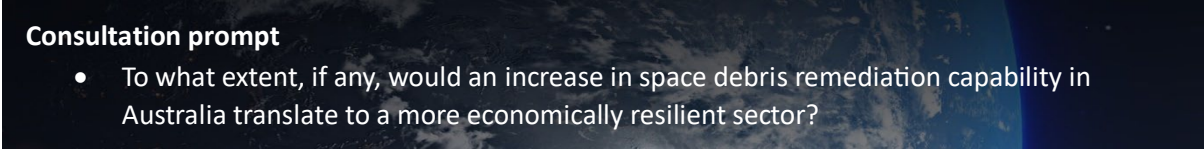
<sup>30</sup> Such as the IADC Space Debris Mitigation Guidelines, the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space (COPUOS), and the ESA Space Debris Mitigation Requirements.

<sup>31</sup> Space debris remediation refers to any action taken to reduce the risks posed by orbital debris by moving, removing, or reusing it. This definition is taken from [NASA's Cost and Benefit Analysis of Orbital Debris Remediation](#) (2023).

<sup>32</sup> [https://www.esa.int/Space\\_Safety/Space\\_Debris/Active\\_debris\\_removal](https://www.esa.int/Space_Safety/Space_Debris/Active_debris_removal)

<sup>33</sup> <https://astroscale.com/astroscale-raises-u-s-76-million-continuing-to-lead-the-growing-on-orbit-servicing-sector>

- Space debris remediation features in the first volume of NASA’s Space Sustainability Strategy (2024), with NASA also publishing a cost benefit analysis on orbital debris remediation in March 2023.



**Consultation prompt**

- To what extent, if any, would an increase in space debris remediation capability in Australia translate to a more economically resilient sector?