A discussion paper towards the development of a

SPACE+SPATIAL INDUSTRY GROWTH ROADMAP

EXECUTIVE VERSION

Acknowledgement of Country

First Nations people have long looked to the night sky for guidance and knowledge. For thousands of years, First Nations astronomers have recorded the movements of the stars, planets and moon, developing a deep understanding of the cosmos. This knowledge has played a vital role in First Nations culture and traditions, helping to shape everything from agriculture to architecture. First Nations people have also made significant contributions to Western science. Today, First Nations people are still playing an important role in scientific discovery and the advancement of the earth observation industry. First Nations science is a rich source of knowledge and discovery, and its importance cannot be underestimated. As such, we pay our respects to Elders past and present, from all Nations across the lands and waters, also known as Australia, and all First Nations peoples who continue to contribute to the vibrancy of the space and geospatial industries.

IN MEMORIAM

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2030 Space + Spatial Roadmap
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The companion document to this Executive version of the Roadmap is the Extended version which includes a thorough summary of the many issues and suggestions provided in the detailed submissions and through the workshops and website in response to the Consultation Paper (June 2021, 100 pages) (https://2030spaceandspatial.com/key-issues/)

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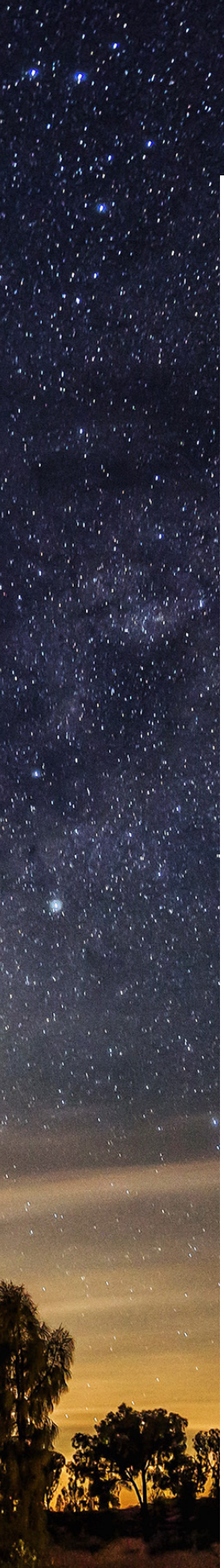


Foreword

Australia's space and geospatial* industries have reached a pivotal moment in their development. Both are small by the Organisation for Economic Co-operation and Development's (OECD) standards. Neither has yet created a multi-national commercial enterprise. Without additional and specific actions, neither is likely to meet the rapidly growing needs of Australia's civilian and defence sectors over the coming decades.

Australia needs to significantly strengthen, integrate and coordinate these two vital sectors so that they can innovate, grow and deliver at pace and position Australia to join the digital age's global leaders.

Australia is fundamentally reliant on space and geospatial based information flows for economic productivity and management of critical issues including climate change, security and environmental management. As a nation, Australia must decide if it is going to keep pace with global developments in space and geospatial industries. Will Australia choose to make sufficient investment in areas including satellite manufacturing, Spatial Digital Twins, artificial intelligence, machine learning and data reception and become an active player in these markets or will Australia miss the opportunity to fully participate strategically and economically?

This roadmap is the product of extensive and industry-wide consultation. It sets out nine high-priority objectives that, if undertaken, will help ensure Australia's interlinked space and geospatial industries maximise their growth potential, and deliver critical services to Australia's governments, commercial and defence sectors, and the wider community.

These objectives are designed to inform government policy and support industry. They will strengthen and integrate the space and geospatial sectors. They advance and champion space and geospatial industry expertise in areas including:

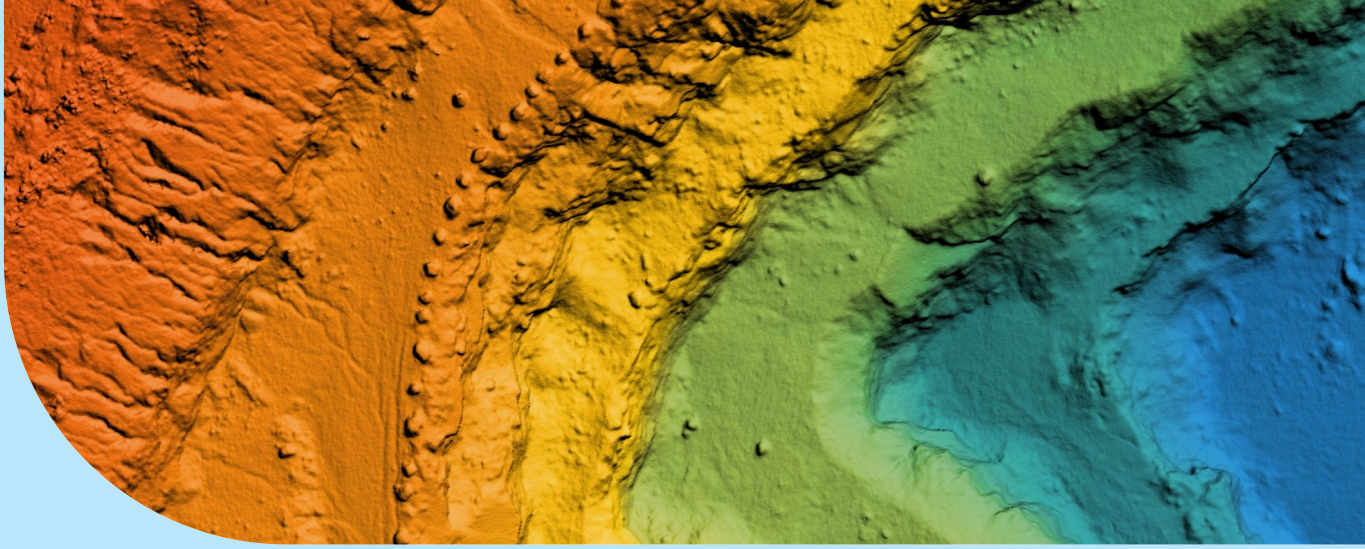
- Weather and climate forecasting
- Natural disaster preparation and response
- Telecommunications including broadcasting, telephony and internet access
- Positioning, Navigation and Timing (PNT) for all forms of transport and logistics operations
- Timing signals for financial transactions
- Critical infrastructure
- Defence.

A competitive advantage for Australia
A wide range of space and geospatial roadmaps, plans and strategies already exist. This paper acknowledges these important contributions. However, the nine priorities in this paper do more than complement these previous works. They are a call to action.

Australia has a golden opportunity to establish new and deeper relationships with the emerging sovereign space industry as well as with the established players in the geospatial industry. Australia must think long term and do so with foresight, planning and ambition. If Australia collectively seizes this opportunity, it can accelerate the rate of growth of both industries and achieve critical mass far more quickly. Building Australia's space and geospatial capabilities are mission critical to the future of this nation.

Dr Peter Woodgate
Chair, Steering Committee
2030 Space+Spatial Industry Growth Roadmap

*The terms 'spatial' and 'geospatial' are used interchangeably throughout this document.



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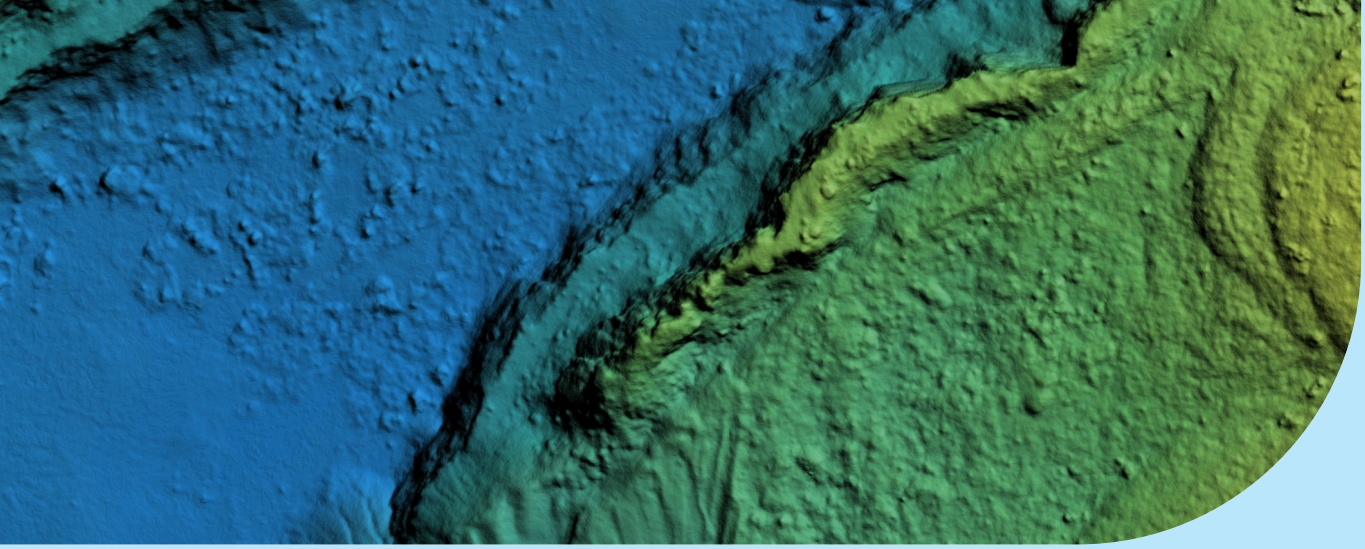


Executive Summary

This paper has been developed by Australia's space and geospatial industries. It sets out nine objectives and accompanying actions to accelerate the growth of these two industries working together in the national interest.

Three growth scenarios for the Australian space and geospatial industry are presented; from high-growth with appropriate capital investment through to a modest, business-as-usual approach. The goal is to ensure that the Australian space and geospatial industries can reach their full economic, social and technological potential.

This paper has been shaped by extensive industry-wide consultation led by industry bodies including the SmartSat CRC and its space industry start-up cluster AURORA Pty Ltd, the Spatial Industries Business Association (SIBA), the Surveying and Spatial Sciences Institute (SSSI), and Earth Observation Australia (EOA) and FrontierSI. Leading government bodies including the Australian Space Agency (ASA), the Australia and New Zealand Land Information Council (ANZLIC), the Department of Defence (Defence), Geoscience Australia, the Bureau of Meteorology, the Department of Home Affairs and Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science agency, amongst others were also consulted.

Background

The space industry provides critical elements of the communications supply chain through satellite communications, and vital elements of Earth Observation and Positioning, Navigation and Timing services from Global Navigation Satellite Systems (GNSS) and Earth Observation sensors. The geospatial industry provides the bulk of the subsequent data infrastructure, value-added content and analytics, and the 'last yard' delivery channels to customers and end users economy-wide.

In 2016 the Australian Civil Space Strategy sought to triple the size of the industry from an estimated $3.8 billion to $10-12 billion by 2030. To reach these goals, a Compound Annual Growth Rate (CAGR) exceeding 8.5% is needed[1]. Currently, Australia's space industry is growing at a CAGR of about 5% per annum[2]. To build Australia's underpinning space and geospatial capability and meet the growth goals, Australia needs to shift into a higher gear.

In 2022, the global market size of the geospatial sector is estimated to be $540 billion in direct revenue with a CAGR at 13.6%, and an economic impact exceeding $2 trillion[3].

A recent Euroconsult study[4] of government space expenditure shows that as a proportion of GDP[5], Australia ranks 21st despite having the 13th largest economy. By way of comparison, the Australian Government spent less in 2021 than Belgium, a nation with an economy less than one third the size of Australia's. When compared to nations with equivalent national economic outputs, the Australian Government spent, for example, about half that of South Korea.

The implications for industry are that, compared with peer nations, Australian governments spend far less on space products and services. Furthermore, there is evidence within the Australian Government procurement database that much of this government expenditure is directed towards imported space products and ends up supporting the strategic space industries of other nations.

1 Advancing Space: Australian Civil Space Strategy 2019-2028, Australian Space Agency, April 2019

2 Economy, Jobs and Insights, Economic Development Australia, website accessed 17 May 2022. Recent South Australian government figures (March 2022) indicate that that state is currently delivering 5.8% growth per annum for the space sector.

3 GeoBuiz 22: Global Geospace Industry Outlook, GW Consulting, April 2022, accessed 8 May 2022.

4 Government space budgets driven by space exploration and militarization hit record $92 billion investment in 2021 despite COVID, with $1 trillion forecast over the decade, Euro Consult, 6 January 2022, accessed 8 May 2022.

5 World Economic Outlook Database, IMF, October 2021, accessed 8 May 2022.

Key findings

A number of key findings and observations from extensive consultation and industry discussion have framed the creation of this paper:

- **Space and geospatial technologies are essential for addressing critical national challenges, including climate change**
  Space-derived geospatial data is critical to the management of many key challenges facing the nation in the decades ahead, especially the existential threat posed by climate change. For example, the Global Climate Observing System notes that 32 of the 54 essential climate variables can only be monitored from space and many of these require advanced geospatial analytics. This underlines the importance of a strong and coordinated relationship between the space and geospatial industries and greater sovereign capabilities.

- **It is time to gain consensus on national priorities for space and geospatial investment**
  Australia has at least 25 existing space and geospatial strategies and plans, many developed in isolation of each other. Australian governments have many existing programs funding space and geospatial industry development and research. At present Australia lacks a clear statement of the agreed national capability priorities and a coordinated governance approach focused on delivering these national priorities. By acting with pace, purpose and with better coordination, Australia can substantially improve the allocation of resources and the outcomes for the space and geospatial industries.

- **Australia is exposed to the sovereign risk of being denied access to space-derived information**
  Australia's reliance on space assets and their geospatial information products and services is growing rapidly in both the civilian and defence sectors. However, almost all of the space assets and information upon which Australia relies (used to provide services such as weather and positioning services) are based on information and assets that are provided and controlled by foreign entities. This leaves Australia exposed to the risk that access to this critical infrastructure can be denied.

- **The space and geospatial requirements and procurement approaches of the Australian Government Agencies (including the Department of Defence) are fundamental to the viability of the space and geospatial industries**
  Clear statements of sovereign capability requirements are needed together with procurement approaches which support the growth of Australian capability. At present, Australian space and geospatial capability largely reside in small and medium-sized enterprises (SMEs) which will need to attain critical mass to be able to successfully bid for larger contracts.

- **Australia needs to be involved domestically and internationally in services provided by satellites**
  Most new satellites are designed to provide Earth Observation (EO); Position, Navigation and Timing (PNT); and tele-communications services. EO (including Internet of Things sensors) and PNT derive highly valuable geospatial information. Telecommunication is vital for the dissemination of this information. The world is moving towards precision positioning (centimetre accuracy) in near real time for everything from robotic mine and port equipment to autonomous vehicles. PNT systems working with telecommunications provided by satellites will be crucial to meeting this market need. Precision positioning provides a premium return for users. Australia needs to be involved at both a domestic and international level to reap the benefits of these changes and mitigate sovereign risk.

- **Australia needs to develop a greater understanding of the threats to Australia's space and geospatial assets**
  The threat environment for space and cyberspace has increased significantly in recent years, and this trend is expected to continue. Australia needs to strengthen the resilience of its critical space and geospatial assets by improving understanding of threats and dependencies and then developing strategies to mitigate risks. This will become increasingly important as Australia becomes even more dependent on space and geospatial products and services.

- **The cost of launching commercial space assets is rapidly reducing**
  Lower satellite manufacturing and launch costs are seeing rapidly increasing numbers of commercial space assets. There are more than 5,000 active satellites currently in orbit. Satellite filings with the International

Telecommunication Union now exceed 70,000 satellites, most by commercial organisations. These are powering massive growth in digital enablement, an ever-widening range of sensor data and expanded connectivity. At this stage, it is uncertain whether Australia will have the capability (satellite manufacturing, launch systems, control and data reception) to be a significant contributor to this growth. Australia is at risk of missing an important opportunity to participate in this growth, both economically and strategically.

- **A key driver of space industry growth is National Space Missions**
  History has shown that the leading space capable nations have built and sustained their space expertise through National Space Missions. Those governments fund National Space Missions to provide their country with new capabilities which may not have existed previously, or to replace or augment capabilities for which it is dependent on foreign providers. For example, Australia's National Space Mission for Earth Observation will place four satellites into space and provide data for use in weather forecasting, land observation and national security in order to assure access to critical data currently supplied by foreign providers.

With appropriate policy settings, National Space Missions enhance capabilities across the public and private sectors and provide industry with the experience, operational expertise and supply chains to attain international competitiveness. National Space Missions also give these companies the international recognition and capability necessary to successfully win business on international space projects.

Many countries have lifted themselves to become major space capable nations through an ongoing program of National Space Missions (e.g. India, Canada, and Israel). Australia has the nascent capability to follow this path to achieve strong space capability. It can accelerate innovation in the space and geospatial industries while simultaneously mitigating sovereign risk through an ongoing series of National Space Missions. A series of properly chosen missions can catalyse the growth of the Australian space and geospatial industries, positioning them to win additional business on international space programs, while delivering some of the essential data services needed within Australia for its future economic productivity and growth.

Nine Objectives to Optimise Industry Potential

The space and geospatial industries have identified nine critical objectives to accelerate the growth and capabilities of these two industries:

1. **Establish the Blueprint with ongoing National Space Missions**
   Establish an overarching space and geospatial strategy with ongoing National Space Missions – the Blueprint
   The industry Blueprint will clearly lay out the critical sovereign capabilities and key actions needed to grow these two industries and develop a program of National Space Missions to build the Australian space capability and simultaneously address sovereign needs. The Blueprint and associated national missions must be all-embracing, covering civil and defence, private and public sectors. A new national governance mechanism is needed to facilitate coordination and align strategies and planning across all of these areas.

2. **Drive Industry Growth**
   Drive sustainable long-term growth through development of a robust ecosystem of local space and geospatial companies
   Government and Defence prioritising local supply chains and Australian industry content will be critical to growth. An essential first step in driving the level of industry growth being sought is developing a clear understanding of the composition, capability and structure of Australia's current space and geospatial sectors. Growth targets by industry sub-sector to 2030 and 2040 can then be effectively set.

3. **Coordinate Research**
   Improve coordination of publicly funded research for the space and geospatial industries
   Coordinating publicly funded R&D nation-wide and clearly targeting innovation in high-impact opportunities for industry through national and International Space Missions is crucial to accelerating industry growth.

4. **Increase Capability**
   Drive high-tech employment opportunities through a technologically capable workforce by building space and geospatial skills capacity
   Developing space and geospatial industry capacity and competencies by nurturing local SMEs, particularly through Government procurement (including Defence procurement) to meet sovereign needs, will create more high-tech employment opportunities. Increased investment in space and geospatial career promotion, wider availability of suitable education and training pathways, and improved skilled migration schemes are needed to build the required skilled workforce.

5. **Develop Spatial Digital Twins (SDT)**
   Build Australia's sovereign capability in SDT as a critical national capability and an economic growth opportunity
   Australia needs to coordinate and further grow its investment in SDT, acknowledging that these virtual representations are a critical national capability with significant economic, environmental and social benefits.

6. **Upgrade Position, Navigation and Timing (PNT)**
   Upgrade Australia's PNT capabilities and technologies to meet national needs and position Australia to capture a bigger share of global economic growth in PNT
   Australia has many planned significant developments in PNT. Enhanced PNT will be essential for many future technologies and Australia will need to invest and carefully manage the resilience and future growth of this key capability.

7. **Enhance Sovereign Capability**
   Reduce sovereign risks to the supply of Australia's critical space and geospatial infrastructure, systems and data
   Australia's dependence on space and geospatial capabilities is rapidly growing. It is a strategic imperative for Australia to secure assured access to critical space assets and the associated geospatial services. Enhanced sovereign capability and secure access to critical assets, systems and data management facilities facilitated through ongoing National Space Missions will ensure timely access to data and services essential to Australia's economy and security.

8. **Grow Support for Defence**
   Support Australia's sovereign space and geospatial industries to meet more of the short, medium and long-term needs of the Department of Defence, with local industry supplying globally competitive space and geospatial products and services
   Space and geospatial industry peak bodies to lead development of a strategy, in consultation with Defence and the ASA, that aligns Defence Priorities with Civil Space National Priority Areas to build domestic space and geospatial industrial capabilities. National Space Missions could help build domestic capacity to support Defence capability and sovereign supply requirements.

9. **Enhance National Mapping Base and its Foundation Geospatial Data**
   Maintain and enhance Australia's national map base to ensure the accuracy and integrity of Australia's geospatial reference system and the critical national geospatial data that it supports.
   Australia's current map base, upon which all map-based data relies, from land ownership to vehicle navigation, is in need of fundamental improvement to meet the future needs of government and industry. Work is underway to modernise these geospatial resources so that they are fit for purpose, but the need to do so is insufficiently recognised and funded. Greater priority and resources are required to meet the enhanced mapping and analytical needs of Australia in the 21st century.

Government, firms, industry bodies and research providers each have a critical role to play in realising these objectives. For each of the objectives specific 'Actions' and 'Action Champions' have been proposed.

A golden opportunity

Australia's future prosperity and security will depend on our space and geospatial industries. Productivity gains and management of critical issues including climate change, security and environmental management are now all fundamentally reliant on space and geospatial based information flows, with this is only set to increase.

The synergies of the space and geospatial industries working together creates enormous benefit. Optimising and enhancing their combined ecosystems, including through an ongoing series of National Space Missions, will create significant competitive advantage for Australia. This will drive significant economic growth and lead to new businesses, job opportunities, and export revenue. This will also play a critical role in managing the environment, improving our national wellbeing, and will greatly strengthen our sovereign capabilities in terms of defence and security.

Australia has a golden opportunity to establish new and deeper relationships with our emerging sovereign space industry as well as with established players in the geospatial industry. If Australia collectively seizes this opportunity, it can accelerate the rate of growth of both industries and realise critical mass far more quickly. Building Australia's space and geospatial capabilities is mission critical to the future of this nation.

Australia's Space and Geospatial Industry: The Vision

Australia's space and geospatial industries are committed to the Vision that:

Australia becomes a global leader in space and geospatial systems and services.

Globally competitive sovereign space and geospatial industries will give Australia the capability and capacity to:

1. Provide the nation with its critical sovereign space and geospatial needs, including assured access to space
2. Execute complex space projects in Australia and make substantial technical, operational and management contributions to international missions
3. Provide global leadership in integrating the space and geospatial domains and create market opportunities in adjacent and emerging disciplines. These include data-driven decision-making, artificial intelligence (AI), precise positioning in real time, remote operations, AI, machine learning, SDTs, optical communications and quantum technologies, amongst others
4. Capture a much larger share of the rapidly growing global space and geospatial markets
5. Be a destination of choice for space and geospatial specialists and companies and highly attractive for new space and geospatial start-ups
6. Be recognised as a key provider of research, education and training in space and geospatial sciences and technologies with a highly skilled workforce capable of achieving critical mass for sovereign needs
7. Underpin critical supply and value chains across the whole Australian economy

The synergy of space and geospatial working together

The space and geospatial industries have a clear understanding of the nature and strength of their self-reinforcing relationship, and this is illustrated in Figure 1.

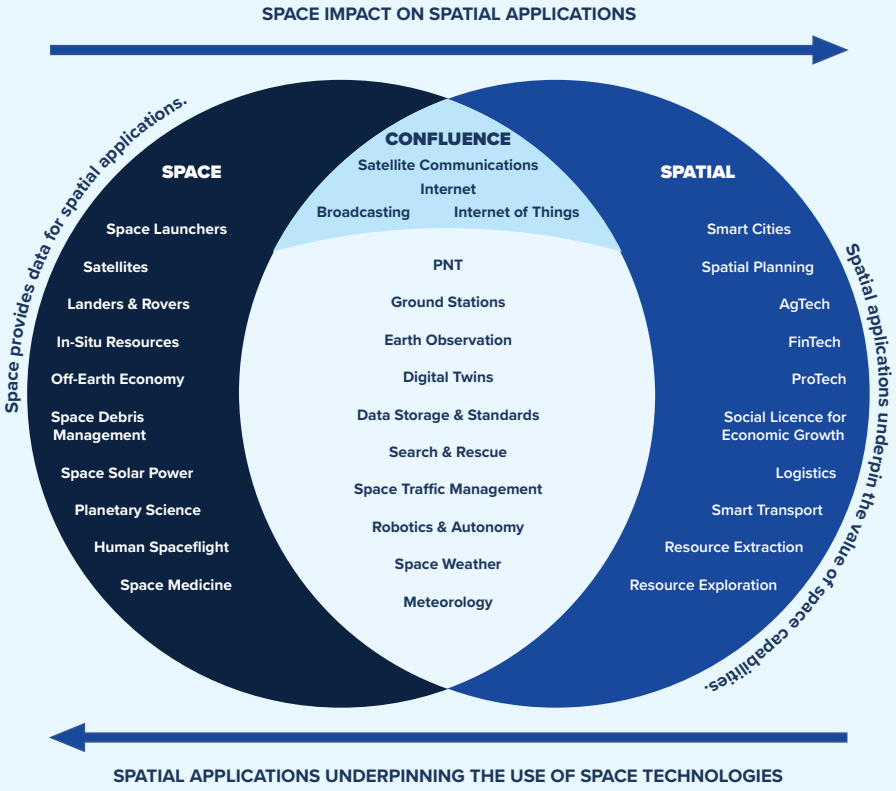


Figure 1: The close relationship between Australia's space and geospatial industries

Where We are Today

Today, Australia has a relatively small space and geospatial ecosystem comprising a diverse yet vibrant collection of companies that are mostly SMEs, with some foreign-owned primes (large multi-national companies), and a growing number of start-ups. Despite a great start in the 1950s and 1960s and occasional activities since then, the Australian space industry languished for many decades, and only recently have efforts resumed to actively grow our space capability again. By contrast, the geospatial industry has been steadily growing over the past 50 years, building our capacity and capability and developing geospatial innovations recognised around the world.

While the relatively recent remergence of this space capability is promising and there is clear evidence of industry growth, large gaps in planning remain. Government procurement (particularly Defence) is critical to the growth of both industries, especially space.

At present, Australia is highly dependent on international partners for the delivery of space capability and its imported intellectual property and assets. Recent studies have shown Australia is not capturing a proportionate share of the space market. In 2016, Australia's share of the global economy was 1.8% while it only captured 0.8% of the global space market. A recent report by Euroconsult on global space expenditure shows that as a proportion of GDP, Australia ranks 21st despite having the 13th largest economy – see Figure 2. The Australian Government spent less on space in 2021 than Spain and Belgium, two nations with a smaller GDP. When compared to nations with equivalent national economic outputs, the Australian government spent one tenth that of the Russian Federation and about half that of South Korea. The implications for industry are that, compared with peer nations, the Australian Government is a relatively small customer of the space industry. Perhaps of greater importance is that much Australian government expenditure goes offshore when capabilities exist in Australia that could be nurtured in a similar fashion to those in other countries.

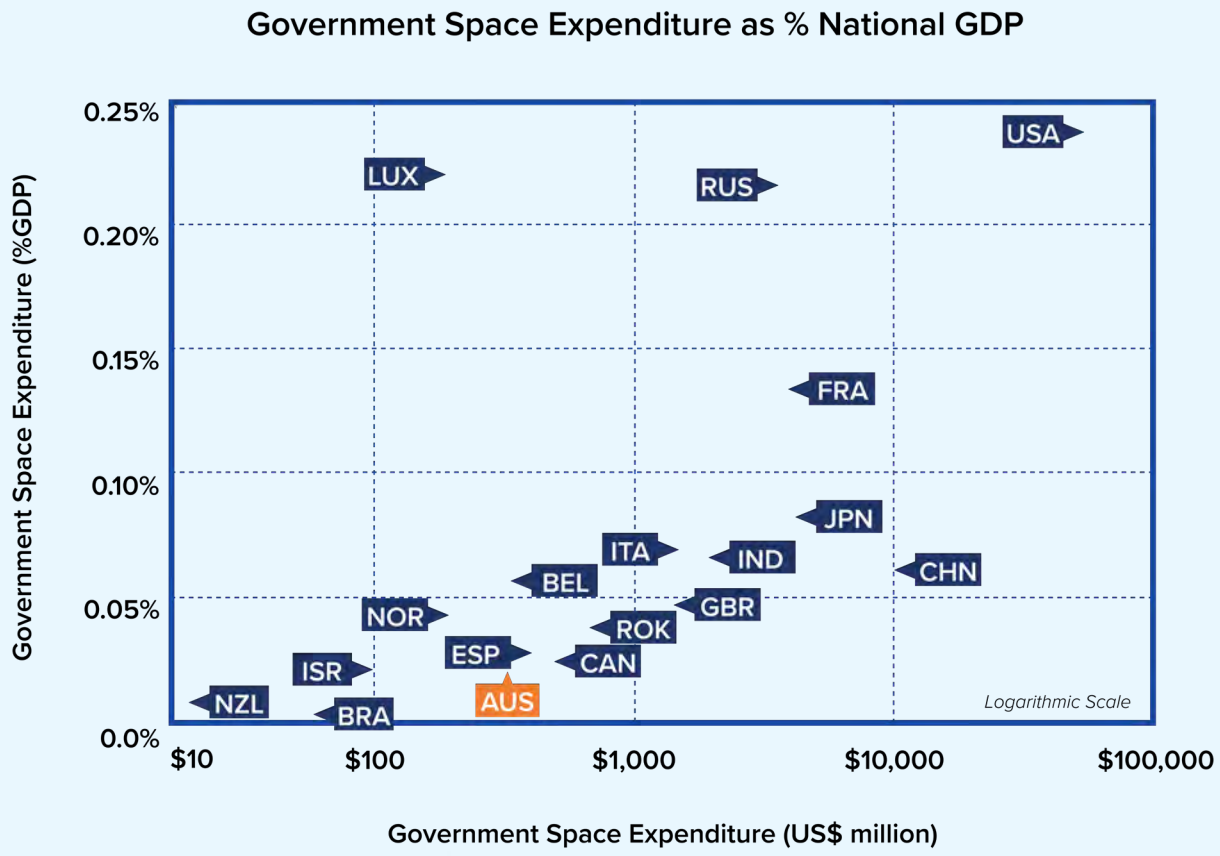


Figure 2: Australian Government Space Expenditures vs Comparator Nations. Note the expenditure axis is logarithmic so that each rectangle to the right is ten times the amount of its neighbour to the left, thereby highlighting the proportionally very large expenditure of those nations to the right of the figure.

"The Now Frontier"

In November 2020, the then Minister for Industry, Science and Technology requested a House of Representatives committee inquiry into developing Australia's space industry. This inquiry held 15 public hearings and received 89 submissions. In November 2021, the committee released their report[6], 'The Now Frontier: Developing Australia's Space Industry' which made 38 recommendations. These bipartisan recommendations are consistent with the nine Roadmap objectives outlined in this document.

A Roadmap for Growth

This paper proposes nine key national objectives critical to meeting the space and geospatial industries' vision for accelerated growth and increased capability for the two industry sectors to 2030, on to 2040 and beyond. Each objective has one or more Actions and these are accompanied by their Action Champions who will help drive progress and change.

The degree to which Australia acts on these nine objectives will govern the growth trajectory for Australia's space and geospatial industries. Three growth scenarios have been identified:

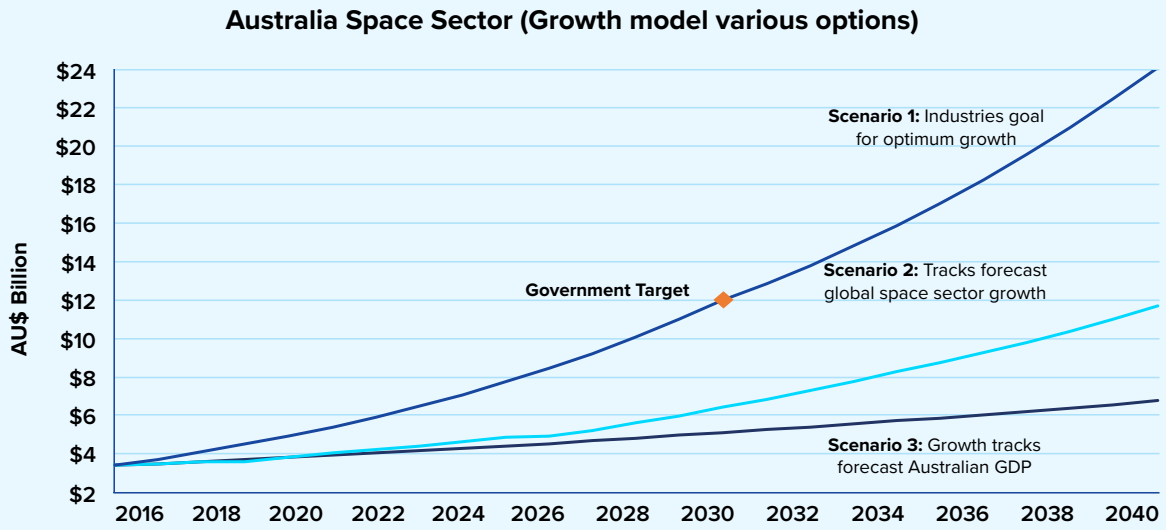
Scenario 1

Transformational growth

This scenario assumes all nine objectives are met and the actions undertaken. This scenario transforms Australia's space and geospatial industry sectors to be globally competitive and relevant, with an increased share of the global space and geospatial economies. This will see:

- The emergence or creation of at least one large-scale Australian space company of sufficient size to successfully compete in delivery of large defence, government or international contracts
- Broadening of the sovereign capability set including regional data connectivity and earth observation requirements and greater self-sufficiency in areas including defence and weather forecasting
- Strengthening and consolidation of the SME base
- A much larger pipeline of start-ups

New policy settings will help drive innovation, build global competitiveness and deliver a range of 'public good' national capabilities. The CAGR of about 8.6% p.a. is the only scenario that delivers the 2030 goal of a tripling of the value of the space industry, as set by the Australian Government when establishing the ASA. This also results in Australia increasing its share of the global space economy from 0.8% to 1.7%.



Scenario 1: Transformational Growth – 8.6% growth. Meets Government target of 20k jobs and a $10 billion industry by 2030
Scenario 2: Medium Growth – 5% growth. No change to Australia's share of global space economy at 0.8%, fails to grow local primes
Scenario 3: Modest Growth – 2.6% growth. Few if any of the objectives met. Global share falls to 0.5%

Figure 3: Three Australian Space Industry Growth Scenarios[7]

6 https://www.aph.gov.au/Parliamentary_Business/Committees/House/Industry_Innovation_Science_and_Resources/SpaceIndustry/Report

7 Note that these are aspirational scenarios for illustrative purposes only. In developing a blueprint for growth, Australia needs better data to understand the baseline figure for future growth and this should be determined by Gross Added Value, not revenue. Most economic forecasts estimate growth based on revenue and this can be misleading as outlined in the IDA report. (Source: Bryce 2019 Global Space Economy at a Glance)

Scenario 2

Medium growth: Tracks to the forecast global space industry growth

This scenario assumes that only some of the objectives set out in this industry paper are met. It assumes that Australia's growth matches the forecast global space sector growth of an estimated 5% CAGR to 2030. As a result, Australian industry is unlikely to achieve sufficient scale and capability to address larger government procurement needs including defence capability programs, regional data connectivity and earth observation requirements as well as ensuring greater self-sufficiency in weather forecasting. There will be on-going reliance on foreign companies to deliver Australia's needs. Importantly, this scenario will not deliver the target for industry growth set by the Australian Government which assumes a growth exceeding 8.5% to 2030. Under these assumptions, Australia's share of the global space economy remains at 0.8% by 2040.

Scenario 3

Modest growth: Tracking to the forecast for Australian GDP growth

In this scenario – a business-as-usual approach – it is assumed that few of the actions are implemented and few, if any, of the nine objectives are met. This scenario tracks current national long-term GDP growth forecasts of 2.6%. It assumes that Australia will continue to follow current policy settings with a high reliance on foreign suppliers with the attendant sovereignty risks that this implies and a failure to capitalise on the commercial potential presented by the fast-growing global industry. Australian industry will continue to struggle to translate world-class research into commercial opportunity and to compete in global markets. Under this scenario, Australia can expect growth but with an overall decline in Australia's share of the global space and geospatial economies due to falling industry competitiveness and capability. The result will be a nation that continues to be reliant on foreign providers except in a diminishing number of niche areas including earth observation analysis and precision positioning. The Australian space industry will only capture 0.5% of the global market by 2030, a significant reduction from 0.8% in 2016.

Key Objectives, Actions and Action Champions

This industry paper sets out:

- Nine key objectives to accelerate the growth of the space and geospatial industries
- Clear Actions that will progress each objective
- Organisations that will be the Action Champions and that will play a lead role in driving the Actions towards completion

Objective 1: Establish the Blueprint with ongoing National Space Missions

Establish an overarching space and geospatial strategy with National Space Missions – the Blueprint

Australia has existing space and geospatial capabilities but lacks critical mass and lags behind its Organisation for Economic Co-operation and Development (OECD) cohorts. Australia risks missing out on the tremendous economic growth and structural efficiencies that these industries can deliver. It is imperative that the planned ASA's Space Strategic Update and accompanying Blueprint incorporate an ongoing program of National Space Missions as well as the full suite of geospatial capabilities to ensure the highest value supply chain of space-derived geospatial information products.

Moreover, the creation of the ASA in 2018 with a clear goal of rapidly developing the Australian space industry has highlighted the complete absence of any equivalent body responsible for assisting the Australian geospatial industry to flourish, which is more established and mature than the local space sector. A review of the market research reports available in the public domain has determined that the size of the Australian Geospatial sector in direct revenue generated is $2.9 billion p.a. (estimated for 2022) and is growing at a CAGR of 5.5%, with approximately 18,000 geospatial professionals nationally identified in the latest Australian Bureau of Statistics (ABS) data. The economic impact of geospatial technologies and services for Australia's economy is approximately $18 billion p.a. The global geospatial market is forecast to be USD 681 billion in 2025 and grow to USD 1.44 trillion by 2030, with an economic impact for the global economy of between USD 5.4 to 10.2 trillion by 2025[8].

With average growth of geospatial services and technologies globally running at more than 13% CAGR, and the Asia Pacific region growing at nearly 18%, Australia's growth of only 5.5% CAGR, less than half the rate of the global average, a failure of industry and policy. Given Australia is considered to be highly advanced in its geospatial

8 Geospatial World: Geobuiz 22 (2022), Global Geospatial Industry Outlook, https://www.geospatialworld.net/consulting/reports/geobuiz/2022 accessed 3/8/2022

capabilities, it is clear that with strong government policy aimed at developing this sector, leveraging the benefits of exploiting the synergies of the space and geospatial activities and some targeted investment, the growth potential for the geospatial sector is equally as exciting as the space sector.

Moreover, a new national governance mechanism with space and geospatial working together would greatly facilitate coordination, policy formation, strategic planning and aligned investment across the industry, civilian government, defence, research and academic sectors – Australia operating as one cohesive nation.

Action 1.1
Australia needs a single guiding national space and geospatial strategy and detailed Blueprint that sets out in detail the priority space and geospatial capabilities needed by the nation. It will incorporate major National Space Missions that address critical national challenges, and civil and defence applications of space and geospatial capabilities across all sectors of Australian society, the environment and the economy.

Action Champion 1.1
The ASA in collaboration with ANZLIC.

Action 1.2
Australia needs to develop a clear investment strategy to sustain both commercial and defence industry supply chains. The Blueprint will provide a clear strategic direction for government and industry and needs to be underpinned by an investment strategy — including National Space Missions — which will concurrently inform and grow our space industry with a stable pipeline that is competitive both nationally and internationally. Formulating and funding National Space Missions that drive development of high priority sovereign capabilities that are globally competitive will also play an important role.

Action Champion 1.2
The ASA and Department of Defence, supported by SIBA and Earth Observation Australia (EOA).

Action 1.3
Government procurement programs must be reviewed to ensure that critical components of the Blueprint can be delivered.

Action Champion 1.3
The ASA and the Department of Defence to collectively determine the best national approach to aligning government policy across all jurisdictions at Commonwealth, state and territory levels in order to achieve a truly “Whole of Government” response to space and geospatial industry growth.

Action 1.4
A new governance mechanism be found that enables regular dialogue and coordination on strategy formulation by the jurisdictional lead bodies in both space and geospatial, civilian and defence, to synchronise their goals, and the consequential planning and road-mapping that drives the achievement of these goals in the Space and Geospatial Strategy and the capabilities set out in the Blueprint.

Action Champion 1.4
The ASA, supported by ANZLIC and the Department of Defence, convene a group of industry and research peak bodies.

Photo courtesy of Geoscience Australia

Objective 2: Drive Industry Growth

Drive sustainable long-term growth through development of a robust industrial ecosystem of space and geospatial companies

Development of growth strategies for specific segments of the space and geospatial industries for 2030 and 2040 will result in a robust space and geospatial industries ecosystem and capitalise on the long-term global economic growth opportunities for these two industries. Morgan Stanley forecasts that in 2022 the global space industry is worth USD $411 billion per annum and is expected to grow to USD $1.1 trillion by 2040. This represents one of the key global growth market opportunities of the coming decades. Critical to establishing growth strategies is the need to understand the existing industry structure and composition by company and capability. This data needs to be collected and maintained in order to underpin sound growth planning and monitor progress towards goals. Growth targets by industry sub-sectors to 2030 and 2040 can then be effectively set. National Space Missions will be critical to growth.

Action 2.1
Acquire data to understand existing industry structure and identify current Australian presence in relevant segments.

Action Champion 2.1
SmartSat CRC (which has around 100 partnering companies, including 70 start-ups) will undertake a first-phase study, drawing on support from the ASA and SIBA/SSSI.

Action 2.2
Agree 2030 and 2040 growth targets across each segment of the space and geospatial industries.

Action Champion 2.2
A first-pass set of 2030 growth targets to be developed by SmartSat CRC, supported by EOA and by industry peak bodies and government.

Action 2.3
Undertake a full ABS stocktake of the industry including reviewing the ANZSIC system with respect to the treatment of space and geospatial.

Action Champion 2.3
ABS, prompted by the SmartSat CRC and SIBA/SSSI.

Objective 3: Coordinate Research

Improve coordination of publicly funded research for the space and geospatial industries

Publicly funded research will play a crucial role in achieving Australia's long-term objectives for sovereign space and geospatial capabilities as well as capturing a larger share of the global commercial space and geospatial sector. Australia already conducts significant research in the space and geospatial sectors (spanning the publicly funded research sector, the private sector and the defence sector) and has a growing international reputation for providing significant space and geospatial research. Moreover, in recent years Australian governments have implemented a number of programs to accelerate the translation of the outputs of research into commercial ventures.

Australia also has research strengths in a number of potentially disruptive technologies. Australia can combine space and geospatial capability with disruptive technologies from other sectors and leapfrog into world leadership roles, generating a competitive advantage and the potential to capture significant market share. Australia currently has several publicly funded programs that provide investment for space and geospatial research and development at the national and state level (some specific to space and geospatial but others open to the broader range of high technology sectors). There is little strategic direction or coordination of space and geospatial investment and projects across these programs. By introducing strategic guidance for space and geospatial priorities and aligning these programs with the high-priority elements of the Blueprint that require R&D, the nation could significantly improve its ability to achieve nation-building critical mass.

Building enduring new space and geospatial capabilities through technological innovation requires sustained investment programs including ongoing National Space Missions over the long term with repeated investment cycles, especially in areas of science that require significant capital investment at the early stage and that are deemed to be needed sovereign capabilities.

Action 3.1
Consideration be given to establishing a standing body for guiding priorities for publicly funded R&D in the space and geospatial sciences which could include a process for providing advice to the National Science and Technology Council (NSTC). This body would be part of the new governance mechanism suggested under Action 1.4. A key role would be to determine the Technology Readiness Levels (TRL) for nationally agreed research and development priorities (focussing on TRLs 1-4). A body of this kind could also support the identification of how the space and geospatial industries can support the agenda setting for the NSTC.

Action Champion for 3.1
SmartSat CRC to develop options for the development of this standing body, supported by the Office of Australia's Chief Scientist and FrontierSI.

Action 3.2
Improve the alignment of existing funding (particularly ARC, ITRP, ARC linkage, CRC-P, NCRIS, Critical Technologies Fund and Defence) across space and geospatial to specifically target prototyping activity and advanced technology demonstration in space. This could be structured in some instances as grants requiring co-investment from industry with the co-investment ratio recognising technical risk and commercial risk and rewards.

Action Champion for 3.2
SmartSat CRC to develop options for an appropriate mechanism in consultation with the group of Australian Chief Scientists and EOA.

Objective 4: Increase Capability

Drive high-tech employment opportunities through a technologically capable workforce by building space and geospatial skills capacity

A technology driven world requires a technologically capable workforce. Deeper investment in capacity building in space and geospatial skills, including through ongoing National Space Missions, will drive employment opportunities in these high-tech industries. It will underpin the ability for Australia to capitalise on the growth opportunities of the growing space and geospatial industries and develop the technologically savvy workforce needed by Australia across the increasingly interconnected technologically driven growth industries of the future.

Action 4.1
The challenge of meeting the jobs growth target needs a systematic approach including:

4.1.1 Establishing an agreed national taxonomy of skill sets for space and geospatial

4.1.2 Extending the 2021 SmartSat-ASA skills gap study to cover other geospatial skills that are dependent on space and that support the growth targets.

4.1.3 Undertaking an audit of the existing suite of courses at the tertiary level in Australia covering both the university and vocational education and training sectors, including the current size of the pipeline of graduates from micro-credentialing through to the doctoral level.

4.1.4 Publication of an analysis of the estimated shortfall in skill sets against the taxonomy in order to better inform education providers to help with forward planning, investment and expansion of degree and training options.

4.1.5 Sourcing additional resources for the Space, Spatial and Surveying Diversity Leadership Network (SSS-DLN) and allied activities including Traditional Owners to significantly strengthen the diversity outcomes for space and geospatial.

4.1.6 Creating an inventory and profile of the companies that generate space and geospatial services and the companies that rely on these capabilities.

4.1.7 Examination of micro-credentialing programs to rapidly grow the space workforce to meet the immediate as well as long-term needs of industry.

4.1.8 Establishing a regular flow of space missions to attract space-qualified individuals back to Australia as well as attracting other space-qualified personnel from other countries to migrate to Australia.

4.1.9 Embedding skills training and career pathways in space across primary through to tertiary education.

4.1.10 Developing a coherent and integrated approach to space and geospatial education programs in Australia that better meets the needs of government, Defence, academia, and industry.

Action Champions for 4.1
SmartSat CRC supported by EOA and the SSSI to develop a detailed plan for each of the issues identified under 4.1 that includes the identification of specific organisations to take responsibility for key elements of the action plan.

Objective 5: Develop Spatial Digital Twins (SDT)

Build Australia's sovereign capability in SDT as a critical national capability and an economic growth opportunity

SDTs are an advanced spatially accurate digital representation of the real world with 3D and 4D (time) dimensions that are emerging globally as a powerful tool to improve understanding of the physical environment and enable better-informed decisions. SDTs develop predictive capability through AI and machine learning and offer just-in-time analytics, products and services. They vastly improve the value of data through aggregation from multiple sources and shared access, leading to better information for decision-making and lower service life costs for many forms of infrastructure. With their rich information suite, analytics and services, SDTs are rapidly becoming an essential component of global critical cyber infrastructure.

SDTs will be a critical information and decision-making tool to address Australia's key challenges and will play an important underpinning role as a sovereign capability (ANZLIC Strategic Plan, 2020). With appropriate support Australia is ideally positioned to become an international innovator and leader in the operational delivery of real-time SDTs, capitalising on its rich geospatial data sets, strong focus on developing practical use cases, well-established geospatial data governance arrangements and our long-established and globally competitive geospatial information analytics capabilities. Given the importance of these SDTs, careful thought needs to be given to their security including on-shore provision of their data, AI algorithms and systems.

Action 5.1
Develop and publish use cases of SDTs that profile their application in addressing high-priority national challenges. Key candidate areas for consideration include: landscape assets at threat from climate-induced catastrophic fires and floods; urban infrastructure planning for excessive heat under energy and water constrained conditions; and supporting pandemic tracking of rates of spread and contributory factors.

Action Champion for 5.1
SIBA/SSSI and ANZLIC.

Action 5.2
Develop the case for inclusion of SDT research infrastructure capabilities in the National Collaborative Research Infrastructure System Program to enable the research community to develop solutions to the challenge of ingesting, storing and developing value-added analytics, information products and systems.

Action Champion for 5.2
AURIN and ANZLIC.

Action 5.3
Improve the usability and application of SDTs through development of national standards frameworks for SDTs to improve their interoperability, custodianship and access supported by the development and expansion of open and federated data policies to improve access, use, maintenance and integration.

Action Champion for 5.3
ANZLIC, SSSI and the ASIERA.

Action 5.4
Establish a collaboration with First Nations on Digital Twin creation and use.

Action Champion 5.4
SmartSat CRC

Objective 6: Upgrade Position, Navigation and Timing (PNT)

Upgrade Australia's precise and assured PNT capabilities and technologies to meet national needs and position Australia to capture a bigger share of global economic growth in PNT

PNT services are an increasingly important aspect of a modern technological society underpinning the precision required for modern navigation services, precision construction services and even the timing signals required for ATM banking, increasingly in near real-time. The use of PNT services will continue to grow globally with the provision of assured PNT for mission-critical and safety-critical applications including automated industrial machines, robotics, driverless vehicles, aircraft and infrastructure. PNT represents a major growth sector for the space and geospatial industries as well as an essential element to enable those industries, especially as demand for centimetre-accurate, near-real-time positioning grows. Australia has significant expertise in PNT technologies, research and innovation and enhancing the Australian PNT space and geospatial sector can develop the capability to meet Australia's needs for PNT services as well as potentially capturing global market share in areas such as ground-based low-cost mass-market GNSS receivers, space-based GNSS receivers and all aspects of PNT services. Australia has planned many significant developments in PNT and will need to carefully manage and maintain the resilience and future growth of this key capability.

Action 6.1
Facilitate the compilation of an overarching updated 'GNSS Strategic Plan for Promoting Enhanced PNT Capabilities across Australia' building on existing documents (e.g. the PNT Roadmap, due for release from the ASA mid-2023, and the Australian Academy of Science Decadal Plan for Space released in 2022) detailing industry strategy and aligned incentive mechanisms to facilitate development of high-tech GNSS-related products, services and workforce by local companies and organisations, which endeavour to adopt the new PNT capabilities that will become available across the nation. Leadership of this strategy development will require disciplined coordination across government, Defence, industry, and education

Action Champion for 6.1
ASA, Geoscience Australia and FrontierSI.

Action 6.2
Form a multi-stakeholder 'Strategic Coordination & Engagement Group' responsible for monitoring and advocating for the updated GNSS Strategic Plan (see Action 6.1) and providing guidance where necessary, to provide consistency, ensure clarity and eliminate duplication through effective collaboration. Ideally, this would comprise government, academic and industry representatives.

Action Champion for 6.2
The ASA and Department of Industry, together with support from Geoscience Australia and FrontierSI.

Action 6.3
Mobilise the PNT ecosystem by boosting investments in the research, development and commercialisation pathways for local companies and industry to create novel high-tech PNT products and services which complement and augment GNSS, ultimately creating new sectors and jobs. These innovations to include new quantum sensors, terrestrial positioning systems, vision and imaging sensors, signals-of-opportunity, chip-scale atomic clocks, inertial measurement units and others, along with the sensor fusion engines required to successfully integrate all these measurements together with existing PNT.

Action Champion for 6.3
The ASA, Department of Industry and SmartSat CRC (with its partners).

Action 6.4
Mechanisms to utilise Defence investments in technology for assured and resilient PNT should be explored as appropriate. This includes the use of quantum PNT and systems to detect and mitigate denial-of-service, interference and spoofing within the consumer marketplace.

Action Champion for 6.4
Department of Defence, with others to be determined through consultation with stakeholders.

Objective 7: Enhance Sovereign Capability

Reduce Australia's sovereign risks around the supply of critical space and geospatial infrastructure, systems and data

The Australian economy is critically dependent on services provided by space assets and their supporting geospatial infrastructure including, but not limited to:

- Weather and climate forecasting
- Natural disaster preparation and response
- Telecommunications including broadcasting, telephony and internet access
- Navigation and PNT for all forms of transport and logistics operations
- Timing signals for financial transactions
- Critical infrastructure
- National Defence

Australia's dependence on space and geospatial capabilities as critical capabilities is rapidly growing but the threats to these capabilities and potential denial of access are growing equally rapidly. It is a strategic imperative for Australia to strengthen its resilience to access space assets and their geospatial capabilities and to create secure data management facilities to ensure timely access to the data and services essential to maintain our modern economy. Improving resilience to these capabilities through targeted and specific National Space Missions will also facilitate opportunities for growing commercial utilisation of space and geospatial services. To maintain the nation's modern economy, secure and timely access to geospatial data and services is essential.

Action 7.1
Undertake a thorough risk analysis of the critical dependencies of each of Australia's recognised critical infrastructure areas on space assets and services, geospatial infrastructure, data and services, the threats faced, the consequences and likelihood of damage, the mitigating actions and the residual risk using the ISO 31,000:2018 Risk Management standard and the ISO 27,000-Series on Information Security Standards.

Action Champion for 7.1
The Space Trusted Information Sharing Network of the Australian Critical Infrastructure Advisory Council, supported by the Department of Home Affairs, the Department of Defence, ASA and EOA.

Objective 8: Grow Support for Defence

Support Australia's sovereign space and geospatial industry to meet more of the short, medium and long-term space needs of the Department of Defence, with industry supplying globally competitive space and geospatial products and services.

Defence, national security and civil infrastructure all heavily rely on space and geospatial capabilities. Many of the space capabilities are dual use and can potentially meet requirements across the Defence and civil domains. Defence will increasingly require space capabilities, recognising the importance of sovereign control of these space assets and space-derived information and services. Defence should use its growing need for space assets and products to catalyse and grow the Australian space and geospatial industries. This could be achieved by implementing procedures and procurement policies to purchase these assets and services from Australian companies to meet national Defence needs and simultaneously stimulate and grow the Australian space and geospatial industries. This would align Australia with other space powers that use government procurement to advance national interests in space..

Action 8.1
Align Defence Priorities and Civil Space National Priority Areas with 10-year and 20-year goals as part of an Integrated National Civil-Defence Space Industry Growth Policy. Industry peak bodies to lead the development of a strategy that gives Defence confidence that it can provision the majority of its allocated $17 billion forward space and geospatial expenditure on Australian sovereign capability, including proactive industry formation of consortia of critical mass, granting programs of scale and procurement that are agile and build to the Blueprint.

Action Champion 8.1
Department of Defence and ASA supported by industry groups.

Action 8.2
Develop a project plan outline that could lead to an integrated National Joint Civil-Defence Disaster Response space and geospatial capability with strong links to Action 7.1. This should include consideration of the Australian Climate Service and key customers in Emergency Management Australia and the National Recovery and Resilience Agency.

Action Champion for 8.2
Department of Home Affairs, ASA and Department of Defence with support from SmartSat CRC.

Photo courtesy of Geoscience Australia

Objective 9: Enhance National Mapping Base and its Foundation Spatial Data

Maintain and enhance Australia's National Mapping Base to ensure the accuracy and integrity of Australia's Geospatial Reference System and the critical national geospatial data that it supports

Australia maintains large, diverse and growing stores of geospatial datasets that are critical to Australia's national well-being. Anchoring these data in a common reference frame for interoperability, increasingly at cm level accuracy, permits geospatial measurements that underpin applications such as disaster response, intelligent transportation, environmental and climate-change modelling are captured at a specific time or at specific locations. For these measurements to be meaningfully combined, a highly stable and accurate global coordinate reference system is required. This is a global challenge, the importance of which was recognised by the United Nations in 2015 with the adoption of a General Assembly Resolution promoting the importance of an accurate, sustainable, and accessible Global Geodetic Reference Frame to support science and society.

Australia's current developments and investments to enhance our geospatial reference system recognise that future spaceborne sensors and measuring techniques, enhanced EO capabilities and the unprecedented positioning accuracies achievable from multi-constellation, multi-frequency smartphone like devices generate data that is inherently aligned to the International Terrestrial Reference Frame (ITRF) or World Geodetic System of 1984 (WGS 84). These are called time-dependent (or dynamic) reference frames – they accommodate tectonic plate motion. For example, without accounting for dynamics, coordinates in Australia will change continuously by between 6 and 7 cm per year to account for movement of the Australian tectonic plate.

In anticipation of the growing use, generation and reliance on geospatial data, ANZLIC and ICSM are leading the modernisation of a number of elements of Australia's Geospatial Reference System including: the current static datum; the introduction of a time-dependent reference frame; improved geodetic infrastructure and standards to improve access and efficiency of geodetic data. Without adequate support and empowerment these agencies are unable to provide the tools, models and standards that will unlock the maximum benefits for critical sectors from precise positioning and emerging space and terrestrial technologies and support the further development of Australia's Foundation Spatial Data Framework and the many related geospatial data stores nation-wide.

Action 9.1
Adequately resource ICSM and ANZLIC to coordinate the upgrade of the Australian Geospatial Reference System.

Action Champion 9.1
ANZLIC and ICSM.


“Building Australia’s space and spatial capabilities is mission critical to the future of this nation.”

Glossary

ABS ..... Australian Bureau of Statistics
AI ..... Artificial Intelligence
ANZLIC ..... the Spatial Information Council
ANZSIC ..... Australian and New Zealand Standard Industrial Classification
ARC ..... Australian Research Council
ASA ..... Australian Space Agency
ASIER ..... Australasian Spatial Information Education and Research Association
ATM ..... Automatic Teller Machine
AURIN ..... Australian Urban Research Infrastructure Network
BoM ..... Bureau of Meteorology
CAGR ..... Compound Annual Growth Rate
CRC ..... Cooperative Research Centres
CRC-P ..... Cooperative Research Centres Projects
CSIRO ..... Commonwealth Scientific and Industrial Research Organisation
EO ..... Earth Observation
EOA ..... Earth Observation Australia
GA ..... Geoscience Australia
GDP ..... Gross Domestic Product
GNSS ..... Global Navigation Satellite System
IoT ..... Internet of Things
ICSM ..... Intergovernmental Committee on Surveying and Mapping
IP ..... Intellectual Property
ISO ..... International Organization for Standardisation
ITRP ..... Industrial Transformation Research Program
NCRIS ..... National Collaborative Research Infrastructure Strategy
NSTC ..... National Science and Technology Council
OECD ..... Organisation for Economic Co-operation and Development
PNT ..... Position, Navigation and Timing
R&D ..... Research and Development
SIAA ..... Space Industry Association of Australia
SIBA-GITA ..... Spatial Industries Business Association, Australia and New Zealand
SICP ..... Structure and Interpretation of Computer Programs
SDT ..... Spatial Digital Twin
SMEs ..... Small to Medium Enterprises
SSS-DLN ..... Space, Spatial and Surveying Diversity Leadership Network
SSSI ..... Surveying and Spatial Science Institute
TRL ..... Technology readiness level

Acknowledgement

The Authors gratefully acknowledge the submissions and guidance provided by the following organisations in the activities leading up to and including the preparation of this Roadmap:

- Adelaide University
- ANZLIC (Australia New Zealand Spatial Information Council)
- Australasian Spatial Information Education and Research Association (ASIERA).
- Australian National University
- Australian Space Agency
- Asia Pacific Aerospace Consultants
- Bremer and Co
- Bureau of Meteorology
- CSIRO
- Department of Defence
- Department of Home Affairs
- Earth Observation Australia
- Engineers Australia
- FrontierSI
- Geoscience Australia
- National Committee for Space and Radio Science
- Positioning Insights Pty Ltd
- RMIT University
- SmartSat Aurora Start-up Cluster
- SmartSat CRC
- Spatial Industry Business Association (SIBA)
- Surveying and Spatial Sciences Institute (SSSI)
- University of Queensland
- University of New South Wales
- The several hundred individuals who participated in workshops and contributed submissions throughout the consultation process.

Finally, the Authors would like to acknowledge the great support provided by the Steering Committee of the 2030 Space+Spatial Industries Growth Roadmap who met monthly from June 2020 to August 2022.

Vale, Dr Peter Woodgate

Chair, Steering Committee& Working Group
2030 Space + Spatial Roadmap
December 1957 - December 2022

Dr Peter Woodgate was the founder, visionary leader and Chair of the 2030 Space + Spatial Roadmap Steering Committee and Working Group. The aim of the Steering Committee is to highlight the importance of Australia's interlinked space and spatial industries and ensure they maximise their growth potential. Peter was a tireless advocate and champion, nationally and internationally, for the Australian spatial and space industries.

Throughout his career, Dr Woodgate displayed balanced and thoughtful leadership, with an enduring commitment to championing the space and spatial industries, spanning over 40 years. He helped establish several companies and managed an industry cluster of over 100 companies, translating applied research into commercial outcomes. He was an Honorary Fellow of the Surveying and Spatial Sciences Institute, a life member of the International Society for Digital Earth and a graduate of the Institute of Company Directors. He held a Doctor of Business Administration from RMIT University in factors that drive innovation in the spatial industry, a Masters of Applied Science from the University of New South Wales focused on bushfire mapping using satellite remote sensing, and a Bachelor of Forest Science from the University of Melbourne.

His professional contributions and achievements are too numerous to list. His most relevant and recent appointments were as inaugural CEO of the CRC for Spatial Information, inaugural Chair of SmartSat CRC, co-chair of the Australian Spatial Industry 2026 Growth Agenda and Roadmap, inaugural President of the Geospatial Council of Australia, member of the Australian Space Agency's Space Industry Leaders Forum, Chair of the Australian Urban Research Infrastructure Network, co-chair of the Trusted Information Sharing Network (TISN) Space Sector Group and Board member of the Public Sector Mapping Agency, and former Board member of the Terrestrial Ecosystem Research Network, Auscope, and CRC Association.

As a colleague, Peter will be remembered for the respect he showed to all, the values that informed every decision and the tireless work and passion he committed to every role. The space and spatial industry sectors have lost a truly extraordinary individual and a tremendous leader, colleague, mentor and friend. He will be deeply missed.

Space+Spatial Industry Growth Roadmap 2030

Steering Committee

Dr Peter Woodgate	Chair
Mr David Ball	Deputy Co-Chair and Chair, SIAA (May to December 2020)
Dr Tim Parsons	Deputy Co-Chair and Chair, SIAA (from February 2021)
Mr Glenn Cockerton	Deputy Co-Chair and Director, SIBA-GITA
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Space+Spatial Industry Growth Roadmap 2030

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