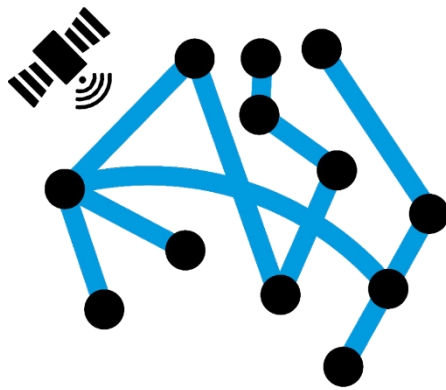


4 JUNE 2021



SPACE+ SPATIAL

INDUSTRY GROWTH
ROADMAP 2030

CONSULTATION PAPER -
A CALL FOR VIEWS

Authorised By:

*The Steering Committee of the Space+Spatial
Industry Growth Roadmap 2030*

EXECUTIVE SUMMARY



Note

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FOREWORD

The space and spatial industries have never been more important for the future of Australia. They both have a fundamental role to play in helping Australia navigate the response to catastrophic bushfires, the impacts of climate change, and the development of recovery plans for the economy following the global pandemic and its impact on our society and the economy. The growth of these two sunrise industries will have a profound effect on the well-being of Australia over the next decade and beyond.

The combination of space and spatial working together adds enormous value. In many ways these two industries are co-dependent and synergistic. The space industry sets up critical elements of the communications supply chain (through satellite communications (SATCOM)) together with vital content from Global Navigation Satellite Systems (GNSS) and Earth Observation (EO) sensors). The spatial industry provides the vast bulk of the subsequent data infrastructure, value-added content and analytics, and the 'last yard' delivery channels to customers and end users for most industries and across global societies.

Optimising this combined ecosystem over the next decade will create a premium competitive advantage for Australia; greatly strengthen our sovereignty, defence and security; and play a key role in managing our environment and improving our well-being.

But the nation faces a major challenge in growing its emerging and fragmented space community so that it can reach the critical mass required of a modern space-capable nation.

The purpose of this consultation paper is to specifically seek the advice of key stakeholders in the space and spatial ecosystems on actions that can be taken over the coming decade to accelerate the growth of the space and spatial industries working together.

This input will then be used to develop the 2030 Space and Spatial Industries Growth RoadMap which will be completed later in 2021.

Your input and feedback is warmly welcomed.

Dr Peter Woodgate

Chair of the Steering Committee of the 2030 Space and Spatial Industry Growth RoadMap



EXECUTIVE SUMMARY

In this information age, economic success, societal well-being and national security pivots around our ability to collect, disseminate and exploit complex data in a timely and effective manner. Space and spatial capabilities are central to achieving this, providing essential data and services to support areas of national importance such as land and water security, emergency management, and, increasingly, autonomous systems and smart cities management.

The Australian space and spatial industries are poised for great growth. By systematically and strategically working together, these two closely allied industries will realise enormous benefits that would otherwise not be possible.

The Space and Spatial Growth RoadMap is being developed to:

- 1) highlight the strategic importance of a strong Australian space and spatial capability,
- 2) identify the critical characteristics of such a capability, and
- 3) outline the steps required to realise an integrated space and spatial ecosystem that will be a key national asset.

This paper sets out a series of issues that are designed to elicit feedback through a comprehensive process of consultation. The desired outcome from the consultation process will be a growth RoadMap focused on the most important areas where space and spatial can work together and a set of actions to optimise the accelerated growth of these two industries looking out to 2030.

The paper focusses on those issues that have not yet been factored into the many existing strategies and plans of the agencies, organisations and companies that have contributed to the paper. The priority for this paper is on the growth potential for earth-oriented applications, recognising that the outward looking space will warrant similar attention in the future. The issues raised here are therefore those that should be considered in addition to existing planning arrangements which are shown in Figure 1 below:

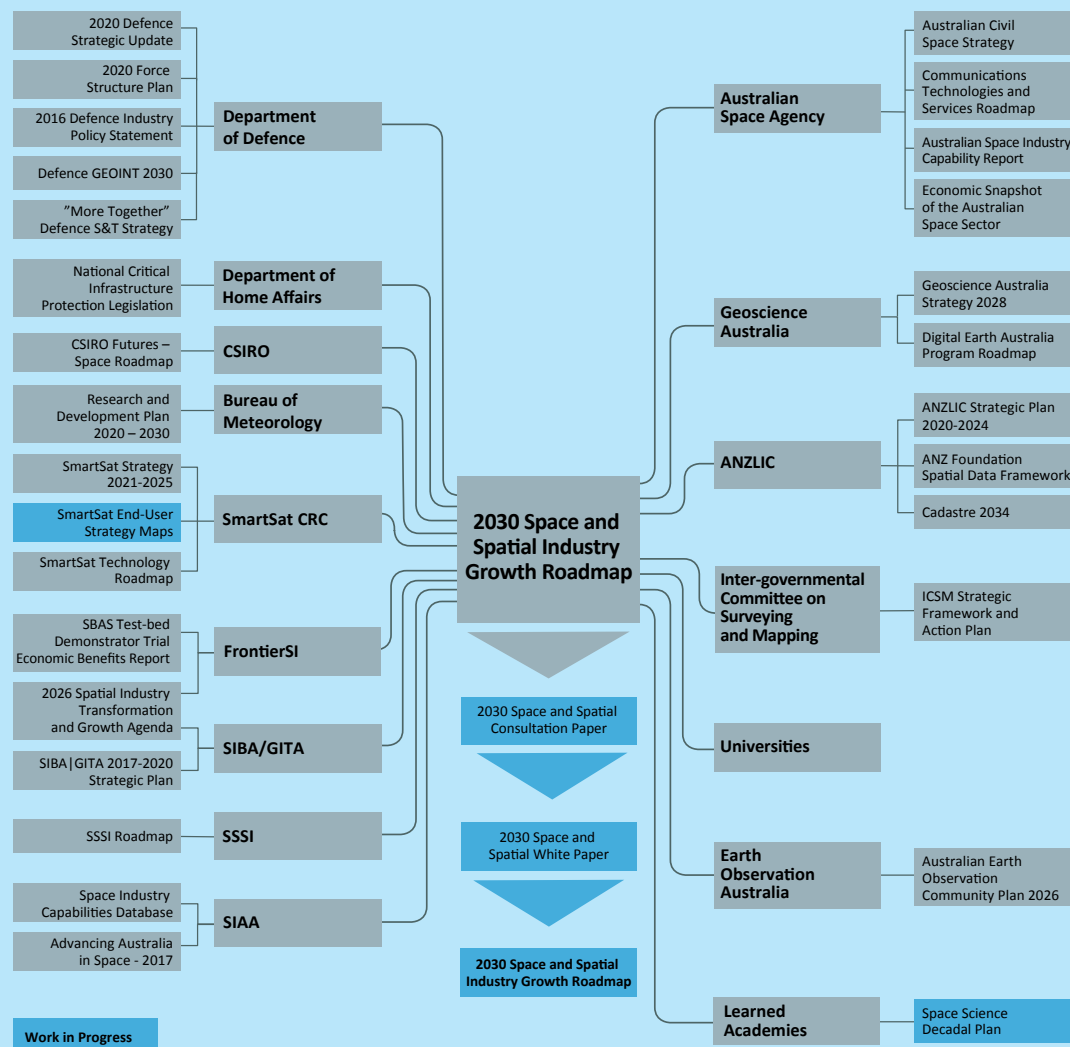
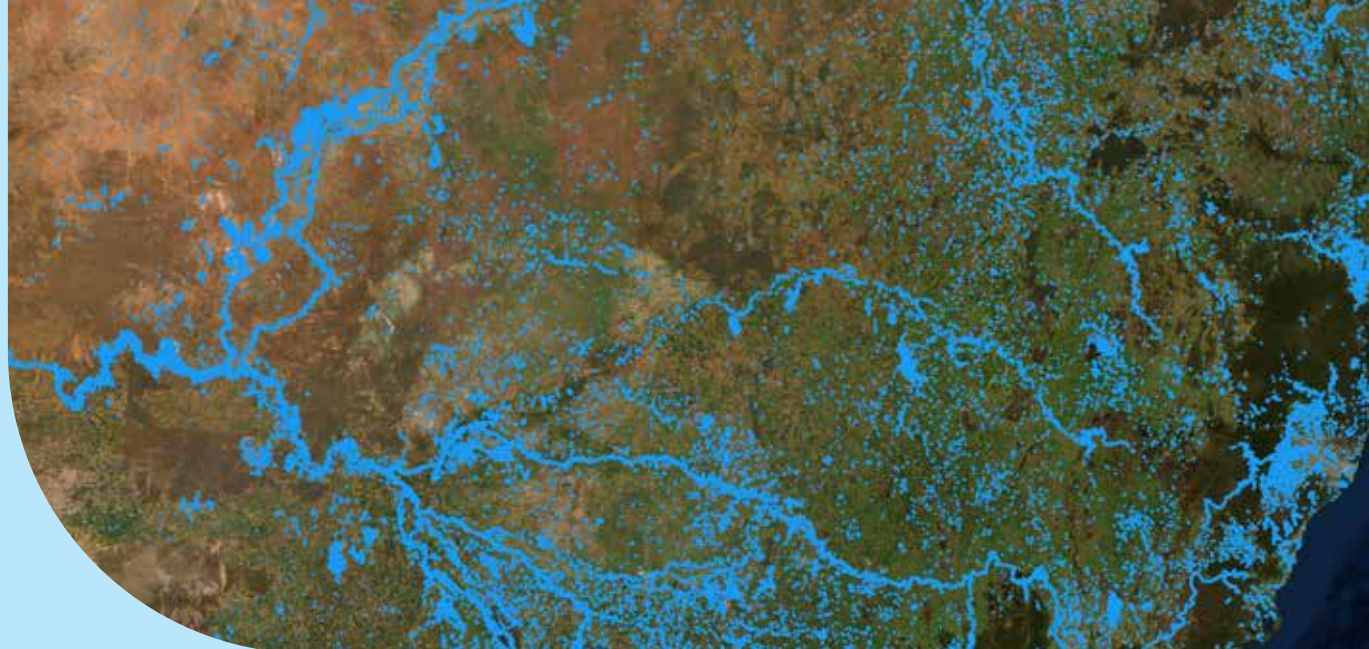


Figure ES1: A summary of the current strategies and plans in the space and spatial industries in Australia

We are seeking your feedback on the issues highlighted in this Executive Summary and the more detailed Consultation Paper:

- Do these issues represent the right priorities for Australia?
- What issues are missing, understated or overstated?
- What are the must-have capabilities that Australia needs to integrate into the nation's space and spatial ecosystem to optimise growth and build national resilience over the next decade that are not yet part of any published and intended plans?

Mainstreaming integration of the space and spatial sectors has the potential to achieve direct, indirect and cumulative impact across almost all areas of Australia's society and economy.



Benefits of the Integration of Space and Spatial

Australia's space industry, although small, has well recognised world class expertise in certain areas from which we can build. By contrast, Australia's spatial community is much more dominant by world standards but still exhibits strong growth potential. Operating in tandem, these competitive advantages serve as a strong basis from which both industries can grow.

Space and spatial are making an increasingly critical contribution to digital transformation. Global spending on the digital transformation is expected to reach \$2.3 trillion by 2023, a five year compound annual growth rate of 17.1% for the period 2019 - 2023. The space industry has been estimated to be worth US\$350 billion in 2019 with potential to grow to over \$US1.1 trillion by 2040. The Australian space sector was estimated to be around \$3.9 billion in size in 2019 and forecast to grow at 7.1% pa over the five years to 2024.

The total direct economic benefits from the use and application of earth observation from space data alone was found to be worth A\$496 million to the Australian economy in 2015, and predicted to reach A\$1,694 million by 2025. In 2016, geospatial services were conservatively estimated to generate US\$400 billion per year globally. However, the total economic contribution was predicted to be several times higher, through approximately US\$550 billion derived from consumer benefits; the creation of approximately 4 million direct and 8 million indirect jobs; and improvements of revenues and costs of sectors that contribute 75% of global GDP.

The global markets for big data from satellites alone is growing rapidly (see Figure 2) .

Global Big Data Analytics via Satellite

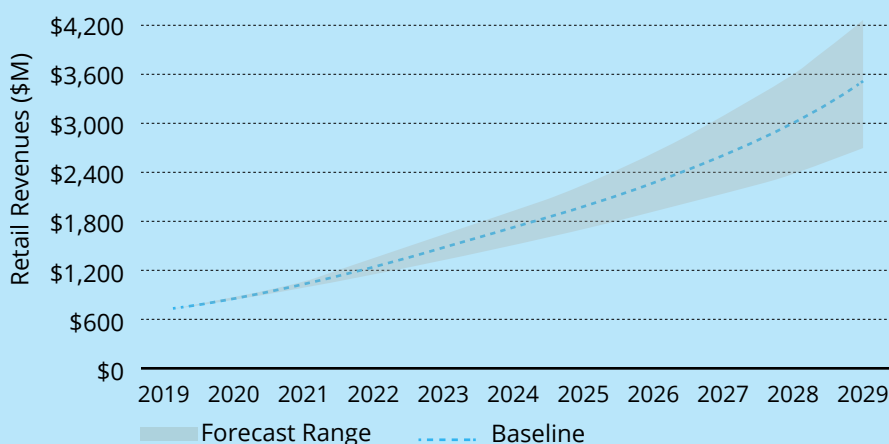


Figure ES2: Forecast Global Revenues for Spatial Data Analytics, 2020 (Source: NSR 2020)

Most industries require spatial data analytics as illustrated in Figure 3:

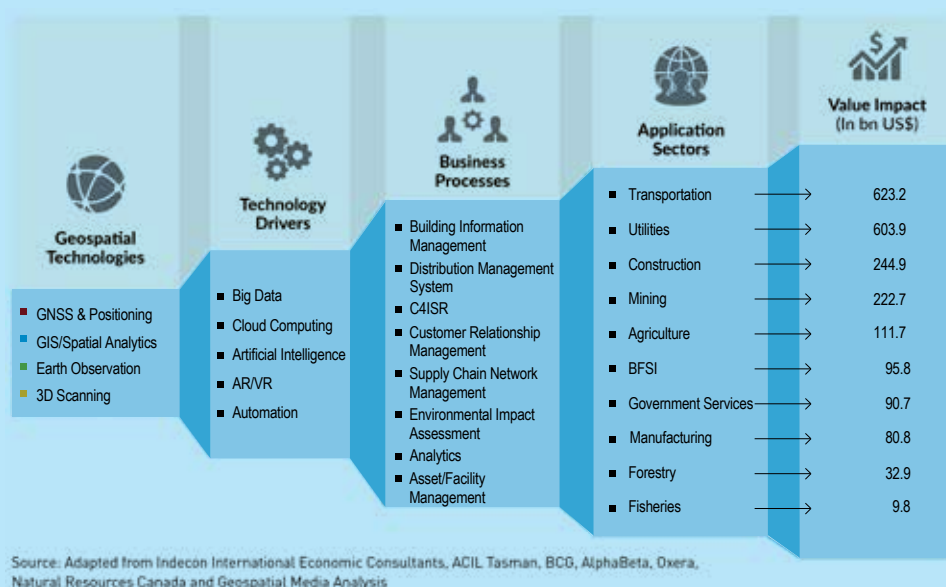


Figure ES3: Value Impact from Geospatial Technologies (Source: GeoBuiz 2018)

A coordinated, strategic approach to integration of Australia's space and spatial sectors could:

1. Increase productivity in key Australian sectors including agriculture (food, fibre and carbon), mining, transport, construction and energy through improved coordination between the end users and technology/data providers developing solution-based products and services.
2. Support the delivery of public good services including defence, national security (and in particular cyber security), disaster response, emergency management, environmental monitoring, urban planning, sustainable cities and digital twins to name a few.
3. Grow the domestic space and spatial industries, achieving an internationally competitive advantage in high value-add areas including:
 - a. advanced instrumentation;
 - b. advanced geospatial analytics;
 - c. location intelligence services; and
 - d. telecommunications.
4. Accelerate the maturation of Australia's space and spatial industries, by leveraging the successes of the Australian Space Agency, SmartSat CRC, Frontier SI, Digital Earth Australia (DEA) and the National Positioning Infrastructure (NPIC) of Geoscience Australia (GA), and CSIRO, amongst other programs.
5. Better align academic programs with industry needs, including by producing industry-ready graduates who meet the skills demanded by this industry growth.
6. Increase Australian participation in the global space and spatial industries.
7. Increase the commercialisation and utilisation of research in the space-spatial sectors.
8. Increase surety of access for Australia's vital information supply chains.
9. Establish the nexus of an enduring space-spatial integration in Australia.
10. Address the challenges and opportunities presented by open data, open technology and the introduction of modern telecommunications (including fibre and 5G).
11. Reduce duplication and increase efficiency in the delivery of state and government geospatial services.

Focus Areas Driving National Benefit

There are already many applications dependent on the contribution of space and spatial services. The key premise of this consultation paper, and the intended space-spatial industries growth RoadMap that will follow, is that much more can be done to build and accelerate Australia's capabilities, and that such action will lead to improved national outcomes and sustainable economic growth.

In the following summary, issues are grouped under the three broad areas where space and spatial technologies and services can benefit Australia:

1. National Security
2. Economy Development
3. Societal/Environmental.

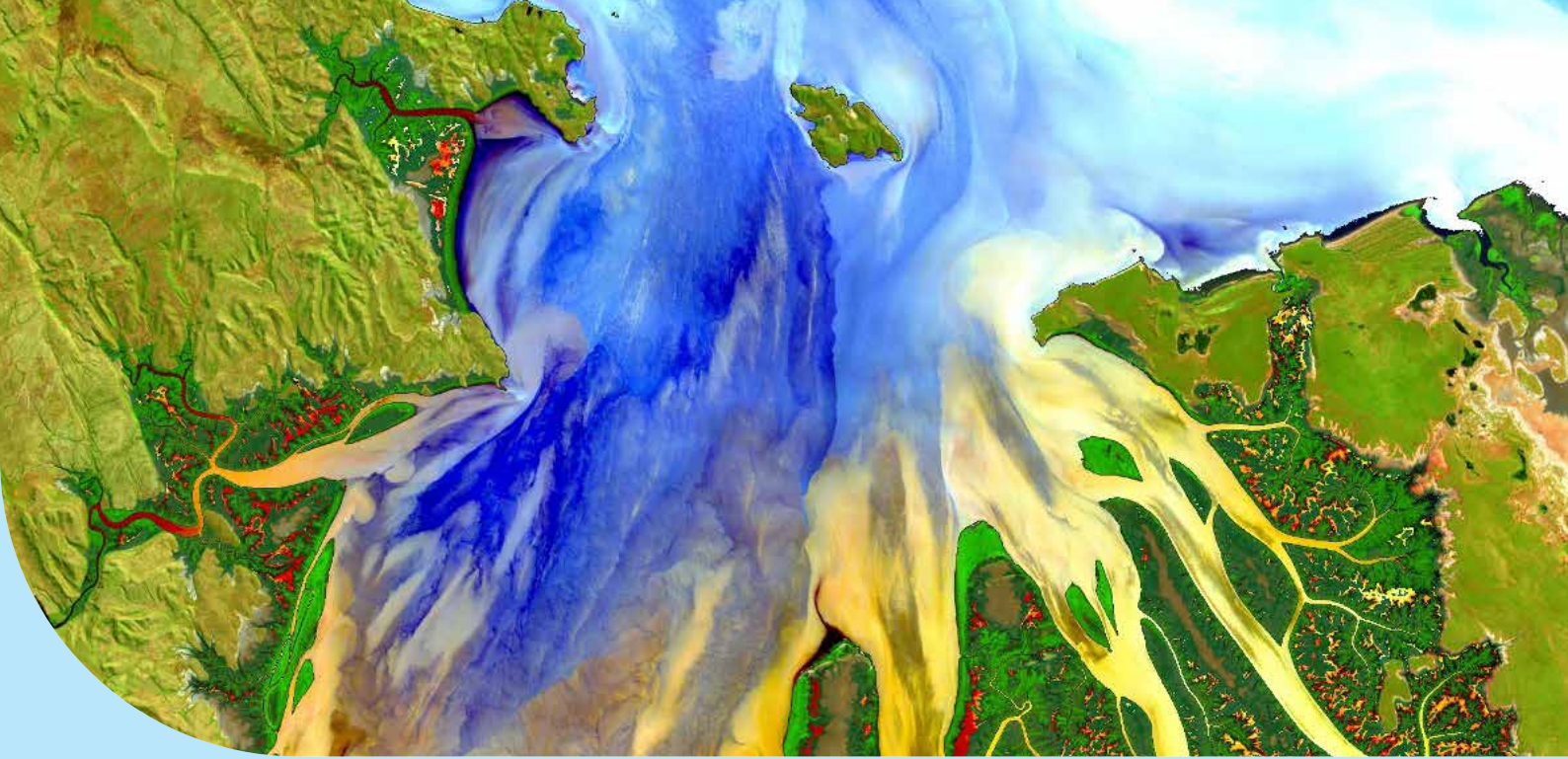
National Security

Establishing Critical National Space and Spatial Systems

Australia has a small space industry and relies heavily on the goodwill and cooperation of the world's spacefaring nations for access to vital space-based assets, products and services. *For Australia to take its place as a modern space nation capable of managing its own space needs, rapid and very substantial growth in our space industry is required.* What are the must-have capabilities that Australia will need to integrate into the nation's space and spatial ecosystem to optimise growth and build national resilience over the next decade that are not yet part of any published and intended plans? What additional steps need to be taken to ensure assured access to the full range of space and spatial related capabilities needed by this nation?

Australia's capacity to design and manufacture critical elements of space systems is increasing but from a much lower base than many countries with equivalent economies. Key issues for growth include the level of desired sovereign capability and the balance of sourcing from domestic markets and international markets, the right size for Australia's space manufacturing and testing capability and answering the question of how to sustain this capability in a globally competitive and often distorted market. Other countries use offsets to 'protect' national capabilities, but Australia moved away from that policy some time ago. What mechanisms can be brought to bear to ensure Australian manufacturers can compete in international markets? Should a level of Australian content be mandated? Which areas of the space supply chain should not be developed in Australia but should still be sourced from overseas? What underlying capabilities will deliver the most sustainable and enduring space and spatial industries?

The ability to connect space services and spatial information products with end-users is vital to the growth of the Australian space and spatial sectors. Without sufficient spectrum and the capacity to downlink large amounts of data, many of the emerging growth areas in the space and spatial domain will be constrained. The challenges of accommodating more satellite systems within existing spectrum allocations as well as finding spectrum for the increasing amounts of data to be downlinked is driving significant development activity. Australia has world class capability in ground infrastructure and has opportunities as a location for ground networks for high volume data downlinks. There are a number of activities that Australia could undertake. They include Australia playing an active role in international fora to preserve key spectrum for space and spatial activities including in higher spectrum bands and for optical links. An information campaign could raise awareness across all government agencies of the critical strategic importance of satellite spectrum for the space and spatial industry and how erosion of satellite spectrum will reduce the availability of space and spatial services; exploring all opportunities for Australia to provide high speed data downlink sites for space and spatial data particularly for high data downlinks from Asian, European and American satellites. The Australian development of waveforms and spectrum sharing techniques could be encouraged and supported as well as on-board processing techniques to optimise the downlinking of essential data. Focusing research on emerging technologies such as Australian development of optical communications capabilities and infrastructure as well as exploration of higher Radio Frequency bands to reduce interference and increase capacity of satellite communications could create global market opportunities for Australian industry.



Finally, Australia's growing security dependence on space and the increasing vulnerability of national security space capabilities has created the need to rethink the scope and scale of Defence space capabilities. The 2020 Defence Strategic Update states the intent for sovereign space capabilities in both satellite communication and satellite imaging capabilities and the recognition of space as a military operating domain. This increased focus on space capabilities, with a corresponding increase in future funding, for our national security creates new opportunities for Australian industry to develop and deliver space-based capabilities to government, both directly and in partnership with international allies.

Economic Development

Accelerating Growth of Australian Space and Spatial Businesses

The COVID-19 global pandemic has brought into sharp relief the importance of high growth industries in helping rebuild the national economy, stimulating creation of new jobs and supporting business development. Space and spatial are critical sunrise industries in the digital world that offer great potential for Australia.

From a nascent ecosystem just three years ago Australia now has over 60 space start-ups. In order to grow into a large and sustainable ecosystem four key questions will need to be answered: How can we grow the funnel of the start-ups (per million people) in Australia? How can we increase the start-up success rate? How can we maximise the economic value-add to Australia? What impediments do we need to identify and address? Consideration should be given to development of a formal national plan of action for space and spatial start-ups.

Whilst Australia has hundreds of SMEs in both the space and spatial industries, very few have grown to become billion-dollar multi-nationals. It is important that we understand the barriers to this growth and consider appropriate corporate incentives without resorting to inefficient subsidies. How might Australia respond to this challenge?

Governments, and particularly Defence Departments, are playing a key role around the world in fostering vibrant and large national space and spatial sectors. A coordinated national approach for defence and the civilian sectors would see investments made in companies as part of a strategic design that seeks to optimise an enduring space and spatial ecosystem with a vibrant private sector at its core.

Governments across Australia are increasingly recognising the value of a whole-of-government, whole-of-jurisdictional, enterprise-wide approach to procurement. Given the need to get this right across all of Australia's tiers of government and across the defence and civilian divide, advice is sought on how best to develop a national approach to procurement of space and spatial services and capabilities that operates in the national interest.

Enhanced decision-making through Critical Spatial Data and Systems

Australia possesses many significant spatial data stores within government agencies and research organisations (eg GA's DEA, the National Computational Infrastructure, jurisdictional agency systems, and NCRIS facilities to name a few) which have been created fit for a specific purpose. These have been or are in the process of being migrated to cloud environments, mostly owned and operated by multi-national private sector providers, some of which are located offshore. It is timely to examine the risks to these national spatial data stores, their infrastructure, systems and analytics, including the physical location of the systems on-shore and off-shore. Of the potential to create and manage datastores on-board in space, which elements are considered high priority? How big an impediment to growth is the cost of data?

Consideration could be given to redefining and expanding the existing list of Foundation Spatial Data Framework (FSDF) themes and the systems that support their creation and use. These data need to be optimized for the three and four dimensional needs of a future sensor and information world powered by artificial intelligence. Another key task could be to map the needs of sectors and organisations that service Australia's critical infrastructure and systems of national significance (as defined by the Department of Home Affairs) against what the FSDF can provide in its current and in future forms.

Spatial Digital Twins are an advanced spatially accurate digital representation of the real world and are emerging as a powerful tool to help people improve their understanding of our physical environment and make better-informed decisions. The use of digital twins should lead to improved outcomes and benefits, build predictive capability, and offer just-in-time analytics and products. Digital twins vastly improve the value of data through aggregation and shared access, leading to better decision making. Spatial digital twins are an essential component of the overall digital transformation agenda across government and industry and are advancing rapidly. It is essential that Australia collaborate with the local and global initiatives to develop the use of this technology. These organisations include Open Geospatial Consortium (OGC), International Standards Organisation (ISO), the US based Digital Twin Consortium and The Smart Cities Council. The Australia and New Zealand chapter of The Smart Cities Council is stewarding the development of a Digital Twin Strategy for Australia and New Zealand. Their goal is to create the conditions for a thriving digital twin marketplace in the region. OGC is working closely with ISO on standards development with active working groups. The Digital Twin Consortium even though still in its formational stage, has, given its membership, the potential to have a powerful influence on the way forward.

Trusted, Precise Global Navigation Satellite Systems (GNSS)

To capitalise on the rapidly growing demands for Position, Navigation and Timing (PNT) systems which are accessible, accurate and available for all Australian sectors, a major challenge will be developing an indigenous capability that provides assured access to PNT across the nation by improving its resilience, robustness, precision and trustworthiness over the long-term. Australia is ready to update its current GNSS Strategic Plan for Promoting Enhanced PNT Capabilities. The update could consider setting out strategic and industry-aligned incentive mechanisms to facilitate development of high-tech GNSS-related products, services and workforce by local companies and organisations, and making these new PNT capabilities available across the nation. In Australia, leadership of this strategy development will require disciplined coordination across government, Defence, industry and education.

Societal/Environmental Wellbeing

Optimising the Workforce: STEM and Diversity

There is a significant opportunity for the space and spatial industries to work more closely with Australia's strong educational and vocational training systems. The need to attract, train and retain people with advanced Science, Technology, Engineering and Mathematics (STEM) skills to support long-term and sustainable growth across the sector has been identified by many reviews. A key task will be to review and extend the current analysis of the skills gap being undertaken by the Australian Space Agency and SmartSat CRC to ensure that it identifies both space and spatial skills that are not adequately meeting these industry's current and future needs.

For the space and spatial sectors to be able to sustainably grow, innovate and deliver leading and useful research in the coming years, a diverse and inclusive workforce will be needed. It is proposed that the Space, Surveying and Spatial Diversity Leadership Network (SSS-DLN) continue to leverage, amplify and expand existing successful D&I initiatives and actions plans at sector level and that peak bodies take a leadership role in advancing efforts to improve the diversity of our sector. A key outcome should be to benchmark, monitor and report on the state of D&I in the sector on a regular basis. Best practice outcomes from this network can be applied more broadly across the space and spatial sectors.

At the Commonwealth Government level, the Thodey report into the Australian Public Service pointed to the need for urgent improvements so that Australia can leverage the full potential of digital systems and data analytics facilitated by suitably skilled people. This observation is particularly prescient for space and spatial. One option is the development and implementation of a space and spatial awareness program for the public services operating at all layers of government. This program could be aimed at enhanced understanding of policy, technological and regulatory implications of space and spatial systems and services across Australia's society and economy as a formal part of the implementation of the Thodey review. Case studies of existing best practice would inform the awareness program.

Essential Systems for Climate Resilience

Increasing bushfires, floods and other natural and human-induced disasters are sharpening the focus on the responsibilities of Federal and State Governments to improve coordination and response to larger scale natural disasters. This has come under close scrutiny in recent years. The 2019-20 fire season has brought this issue to the fore. Many inquiries, especially the Royal Commission into National Natural Disaster Arrangements, have examined these issues from a national and regional perspective. What more can be done, that has not already been identified, to deploy space and spatial capabilities to greater effect in the effort to deal with natural disasters?

The current paradigm for earth observation systems supporting broader economic and environmental objectives involves data collection to monitor ecological/environment systems with data analysis informing decision makers on actions that may deliver certain outcomes. Moving to a management-focused approach requires access to a wider range of data with better data governance, coupled with advanced analytics/machine learning techniques and greater use of spatial digital twins. The key is to develop phenomena-specific systems purposely designed to respond to societal, environmental and economic pressures to produce the highly valuable information products that end users need, rather than just creating more low value data.

Ongoing and cross-agency collaboration across industry and governments is key to improving spatial information capability and datasets to inform decision-making across the environment portfolios of governments. In addition, next generation data governance and clearly defining accountability for data collection, storage, management and integration across agencies could provide a systematic approach to ensure high quality data capture to empower analytic methods including artificial intelligence and machine learning. It is important that end users of spatial technology are regularly informed of megatrends in spatial technologies so current information and understanding can be applied to their land and environmental monitoring, management and decision-making processes and diminish the barriers to adopting new technologies for sustainable environment management.

Executive Summary – Key Questions for Readers

We are seeking your feedback on the Focus Areas highlighted in this Executive Summary and Key Issues outlined in Section 5 of the detailed Consultation Paper:

- 1. Are the three Focus Areas; National Security, Economic Growth and Societal/Environment Benefit, the right lens to view opportunities for Space and Spatial sectors?**
- 2. Do the key issues outlined in Section 5 represent the right priorities for Australia?**
- 3. What issues are missing, understated or overstated?**

Furthermore, your responses to the following questions or other views raised in this consultation paper would be appreciated.

4. What are the must-have capabilities that Australia needs to integrate into the nation's space and spatial ecosystem to optimise growth and build national resilience over the next decade that are not yet part of any published and intended plans?
5. What additional steps need to be taken to ensure assured access to the full range of space and spatial related capabilities needed by this nation?
6. What mechanisms can be brought to bear to ensure Australian manufacturers can compete in international markets?
7. Should a level of Australian content in Critical National Space and Spatial Systems be mandated?
8. Which areas of the space supply chain should not be developed in Australia but should still be sourced from overseas?
9. What underlying capabilities will deliver the most sustainable and enduring space and spatial industries?
10. How can we grow the funnel of the start-ups in Australia in order to drive innovation?
11. How can we increase the start-up success rate?
12. How can we maximise the economic value-add to Australia from the Space and Spatial sectors?
13. What impediments to start-up/SME growth do we need to identify and address?
14. Looking at the potential to create and manage datastores in space, which elements are considered high priority?
15. How big an impediment to economic growth is the cost of data?
16. What more can be done, that has not already been identified, to deploy space and spatial capabilities to greater effect in the effort to deal with natural disasters?





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