

Wednesday, August 23, 2017

Dr Megan Clark AC,
Chair, Expert Reference Group
Review of Australia's Space Industry Capability

Re: Submission from the Australian Earth Observation Community Coordination Group to the Australian Space Industry Capability Review and its "Issues Paper"

Dear Dr Clark,

In response to your email of 14 August 2017 I am very pleased to provide a submission on behalf of Australia's Earth Observation Community Coordination Group (www.aeoccg.org.au), representing a broad cross section of EO (earth observation) producers and users across multiple industries, local to national government agencies and research institutions. Our submission outlines the results of several years of national consultation and coordination activities that have delivered a 10 year plan for EO data collection with well defined and rapidly growing science, government and industry applications, both upstream and downstream, in Australia's space sector – the Australian Earth Observation Community Plan –herein referred to as AEOCP 2026 (www.aeoccg.org.au/aeocp-the-plan). Our consultation and national planning identified strengths and gaps in Australia's EO capability and clearly defined five key priority actions for a national strategy to develop EO as a cornerstone to Australia's Space Industry.

Based on the AEOCP 2026, we identify three key points in response to the Issues Paper:

- Australia's existing strengths in Earth Observation need to be built upon as a foundation pillar for Australia's Space Capability.
- The AEOCP 2026 presents five priorities for the development of EO in Australia. These priorities align well with the three proposed principles of the SCR. The AEOCP should be used as the framework to guide all future policy and investment with regards to EO.
- There is a major limitation to the current SCR process, which is reflected in the issues document, and this is that the full extent of EO capability and use in Australia that can support Industry is not acknowledged. The document only acknowledges activity in Commonwealth agencies, which means it misses the majority of current and future industry, state and local government, and research EO activities in upstream and downstream sectors. These sectors already deliver fully operational, world leading science and applications for business and government, yet seem to have been ignored in the SCR so far. The review needs to properly assess and recognize existing activities before moving forwards. This is a critical limitation that must be addressed urgently.

Our submission expands on these points and also outlines:

1. The role and context of AEOCCG;
2. The role and context of AEOCCG with AGEOSWG and key documents such as the 2026 Spatial Industry Transformation and Growth Agenda, and White Paper: Advancing Australia in Space issued by the Space Industry Association of Australia's (SIAA); and
3. Whole of EO community responses to the three principles put forwards in the discussion paper: direction, capability and governance.

I and other AEOCCG members welcome the opportunity to discuss this face to face at a one of your meetings or to attend and Expert Working Group Briefing.

Please contact me at the addresses below if you need more details.
On behalf of the Australian Earth Observation Community Coordination Group

Sincerely, 

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1. Introduction

The vision of the Australian Earth Observation Community Plan for 2026 (AEOCP 2026) is as follows:

“By 2026, the Australian Earth Observation sector will develop and deliver high-quality Earth Observation information, infrastructure, and services that are used widely by government, industry, research and the community in Australia and internationally....”

The EO Community’s Vision aligns with the rationale for the Australian Space Industry Capability Review (the Review):

“The Australian Government wants to ensure that Australia can capitalise on its areas of comparative strength in its space industry, to develop a strong and globally competitive domestic sector that is able to participate effectively in the global market.”

Our submission will use the AEOCP 2026 to provide responses to the Review, and to show how EO needs to be included and build on as a foundation pillar for Australia’s Space Capability in Private Industry, Government and Research.

The five priorities or pillars of the AEOCP 2026 match the three proposed principles of the Review (Capability, Development, and Governance) and its outlined “Opportunities”, and provide specific whole-of-EO-community actions for addressing these. The alignment is shown in the table below:

Australian Space Industry Capability Review Principle	Relevant AEOCP 2026 Priority
Capability	3. Infrastructure and People — developing, supporting and sustaining a wealth of trained professionals and quality infrastructure to enable world-leading EO research, innovation and application development. 4. Access to EO Data and Services — ensuring all Australian EO producers and users can easily and reliably access the data and services they need.
Direction	2. Securing Australia’s Role in the International EO Community — Australia must be an essential component of the international EO capability, delivering benefits to the international community and securing our access to and involvement in international EO programmes. 3. Infrastructure and People — developing, supporting and sustaining a wealth of trained professionals and quality infrastructure to enable world-leading EO research, innovation and application development. 4. Access to EO Data and Services — ensuring all Australian EO producers and users can easily and reliably access the data and services they need.
Governance	1. Connection and Coordination — establishing a consistent vision within the Australian EO community, and delivering processes for internal coordination to ensure effective collaboration, resource use, and advocacy for EO in Australia and internationally.
Comment provided on “Opportunities” section of Issues Document	3. Infrastructure and People — developing, supporting and sustaining a wealth of trained professionals and quality infrastructure to enable world-leading EO research, innovation and application development. 5. Generating Value — strengthening end-user engagement to enable delivery of high quality EO products and services suited to user needs, and supporting commercial development of EO applications.

We note with great concern that while extensive Government, Industry and Scientific uses of EO are consistently used in the Review materials to justify broad calls to enhance Australia’s space capability, the true existing scope of Australia’s EO capabilities and their potential future directions, outside of

Commonwealth agencies is omitted. Thus the Review currently misses the majority of current and future industry, government and research EO activities in upstream and downstream sectors.

To adequately achieve its stated goals the Review and Issues Paper needs to be changed to take into account the full extent of EO use across state and local governments, private industry, and research sectors. These sectors already deliver fully operational, world leading science and applications for business and government, yet seem to have been ignored as a base to build on by the review process. The AGEOSWG, Spatial 20206 Agenda and the Space – Trusted Information Sharing Network of the Critical Infrastructure Resilience Program, also recognise this point. The review needs to properly recognise existing capability before moving forwards. We understand there are time limitations in what the Government and Expert Reference Group has been asked to do, but this is a critical limitation that must be addressed ASAP.

As an example, by 2012 a consortium of state agencies, in the absence of support from Commonwealth agencies, produced the world's first fully operational, whole of continent, Landsat archive to support their operational mapping needs across multiple agencies from monthly to decadal scales, with direct links to thousands of field sample points. This was done well in advance of the Australian Government's 'Data Cube' and continues to be used and advanced, now delivering the world's first fully linked Landsat to Sentinel operational archive and environmental monitoring products, just over a month ago. This capability is state of the art and Australia is the first country in world to deliver operational 'virtual' constellation of Landsat to Sentinel for biophysical products. Subsequent state to national collaboration enabled development of a 'team Australia' approach to deliver the Copernicus-Sentinel hub and efforts extend implementation of Digital Earth Australia. This is the kind of world-leading capability that already exists, and must be acknowledged and built upon with Commonwealth initiatives and NOT ignored.

Australia has developed strong and world-leading capability in the downstream EO, but we are in urgent need of proper coordination and integration with industry. Thus, this Review's timing is ideal. We have highlighted how to address challenges for each of proposed 'principles' of the Issues paper below.

2. The role and context of Australian Earth Observation Community Coordination Group (AEOCCG) for the Review

The Australian Earth Observation Community Coordinating Group www.aeoccg.org.au represents industry, research and education, and government groups (Commonwealth and State) that use and produce EO data for Australia.

A primary activity of the AEOCCG from 2014-16 was to significantly improve collaboration and cooperation across all areas of the EO sector. This was done through extensive national consultations and workshops, and delivery of a 10 year plan for industry, government, research and education groups across Australia who use and/or produce EO data, information and services from satellites, aircraft, remotely piloted systems, and ground based platforms (www.aeoccg.org.au/aeocp-the-plan). These data, information and services have a minimum economic impact on the Australian economy of \$5.3 billion annually, and are projected to generate over 15000 jobs by 2025. Thus, the attached AEOCP 2026 is timely and directly relevant to Australia's national interests.

The AEOCP 2026 demonstrates what is possible when an open and inclusive truly 'national' consultative approach is taken across all the EO sectors in Australia and everyone has input. The AEOCP 2026 details industry, government and research requirements to build Australia's unique EO capacity, especially in relation to government-industry partnerships and expanding our world leading research.

The AEOCP 2026 links closely with other major national Science and Innovation activities, and is explicitly recognised by complementary activities including:

- the 2026 Spatial Industry Transformation and Growth Agenda (<https://2026agenda.com>),
- National Research Infrastructure Roadmap,
- National Innovation and Science Agenda, and
- the Attorney General Department's Critical Infrastructure Resilience Programs - Space Cross Sectoral Interest Group.

AEOCCG takes leadership for implementation of the AEOCP 2026, working in collaboration with the Australian EO community. Ultimately, the AEOCP 2026 can enable development and delivery of innovative new science and applications to underpin growth in EO related industry and research.

3. The role and context of AEOCCG with AGEOSWG (Australian Government Earth Observation from Space Working Group) and other lead groups

Our submission is based on extensive and ongoing discussions with AGEOSWG (The Australian Government Earth Observations from Space Working Group) which brings together Australian Government agencies to coordinate civilian activities relating to the exploitation of EOS to support Australian Government priorities. Like AGEOSWG, AEOCCG was established under Australia's Satellite Utilisation Policy, which recognised EOS as a space application of national importance, and charged the group to ensure Australian EOS activities became more coordinated.

AGEOSWG have noted – *'Two years ago there was no community-owned unified vision for EOS in Australia beyond what the Commonwealth may have driven. Now there is.'* This statement demonstrates the essential roles that AEOCCG now plays in the coordination and governance of EO in Australia, especially in establishing and informing Government of 'whole of community' perspectives and an imperative to build on these as part of developing Australia's space capability.

AGEOSWG's has also commented on the effective, inclusive and successful collaborative approach that AEOCCG enables: *'AEOCP highlights the need for a 'Team Australia' approach. Under this approach governments continue to play a strong role in provision of upstream and downstream infrastructure, and as a key consumer of EOS products and services.'*

This statement highlights a key role for governments, and Priorities 2 and 5 of AEOCP 2026 also highlight the importance of other key stakeholders, particularly industry, which AGEOSWG also notes *'However, industry must be supported and encouraged to play a greater role than has been the case to date.'*

There continues to be a rapid increase in availability of high quality EO data, in public and private domains, development of 'big space data' technologies by government and industry, e.g. Google Earth Engine, Amazon Web Services and Australian Geoscience Data Cube (now Digital Earth Australia). It is essential to recognise this areas is not the sole purview of government and activities such as Digital Earth Australia. This is especially the case if industry involvement is to be built, and many government agencies are moving to private data storage and processing options. AEOCCG and AGEOSWG now provide a highly effective mechanism for coordinating across Australia's EO communities and enabling state and commonwealth agencies to tackle problems constructively for their mutual benefit.

4. Whole of EO community responses to the three principles put forward in the discussion paper: direction, capability and governance.

The text below represents AEOCCG comments on each of the three Principles and Opportunities sections, and specific responses to the ‘considerations’ for each principle highlighted in the review.

4.1 PRINCIPLE 1 - CAPABILITY

The AEOCCG agrees that “*The current Australian Government policy settings identify Earth Observations from Space (EOS), Position, Navigation and Timing (PNT) applications, and Satellite Communications as the focus for Australian capability development.*”

The AEOCCG considers that the review text does not represent the full scope of “*Space-related capability has been supported by the Australian Government.....*” through Commonwealth to State level and research institutions. The full extent of space related capabilities in the EO sector supported and used by all levels of government, industry and research is detailed in the AEOCP 2026.

Response to Headings:

1. *Identify Australia’s current industry capability and areas of comparative advantage for Australia to develop*

The AEOCP 2026 identifies Australia’s industry capability in the EO segment of space industry in terms of all of the elements shown in Figure 1 below and their interactions as shown in Figure 2.

Figure 1: Components of the EO sector in Australia with fully operational status and capability to expand:
 Source: AEOCP 2026

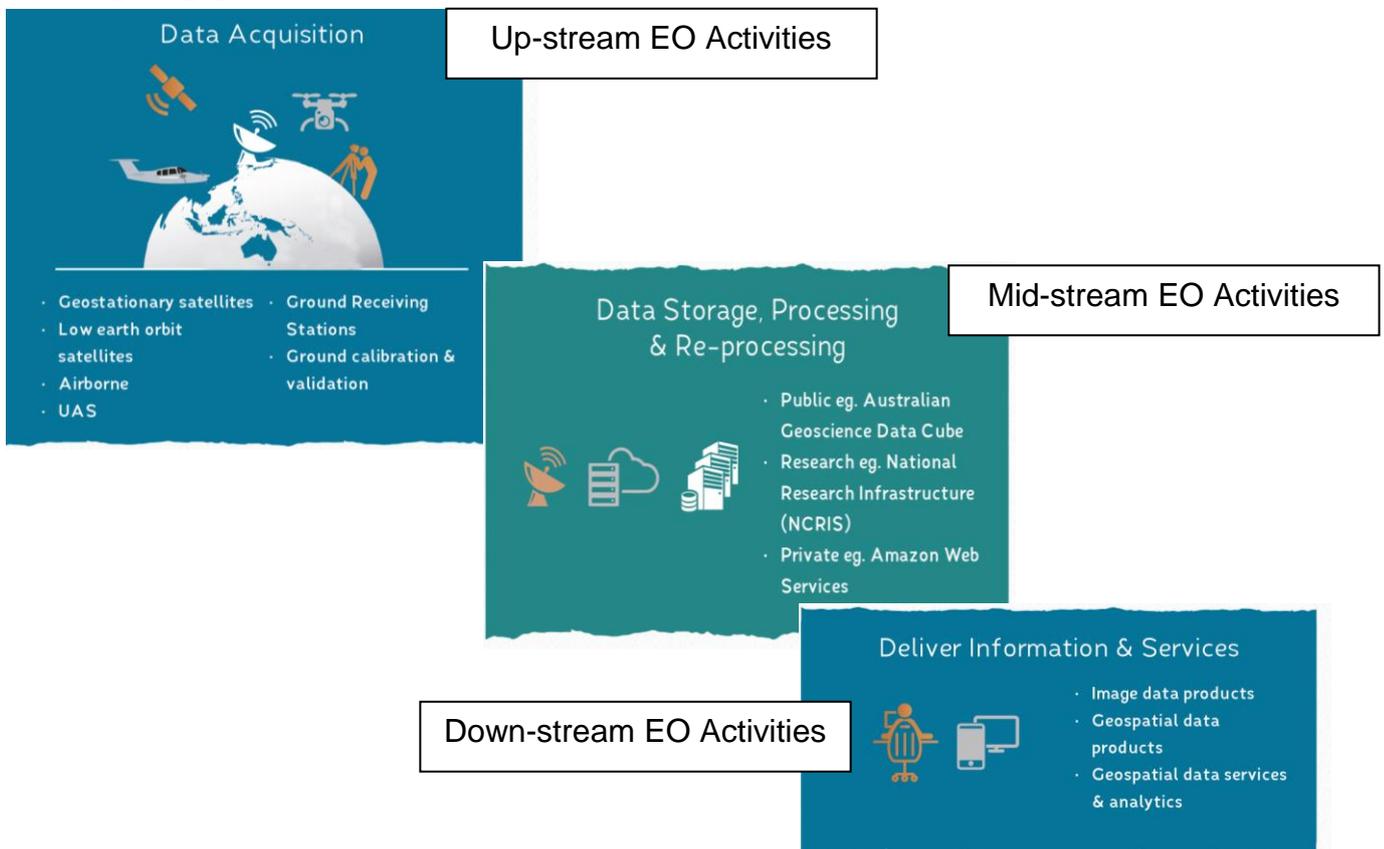
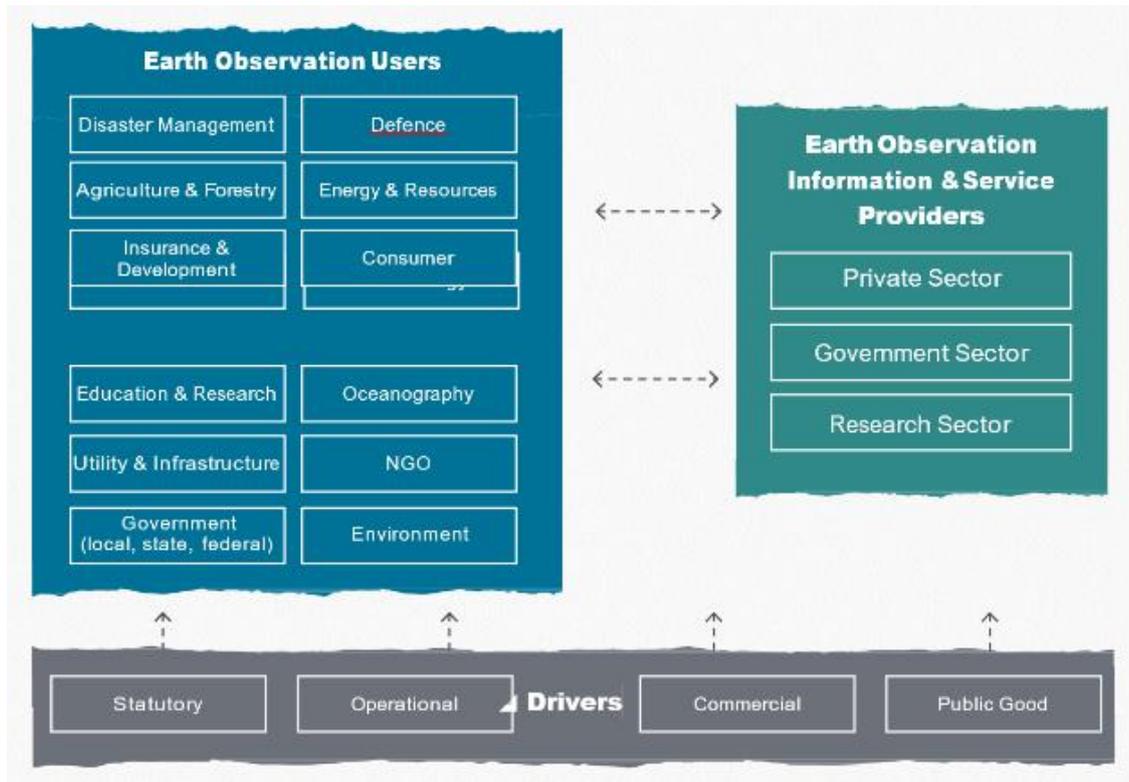


Figure 2: Interactions between components of the EO sector in Australia. Source: AEOCP 2026



Listings and assessment of the extent of these capabilities can be found at:
 Coppa I, Woodgate PW, Mohamed-Ghouse ZS. (2016) 'Global Outlook 2016: Spatial Information Industry'. Published by the Australia and New Zealand Cooperative Research Centre for Spatial Information (CRCSI).
 ACIL Allen Consulting (2015) 'The Value of Earth Observations from Space to Australia: Report to the CRC for Spatial Information';
 Space Community of Interest (2015) 'A first pass analysis of risks associated with Australia's dependencies on space-based assets: Communications, Positioning, Navigation, Timing and Earth Observation.' Trusted Information Sharing Network for Critical Infrastructure Resilience, Attorney General's Department, Canberra, RESTRICTED ACCESS.

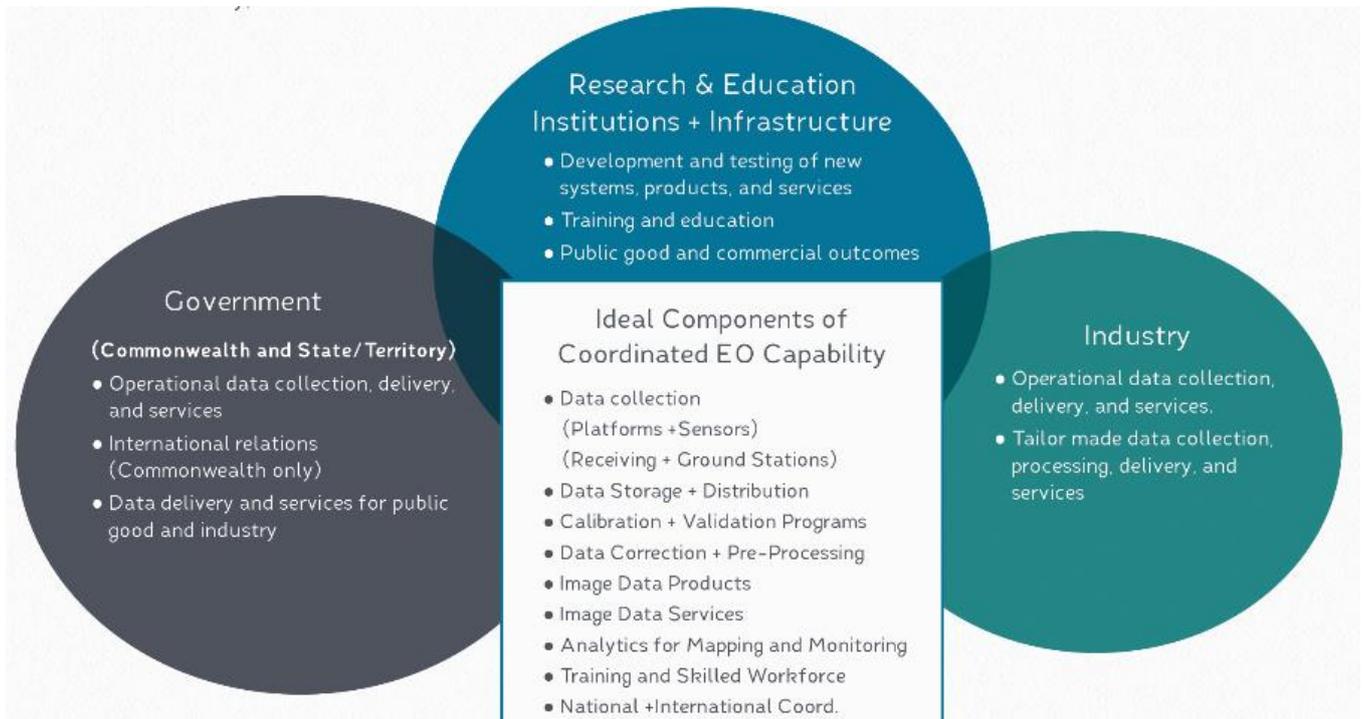
The AEOCCG considers that the main areas of competitive advantage to develop are:

- Downstream applications development to provide analytics and information across a broad range of private industry and government sectors using analysis of time series data derived from satellite image archives (current examples in horticulture and agriculture);
- Integration of upstream and downstream services to deliver end to end solutions using small/cube-sats and on-ground measurements

2. Identify capability gaps to support the global competitiveness of Australian firms in the space sector

Capability gaps can only be addressed once the overlaps and duplications between all sectors of the EO capability (see Figure 3 below) are reduced and these sectors function in a more direct and complementary manner as an ideal system.

Figure 3: Ideal components of the EO sectors for Australia. Source: AEOCP 2026



3. *Identify capability gaps to support the use of products and services of the civil space sector*

Current capability gaps in this area include:

- Access to assured 24/7 data streams from a variety of satellite image data sources that will allow industry and application specific service development of monitoring tools, e.g. dam water levels across a catchment, water quality in aquaculture, current forecast crop yield; number of houses with solar panels; and
- Development and delivery of a fully operational end to end, upstream and downstream EO data collection, analysis and delivery platform that is Australian owned and operated. Ideally this would be delivered into one of our critical infrastructure high use EO data sets, the main being high spatial resolution multi-spectral (visible, IR, short-wave IT and thermal) data. We could also provide this capability globally, not only serving and developing Australian capability and markets, but doing the same overseas.

4. *Strategies to promote Australian firms engaged in the civil space sector, both domestically and internationally*

We suggest a key strategy should be the introduction of a program to enable more effective research-industry partnerships using government and industry EO Infrastructure. This must sit outside the context of existing mechanisms such as the CRC Program and ARC-Linkage, and use a new more flexible research to operations structure. Examples of this from other countries include the UK Catapult – Earth Observation, or the European Space Agency/European Commission- EO Innovation Europe programs and the US National Science and Technology Council’s, “National Plan for Civil Earth Observations 2014”. The proposed Space and Spatial Growth Centre in the 2026 Agenda would be a start in right direction to address this.

5. *Identification of current risks and opportunities in critical space derived data sets and strategies to provide resilient national access to such data sets*

Refer to: SPACE COMMUNITY OF INTEREST - Trusted Information Sharing Network (2016) A first pass analysis of risks associated with Australia's dependencies on space-based assets. Edited by P.Woodgate and M.Nix.

Current key risks include:

- Australia is wholly dependent on foreign governments to provide essential space based EO used for essential day to day activities of the Bureau of Meteorology, Emergency Services, Defence Forces, Transport Industries (aviation, marine and ground), Energy Generation and Distribution Industries, Water Supply and Distribution, Food Production Industries and a range of local to state and national government activities.
- A multi-level strategy is required to address these across: maintaining engagement with, financial contribution to international EO programs such as CEOS and WMO; enabling international science using Australian EO resources to contribute to use and development of foreign data sources; and development and implementation of fully operational Australian EO platform and sensors (e.g. high and moderate spatial resolution multispectral) that can be used in essential activities across Australia and internationally.

Response to 'Considerations for Capabilities'

- ***What are Australia's space capability strengths? What are the factors that contributed to the development of these strengths?***

The following text from the AEOCP 2026 outlines our space capability strengths in EO and why they are strengths:

"Australia has an active Earth Observation community distributed across research and education, government, private industry and NGOs (Figure 1 and 3). Although Australia does not operate any EO satellites, we are active across the entire EO supply chain beginning with the initial stages of data collection, storage, processing and distribution, and also in the research development of new EO sensors and processing algorithms. Our EO sector transforms EO data to value-added spatial information and services for government and industry and supports the end use of EO-based spatial information products and services by public and private sectors in everyday activities.

Australian government agencies at all levels have collected EO data over Australia since the 1940s, as evidenced by our extensive state-based aerial photo and image archives. Since the late 1970s we have moved to routine acquisition of satellite data, and since 2010 we have seen dramatic advances in all sectors (Figure 1 Up-, Mid- and Down-stream).

EO services, delivered by both the public and private sector, are recognised as essential public-private infrastructure with numerous national reviews showing that Australian governments and industry are dependent on EO to maintain our economy and societal wellbeing. Data and information applications from EO are now commonly used across all levels of government, industry and society in a range of sectors. Over 140 Commonwealth, state and territory government programmes are dependent on EO from space, and the minimum economic impact of these observations on the Australian economy is approximately \$5.3 billion per annum. These services are also estimated to have created more than 9000 jobs in 2015, and are projected to generate over 15000 jobs by 2025. There are numerous examples of the economic and societal benefits generated from EO in Australia, across areas such as weather forecasting, onshore and offshore mining,

mitigation and management of natural disasters like bushfires and floods, water resource management, design and assessment of conservation areas, insurance assessment, and land use planning (an excellent series of case studies showcasing the value of Earth Observation for different sectors is available in ACIL Allen (2015) 'The Value of Earth Observations from Space to Australia: Report to the CRC for Spatial Information')."

- ***What are the weaknesses in the Australian space industry sector?***

The text below from the AEOCP 2026 explains the most recent advances in EO and their future trends, then uses this to identify where the EO sector of Australia's Space Capability has weaknesses that need to be addressed:

"Since the late 1970s we have moved to routine acquisition of satellite data, and since 2010 we have seen dramatic advances in:

- 1. The ability to collect EO data across multiple satellite, airborne, and other platforms such as unmanned aircraft systems (UAS) and the types of sensors these use; from digital photography to multi and hyper-spectral sensors, airborne LIDAR, and satellite radar and radiometry;*
- 2. Improved access to these data from sites of a few square metres to continental and global scales on a regular basis; and*
- 3. Our ability to store, process, analyse, visualise and distribute very large and long-term EO data sets online, and to deliver derived spatial information and services to a wide range of users through mobile devices and websites.*

While Australia operates no EO satellites of its own, we access a wide range of satellite imagery, at moderate to low spatial resolution (20m — 1km pixels) through long-standing partnerships and arrangements with other countries. As part of these arrangements, Australia provides important ground station capability, highly skilled personnel, data access and distribution infrastructure, along with calibration and validation data to our international partners, and development of new algorithms and processing workflows. In combination, these activities add value to the available data for both our partners and ourselves. Access to higher spatial resolution data is through a range of private industry satellite, airborne, and UAS providers. The number and types of all these data sources are increasing continually.

While the existing impacts and level of dependence on EO in Australia are very significant in terms of diversity of activities and economic value, there is unrealised potential for the EO sector in Australia. Unless change occurs across the sector, this unrealised potential will grow, in effect translating to a net loss in essential capability for satellite, airborne and UAS data collection, processing and delivery. Some well-documented challenges will become significant barriers to growth if not addressed, including:

- coordination and a consistent vision within the EO community across research and education, government, and private industry, to ensure effective cooperation, collaboration, and use of resources within the sector, as well as improving advocacy by the sector at national and international levels. This vision needs to be backed by a clear strategy. When realised this will bring together a far more effective critical mass of expertise significantly increasing the value returned from Australia's investment in EO;*
- Developing a clear, coordinated strategy to invest in and protect our international partnerships to ensure continued access to satellite data and international expertise, especially given our high dependency on foreign-owned satellite data;*
- Providing clear pathways to develop, support and sustain the EO capacity required for Australia through skilled people, a growing knowledge base, and advanced data collection, storage, and analysis infrastructure;*

- *Effectively managing and enabling access to the very large and rapidly growing collections of EO data including historical archives and required new data streams, and taking advantage of new information systems technologies for storage, processing analysis, visualising and transfer, to overcome historical problems and future challenges with discoverability and access to the data, products and services; and*
- *Establishing connections between EO producers and users to enable the development of EO products and services suited to current and future user needs, and supporting the commercial development of EO applications to deliver productivity gains across the economy, amongst other societal benefits.”*

- ***What is the cross-over potential of space-related industry capabilities to the rest of the Australian technology/manufacturing sector?***

The cross-over potential of space-related industry capabilities in EO to the rest of the Australian technology/manufacturing sector is very large, specifically:

- Upstream: development of sensors, satellites, and ground components can be built up as a capacity within Australian private industry, and not necessarily by large foreign aerospace. We have the opportunity to be more agile and develop applications that are multi-use and tied to Australian capabilities and will keep the investment and returns in Australia.
- Mid-stream: development of appropriate data storage, processing and distribution capabilities can also be done by Australian companies.
- Downstream: This is the area where we have most existing strengths and base capabilities, but also one where the potential for growth is very broad, stretching across small start-ups and SME, to large national environmental, mining-engineering and agricultural companies. This would be supported by the extensive use of EO across all levels of government, agriculture, horticulture, mining, water resource, infrastructure/asset management.

- ***Are there space systems or activities that require Australia to maintain specific sovereign space industry capabilities?***

Yes – currently public good data (high spatial resolution multi-spectral (visible, IR, short-wave IR and thermal) data) that support our essential government and defence services, and these now offer greatest potential for multiple private sector applications at many scales to be built on these, if an assured high quality data stream can be provided. In addition, Australia could easily build it’s upstream EO capabilities (such as AITC at Mt Stromlo) to build new and advanced version of these sensors on suitable small to cube-sat platforms. Building and launching several of these platforms would provide Australia with assured access to its most frequently used and essential EO data stream, and build significant potential for commercial applications.

- ***Are there specific space services that provide greater opportunities for the Australian space industry sector within Australia or the Australian region?***

EO downstream applications for advanced environmental measurement and monitoring from building to continental scales. Note our response to the consideration above. We have world leading state based and whole of country analytics delivered on environmental conditions for terrestrial and marine applications from non-Commonwealth agencies. This is also the area with greatest private sector interest now in start-up SME scale activities linked to agriculture, horticulture, and urban utilities.

- ***What space products, upstream or downstream, are being exported by Australia?***

The basic science behind capturing all forms of EO data and transforming that into accurate, scientifically and legally defensible information, from all forms of EO data, in terms of scientific papers, code and output data streams.

- ***What products could be exported in the future?***

EO downstream applications for advanced environmental measurement and monitoring from building to continental scales. Full systems from sensor, platform, ground segment to processing and delivery.

4.2 PRINCIPLE 2 - DEVELOPMENT

The second paragraph in this principle does not recognise the full scope of achievements across Australia since the release of the 2013 Australian Satellite Utilisation Policy.

AGEOSWG also recognises this omission and highlights the formation and successful national coordination activities of the AEOCCG, which is whole of country, and community driven across Government-Industry-Research. The AEOCCG activities and the AEOCP 2026 show that a clear national scale cooperative basis has been formed for the EO component of Australia's Space sector and that it has a national mandate for action in its five priority areas. **AEOCCG has already done the consultation and engagement required for defining national EO priorities for the space sector.** The AEOCP 2026 priorities have also been adopted as directives for Australia's current National Research Infrastructure Roadmap and its implementation.

In the fourth paragraph on page 11, the Issues Paper identifies that *"The challenge motivating the development Australia's space industry capabilities is ensuring that we are able to effectively utilise the space systems and data streams that are essential to our national security and economic prosperity."* The AEOCP 2026, activities of the AEOCCG, the Space Critical Infrastructure Group and activities like the Joint Remote Sensing Research Program show we already do this and can produce effective new capabilities like Australia's Copernicus Data hub.

To develop EO as a pillar for Australia's Space Industry we need to remove inefficiencies in the form of overlaps, duplication and ill-defined roles of the industry-research and government sectors as shown in Figure 3 above. These are outlined below.

Our main barriers to developing and growing EO as a pillar for Australia's Space Industry were identified in AEOCP 2026, and the text is included below:

"While the existing impacts and level of dependence on EO in Australia are very significant in terms of diversity of activities and economic value, there is unrealised potential for the EO sector in Australia. Unless change occurs across the sector, this unrealised potential will grow, in effect translating to a net loss in essential capability for satellite, airborne and UAS data collection, processing and delivery. Some well-documented challenges will become significant barriers to growth if not addressed, including:

- *Assuring coordination and a consistent vision within the EO community across research and education, government, and private industry, to ensure effective cooperation, collaboration, and use of resources within the sector, as well as improving advocacy by the sector at national and international levels. This vision needs to be backed by a clear strategy. When realised this will bring together a far more effective critical mass of expertise significantly increasing the value returned from Australia's investment in EO;*
- *Developing a clear, coordinated strategy to invest in and protect our international partnerships to ensure continued access to satellite data and international expertise, especially given our high dependency on foreign-owned satellite data;*
- *Providing clear pathways to develop, support and sustain the EO capacity required for Australia through skilled people, a growing knowledge base, and advanced data collection, storage, and analysis infrastructure;*
- *Effectively managing and enabling access to the very large and rapidly growing collections of EO data including historical archives and required new data streams, and taking advantage of new information systems technologies for storage, processing analysis, visualising and transfer, to*

overcome historical problems and future challenges with discoverability and access to the data, products and services; and

- *Establishing connections between EO producers and users to enable the development of EO products and services suited to current and future user needs, and supporting the commercial development of EO applications to deliver productivity gains across the economy, amongst other societal benefits.”*

Response to Headings:

1. *Technologies and practices that promote innovation in both the downstream (users of space technologies) and upstream (providers of space technologies) elements of space activities, particularly in areas of niche capability and competitive advantage*

Addressing this issue requires careful attention to the current overlaps and duplications set out in Figure 3 above, and what is needed in the form of an ideal EO capability across Government at all levels, Research and Private Industry. In particular, it means recognition that research, industry and Commonwealth and State Users of EO data need access to an assured 24/7 stream of high quality and suitable EO data to build applications and services around, and start-up programs to enable this and ensure data are fit for use. This activity does not fit the definition of research infrastructure. For essential data streams this should be provided through an agency whose sole role is to deliver that datastream (analysis ready to national and international standards), so industry and other agencies build applications around it. This means the research sector uses EO research infrastructure and operational infrastructure to work with government and industry to build solutions, which are then taken up to be made operational in government and/or industry.

2. *Risks and opportunities, including ongoing access to space data and associated infrastructure essential to our national interests*

Refer to the response outlined above in the opening statements of this section. We have several major risks to continued operational use of EO data and restrictions that severely limit the ability of private industry to build on assured data streams and work with research and government sectors to provide solutions.

Response to “Considerations for Development”

- ***What elements of the global space sector are most beneficial for an Australian space industry to participate in?***

There are two main areas with extensive opportunity:

- In the short term 2-5 years, EO mid- and down-stream infrastructure and applications for the collection, analysis and delivery of products, analytics and services to any form of environmental monitoring from site to continental scales.
- In the longer term, > 5 years, EO upstream infrastructure development to fill a national and international gap in terms of assured access to moderate to high spatial resolution multispectral sensor.

- ***What are the key enabling technologies, infrastructure, processes and/or skills that will underpin the future of the Australian space sector?***

EO technologies: optical and thermal sensor development for satellite and airborne systems

EO infrastructure: existing satellite EO data collection infrastructure operated by Commonwealth government; existing satellite EO data processing, analysis and distribution infrastructure operated by state and territory governments; and existing and planned and highly coordinated EO research infrastructure.

EO Processes and Skills: Highly developed, trained, experienced and coordinated EO workforce with extensive experience in collecting field data, collecting image data sets, correcting and processing multiple image data sets, and building workable solutions for a multitude of applications.

- ***What are the competitive advantages available to space activities in Australia?***

EO applications development using high to moderate spatial resolution multispectral image data from archives or new data sources. Extensive national EO research infrastructure to enable development and testing of globally applicable satellite and airborne EO products.

- ***What opportunities are available to develop Australia's space industry capability?***

There are multiple direct opportunities in the EO sector to build Australia's space industry capability, all of which build on established capabilities, notably those outlined in Figure 3, and fall into the following capabilities:

EO technologies: optical and thermal sensor development for satellite and airborne systems

EO infrastructure: existing satellite EO data collection infrastructure operated by Commonwealth government; existing satellite EO data processing, analysis and distribution infrastructure operated by state and territory governments; and existing and planned and highly coordinated EO research infrastructure.

EO Processes and Skills: Highly developed, trained, experienced and coordinated EO workforce with extensive experience in collecting field data, collecting image data sets, correcting and processing multiple image data sets, and building workable solutions for a multitude of government and industry applications.

- ***How can Australia grow the capabilities needed to foster an internationally competitive space sector?***

The text below is from the AEOCP 2026 and explains how specific Australian EO capabilities can be grown internationally as a pillar within Australia's space industry:

"Priority 2

2.1 Establish and resource a transparent and inclusive mechanism to coordinate Australia's strategy and partnerships with priority space agency partners, public and private, working in the interests of and in consultation with the Australian EO community.

2.2 Develop a robust process to assess options and costs/benefits for meeting Australia's EO satellite data needs for the future and compare possible options including, but not limited to: (1) major and ongoing financial contribution to international public and/or private space programmes to ensure Australian input to design of missions and ongoing access to data and services, (2) development and deployment of dedicated Australian EO satellite(s).

2.3 Consistent with their mandates, relevant government agencies continue to provide strategic and sustained support for ground station facilities that support international partners.

2.4 Establish a formal programme and partnerships that bring the Australian EO community together to co-invest in a suite of internationally relevant calibration and validation sites and facilities, to run on an operational basis with long-term certainty.

2.5 Support, engage with, use and expand on government-funded essential infrastructure that enhances access and use of satellite data, including data access and analysis hubs such as the Copernicus Hub.

2.6 Government agencies and research institutions financially support and encourage participation of Australians in teams for key international programmes, such as science teams and validation teams.

2.7 Consistent with their mandates, relevant government agencies promote Australia's capability and willingness to contribute to the international EO community, e.g. using the embassy network, trade delegations, and relevant multi-lateral forums."

- ***What capabilities are needed to ensure access to the space systems and data flows that are becoming critical to Australia's economy?***

The text below is from the AEOCP 2026 and outlines the capabilities needed to ensure access to the space systems and data flows for EO that are already recognised as, and also becoming critical to Australia's economy:

"Priority 4

- 4.1 Undertake ongoing and periodic assessment of EO data requirements that includes regional and industry requirements, and non-satellite data sources.*
- 4.2 Increase investment in long-term partnerships with international space agencies able to provide critical public good datasets, building on existing responsibilities of operational government EO agencies in partnerships across national-state levels, and with research and industry (see also Priority area 2).*
- 4.3 Ensure efficient and predictable access to key public good EO datasets delivered through operational government EO agencies.*
- 4.4 Establish a centralised website, maintained by the EO community, with an up-to-date overview of scientific and commercial EO data acquisition, locations of data, access protocols, description of processing levels, description of routine data products and analytic services.*
- 4.5 Encourage relevant agencies to work closely with major computing facilities to facilitate access to public data, and data analysis tools, for the whole Australian EO community.*
- 4.6 Establish mechanisms to facilitate the spread of state-of-the-art knowledge and techniques, define EO standards, and EO best practices."*

- ***What linkages could be made between the space sector and other sectors to achieve the most benefit from the development of Australian space industry capability?***

The text below is from the AEOCP 2026 and outlines the linkages that could be made between the space sector and other sectors to achieve the most benefit from the development of Australian space industry capability in EO:

"Priority 3

- 3.1 Promote increased investment in education and training to ensure that the next generation of EO-application developers and users are being provided with the appropriate EO background and software skills.*
- 3.2 Promote increased investment by Australian governments into the core infrastructure and trained professionals required to receive, store, process and make EO data publicly accessible in formats relevant for subsequent users.*
- 3.3 Effectively coordinate and promote investment in infrastructure to meet research and industry needs including data portals, processing of raw data into data products tuned to Australian conditions, calibration and validation of these datasets, and user-friendly web-based access to data products.*
- 3.4 Develop a coordinated national plan for spectrum assurance and scheduling.*
- 3.5 Australian EO community to develop and annually update a statement of infrastructure requirements, covering critically significant ground station facilities, communications links, storage and archival facilities, processing facilities, calibration and validation sites, and any other infrastructure needs (linked with the assessment of data needs identified under Priority 4). An initial statement of needs for government and research is already available as supporting documentation for this Plan."*

- ***What are the technology trends over the next 5-10 years and what opportunities/impacts for Australia?***

As discussed in the AEOCP 2026, “We are currently seeing a step-change in EO globally that will radically change its sources, the ability of populations to access and use its data and services, and the potential applications and value of EO products and services for Australia in the coming decade. Australia’s EO producer and user communities have indicated that substantial changes are required if we are to engage with these advances. A new generation of public-access and private EO satellite programmes, new opportunities from ‘micro’ satellites, rapid proliferation of UAS, and ubiquitous sensors in our environments will soon deliver an unparalleled deluge of complementary datasets at far more frequent coverage rates and finer spatial scales than previously achieved. Alongside this, new and more powerful storage and processing platforms through cloud computing capabilities and continued advances in computational hardware are enabling scalable processing of these data over small to large areas and timeframes, with output products and analytics for use in a range of contexts.

As a nation we must be proactive about taking advantage of these changes, ensuring a future Australian EO capability across government, industry, and research that can collect the right data, store and process it effectively, and deliver the right information in the right format at the right time to the right user. Australia has a solid foundation upon which to build this future capability: we have invested wisely in building core EO data acquisition capabilities, and world- leading scientists and applications development in some government, industry, and research sectors. It is now time to build on this foundation, and establish a whole-of- EO-sector coordinated approach to grow our capability and provide the essential EO services of the future, so Australia’s economy and society benefits. Effective linkage across all parts of the EO sector is critical, and that is why this Plan represents a holistic view on Earth Observation in Australia: it is inclusive of government at all levels, research, and the private sector, working in all parts of the EO life cycle from varying types of data acquisition (ground to air to space) to data processing and management, and application development.”

The following trends were noted earlier in our submission, and are listed below to highlight which technology trends Australia’s Space Industry is best placed to build its existing expertise in EO:

- **EO technologies:** optical and thermal sensor development for satellite and airborne systems, especially the almost universally used (from local to national scales) multi-spectral VIS-IR-SWIR-TIR high spatial resolution sensors, that could be incorporated into small-sat and cube-sats able to be built in Australia.
- **EO infrastructure:** existing satellite EO data collection infrastructure operated by Commonwealth government; existing satellite EO data processing, analysis and distribution infrastructure operated by state and territory governments; rapidly growing and advancing private industry mid-stream data storage, processing and distribution capabilities that can easily be scaled up and down as required, and existing and planned and highly coordinated EO research infrastructure.
- **EO Processes and Skills:** Highly developed, trained, experienced and coordinated EO workforce with extensive experience in collecting field data, collecting image data sets, correcting and processing multiple image data sets, and building workable solutions for a multitude of government and industry applications.

- **What ‘blue sky’ future opportunities can Australia prepare for now?**

Complete EO production and delivery, from sensor and platform to mid-stream ground segment, to downstream delivery of products, services and analytics.

4.3 PRINCIPLE 3 - GOVERNANCE

This principle requests that *“As part of a strategy, a governance structure should align the space-related activities of industry, research and government organisations to maximise the benefit to Australia.”*

AEOCCG agrees with that, and has a structure and fully operational processes and community trust in place to achieve parts of this across all levels of government, research institutions and private industry in Australia. AEOCCG is ready to cooperate and participate in any type of formal space agency or coordinating government body that the Commonwealth proposes as part of this review.

As noted in other submissions (AGEOSWG and SpatialAgenda2026) and other national plans, e.g. Space Industry Association of Australia’s white paper, there is a clear and urgent need for a new whole of government agency that has a remit and resourcing significantly beyond anything that was previously in place (e.g. Space Policy Unit), along the lines of various “space” agencies in Europe, Asia and North America.

AEOCCG also notes that for each of the longest running and most effective foreign national space agencies e.g. NASA USA , ESA Europe, JAXA Japan, INPE Brazil, ISRO India and CNSO China, the majority of their organisational structure and activities are focused on developing, delivering and maintaining the most appropriate EO systems (up-, mid- and down-stream) for their country’s needs and to support defined priorities of the international EO and environmental and meteorological agencies, e.g. CEOS (www.ceos.org).

AEOCCG and the AEOCP 2026 fully support the following statement from the Review and are open and willing to participate in *“Building an Australian Government governance framework to support Australian space industry development needs to recognise opportunities from greater coordination and focus on realising the benefits of a holistic approach to Australian space activities.”* AEOCCG has achieved a level of national awareness, collaboration and coordination across all levels of government, industry and research in EO that was not previously possible. It is essential that whatever governance framework is built from this review, it includes AEOCCG in an explicit and active role.

AEOCCG however, does not agree with the following statement and notes that significant work is required to move to a more active and inclusive forms of collaboration to build coordination across Australian EO activities, especially linking government-research-industry and supporting research and industry to use and build on government resources: *“The Australian Government maintains appropriate arrangements to coordinate Australian space activities and engage with international forums.”* Both AGEOSWG and AEOCCG have significantly advanced this, but have been limited in their ability to expand and implement community requirements due to lack of higher level government support.

Response to Headings :

1. *Australia’s level of regional engagement and international collaboration, including identifying critical future and existing partnerships*
No comment
2. *Alignment with other sectors and Australian Government priorities, including Defence, critical infrastructure and cyber security, and meeting Australia’s international obligations*
No comment
3. *The most effective institutional arrangements to support the strategic direction of Australia’s space industry*

See introductory text above. Formation of a Commonwealth Agency in this context to coordinate “Space” related Government business and to enable research and industry development using Government resources is sensible and would allow Australia to significantly build on its capacity and global contribution, while at the same time growing its own industry. The agency must recognise EO and strategic provisions of essential EO data streams as a priority activity and conduct other activities that enable research around these data streams and development of significant private industry use of these data streams.

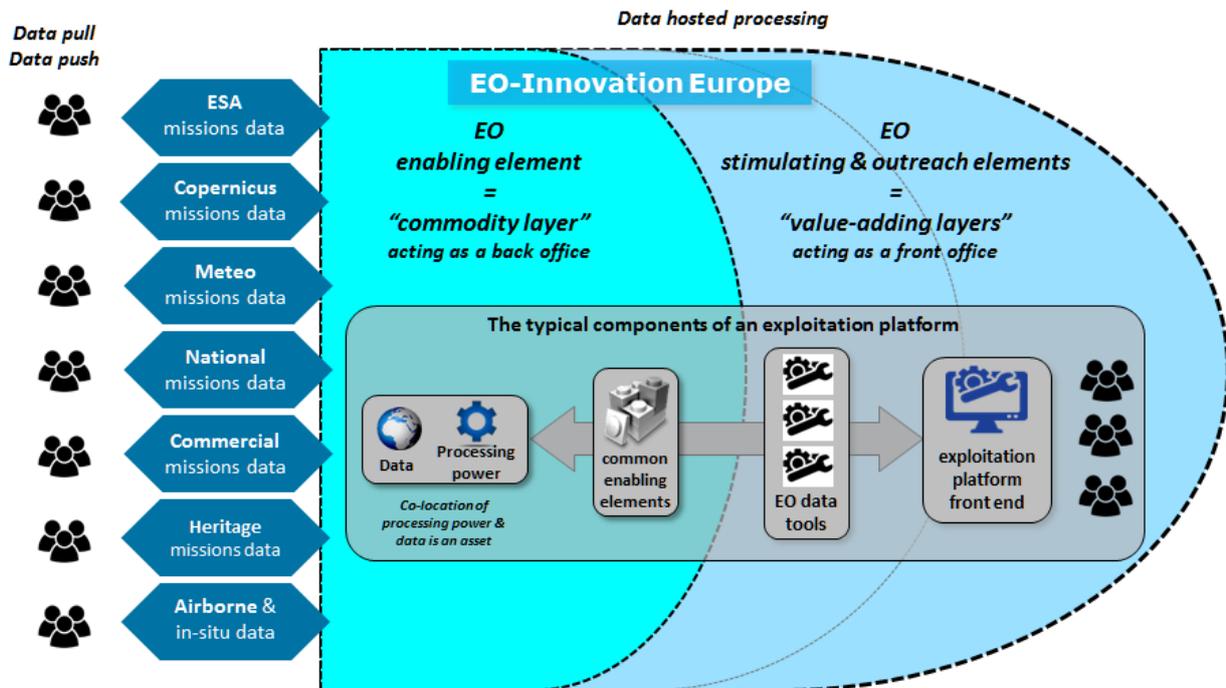
Response to “Considerations for Governance”:

- *What are the successful international models for the governance of national space activities, especially in regards to the development of space industry capabilities?*

Several of the most relevant here are:

- UK Satellite Catapult - <https://sa.catapult.org.uk/>
- European Space Agency approaches to preparing for the future, three interlinked programs: www.esa.int/Our_Activities/Preparing_for_the_Future/How_ESA_Pre pares_for_the_Future
- European Commission Horizon 2020 Program : <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/space>
- EO Innovation Europe: <https://earth.esa.int/documents/1656065/2066722/2-Laur-Future-Scenario-of-interconnected-EO-Platforms.pdf>
- NASA Earth Systems Science <https://earthdata.nasa.gov/earth-science-data-systems-program>
<https://earthdata.nasa.gov/eosdis-cumulus-project>

Figure 4: EO Innovation Europe Framework from ESA (2016) A Future Scenario of interconnected EO Platforms - How will EO data be used in 2025 ?



- ***What responsibilities appropriately fall under an Australian Government space activities governance framework?***

From the AEOCP 2026 the following activities could fall under an Australian Government space activities governance framework:

“Priority 1:

1.1 Formation of a national Earth Observation coordination mechanism with a clear mandate and operational funding to provide a central point of connection and coordination for all sectors of the EO community in Australia. This will enable the identification and communication of essential EO needs, better strategic investment in the sector to achieve goals, and a clear mechanism for advocacy on behalf of the EO community.

1.2 Development of new national EO forums (e.g. targeted seminars, webinars, online resources, workshops, conferences) to enable collaboration across the EO community and between the EO community and end-users in activities such as agribusiness, planning, environmental monitoring, resources and utilities. This includes building links to the spatial sector and the space sectors through their coordinating bodies, actively engaging with national science and innovation bodies and research infrastructure programmes.”

- ***How should the priorities of non-government organisations be incorporated into an Australian Government strategy?***

It is critical that non-government organisations be explicitly incorporated, and included in effective consultation.

The continued failure to do this in the past is why we have not had effective uptake of the majority of Commonwealth initiatives on EO by industry, research and the state governments as they either: (a) overlapped and duplicated existing operational capabilities or commercial products provide by state governments or industry (e.g. Australian Geoscience Data Cube); or (b) have been totally disconnected from the requirements of the majority of the EO user and producer base in Australia, which is in state and local governments, private industry and research bodies.

Any path forwards must establish and recognise the needs of all these groups – as we have done with AEOCCG and in the AEOCP 2026 – and work with them to develop a strategy that is enabling and accessible for government, industry and research across Australia.

4.4 Opportunities for Australia's Space Industry

Although this section of the issues document was not necessarily a “principle” we have provided comment. AEOCCG and the main priorities established in the AEOCP 2026 agree with the two critical points raised in the review on page 15:

“This need creates new demands on governments to facilitate access to this data and opportunities for the private sector to provide products to a global market.

“In parallel to our growing use of space-derived data and systems is our growing dependence on them. Access to these data and systems, as well as the capability to exploit them, is an increasing requirement of both government and the private sector. Meeting this challenge has the potential in itself to create opportunities if we position ourselves to take advantage of them.”

AEOCCG and the AEOCP 2026 support both of these points. It is our position that as a national community we should build on the areas where we have expertise and a head-start in capability in space (that is EO), instead of investing in very small niche areas with little commercial opportunities or limited applications for a very small part of the scientific community, even if that science is high profile.

The Issues Paper notes that *“For Australia to maximise its investment in space activities it is not feasible to develop space industry capabilities in all aspects of international space activity. The identification of appropriate niche areas to focus the Australian space industry will deliver the most benefit to Australia.”*

We believe that EO is the niche area of Australia's Space Capability that offers the most potential for maximum return in building industry(ies) that use our established investments and expertise. It will have returns that create significant amounts of new jobs, economic activity AND most importantly increase our national security and support a huge range of activities across all levels of government, science and industry. The EO sector has a plan AEOCP2026, a clear mechanism for national coordination and collaboration, and is ready to act.

Response to “Considerations for Opportunities”:

- ***What opportunities are available for Australia in the global space sector?***

The following text from AEOCP 2026 demonstrates the opportunities are available for Australia in the global space sector:

“Priority 5:

- 5.1 Create a communication and marketing plan that expresses the benefits of EO for different end-users, and that highlights the potential of EO services as a growing industry.*
- 5.2 Lobby for the development of favourable policies to advance the commercial potential of EO services, increasing the uptake of EO products and services and subsequently driving further investment in the sector.*
- 5.3 Measure and record the uptake and economic benefits of EO across different sectors.*
- 5.4 Clearly articulate the benefits of our calibration and validation facilities, and maintain and grow investment in these to ensure our EO products are accurate, leading edge and world class.*
- 5.5 Develop a Standards-Based Approach for the capture, analysis, storage and dissemination of EO data, information and services to ensure ongoing confidence in our EO products and services.*
- 5.6 Advocate for innovation programmes, grants and subsidies to encourage entrepreneurship in the EO service industry.”*

- ***What should the priorities be for the Australian space industry?***

This directly addressed by all of the points we have outlined on pages 15-17 of our submission.

- ***How can the private sector be encouraged to invest in areas of Australia's comparative advantage?***

We believe this issue requires a separate working group and dedicated effort, but provide some initial thoughts:

- This cannot be addressed until all of the overlaps identified in Figure 3 are identified, duplications are reduced, and then we can link government-research-industry effectively to build a space EO capability that uses our extensive national and state agency EO activities, with the world leading research base for downstream application, and links in private industry to provide the much needed upstream sovereign space capability and mid-stream storage, analysis and delivery resources.
- Seed funding of priority capabilities (e.g. multi-spectral VIS-IR-SWIR-TIR high spatial resolution sensors, that could be incorporated into small-sat and cube-sats able to be built in Australia) with required research and industry partnership.
- Development of a program similar to EO Innovation Europe, see page 19.

The extensive national community consultation used to develop and deliver the AEOCP 2026 identified challenges to these activities and over 50 suggested solutions to building these new initiatives. All of this information is stored in databases with the AEOCP 2026 and is to be used to implement Priority 5 of AEOCP 2026 "Generating Value — strengthening end-user engagement to enable delivery of high quality EO products and services suited to user needs, and supporting commercial development of EO applications." which could linked directly to this activity of the Review.

- ***Should priorities for space industry capability development be applied across all space-related research funding?***

Yes – especially in relation to up-, mid- and down-stream industry potential and research

- ***What should the vision for the Australian space industry be?***

The AEOCP 2026 vision is:

"By 2026 Australian EO information and services will be used broadly as a matter of course by a wide range of industries and the general public, and as a trusted decision-making tool. Strong connectivity and communication across the EO community and with other industry sectors will result in increasing numbers of joint research projects, value added products, and paths to impact for research outcomes. We will become a leading provider of EO services worldwide, strengthening our place in the global EO landscape."

There are already good examples of cross-sector collaboration and commercial EO benefits through our Cooperative Research Centres (past and present), Joint Remote Sensing Research Program and the AEOCCG. However, further improvements in collaboration with end-users of EO data will assist in realising the commercial benefit from EO products and services in Australia and globally.

The current disconnect between EO producers and potential users means the benefits of EO are not being fully exploited by all beneficiaries. Concerted efforts to communicate and extend these benefits and the real world applications of EO are critical to driving user uptake and long-term demand. The EO community has a responsibility to actively work with potential users in all markets to better understand their respective needs and to assist them in the application of EO solutions.

Adapting quickly to changing conditions in the market will suit small and medium-sized enterprises (SMEs) in the EO sector that provide value-added products and services, and that can move quickly to meet the market's needs. To support growth, policies and processes must be designed in ways that can maximise the commercial potential of private EO service providers. Australia has the potential to lead a rapidly emerging global EO service market, but could well miss out as other countries scale up their support for SMEs in this sector.

As the uptake of EO applications grows in coming years, the Australian EO community must also maintain strong quality assurance standards underpinned by calibration and validation processes, to ensure they are delivering high quality and trusted products. As the commercial benefits of EO are realised by a growing user base, it is vital that we maintain the high quality of our EO products, which in turn assures trust in those products and an ongoing demand for the products and services our sector can offer.

END OF SUBMISSION