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**The Australian Space Agency: Contributions from attendees of the
2017 Australian Space Research Conference**

Dear Dr Clark,

We write to convey to you the consensus views and advice on the roles, nature, and structure of the future Australian Space Agency from attendees at the 17th Australian Space Research Conference, held 13 – 15 November at the University of Sydney.

This letter is motivated by the announcement on 25 September at the International Astronautical Congress that the Government will move to form an Australian Space Agency. There was no time at the Congress for community consultation. Accordingly a 2-hour community discussion was scheduled and held at this year's Australian Space Research Conference, 4 - 6 pm on 15 November. Organised jointly by the National Committee for Space and Radio Science (Australian Academy of Science) and the National Space Society of Australia, this year's conference was attended by over 150 members of Australia's space community, including academic staff and students, business and industry people, and people from space-related Government units. The discussion was moderated by Conjoint Professor Fred Menk (University of Newcastle and Chair of the Australian Academy of Science's National Committee for Space and Radio Science) and Professor Iver Cairns (Co-Chair of the conference and Director of the new ARC Training Centre for CubeSats, UAVs, and Their Applications). This letter summarises the consensus position reached by the approximately 100 people at the community discussion.

Executive Summary - The community:

- strongly supports formation of a civil Australian Space Agency;
- suggests the purpose should be, briefly, "Understand Space, Operate in Space, and Use Space for National and International Benefit";
- overwhelmingly favours a broad Space Agency, not one narrowly focused on space industry but instead one that pursues (i) fundamental "blue sky" science and technology research, (ii) "public good" and national goals using research, data, and services, (iii) space weather and space situational awareness prediction, mitigation, and commercialisation, (iv) space industry development and commercialisation, and (v) education and outreach across STEM;
- notes that space science and technology underpin space industry capabilities, and we cannot have a thriving industry in the longterm if our national space science and technology capabilities languish.
- emphasises the need for certainty in the Agency's funding over a 5-10 year time horizon, so it can participate properly in both Australian-led and foreign-led space projects with international partners;
- believes that the Agency cannot fund all space-related matters, with Defence and the Australian Research Council necessary counterparts, but that targeted extension is needed of Australia's academic space sector across business, engineering, entrepreneurship, science, and technology;
- believes that Academy and expert group Decadal and Strategic Plans should inform the Agency's choice of Australian-led and internationally-leds space projects which the Agency participates in;
- suggests the Agency focuses initially on specified areas of Australian expertise worldwide; and
- identifies an approach to address these foci and the foregoing ideas in a first Agency project.

The detailed consensus views of the Meeting are as follows.

The primary reason why Australia should develop a civil Space Agency, with concomitant implications for how it should do this, is to link Australia's current disparate space industry, academic, and government groups, many of which have expertise and capabilities that are internationally state-of-the-art in niches, into a united, sustained, and national space research and applications program that is internationally recognised and delivers greatly increased benefits to the nation. **Additional reasons include to:**

- 1) Significantly increase the production of space-related hardware, data, and services with strong commercial, societal, and national benefits that are based on research and assets for which we have a competitive advantage.
- 2) Sustainably capture 1 – 4 % of the global space market and associated financial benefits for Australia, increasing GDP by \$10 – 40 B pa (of \$1 T) by 2030. In comparison the UK's goal is 10%.
- 3) Bring at least 20% of Australia's current national spend of \$4 B pa back onshore, for at least a \$4 B pa increase in GDP assuming an indirect to direct cost benefit multiplier of 5, the international norm.
- 4) Support fundamental science / engineering and related public good and commercial applications to strengthen the national innovation system and Australia's international standing and competitiveness, produce more world-class discoveries and financial / societal benefits, identify and profit from spin-offs, and develop its human capital.
- 5) Develop a sovereign capability in this increasingly crucial domain;
- 6) Grow the supply of highly trained workers in advanced systems and technology, many of whom will transition to other high-tech sectors with high impact;
- 7) Improve public understanding of science via education & outreach.

A national space agency that aims to support the Australian space sector to innovate and mature should:

- be substantive and demonstrate sustained commitment internationally, with at least a rolling 5-year time horizon and suitable budget;
- provide authoritative coordination and priority setting for strategy, and also sufficient funding to achieve the goals;
- be led by a diverse set of space professionals with real expertise in and a broad view of the space sector; they should also have management expertise and a focus on developing an indigenous Australian space capability that links the academic, Government, and industry communities for the national benefit;
- be informed by Learned Academy Decadal^{1,2,3} and Strategic Plans^{4,5} when choosing both national and international space projects; and
- create operational mechanisms to consult with and seek relevant advice from an expert panel with whole-of-sector representation, including academia, industry, government and Defence.

¹ ``2010–2019 Decadal Plan for Australian Space Science: Building a National Presence in Space'', Australian Academy of Science, 2010.

² ``A Vision for Space Science and Technology in Australia: Securing and advancing Australia's interests through space research'', Australian Academy of Science, August 2017.

³ ``Earth Observation Community Plan 2026: Delivering essential information and services for Australia's future'', Australian Earth Observation Community Coordinating Group, 2016.

⁴ ``An Australian Strategic Plan for Earth Observations from Space'', Australian Academy of Science and the Australian Academy of Technological Sciences and Engineering Australian, 2009.

⁵ ``Australian Strategic Plan for GNSS'', Australian Spatial Consortium, 2012.

The meeting unanimously rejected the idea that the Australian space agency should be focused only on space industry and associated commercial ideas. No successful foreign space agency follows this model.

Instead, the space agency should be broad-based, have statement of purpose along the lines of

“Understand Space, Operate in Space, and Use Space for National and International Benefit”

and have 5 themes:

1. **Commercial space industry applications and development**, involving remote sensing data and services, communications, and other space industry data and services, whose importance is well attested to elsewhere.
2. **Public good and national applications**, both for science and management, that involve remotely sensing the Earth and human activities from space via optical, GPS /GNSS, and radar techniques, as well as communications;
3. **Space weather & situational awareness**, via researching and operationally predicting and mitigating space weather and environment events driven by solar activity and human actions, which have the potential to catastrophically affect the economies and societies of Australia and the world;
4. **Fundamental, “blue sky”, public good science and technology research**, led by Australia or in international projects, so as to contribute to humankind but to develop the STEM “pull” into the Space sector,
5. **Education and outreach in STEM and space sector matters** at secondary and tertiary levels, necessary to develop Australia’s human capital and knowledge so as to create an internationally recognised and competitive space sector for Australia.

The meeting considered where the proposed (civil) Space Agency might sit within Government. While reluctant to give advice on this, it is clear that the scale, prominence, location, and roles of a properly funded and internationally recognised national space agency need to be very different from those of the previous Space Policy Unit and the current Space Coordination Office and CSIRO Astronomy and Space Science.

The Space Agency must have certainty in its funding over a 5-10 year time horizon, due to the strong likelihood that it will participate in both Australian-led and foreign-led space projects with international partners. Such projects typically have similar lifetimes. Moreover, commitments to international partners will need to be upheld. Similarly, in connection with space industry development the funding time horizon must be 5 years or more so that new industries can grow to address needs and existing industry can plan confidently. We presume that the Agency will start at a low level and ramp up to a significant level over a few years.

Some flexibility in the budget for joining internationally-led projects would be sensible, so that Australia could rapidly take up invitations to join new projects and for Australian teams to be able to propose instruments and other components in internationally-led projects that might arise on short times scales less than a year. The meeting did not consider it appropriate to suggest a suitable near-term budget; however, a minimum of order \$10 – 20 million per year is suggested to give credence to Australia forming a national space agency and it is relevant that the Decadal Plan for Australian Space Science’s^{1,2} suggested budget is of this order without explicitly funding space industry development. That Plan contains a number of Australian-led projects and a program to participate in internationally-led projects focused on fundamental science, public good / commercial applications and national goals related to Earth observations and GPS/GNSS, space communications and development of Australia’s space industry, human capital, economy, security, and society. Small satellite and constellation programs (e.g., CubeSats) offer a very powerful, timely, and cost-effective approach to space projects that Australia can use to leapfrog more established space nations and develop a sustainable and internationally competitive space program. This will lead to capabilities for larger satellites, which will be required for some purposes.

The meeting notes that the space agency cannot fund all space-related matters. Specifically, Defence projects would be out of scope and Australian Research Council funding must continue to be available for research not specifically required for a space agency project. However, the current funding for Australia space-related research is much smaller per capita than for Canada, EU nations, Japan, and the USA and therefore Australia's academic programs for space research and commercialisation require revitalisation. A useful analog might be to Canada's recent program of creating tenured professorial chairs for space research, funded nationally for several years and then by the host institutions. Mid-level positions and specialisations across the space sector (e.g., areas like business, entrepreneurship, law, and start-ups rather than just science, engineering, and technology) appear to be sensible generalisations.

The meeting suggested a number of initial foci for the agency, each an area of significant Australian expertise that is internationally competitive:

- Earth observation applications and instrumentation,
- GNSS / GPS applications and instrumentation,
- Space weather and space situational awareness, including space plasma physics,
- CubeSat and UAV (un-crewed aerial vehicle) hardware, instruments, sensors, data, and services,
- Over-the-horizon radars and ionospheric physics,
- Australian ancient environments and Martian analogues,
- Mars and the Moon, including their composition, geology, evolution, and sample return analysis,
- Meteorite tracking (fireball) and characterisation, precision cosmo-chemistry, and
- The atmospheres, characteristics, and evolution of planets, exoplanets, and solar systems.

A very suitable first project for the agency is a multi-generation CubeSat constellation focused on Earth observations, GNSS/GPS, space weather and situational awareness, over-the-horizon radars and ionospheric physics, fireball detection from orbit, and both Mars-analogue and other solar system object research. This addresses many of the above initial foci, all five proposed agency themes, and has both commercial and research goals. Moreover, it is informed by Learned Academy Plans, being a generalisation of the Decadal Plan for Australian Space Science's "Marabibi Constellation"¹ and is consistent with the updated Vision², the Australian Strategic Plan for Earth Observations⁴, the Strategic Plan for GNSS⁵, and the 2017 NCRIS request for an Australian Earth Observation capability. It is also very timely since it offers an opportunity for Australia to contribute to the US – Taiwan COSMIC 2 project, specifically by providing the "polar" part of the constellation that is urgently needed due to the impending demise of the last polar satellites for COSMIC 1. The Australian Bureau of Meteorology's Dr John Le Marshall finds that the radio occultation data provided by COSMIC 1, especially the polar satellites that actually cross over Australia (the equatorial satellites do not), makes significant contributions to reliable 5-day weather forecasts for Australia. If Australia developed a CubeSat constellation that provided these radio occultation data and addressed the other topics at the start of this paragraph then it would be directly beneficial to our society and economy, be a significant contribution to international space collaborations and a driver for our space sector, announce Australia's space capabilities and ambitions, and also be a major step towards developing a sustainable and long-term Australian space capability and space agency.

We hope that these contributions will prove useful to you, your colleagues on the Expert Reference Group, and Ministry staff. If requested then we will seek to provide clarifications.

Sincerely,



(Iver Cairns and Wayne Short, as ASRC Co-Chairs).