2030 STRATEGIC PLAN:

SUBMISSION BY THE NATIONAL COMMITTEE FOR SPACE AND RADIO SCIENCE

OF THE AUSTRALIAN ACADEMY OF SCIENCE

The National Committee for Space and Radio Science welcomes the opportunity to comment on the "2030 Strategic Plan" issues paper released in March 2017 by Innovation and Science Australia (ISA). The following response references aspects of the National Committee's Decadal Plan for Space Science 2010 – 2019: building a national presence in space[1], noting that the Committee is currently preparing a strategic vision statement on space science to respond to changes in policy and the sector since the Plan was developed.

Space science encompasses the science that can be done from space, and the science of space. This includes everything from Earth's middle atmosphere to the centre of the Sun and boundaries of the solar system, planetary evolution and life, Earth observation and climate, and the requisite technology including ground instruments and space missions and hardware. Space science and technology are integral and transformative elements of Australian life. For example, the position, navigation and timing data provided by Global Navigation Satellite Systems (GNSS) such as GPS is so heavily integrated into today's transport, logistics, security and finance services, amongst others, that a denial of GNSS service would have extremely serious economic and societal ramifications. Similarly, data and information applications derived from Earth observations from space are used across government, industry and society in such areas as weather forecasting, onshore and offshore mining, mitigation and management of natural disasters, water resource management, national security, insurance assessment and land use planning and monitoring[2]. In addition, satellite communications bring essential telephony and internet connectivity to rural and remote areas.

Such services are currently worth at least $8B per year improved GDP alone[3]. Specific applications of space science and technology of national significance were highlighted in Australia's Satellite Utilisation Policy[4] which also identified principles for the development of Australia's space industry. The 2016 Defence White Paper discusses the importance of ensuring the security of Australia's space-enabled capabilities, and prioritises strengthening Defence's space surveillance and situational awareness (SSA) capabilities[5]. The Defence Industry Policy Statement also identifies space capabilities as a priority area[6].

Australia has developed a world leadership role in aspects of space science. Specific examples appear in the Decadal Plan. In addition, Australia is hosting major international space science conferences, including the 68th International Astronautical Congress in 2017 and the 43rd Committee on Space Research (COSPAR) Scientific Assembly in 2020. Nationally, space science activities engage university research groups, government departments and agencies (e.g. Defence Science Technology Group, Bureau of Meteorology, CSIRO) and industries ranging from large players such as BAE Systems and Lockheed Martin, to SMEs.

Challenges

The ISA issues paper highlights the need to anticipate waves of major change that will affect our economy and society. It identifies six key challenges to which Australia will need to respond in order to evolve and secure its economic and societal base. These are:

1. Moving more firms, in more sectors, closer to the innovation frontier
2. Moving and keeping government closer to the innovation frontier
3. Delivering high-quality and relevant education and skills development
4. Maximizing the engagement of our world class research system with end users

5. Maximizing advantage from international knowledge, talent and capital
6. Bold, high-impact initiatives.

By definition space science and technology are drivers of innovation and collaboration between researchers, developers and end users. For example, the Space Weather Service at the Bureau of Meteorology is a world leader in developing research-based space weather applications for civilian and defence use. Space science also excites the public and is a powerful motivator of engagement by students in STEM disciplines. Recognising this, the Decadal Plan for Space Science 2010 – 2019 articulated seven drivers to its vision:

- Develop a sustainable space science capability to produce more world class discoveries and technology
- Lead national space projects with international partners and agencies that position Australians to solve major scientific and technological problems
- Develop a strong national capacity in space science and technology that will benefit the nation in international, economic, and environmental affairs, and offset the risks of depending primarily on foreign-controlled space assets
- Develop a major education, training, and outreach capability based on space science and technology that coordinates and leverages exciting new projects
- Leverage Australia's space science capability to benefit fundamental sciences, to grow the supply of highly skilled workers, and to help society understand global issues such as climate change
- Amplify the economic, defence and educational benefits of space services and mitigate space-related disruptions
- Foster growth in space science and technology in areas such as national security, environmental integrity, education and training.

These goals are entirely congruent with the challenges identified in the ISA issues paper. However, since the Decadal Plan was developed exciting and important new developments in space science and technology have changed the landscape so that these goals are now even more closely aligned with the issues challenges. Two important developments are the growth in small satellite technology and capability, and the growing realization of the importance of space situational awareness.

Space technology is now evolving toward the application of resilient, agile swarms of networked low-cost miniature satellites with game-changing capabilities. This includes networks of distributed sensors whose observations can be fused to build up accurate information without the expense and risk of traditional satellites, or networks with secure optical communication links. This is an opportunity in which Australia can establish niche competitive advantage, scientifically and commercially. Australian groups are now developing small cubesats and associated hardware and control systems. These activities involve collaboration between students, engineers and researchers in university groups, with government agencies and SMEs. Examples include the Biarri satellite developed jointly by the University of New South Wales Sydney, the Defence Science Technology Group, and US agencies; and the INSPIRE-2 cubesat which involved collaboration across three universities. New industries in this area include Myriota[7] , Fleet[8] and Saber Astronautics[9]. School students are able to participate in space-related activities through new on-line portals such as Launchbox[10].

At the same time, the risk of in-orbit collisions is also growing and can ultimately limit our use of space. This is at the heart of space situational awareness. Considerable investment is being made here by Australia and its partners in laser-tracking and optical and radar surveillance of space objects. This includes US/Australia Defence investments at North West Cape, and the CRC for Space Environment Management. Australia sits longitudinally between North America and Europe, latitudinally south of Asia, and is profoundly radio quiet. As a result the US Strategic Command, NASA and other space agencies have fundamental dependencies on ground stations in Australia. The vast network of ground-based space environment sensors in Australia, Antarctica and elsewhere in our region provides critical input to the world's space weather database. Australia's growing capacity in small satellite technology is evolving into major investments in in-orbit space research capability, such as at UNSW Canberra in collaboration with industry and government partners. Furthermore, funding for an ARC Training Centre for CubeSats, UAVs and Their Applications, at the University of Sydney and involving several industry and agency partners, was announced in June 2017.

These developments mean that space science and associated technology are positioned to drive scientific and technical innovation in areas of national significance which develop and expand multi-disciplinary and cross-sector collaborations, grow new industries, leverage international partnerships, and stimulate development of human capital.

These opportunities sit in the context of exponentially growing international commercial investment in space, with almost 50% of non-US world expenditure in the sector in 2015 being in the Asia-Pacific region[11]. The development of a mature Australian space industry, underpinned by world-class R&D translating to high tech innovation, powered by a skilled, space-educated work force, and providing a level of national sovereignty and self-reliance where appropriate, will assist our nation respond to national needs and capitalise on emerging opportunities.

Limitation

A key limitation on the growth of Australian space science capacity to date has been lack of a suitable strategic coordinating framework. Many of our successes have grown from individual efforts and tenuous funding and may not be sustainable. A coordinated government-led approach is needed to strategically nurture and mature Australian space capability into a thriving space sector that will contribute to an innovation economy and help meet national economic and security needs. The coordination that is required will mature alongside the space sector that it coordinates.

Such a coordination framework would (i) sit outside any particular existing agency; (ii) provide coordination of the Australian space sector to ensure that the needs of both Defence / national security and civilian activities are met; (iii) provide policy and priority settings so that domestic space capability is developed that delivers a level of sovereignty and helps meet economic and national security needs while delivering export dollars; (iv) provide modest yet sufficient funding to demand and drive activities aligned with strategic priorities; (v) foster an environment in which commercial investment in the space sector can grow organically; and (vi) foster a broader growth in space-related skills across the innovation sector, through STEM outreach and through opportunities for Australia's young talent to engage in space activities.

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