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# DEPARTMENT OF DEFENCE SUBMISSION TO SENATE STANDING COMMITTEE ON ECONOMICS INQUIRY INTO 'THE CURRENT STATE OF AUSTRALIA'S SPACE SCIENCE AND INDUSTRY'

## Introduction

1. Australia relies on space systems to support national security. This reflects the increasingly critical role of space services and products in global development and inter-connectedness.<sup>1</sup> Satellite communications (SATCOM), remote sensing, and position, navigation and timing (PNT) data are key contributors to Australia's political, economic and social development, underpinning a diverse range of sectors including national security, finance, agriculture, transport, the environment and commerce. Australia's indigenous space capabilities and investments, however, are largely limited to ground and space segment operations and the exploitation of space-derived services and products: Australia has no launch or significant satellite component manufacturing capability.

## Defence Use of Space

2. Defence is a significant user of, and investor in, space systems, using services derived from space-based systems to inform decision-making and enable operational capabilities. Space support to the Australian Defence Force encompasses SATCOM, PNT, intelligence, surveillance and reconnaissance (ISR) and meteorological and other environmental information to support terrestrial defence activities. Moreover, several other Government agencies also rely on Defence space support in carrying out their own routine activities, including emergency management. Notably, demand for remote sensing data is expanding across the Australian government, which in part is being supported by the Defence Imagery and Geospatial Organisation (DIGO). Defence's space access and expertise is therefore an integral component of the Australian Government's critical infrastructure. Space capabilities are of such importance to Defence that they will be a key element in the forthcoming Defence White Paper.
3. To date Defence's major direct investments in space systems have been in SATCOM. In the past this has included investment in or purchase of services from foreign allied and civil systems such as Optus C1<sup>2</sup>, INMARSAT and New Skies SATCOM. More recently it also includes a substantial investment and partnership in the US Wideband Global Satellite (WGS) constellation<sup>3</sup>,

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<sup>1</sup> The Space Report 2008: In 2007, the global space economy registered a record-setting USD\$251 billion in revenues.

<sup>2</sup> Defence owns and operates the Defence Payload Segment on the Singaporean-owned Optus C1 satellite bus. This is separate from the 24 non-military transponders on the satellite, which support commercial direct broadcast services to Australia and South East Asia. Optus provides Telemetry, Tracking & Command for this satellite from Australian ground stations.

<sup>3</sup> With effect from 2007, Australia is a proportionate partner in the US military Wideband Global SATCOM constellation, which is currently being established. Australia's investment of AUD\$927

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which will form the backbone of military communications until about 2025. This is by far the largest single Australian direct investment in space to date.

4. Defence has followed the wider national trend and concentrated its investments on systems and organisations to exploit information and services from space supplied by others. Defence has unique access and support from US space systems, and this will continue to be an important benefit of Australia's strong alliance arrangements with the US.
5. Australia's allied space engagement provides for valuable collaboration on intelligence, communications, research and development, operational training, and the planning and execution of military operations. Moreover continued assured access to this support, provided under the alliance, is critical to the Australian Defence Force's ability to operate independently, as part of an international coalition, or in the leadership role of a regional force. Access to allied space systems has largely met our needs, in particular for intelligence and more recently SATCOM. The high operational tempo (both Australian and allied) of recent years, and consequent demand for space products, has highlighted that assured access to allied systems may not necessarily be guaranteed in all circumstances (except WGS), and is subject to host nation priorities.
6. Defence has been more circumspect in its utilisation of commercial space services. In this respect, Defence has sought to achieve an assured level of service, as well as addressing national sovereignty provisions, through careful assessment of the risks and well constructed contractual arrangements. While these arrangements have largely proved adequate, Defence is subject to supply and demand constraints in the commercial market place, especially in relation to managing SATCOM bandwidth, which can be a significant constraint in meeting short-notice operational requirements. However, once the WGS capability has been fully introduced into service the reliance on commercial wideband SATCOM is expected to reduce significantly.
7. Defence's demands for space capabilities are expected to increase over coming years. Notably, greater access to space systems underpins the modernisation of the Australian Defence Force, especially in relation to the network centric warfare (NCW) construct that seeks to enhance operational effectiveness through precision engagement<sup>4</sup>, enhanced awareness, global connectivity and synchronisation of forces. More than 50% of Defence's major capability development projects for the period 2006 to 2016 have a critical dependency on services that are derived from space.

### **Threats and Challenges**

8. The barriers to accessing space are steadily declining due to the diffusion of space technology, knowledge and expertise, particularly over the last decade.

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million is equivalent to the purchase, launch and operating costs of one of the six satellites but gives it access to a corresponding proportion of the full constellation's capability.

<sup>4</sup> GPS guided weapons now form an increasingly critical element of the inventories of the Navy, Army and Air Force.

A growing number of countries and commercial service providers now operate advanced remote sensing satellites<sup>5</sup>, enabling observation of any part of the earth's surface on a regular basis.<sup>6</sup> Commercial imagery from these systems is readily available to state and non-state actors alike. Consequently, Australia's national territory and deployed forces are increasingly subjected to surveillance from space.

9. Nevertheless, despite the increase in the number of providers of services from space, governments, and specifically the US government, still supply the great majority of services. Only the SATCOM industry is truly commercially viable; the commercial imagery providers rely on technology developed by government investment, and either have governments as their major customers or are spin-offs of government systems. Almost all other services, such as meteorology or PNT, are provided in the public interest and only ongoing government investment ensures their continuity.
10. As space becomes more accessible, it will also become more congested and contested. There is a growing demand for access to specific orbital planes in both low earth orbit and geosynchronous orbit. Access to, utilisation of, and disposal of satellites from these orbits will require increasingly careful monitoring. As space utilisation increases, space debris will also become a growing threat to satellites. The emerging threat of anti-satellite systems also has the potential to interfere with Australia's utilisation of space. The destruction of, or interference with, satellites providing space services has the potential to affect many aspects of daily life. An ability to understand objects, events and activities in space is of growing importance.

### **Defence's Involvement in Space Science and Industry**

11. Defence's principal investment in space-related science and research has largely been through the Defence Science and Technology Organisation (DSTO). DSTO has long been involved in applied Defence space support research and technology innovation in the operation of systems to access and exploit satellite communications, remote sensing and PNT products. Of note, DSTO has developed a core of deep expertise in developing and operating military SATCOM systems, which was the source of critical advice in negotiating Australian participation in the WGS system. In developing its expertise, DSTO has recognised that space systems have a dual use nature whereby the space systems can often support both military and civilian applications.
12. DSTO's extensive collaborative research arrangements with Australia's allies have presented it with many opportunities to participate in joint development of space-related capabilities, more than it has had the resources to be able to take up. These opportunities provide Defence – and by association Australia – with access to valuable collaborative space research and technology programs,

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<sup>5</sup> To date, ten states have demonstrated an independent space vehicle launch capability with 47 nations operating indigenous civil satellites.

<sup>6</sup> The sensor capabilities offered by these systems provides increasingly higher resolution encompassing visible, hyperspectral and all-weather radar capabilities.

especially through our relationship with the US. Indicative of these opportunities have been arrangements encompassing remote sensing and hypersonics research.

13. DSTO has also been involved in local collaborative opportunities. Indicative of these opportunities is DSTO's partnership with the University of Adelaide and industry to develop a miniaturised low weight, low power consuming and jam-resistant Global Positioning System processor for use on small unmanned aerial vehicles. DSTO has also been involved with the Commonwealth Scientific and Industrial Research Organisation and industry to develop an indigenous hyperspectral<sup>7</sup> sensor. Finally in its Applied Hypersonics program on scramjet technology, DSTO now hosts the bulk of Australia's only significant investment in launch technologies.

### **Space Training, Education and Governance**

14. The capacity of Defence to utilise space capabilities depends on managing and developing space-skilled personnel. Defence staff are developing the means to identify and manage Defence members who have useful space expertise.<sup>8</sup> While still at the early stages, Defence is committed to ensuring its space capability is underpinned by the proper management and development of its people's space expertise.
15. Space related training and education has been conducted in Defence for some time. In the main, the training has, however, been limited to an immediate focus on satisfying short term operational and technical demands. Recognising this deficiency, Defence is establishing a continuum of space training and education that is intended to address general awareness of space through to specific detailed space expertise education. The aim of Defence's approach is to provide a flexible programme that allows groups to qualify people in the areas most relevant to their needs without mandating the same solution for all.
16. The need for space expertise is particularly acute within the capability, acquisition and R&D realms, especially for higher levels of space-related training. However, due to the lack of focus on space, Australian universities have not had the demand to develop graduates or post-graduates with the necessary space expertise needed in areas of design, fabrication and operation. Accordingly, until such time as universities are able to produce space-qualified graduates DSTO and/or DMO face significant recruitment problems when looking for staff to support R&D or advice on very highly technical and specialist systems.

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<sup>7</sup> Hyperspectral imaging is the analysis of images using a large number of channels (corresponding to spectrum intervals). The advantage of hyperspectral data is that narrow spectral features can be used to give more information from the target than is possible with the wide bands used by the multispectral channels.

<sup>8</sup> Defence space specialist expertise although limited presently ranges from vocationally skilled personnel, such as payload managers and analysts, to post-graduate qualified members in policy and capability domains.

### **Space as a National Capability**

17. Within Defence, better management of its space related effort is being achieved through the implementation of the Defence space governance framework.<sup>9</sup> This is being managed by the Defence Space Coordinating Office (DSCO). Central to the governance framework has been establishment of the Defence Space Council (DSC), which includes senior Defence stakeholder representation for high level guidance, and a subordinate Defence Space Coordinating Group (DSCG) that provides oversight of issues and initiatives. Defence is seeking to benefit from this mechanism through improving coordination of policy, capital and personnel investment, as well as the purposeful engagement of close allies in delivering assured access to space services and products.

### **Australian Space Capability Opportunities**

18. One area of opportunity is remote sensing. Timely, accurate, cost-effective satellite remote sensing information is a critical strategic asset to a country as large and sparsely-populated as Australia. This data is versatile, with applications in fields such as defence and national security, economic security, disaster response, capacity building abroad, energy, and the environment. Notably, demand for remote sensing data is expanding across the Australian government, which in part is being supported by the DIGO in close collaboration with Geoscience Australia.

### **Conclusion**

19. Defence is a significant user of and investor in space capabilities. Accordingly it has developed a deep appreciation of the increasing importance of space systems in maintaining national security, of the dependencies this has engendered, and of the costs, risks, benefits and opportunities associated with the military use of space. Any dedicated Defence investment in space capabilities needs to be underpinned by careful consideration of the resultant costs and potential benefits.
20. At Government direction, Defence is developing a new Defence White Paper and the impact of space systems on the Australian Defence Force's ability to contribute to Australia's security will also be addressed in this major policy statement.

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<sup>9</sup> The Defence Space Coordinating Plan (SCP), which articulates the framework mechanisms and associated responsibilities, was endorsed by the Chiefs of Service Committee (COSC) in September 2007.