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The Australian response to potential space warfare

An edited version of a presentation to the 2016 Seminar on Military Strategy by

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Militaries and civilians around the world are becoming critically dependent upon space capabilities, leaving them uncomfortably vulnerable. Warfare in space has the potential to render large parts of the domain unusable, with significant secondary effects in the other physical domains. Recognising this vulnerability, Australia is investing in space situational awareness, which underpins assured access to space, and supports the strengthening of international norms regarding responsible use of space.

Key words: Warfare in space, space situational awareness, assured access to space.

The genesis of human activity in space was ballistic missile development during World War II (United States Air Command and Staff College 2009: 2 – 10). Later, during the cold war, space-based technologies started to play a new and important role in intelligence gathering and surveillance. Yet despite much of the early exploitation of space being for military purposes, space has been long regarded as a benign domain off limits to conflict. The first United Nations space treaty, the Outer Space Treaty, came into force in 1967, just ten years after the launch of Sputnik 1. This treaty includes the principle that: "[T]he exploration and use of outer space shall be carried out for the benefit and in the interests of all mankind" (United Nations 1967).

Yet there remains a natural tension between realising the potential advantages of hosting highly capable military platforms in space and observing the principles of peaceful use with which the world has so far largely complied. As space technologies advance, this tension appears likely to increase, thereby raising the potential for warfare in space. Furthermore, as both military and civilian dependence on space deepens, the negative consequences of warfare in space also increase, as does the importance of maintaining assured access to space.

Australia's response has been to work with our allies to increase our awareness of events and activities in space, while also strengthening international norms of responsible use of space. At the same time, recognising its vulnerability to an attack in space, the Australian Defence Force (ADF) is working to reduce its reliance on space.

Australia's Dependence On Space

Advances in space technology have precipitated radical changes to how modern societies operate in areas from the commercial to the military. The combination of perspective, persistence and freedom of operation provided by the space domain cannot be provided to the same degree by the land, sea and air domains. These advantages have underpinned substantial and wide-ranging improvements in safety, navigation, timing signals, communications and data collection and distribution. However, due to expense and technical complexity, not all states are able to exploit space capabilities to the same degree.

Nations that can exploit space are able to maintain a significant advantage over those less able to do so. For example, high bandwidth satellite communication capabilities allow the United States to maintain real-time command and control of military forces across the globe, as well as comprehensive and timely reporting back to headquarters.

Space capabilities provide advantages not only for military operations but for many aspects of civil and commercial life as well regardless of a country's ownership of indigenous space-based capabilities. Space pervades modern Australian life. Credit card, automatic teller machine and stock market transactions; precision farming; natural resource management; search and rescue; and disaster response; are reliant on the continuous and dependable availability of space capabilities. Space is now fundamental to the way of life of all Australians.

Societies and militaries are now so highly dependent on space to undertake even relatively basic functions in the other domains that space has become a potential vulnerability for them. The technologically advanced militaries of countries such as the United States and Australia rely heavily on space capabilities to provide a technological edge over potential adversaries in the other domains. Removing access to space capabilities would, therefore, seriously degrade the ability of modern land, sea and air forces to conduct effective operations. Consequently, an adversary is likely to regard Western space capabilities as priority targets, because neutralising them would not only remove important space-based

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capabilities, but significantly reduce the effectiveness of capabilities in the other domains as well.

Space-based platforms are physically vulnerable to advanced anti-satellite technologies because their orbits are predicable. The future location of an adversary's space assets can usually be calculated with a high degree of precision days in advance; and shielding a satellite from a kinetic attack is virtually impossible, because to remain in orbit objects must travel at speeds of several kilometres per second.

Attributing events in space to specific causes can be very challenging, further exacerbating the vulnerability of space assets. For example, if communications are abruptly lost with an operational satellite and a debris cloud is observed at its expected location, the apparent loss of the satellite might plausibly be due to an on-board explosion, a collision with a piece of space debris or a deliberate action of some sort. In 2014 alone, there were 12 breakups of orbiting objects, some of them operational satellites (Liou 2015). The cause of seven of these breakups remains unknown.

Accordingly, the vulnerability of space systems will have to be accepted and managed rather than eliminated. While an attack on its space systems appears unlikely in the immediate term, the criticality of these systems and their associated vulnerability has forced the United States to plan for this possibility. Australia is also considering how to maintain assured access to space.

The Potential for Warfare in Space

A number of coincident conditions are now increasing the chances of warfare extending into space. Firstly, there is no robust global rules-based system governing behaviour in space. Secondly, there is a highly asymmetric use of, and reliance on, space capabilities between nations. Lastly, counter-space capabilities, such as anti-satellite weapons, have been developed by some nations.

The United Nations' Outer Space Treaty provides the framework for international space law. It states that activities in outer space shall be carried out in the interest of maintaining international peace and security (United Nations 1967). A lack of definition of many key terms and phrases, however, leaves significant room for interpretation. There is not even an internationally recognised definition of where space begins above the Earth's surface. The result is that international law does not provide a clear obstacle to pursuing warfare in space. Australia's 2016 Defence White Paper notes that this situation is unlikely to be resolved in the immediate future (Defence 2016: 53). While international law might superficially appear to have so far prevented warfare extending to space, the real reason is probably far more basic in that most states have not yet developed the necessary capability to do so. Certainly, the Defence White Paper highlights that international law is unlikely on its own to prevent warfare in space.

Despite an increasing number of states and non-state entities gaining access to space as the associated technologies become more available and more affordable, the United States and its allies still seek to maintain a technological edge, both directly through stand-alone space capabilities and indirectly by using space to leverage advantages in the other domains. However, excessive reliance on vulnerable space systems could be viewed as a critical point of weakness. Indeed, many observers believe the United States military's space architecture is its Achilles' heel (Colby 2016: 6).

The development of anti-satellite (ASAT) technologies removes another barrier to warfare in space. In 2007, China demonstrated a direct ascent kinetic anti-satellite capability by destroying one of its own defunct weather satellites (National Aeronautics and Space Administration 2007). In 2008, the United States demonstrated a similar capability by shooting down one of its satellites that had malfunctioned (National Aeronautics and Space Administration 2008). However, the international condemnation that would inevitably occur following an attack on a satellite should not be underestimated and, if able to be attributed, would likely invite retaliation in another domain. This is one reason why co-orbital ASAT technology is also being developed that would allow a satellite to be manoeuvred to within close range of a target satellite such that the target could be impaired or destroyed. Attacks by co-orbital ASATs would be difficult to attribute to deliberate action and could be plausibly denied by an attacker. For an adversary, the combination of Western dependence on space and the potential to attack anonymously could make the United States space architecture a particularly tempting target. A significant problem associated with kinetic attacks in space is that the effects cannot be restricted to a particular asset, area, or time. Debris from an attack will remain in orbit, potentially for decades to centuries, travelling at high speed and continuing to pose a threat to all satellites at the same altitude.

Yet, if warfare in space would have serious consequences for modern militaries, the consequences for Western societies would be even worse given the latter's lack of viable alternate options. The targeting of dual-use military/civilian satellites combined with the potentially indiscriminate effects of kinetic ASAT weapons means civilian platforms are likely also to be damaged, deliberately or collaterally.

Australia's Response

Maintaining assured access to space is vital to Australia. The Defence White Paper states that our most basic strategic Defence interest is a secure, resilient Australia and that this includes protecting Australia from non-geographic threats such as anti-satellite weapons (Defence 2016: 17, 69). Australia's commitment to a rules-based global order extends to space. We encourage the responsible use of space through the creation of international transparency and confidence-building measures, including the development of guidelines that help establish norms of international behaviour.

Space situational awareness (SSA) includes knowledge of objects in orbit and of friendly, adversary and civil space capabilities and intentions. SSA underpins assured access to space by supporting freedom of operation and enabling the understanding of conditions in space, the attribution of events and the ability to predict future space events. Australia is investing substantial resources in the improvement of SSA. Phase One of Joint Project 3029 has relocated a United States owned C-band space

surveillance radar to Northwest Cape. Phase Two of this project will relocate an advanced United States space surveillance telescope to the same area. These sensors will be jointly funded and provide Space Surveillance Network coverage across a geographic region that is becoming increasingly active for space launches and the operation of geostationary satellites.

The next project in our programme will seek to provide a SSA Mission System that will also allow the development of Australian expertise in orbital analysis and collision prediction. Later projects will seek to develop space surveillance sensors in Australia and promote Australian capabilities that increase the resilience of our space systems. Ultimately, Australia might consider the acquisition of indigenous satellites.

Australia has a significant history of co-operating with its allies in order to conduct space operations. Australia has had an extremely productive bilateral engagement with the United States since the 1970s. We have built on this arrangement and in 2014 Australia signed a Combined Space Operations (CSpO) initiative memorandum of understanding with its Four-Eyes partners. New Zealand also signed the memorandum last year. The CSpO initiative seeks to enhance the resilience of space operations, and to share the burden of conducting them. The CSpO partners also collectively promote the responsible use of space through co-ordinated diplomacy. Yet there is no certainty that warfare in space will be avoided and so Australia is seeking to increase the resilience of our space capabilities.

The Defence White Paper is funding the exploration of a range of areas where Australia, in conjunction with our allies, could invest in making the space architecture more robust such as technologies that provide an increased level of protection to jamming, including advanced protected satellite communications and more resilient global positioning system receivers. We are also exploring ways in which the space segment can be disaggregated by spreading space-based systems over a greater number of satellites. Further, we are investigating methods to reconstitute space-based systems that have been damaged or destroyed through the use of fast-turnaround launch systems and the use of relatively inexpensive, short-life microsatellites to temporarily fill gaps in capability.

The Australian Defence Force (ADF) is also preparing for operations in a congested, degraded and operationally-limited environment. This includes investigating the use of alternate technologies, such as advanced high frequency radio systems and terrestrial navigation and timing systems that can provide the ADF with the ability to fight on and win in the event the space architecture does fail. Additionally, the ADF has also begun to train to fight in a space denied or degraded environment.

Conclusion

Space provides unique advantages to the ADF and its allies, but these advantages encourage an over-reliance on space that could be a major vulnerability if not properly addressed. In this, the military is not alone. Developed societies rely heavily on space-related capabilities that are easily disrupted and cannot be easily replaced. The benefits and vulnerability of space, combined with unclear international norms for its use, makes warfare in space plausible and, arguably, increasingly likely. Such warfare would have disastrous consequences for most nations.

Australia is focussing its space-related efforts on assuring its access to the space domain. We are promoting the responsible use of space, contributing to enhanced space situational awareness and engaging with allied nations in co-operative Defence space agreements. However, we are also hedging against this approach failing to prevent warfare in space by seeking to improve the resilience of our space systems, developing contingency capability options and training to operate in a space denied or degraded environment. While we still have some way to go, the threat is recognised and we are taking measures to reduce, if not eliminate, it. Perhaps the question might be asked of how well our economy and society more broadly is placed to withstand the consequences of warfare in space.

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