Wark, Wesley K.

Working Paper

National security goes into space

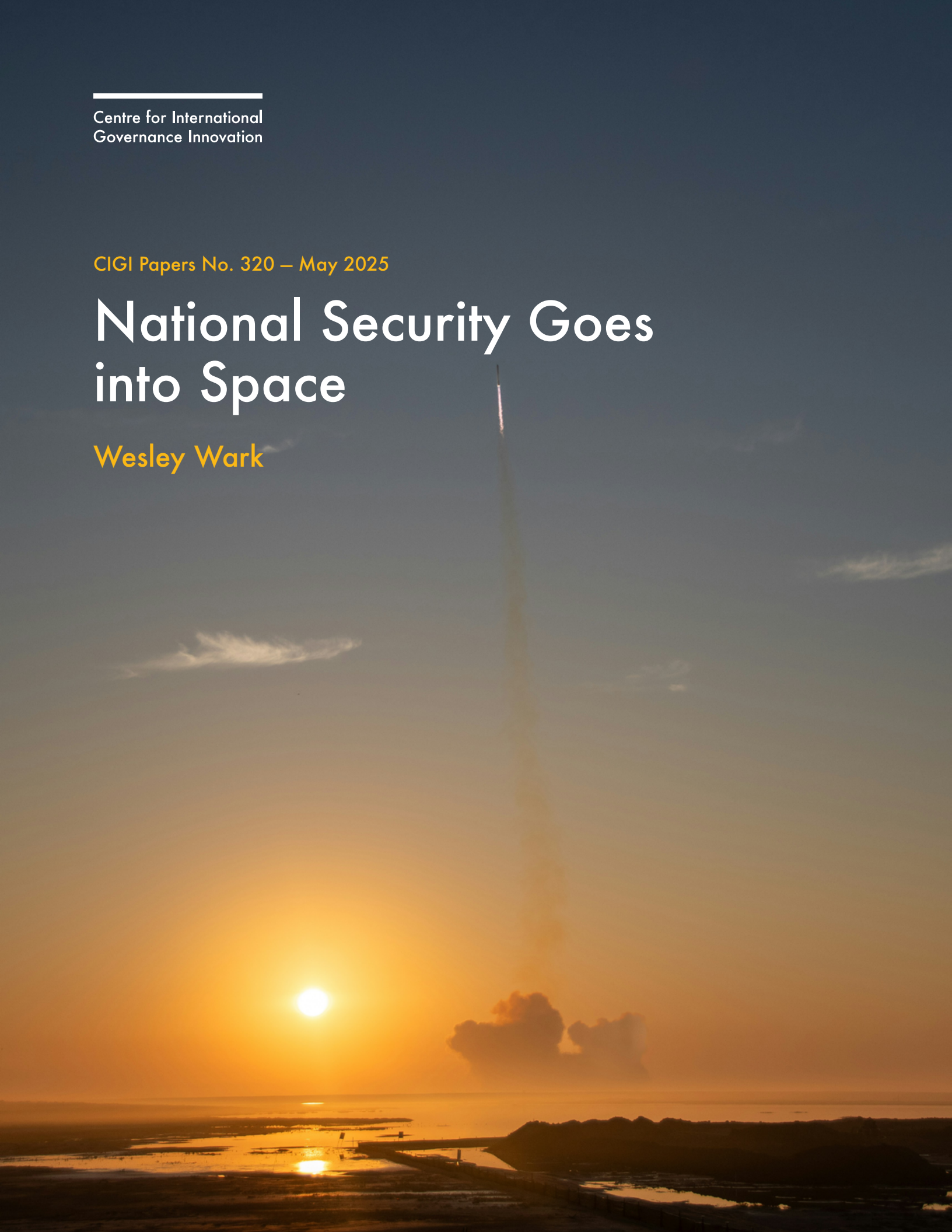
CIGI Papers, No. 320

Provided in Cooperation with:
Centre for International Governance Innovation (CIGI), Waterloo, Ontario

Suggested Citation: Wark, Wesley K. (2025) : National security goes into space, CIGI Papers, No. 320, Centre for International Governance Innovation (CIGI), Waterloo, ON, Canada

This Version is available at:
https://hdl.handle.net/10419/322421

Centre for International
Governance Innovation



CIGI Papers No. 320 — May 2025

National Security Goes into Space

Wesley Wark

Centre for International
Governance Innovation

CIGI Papers No. 320 — May 2025

National Security Goes into Space

Wesley Wark

About CIGI

The Centre for International Governance Innovation (CIGI) is an independent, non-partisan think tank whose peer-reviewed research and trusted analysis influence policy makers to innovate. Our global network of multidisciplinary researchers and strategic partnerships provide policy solutions for the digital era with one goal: to improve people's lives everywhere. Headquartered in Waterloo, Canada, CIGI has received support from the Government of Canada, the Government of Ontario and founder Jim Balsillie.

À propos du CIGI

Le Centre pour l'innovation dans la gouvernance internationale (CIGI) est un groupe de réflexion indépendant et non partisan dont les recherches évaluées par des pairs et les analyses fiables incitent les décideurs à innover. Grâce à son réseau mondial de chercheurs pluridisciplinaires et de partenariats stratégiques, le CIGI offre des solutions politiques adaptées à l'ère numérique dans le seul but d'améliorer la vie des gens du monde entier. Le CIGI, dont le siège se trouve à Waterloo, au Canada, bénéficie du soutien du gouvernement du Canada, du gouvernement de l'Ontario et de son fondateur, Jim Balsillie.

Credits

Managing Director and General Counsel Aaron Shull
Director, Program Management Dianna English
Program Manager Jenny Thiel
Publications Editor Christine Robertson
Publications Editor Susan Bubak
Graphic Designer Sepideh Shomali

67 Erb Street West
Waterloo, ON, Canada N2L 6C2
www.cigionline.org

Table of Contents

About the Author

Wesley Wark is a senior fellow at CIGI and a fellow with the Balsillie School of International Affairs. His academic career included teaching at McGill University, the University of Calgary and the University of Toronto. He served two terms on the prime minister of Canada's Advisory Council on National Security (2005–2009) and on the Advisory Committee to the President of the Canada Border Services Agency (2006–2010). More recently, he provided advice to the minister of public safety on national security legislation and policy. He has appeared on numerous occasions before parliamentary committees and comments regularly for the media on national security issues.

He is the co-editor (with Christopher Andrew and Richard J. Aldrich) of *Secret Intelligence: A Reader*, second edition (Routledge, 2019). He co-led the major CIGI project on Reimagining a Canadian National Security Strategy and wrote, with Aaron Shull, its capstone report. He was the series editor, with Aaron Shull, of the CIGI digital essay series Security, Intelligence and the Global Health Crisis. He is a former editor of the journal *Intelligence and National Security* and now serves on the journal's advisory board.

Acronyms and Abbreviations

ASAT	anti-satellite weapons
ASP	Aerospace Security Project
AUKUS	Australia, the United Kingdom and the United States
CSpO	Combined Space Operations
DIA	Defense Intelligence Agency
DND	Department of National Defence (Canada)
DOD	Department of Defense (US)
G7	Group of Seven
ISR	intelligence, surveillance and reconnaissance
LEO	low-Earth orbit
MOD	Ministry of Defence (UK)
NATO	North Atlantic Treaty Organization
NGOs	non-governmental organizations
NORAD	North American Aerospace Defense Command
PLA	People's Liberation Army
PNT	positioning, navigation, timing
RCM	RADARSAT Constellation Mission
SSA	space situational awareness

Executive Summary

Space capabilities, especially dual-use functions, constitute critical infrastructure for the functioning of states and global society. The combination of competitive advantage enjoyed by states possessing space assets and the vulnerabilities of those assets to accidental or deliberate disruption defines the national security dimension. Alliances and partnerships are recognized as crucial to achieving national security in space. Canada's national security strategy for space is inchoate. It lacks doctrine, delivery on promises of enhanced capabilities and a clear vision of the value of alliance contributions.[1]

Introduction: Space as a National Security Domain

National security is no longer an earthbound preoccupation. It is no exaggeration to say that national security has literally gone into space, with rising fears about the stability and security of space-based platforms set alongside their growing importance to many facets of life on earth. The extension of the national security threat environment into space began during the early years of the Cold War but has taken on fundamentally new characteristics. What is new about national security in space are the players, the risks and the destructive capabilities, all affecting the nature of the space environment that we have populated and continue to populate on an accelerated basis with satellites and other space missions.

The connections between space and national security are the latest manifestation of the multidimensional nature of national security threats and responses. Utilization of the space environment must now be considered a critical enabler of military power, economic prosperity and security, and intelligence gathering for threat monitoring, early warning and earth observation. As an Atlantic Council strategy paper put it, "space is…essential for national security missions, including the transit of intercontinental ballistic missiles, detecting and tracking missile launches, communicating securely with forces deployed across the globe, and observing otherwise-denied areas" (Starling et al. 2021, 14).

Space systems now constitute critical infrastructure, not just for the major spacefaring nations, but for the global system as a whole. As such, threats to the safe and unmolested functioning of space critical infrastructure, whether they are national or commercial space assets, drive rising national security concerns.

Space as a Dimension of National Security

The exercise of security, at the very dawn of statecraft, began with two dimensions — land and sea, armies and navies. By the early twentieth century, two additional dimensions had been added, both accelerated by the demands of the First World War — undersea and aerial. Submarines and military aircraft became new instruments of war and new instruments for intelligence gathering. They could strike at new kinds of targets — namely, economies and civilian infrastructure.

These four spatial dimensions of warfare and national security threats were vastly expanded in global scale and technological sophistication by developments during the Second World War, culminating in the deployment of atomic bombs against Hiroshima and Nagasaki (Andrew 2018; Herman 1996).

That same conflict saw the emergence of a new dimension with the development of rocketry, the result of the Third Reich's desperate search for a final ultimate weapon in the V-2. Rocketry advances continued after the Second World War and were accompanied by the development of high-altitude spy planes, exemplified by the U-2, which was first flown on risky photo-reconnaissance missions behind the Iron Curtain in 1956 to identify Soviet rocket bases. One year later, the Soviet Union shocked the West with the launch of the Sputnik satellite (basically a metal basketball, with three small batteries that sent out a radio signal). By 1960,

1 The research on which this paper is based pre-dated the election of Donald Trump and his second term in office. What approach the Trump administration, with its America First policies, may take to some relevant issues raised in this paper — including multilateral space regulation initiatives, US-led alliances on space issues and US space strategy — remains to be seen.

a first-generation spy satellite (code-named Corona) was launched by the United States (David 2015).

Space had become the newest dimension of national security, and doctrine now races to catch up (Dickey 2020). Attention was fixed for a long time on space exploration and the "space race" as a great-power competition. Doctrinal lag was also compounded by fast-paced developments in the civil uses of space and the emerging overlap between space capabilities devoted to national security purposes and space capabilities meant to serve civil society ends — the "dual-use" problem (Pillai 2016).

Space as Congested, Contested and Competitive

In January 2011, the US intelligence community issued an "unclassified summary" of a "national security space strategy." It was the first doctrinal statement of its kind by a leading space power that tried to explicitly link the space environment to national security concerns (Department of Defense [DOD] and Office of the Director of National Intelligence 2011).

The strategy identified three key trends in the space environment — that it was increasingly congested, contested and competitive. These three trends have since become a kind of mantra, but what did they mean in 2011, and what might they mean today as definitions of national security threats?

In 2011, "congested" referred to vastly accelerated space activity, conducted by many more entities than was the case during the historic decades of the space race. Space "congestion" featured the activities of an expanded roster of nation-states, along with a multitude of commercial and academic operators. Increased space activity itself generated space orbital debris through systems failures, collisions and destructive anti-satellite weapons (ASAT) tests. The authors of the 2011 strategy also worried that heightened levels of space activity would produce a more challenging environment for ensuring radiofrequency access (ibid., 1–2).

Space as contested was rooted in fears of the development of greater counterspace capabilities by US adversaries, who might seek to exploit "space vulnerabilities" (ibid., 3).

When it came to the competitive dimension of space activity, the strategy paper looked inward to acknowledge a decreased US technological advantage, problems with industrial supply chains and potential weaknesses in the US workforce. The particular US fear was loss of its leading status as a space great power (ibid., 3).

The overarching sentiment of the strategy paper was that space was a domain of vital national security importance for the United States. It was a domain that the United States would rely on for "decision advantage" through satellite intelligence capabilities (intelligence, surveillance and reconnaissance [ISR]), global security monitoring and an ability to "respond to natural and man-made disasters and monitor long-term environmental needs" (ibid., foreword). Space systems provided critical capacities in global communications and navigation.

What made the space domain of importance to national security was the value of the information that it could deliver and the information flows it could facilitate. What made the space domain a national security issue was the vulnerability of its critical infrastructure to disruption, technological obsolescence or first-mover advantage passing to some new space rival.

Beyond Congested, Contested and Competitive: A New Threat Environment

Fast forward a decade and into the first Trump presidential administration and we find a different inflection. In June 2020, the DOD issued a public summary of a defense space strategy (DOD 2020). The new strategy found the space domain "drastically changed." It paid much greater attention to geopolitical tensions in space, which it now defined as a "war-fighting domain." The DOD strategy singled out China

and Russia as posing the "most immediate and serious threats to US space operations," and argued that both countries had developed doctrines and capabilities to "win" future wars.

The depiction of space threats contained in the defence space strategy was deepened by an unclassified report produced by the Defense Intelligence Agency (DIA) in 2022, titled *Challenges to Security in Space* (DIA 2022). The report devotes attention to the space programs of China, Iran, North Korea and Russia. China's space program, led by the People's Liberation Army (PLA), was seen as posing the greatest challenge to the United States. The DIA paper noted that "China will continue to launch a range of satellites that substantially enhance its ISR capabilities; field advanced communications satellites able to transmit large amount of data; increase PNT (positioning, navigation and timing) capabilities; and deploy new weather and oceanographic satellites" (DIA 2022, 8). In ISR satellites alone, China was ranked as second only to the United States. Deployment of ISR satellites had doubled in the short space of time between 2011 and 2018.

The DIA also stated that "China has also developed and probably will continue to develop weapons for use against satellites in order to degrade and deny adversary space capabilities" (ibid.). In addition, the report addressed future space trends, including reusable spaceflight technology involving launch vehicles and spaceplanes, deep-space competition (cislunar and beyond), space debris and orbital collisions. Potential national security threats are noted. For example, the DIA suggests that "adversaries could place operational or reserve satellites in deep space so that they are much harder to monitor for later use in lower orbits." Massive object collisions also drew the DIA's concern. The paper states that there are nearly 1,300 "massive" derelict objects in low-Earth orbit (LEO) that "pose a unique threat to LEO space operations" (ibid., 35–40).

A series of annual space threat assessments produced by the Aerospace Security Project (ASP) of the Center for Strategic and International Studies uses open-source information to expand on the classified intelligence-driven depiction of threats in the DOD and DIA papers. The most recent was issued in 2023, covering the period from January 2022 to February 2023. Not surprisingly, geopolitical risks, the ongoing development of counterspace capabilities by various countries and the impact of the Ukraine war dominate the threat assessment (Bingen, Johnson and Young 2023).

The report noted the continued efforts by China to be a leading space power, doubling the number of its satellites in orbit between 2019 and 2021 from 250 to 499. It stated that "U.S. officials continue to view the country as a significant counterspace threat," and noted the country's capabilities in space surveillance using space-tracking ships and ground stations built as part of the Belt and Road Initiative (ibid., 11). ASP also confirmed that China possessed a large number of ISR satellites, second only to the United States.

Iran is characterized as a much smaller-scale space power, with only three satellites in orbit (two of which collect ISR), but boasts of its ongoing cooperation with Russia, which has been deepened following the Russian attack on Ukraine (ibid., 24–26).

North Korea also gets a mention, less for its existing counterspace or ISR capabilities, which are marginal, and more for the possibility of future malevolent activity should the country gain technological assistance from others such as Russia or acquire it illicitly (ibid., 27–29).

The Ukraine war was seen as a test case in the ASP report: "Russia's attacks against space capabilities used by Ukraine are an example of how counterspace weapons can and will likely be used prior to and during future conflict" (ibid., 18). Documented attacks included jamming and cyberattacks.

The report noted that the Russian inspection satellite "Luch" may have been engaged in signals intelligence gathering through manoeuvring into proximity orbits with various Intelsats. Conclusive evidence regarding the anomalous behaviour of Luch, however, was not available (ibid., 19–20).

Otherwise, setting aside some boasting, such as the use of laser weapons, Russian offensive capabilities appear to have been limited according to the 2023 report. It noted that "given the advantage commercial ISR satellites have provided to Ukraine, it is surprising that Russia failed to employ more counterspace weapons to erode this advantage" (ibid., 34).

Elsewhere, the ASP reports that Russia's space program is "atrophying" (ibid., 37). Russian limited use, in practice (to date), of counterspace capabilities can be assessed against what both the

2020 DOD and the 2022 DIA papers defined and graphed as a "counterspace continuum" of threats, with many elements (DIA 2022, 3), including:

- denial and deception;
- directed energy weapons (microwave and laser);
- orbital threats;
- ground-based attacks;
- kinetic energy threats (ASAT weapons);
- cyberspace threats; and
- electronic warfare.

The scariest among these potential threats was — and is — undoubtedly the possibility of "nuclear detonation in space."

The ASP report harboured its own fears of the use of high-altitude nuclear detonations, noting reports of research on their impacts on satellites being conducted at a PLA research institute (Bingen, Johnson and Young 2023, 36).

An even more detailed account of counterspace developments, based on open sources, can be found in the most recent assessment produced by Secure World Foundation. According to its research, "the evidence shows significant research and development of a broad range of destructive and non-destructive counterspace capabilities in multiple countries. However, only non-destructive capabilities are actively being used against satellites in current military operations" (Secure World Foundation 2024, xvi).

To respond to the new space threat environment, the DOD has created a doctrine of "space power" that includes the maintenance of a "comprehensive military advantage in space"; the ability to shape the space strategic environment through deterrence, or warfighting if necessary; and sustained partnering with allies, partners and the commercial space sector (DOD 2020, 7–9).

The newest element of this doctrine may be the concept of sustained partnering.

Advancing Space Power Through Alliances

In notable contrast to potential adversaries, one advantage held by the United States is the potential ability to mobilize a broad alliance of like-minded space-faring nations in pursuit of national space security. The United States can build on various existing alliance foundations to achieve this end.

One key element of allied space security cooperation that emerged in the years after the 2011 US National Security Space Strategy was released is the US-led Combined Space Operations initiative (CSpO), launched in 2014. The original members of the initiative included the Five Eyes intelligence alliance countries (Australia, Canada, New Zealand, the United Kingdom and the United States), plus two close European partners and North Atlantic Treaty Organization (NATO) allies (France and Germany). In late 2023, the CSpO expanded its membership to draw in two additional NATO countries (Italy and Norway) and to add Japan, an important space-faring nation and Indo-Pacific strategic partner, as well as being a member of the Group of Seven (G7) (Vergun 2023).

The founding members of CSpO created a "Combined Space Operations (CSpO) Vision 2031" document in February 2022. It committed the members of CSpO, who take part in a "principals board" as partners in "national security operations," to some high-level principles. These principles were broadly designed to maintain space security, protect the national interests of the partner countries and ensure the peaceful use of space, including through upholding applicable international law, such as the Outer Space Treaty, the UN Charter and the law of armed conflict. Maintenance of space security included an emphasis on collaboration to counter hostile space activities and to share intelligence and information (CSpO 2022).

New CSpO Members: Italy and Japan

Two new members — Italy and Japan — joined the CSpO initiative in late 2023. Both have recent national security space strategies.

The Italian government issued a paper on "national security strategy for space" in July 2019, during its presidency of the NATO Council of Ministers. The paper echoes the US 2011 Office of the Director of National Intelligence assessment by describing the space domain as congested, contentious and competitive (Presidency of the Council of Ministers 2019, 2). It goes on to suggest that space security has been further impacted by the rise of asymmetric threats and the growing commercialization of space. While much of the Italian policy outline is focused on national needs, it does recognize the importance of international cooperation. The Italian approach embraces both the strengthening of bilateral relations, especially among the G7, and multilateral initiatives, focused on NATO and the European Union. The Italian strategy looks to international cooperation to strengthen governance of space, to burdenshare on capabilities costs and even to help refine frameworks for the exchange of classified information. It describes a hoped-for "aggregator" effect through alliance cooperation that would lead to a more sustainable global space governance framework (ibid., 6).

The Japanese government has issued a series of national strategy documents in recent years. Japan's 2022 National Security Strategy provided the foundation for the subsequent development of a "space security initiative," released in June 2023 (2023).

The Japanese paper remarks at the outset that, "as geopolitical competition intensifies, space cooperation among countries sharing common values has increasingly deepened, and the cooperation with our ally and like-minded countries has become indispensable to ensure our national security" (ibid., 2).

Allied cooperation, especially through the CSpO, is seen by Japan as important in terms of achieving space domain awareness, missile defence early warning, secure satellite communications and satellite PNT functions (ibid., 7–9).

But as with Italy, while the Japanese doctrine talks of alliance links, much of the focus is on enhancing Japan's national capabilities, including through dual-use satellite systems. There is a noteworthy emphasis on increasing Japan's intelligence-gathering capabilities from space. This development is in stark contrast to earlier approaches to space security. At the very outset of Japan's development as a space-faring nation, the Japanese Diet ruled in 1969 that the country's self-defence forces were not allowed to deploy satellites for intelligence gathering or communications. This strict policy has evolved over time: first, to allow the use of commercial satellites; then second, in 2008, to recognize that the use of satellites was an important contributor to international and national security (Kazuto 2023).

A unique factor in the Japanese context is its doctrine of limiting its armed forces primarily to self-defence or territorial missions. However much Japan advances its own national capabilities in space, its military doctrine means that it will need to continue to rely on cooperation with allies for the foreseeable future, especially with the United States, for more global capabilities in secure communications, intelligence gathering, PNT and counterspace deterrent effects (ibid.).

In comparing the approaches of Italy and Japan to allied cooperation for space security, there are common elements, despite differences in strategic posture. These commonalities include the recognition of a challenging space domain environment, the importance of enhanced capabilities across the satellite spectrum (especially with regard to space domain awareness) and burdensharing.

The UK Approach

If we turn to the United Kingdom, which is a more embedded power in US-led alliance structures, especially in the Five Eyes, we can discern similar elements. The UK Ministry of Defence issued a "defence space strategy" in February 2022, which builds on both the UK "Integrated Review of Security, Defence, Development and Foreign Policy" of 2021 and the "national space strategy" of the same year, and attempts to operationalize an approach to fulfilling the promise of the UK becoming a "meaningful actor in space," with

space considered a new "operational domain" for the armed forces (Ministry of Defence 2022). The ministerial foreword to the defence space strategy is resounding in identifying a UK approach to space security that will emphasize alliance partnerships, listing the United States and the Five Eyes, the CSpO grouping and NATO (ibid.).

The defence space strategy posits a three-fold strategy for enhancing Britain's space capabilities — what it calls "own-access-collaborate."

"Own" refers to national capabilities that the United Kingdom must acquire. The biggest ambition here is the proposed creation of satellite constellations for intelligence, surveillance and reconnaissance missions, possibly based on synthetic-aperture radar capabilities and more novel applications such as hyperspectral imaging and "quantum field sensors" (Ministry of Defence 2022, 23). At present, the United Kingdom operates no such ISR platforms and has long been reliant on access to imagery from US spy satellites. To achieve the United Kingdom's desired status of positioning itself "as a leading nation among our allies and partners" will be a challenging task (ibid.).

"Access" is where the allied connection comes into play. The Ministry of Defence document makes a pitch for the United Kingdom's attributes as a "key" allied partner, identifying "our strengths in intelligence analysis, space diplomacy, leading edge science and strong industrial innovation" (ibid., 13). The major fora for allied work on space security are listed as CSpO, the Five Eyes and NATO. The Ministry of Defence describes Britain as being "at the forefront of multinational space operations," exemplified by its involvement in the CSpO Center. It also mentions Britain as being the first to join the United States in Operation Olympic Defender in 2020 (Werner 2024). Other founding members were Australia and Canada. Invitations have reportedly gone out to France, Germany and New Zealand to join, which would make it a Five-Eyes-plus-two (France and Germany) group. While the details of Operation Olympic Defender are not publicly disclosed, its war planning includes intelligence sharing, command-and-control integration and joint exercises. Reports on French decision making around joining Olympic Defender include an assertion that France will retain full control of its space operational capabilities (Mackenzie 2024).

"Collaborate" is the catchphrase used to describe the necessity that the UK government build space capacity with private sector firms. Tapping into dual-use capacities will be crucial. The UK doctrine recognizes the need to streamline procurement and build new state investment mechanisms in cutting-edge technology (Ministry of Defence 2022, 14). It also recognizes the need for protocols to ensure access to, and protection of, data from commercial satellite systems.

The UK doctrine is heavy on promises but also suggests tight timelines for some key developments: for example, looking to create an integrated ISR system with Five Eyes partners by 2025, as well as the launch of satellites with advanced sensor capabilities by that same year (Retter, Black and Ogden 2022). The United Kingdom has commissioned the private sector company LeoLabs to launch and maintain its initial ISR satellite, code-named Tycho.[2]

New Zealand and Australia: Five Eyes Allies

Among the Five Eyes countries, New Zealand is an outlier, primarily because its approach to space has been commercially driven without a significant national security or military component. It does have a stated commitment to the Five Eyes in the space domain, focused on supporting an entrepreneurial commercial environment to take advantage of the country's geographic advantages for launching small satellite payloads. The New Zealand military has not proven to be a driver of these developments in any significant way and remains only tangentially connected to its Five Eyes partners in the military applications of space.

Foremost among the private sector space companies operating in New Zealand is Rocket Lab, which utilizes a launch facility on the Mahia Peninsula on New Zealand's North Island. Rocket Lab began as a New Zealand-owned venture but was subsequently acquired by a US technology investment firm, Vector Capital. Rocket Lab has helped New Zealand become a significant provider of commercial launches, aided by the physical conditions available — including

2 See https://aerospaceglobalnews.com/news/leolabs-to-support-the-uks-first-isr-satellite-in-low-earth-orbit/.

clear skies, lows levels of air and shipping traffic, and a large selection of rocket-launch angles for orbital choice (Patel 2021). A financial report conducted by Deloitte for the 2018–2019 fiscal year indicated a strong economic result for New Zealand from its burgeoning space industry (Deloitte 2019).

Rocket Lab's first test launch was conducted in 2017 and its activities have expanded since then to include more than 100 satellite launches. A Rocket Lab launch in 2020 carried a classified US intelligence satellite (codenamed Gunsmoke-J) for the National Reconnaissance Office, which led to some protests, including from the local Maori community from which Rocket Lab leases its land (Roy 2020).

The New Zealand Space Agency has partnered with a US company, Leo Labs, to create a ground-based phased array radar installation to track space objects and space debris (the "Kiwi space radar") in LEO. The Kiwi space radar became operational in 2019 and is one of six phased array commercial systems now operated globally by Leo Labs, with an additional system under development.[3]

Developing its own satellite capabilities may be the next step for New Zealand. The New Zealand Defence Force announced plans in 2019 to invest in its own maritime surveillance satellites to help monitor the country's acknowledged area of responsibility in the South Pacific (New Zealand Government 2019; Walls 2019). This initiative has been slow to develop and constrained by military budget limitations.

New Zealand is a member of the US-led CSpO initiative, but regards its ability to contribute as modest and very much as a reinforcement of its stake in the Five Eyes: "For New Zealand, it is as much a symbol of our ongoing commitment to strengthening the Five Eyes relationship, given that we have modest resources to allocate to this area, albeit one where we can start to build knowledge, understanding and skills over time" (Neas 2020).

Australian space policy, like that of its much smaller Oceania neighbour and Five Eyes partner, has been largely driven by a focus on commercial enterprise and opportunities. While Australia lacks a dedicated space strategy, there have been calls for the country to enhance its space security capabilities and strengthen its alliance posture. As one commentator has noted: "Space is vital to Australia's relationship with the United States, while the United States is in turn central to Australian activities in space" (Moss 2021).

Others want to see Australia broaden its alliance linkages on space issues beyond the traditional defence and security relationship with the United States. Cassandra Steer (2021), for example, would see a strengthening of Australia's diplomatic stance on space governance issues, combined with an exploration of new bilateral ties among space-faring nations, particularly in the Indo-Pacific.

Some commentators have stressed the need for greater sovereign Australian capabilities in space to contribute to deterrence, especially in the face of developing counterspace capabilities by a variety of countries.

One far-reaching set of ideas was laid out in a 2019 paper for the Australian Strategic Policy Institute. The author, Malcolm Davis (2019), argues that Australia has largely been a "passive observer" of an increasingly dangerous space domain. He called for an Australian contribution to space deterrence, for the country to do more to burdenshare among allies, and for the development of greater sovereign Australian space capabilities, including by becoming a space-launch power. Davis goes so far as to suggest the need for Australia to consider creating its own counterspace capabilities. He writes that "for a middle power such as Australia, which is heavily dependent on space not only for its ability to use military power but for its national survival, the growing counterspace threat should be a worrying dark cloud in increasingly stormy skies" (Davis 2019, 37).

In terms of an Australian approach to space security alliances, Davis argued for both the maintenance of Australia's role in the CSpO initiative and for enhanced bilateral engagements with key Indo-Pacific partners, including Japan.

Whatever the future holds for Australian approaches to space security in both a sovereign and an allied context, what seems clear is that there will be three foundation pieces. The first is the strength of the Australian-US security relationship. Second, and related, is the Australian membership in CSpO. The third, not to be overlooked, is Australian "real estate," especially the key signals intelligence and satellite downlink facility at Pine Gap in Western Australia (Nautilus Institute

3 See https://leolabs.space/radars/.

2016). Since Davis described a vision for space security for Australia in 2019, a new partnership has emerged between Australia, the United Kingdom and the United States (AUKUS), which potentially adds to the foundational pieces.

AUKUS

Just as CSpO can take advantage of the foundations laid by the Five Eyes alliance in intelligence sharing, a key element of space national security, a more recent pact may also serve as a forum for some aspects of alliance cooperation in space. AUKUS is a trilateral security arrangement between Australia, the United Kingdom and the United States, announced in September 2021, which has two key pillars. Pillar 1 is designed to provide Australia with assistance to acquire conventionally armed, nuclear-powered submarines for deployment in the Indo-Pacific theatre. It has been backed by new arrangements to guarantee rotational deployment of US and UK submarines to a Western Australian naval base to heighten deterrence in the region (Townshend 2023). Pillar 2 focuses on AUKUS partners' efforts to develop and share new technological capacities and to increase interoperability between their armed forces.

The advanced capabilities that have been set out in Pillar 2 of AUKUS touch on space only in terms of announced plans to develop a deep-space radar capacity to track objects and maintain space situational awareness (SSA) (Brooke-Holland 2024). Discussions between AUKUS partners (Australia and the United States) on deep-space radar capabilities include the possibility of the creation of a phased array radar system in Western Australia, to be operational by 2026 (Connolly 2024).

Recently, the chief of operations for the US Space Force has indicated some trilateral discussions have taken place on extending Pillar 2 to include other forms of technological cooperation in the space domain. This might include new space early-warning assets to track hypersonic missile threats (Martin 2024).

At present, two of the Five Eyes countries are not part of AUKUS, but there have been calls for Canada and New Zealand to join Pillar 2 (Brewster 2023). To the extent that Pillar 2 includes an expanded focus on space capabilities, this would require and stimulate commitments from both countries.

Other Voices on Allied Space Security

A former DIA official, Nicholas Eftimiades, has added his voice to the call for greater allied cooperation in space security. According to Eftimiades (2023, 2), "There is pressure on the United States to act quickly to increase national security space coordination and integration, driven by rapidly increasing global capabilities and expanding threats from hostile nations and orbital debris." His arguments for the benefits of allied cooperation and integration are numerous. They include:

- the impact that a collective security front in space might have on adversary plans;
- the value added by global access to ground-based SSA and telemetry, tracking and control;
- burden sharing to reduce national costs;
- helping to shape global norms for the responsible use of space; providing an enhanced forum for crisis management;
- greater resiliency in the face of any attrition of space-based services;
- building out greater industrial partnerships;
- and the strengthening of supply chains (ibid., 3–5).

It is an attractive list of advantages of allied cooperation and some of them could be built on the AUKUS Pillar 2 framework. But what of practice?

Eftimiades contends that CSpO and the space wargaming conducted under such exercises as Operation Olympic Defender are concrete examples of some of the benefits of allied cooperation, but he finds these insufficient. What is needed, he suggests, is a strategy for allied cooperation in space that might put some of the principles of the CSpO Vision 2031 into practice, including around enhanced intelligence sharing, gap

analysis to assist with the integration of allied efforts and better sharing of SSA data (ibid.).

In a year-long study published in April 2021, the Atlantic Council offered its own vision of a long-term strategy for allied cooperation to achieve space national security, led by the United States. It argued that great power competition and the rapid advance of commercial uses of space required a new collective security pact. The paper's authors concede that this will be a long-term project but suggest that a starting point should be NATO's developments in space strategy.

In 2019, NATO set out a space policy that draws on the language of the 2011 US intelligence report in calling space "contested, congested and competitive." The space policy not only acknowledges the importance of the space domain for NATO, but also its vulnerability to adversary counterspace capabilities. NATO (2019) doctrine is clear that the alliance would not aim to be an autonomous space actor or develop space capabilities itself but would instead draw on the capabilities of individual NATO members to ensure an effective set of space operations.

The Atlantic Council study argues that a NATO foundation for space cooperation will not be enough. Something more global in nature will ultimately be needed, not least to include allies and partners in the Indo-Pacific, such as Japan and South Korea. The long-term objective would be the creation of an entirely new space security alliance, built on the shared ground of national security space concerns among allies and partners, but also one that would need to embrace cooperation with non-allied competitor and even adversary states (Starling et al. 2021).

Whatever the fortunes of a future space security alliance of the sort envisaged by the Atlantic Council, developments in space national security partnerships will continue to evolve from long-established alliance structures, such as the Five Eyes and NATO, supplemented by new bilateral arrangements with space-faring nations, such as India and Japan. The joint statement issued by President Joe Biden and Prime Minister Narendra Modi on the occasion of the Indian leader's visit to the United States in June 2023 signals the kind of bilateral ties that could exist between the two countries, with a strong emphasis on the sharing of space technologies, collaboration on spaceflight missions and enhanced commercial interchanges (The White House 2023).

Whither Canada?

Canada is a space-faring nation, but not a space great power. It represents an interesting case study of space national security needs and challenges, and it also illustrates the potentiality of achieving space national security through alliance efforts, something that will be a necessity for the country.

The issue of "space defence" is currently being studied by the Parliamentary Standing Committee on National Defence. This is pursuant to a motion before the committee that seeks to address some key issues: the current state of Canadian space defence capabilities; international agreements and partnerships related to space defence; and "the impact of advancements in space on Canada's sovereignty and national security."[4] The committee held hearings in the spring and summer of 2024 but has not yet issued a report.

An interrogation of Canada's approach to space national security must address three issues:

- Does Canada have a space national security strategy?
- What capabilities does Canada have in space platforms performing national security functions, including dual-use platforms? What more is needed?
- Is Canada on board with a vision of an alliance approach to space national security?

4 House of Commons, Standing Committee on National Defence, *Review of the Impact of Canada's Procurement Process on the Canadian Armed Forces* (2 November 2023), online: <www.ourcommons.ca/DocumentViewer/en/44-1/NDDN/meeting-79/minutes>.

A Canadian Space National Security Doctrine?

The first question is easily answered: Canada does not have a space national security strategy. Indeed, it does not have an overarching national security strategy, the last and only one having been published in 2004. The 2004 national security policy did not mention space, nor list it among the eight broad-based national security threats it identified. These threats ranged from terrorism and domestic extremism, through the proliferation of weapons of mass destruction, failed and failing states, espionage, natural disasters, organized crime and pandemics (Privy Council Office 2004). The closest that this security policy came to addressing concerns about space security might be seen in the category of critical infrastructure vulnerabilities, but the space sector was not included as an element of critical infrastructure at that time (Public Safety Canada 2009).

A new national security strategy has been promised, but no details are available as to its approach or the timing of its delivery. Meanwhile, a promised critical infrastructure strategy, which may list space as one key element, remains under wraps.

The closest that existing Canadian official documents come to an expression of the demands of space national security can be found in two major defence policies. The first, *Strong, Secure, Engaged*, was issued in 2017 (Department of National Defence [DND] 2017). This policy recognized the importance of the "space domain," both for civil society and for the military. It even adopted the US intelligence community's description of space as "congested, competitive and contested" from 2011. Elsewhere, the policy was replete with promises to strengthen Canadian space capabilities in ISR and to enhance protection for its space assets, including from cyberthreats.

The recent defence policy update, *Our North, Strong and Free*, shifts the focus of Canadian defence policy to the Arctic (Wark 2024). The policy states: "The most urgent and important task we face is asserting Canada's sovereignty in the Arctic and northern regions, where the changing physical and geopolitical landscapes have created new threats and vulnerabilities to Canada and Canadians" (ibid., viii).

References to space capabilities are largely geared toward the defence of the Arctic region, including promises of "improved satellite capabilities"; "better eyes and ears in space"; and a new satellite ground station in the high Arctic (DND 2024, viii, ix, 24). Otherwise, the new defence policy is regrettably light on treatment of space national security threats and responses.

Absent from either defence strategy statement is any indication of the avenues that Canada might pursue in terms of developing ties with commercial space companies. There is no Canadian equivalent of the kind of doctrine set out by the DOD (2024) or by the US Space Force (2024).

The recent announcement of the creation of a Canadian Space Council may serve to facilitate greater integration of the commercial sector into government-funded space projects and policies, but this remains to be seen. Canadian private-sector space companies have lauded this step. The initial remit of the National Space Council is to generate a "whole-of-government approach to space exploration, technology development and research" (Mortillaro 2024).

Canadian Space Capabilities?

Canada operates a small number of satellites, primarily for Earth observation. The best known of these is the RADARSAT Constellation Mission (RCM). This trio of satellites using advanced radar imaging capabilities is a dual-purpose system, built by the private sector firm MDA and operated by the Canadian Space Agency. The satellites were launched in 2019 on a Falcon X SLV,[5] and their primary roles are maritime surveillance (including in the Arctic), disaster management and environmental monitoring.[6]

5 See www.eoportal.org/satellite-missions/rcm#rcm-radarsat-constellation-mission.

6 See www.asc-csa.gc.ca/eng/satellites/radarsat/what-is-rcm.asp.

The Canadian government has access to the RCM's imagery for national security purposes. Unlike previous generations of RADARSAT satellites, the imagery from the RCM is not available to commercial users.[7] Analyzed RADARSAT imagery has been made available to Ukraine for use in its defence against the Russian invasion (Wark 2022). The delivery of RADARSAT imagery is part of a broader pattern whereby commercial space imagery platforms have delivered vital intelligence to the Ukrainian government and military, as well as playing an important role in providing stunning pictures of the destructiveness of the Russian attack on Ukraine to a global public. By the end of 2022, Ukraine had gained access to imagery coverage from approximately 40 Earth-observation commercial satellites (Hammes 2023).

Canada has one dedicated military satellite, which is deployed primarily for SSA — Sapphire. Sapphire was created as a Canadian contribution to the US Space Surveillance network (Government of Canada 2014). Launched in 2013, the Sapphire system is aging and now well past its original five-year mission. The Department of Defence has announced that it will be replaced by a new microsatellite to be launched on an accelerated timetable in late 2026 (Pugliese 2023).

In addition, there is an even older Earth observation microsatellite called SCISAT, launched in 2003 but still operational, which studies ozone layer depletion especially over the Arctic and Canada.[8]

At present, Canada has no active space launch facility (or spaceport), though one is currently in development by a private company called Maritime Launch, based in Nova Scotia and well situated for satellite launches into polar orbits.[9]

Defence needs are clear, at least in terms of promissory notes: Canada must do more to enhance its satellite capabilities.

A Canadian Vision for a Space National Security Alliance?

Official policy documents provide little indication of Canadian thinking on the future shape of any space national security alliance. *Strong, Secure, Engaged* does acknowledge that the Five Eyes alliance has been an "enduring feature of Canada's space program." The CSpO grouping, essentially the Five Eyes plus France and Germany, is described as the "centre" of Canada's allied efforts and is credited with providing a framework for space cooperation with allies, strengthening deterrence, improving the resilience of space systems and optimizing resources through burden sharing (DND 2017, 71–72). As Charity Weeden (2018, 2) related in her analysis of the space elements of *Strong, Secure, Engaged*, burden sharing and enhanced deterrence are two clear benefits for Canada of an alliance formation for space.

The more recent defence policy update has little to say about an alliance approach to space national security, beyond reference to upgrading the North American Aerospace Defense Command (NORAD) early warning capabilities and building, with allies, a "comprehensive worldwide satellite communication capability" (DND 2024, 28, 34).

The cumulative answer to the "whither Canada" question is that the country needs the guidance of a space national security doctrine, whether as a stand-alone product or, better yet, as part of the promised forthcoming national security strategy. In addition, Canada needs to follow through on promises to enhance its "eyes and ears" in space and to generate greater space capabilities and commitments to ensure its "ally-worthiness." This applies to existing alliance frameworks with space national security implications, such as CSpO, NATO and NORAD, as well as potential future openings in, for example, Pillar 2 of AUKUS, and bilateral relations beyond the Euro-Atlantic domain.

7 See https://space.skyrocket.de/doc_sdat/radarsat-constellation.htm.

8 See www.asc-csa.gc.ca/eng/satellites/scisat/about.asp#.

9 See www.maritimelaunch.com/faq.

Communicating the Need for Space National Security

No state can achieve a space national security program without public buy-in. This reality lends emphasis to various statements in space strategy documents about the need for better public understanding. Examples include the promise in the CSpO vision document to collaborate on strategic communications efforts to "set the desired conditions in the information environment" (CSpO 2022). The 2020 US Defense Space Strategy was more explicit: it raised the concern that the protection of national security interests in space was taking place in a vacuum of public understanding. It found that public understanding of the new space domain "and significantly growing counterspace threats to the United States and its allies and partners remains cursory" (DOD 2020, 4). And it promised to work to inform international and domestic audiences, particularly of adversarial threats in space, but did not say how.

Public communication of national security space threats is not absent, as the Center for Strategic and International Studies ASP annual threat assessments and the Atlantic Council report, among others, prove, but such efforts arguably reach primarily a specialized audience.

The publication by government agencies of regular space national security threat assessments, geared toward a public audience, could have greater impacts on awareness. Popular culture writing may also lend a hand. David Ignatius's (2024) recent space spy thriller, *Phantom Orbit,* depicting a scenario of counterspace operations by China, and the defection of leading Russian and Chinese space program scientists to the United States to avoid space catastrophe, may be one indicator of a long-established genre in search of new plot lines and audiences (Ignatius 2024). Where spy fiction goes, perhaps governments will follow?

Conclusion

Concerns about national security in space — or, more accurately, national insecurity in space — are forward leaning. They address future threats as much as demonstrated capabilities and acts. As with all future-oriented threat assessments, those devoted to national security in space face the challenge of striking the right balance between fear and objective fact. To tip too far toward worst-case analysis of both adversary intentions and counterspace capabilities could lead to an exaggeration of the threat and potential escalatory developments. To underestimate space threats would be equally dangerous, leading to vulnerabilities, lack of preparedness and the potential weakening of deterrence posture, especially in an alliance context.

The challenge is compounded by the fast pace of change to the space environment, notably in terms of the proliferation of commercial satellite platforms, and by technological change. Going forward, there will be a strong need for ongoing threat assessments of space national security, to which non-governmental organizations (NGOs), think tanks, academia and private sector space companies could make an important contribution.

Underlying such threat assessments should be enhanced space domain and situational awareness in order to properly evaluate adversarial space intentions and capabilities. Being able to generate a collective allied approach to such threat assessments should be a goal for Western space-faring nations.

Recommendations

- In the face of enduring geopolitical fracture, Western space-faring nations need to pursue collective alliance security policies and practices. The emphasis should be on collective security, deterrence, burdensharing and norm generation, not on warfighting.

- Space national security strategies can be an important tool to guide policy and heighten public education. In the case of the promised Canadian national security strategy, space security should be a prominent element, with more extensive treatment than can be found in existing defence policy documents. A Canadian space defence strategy should be embedded in the national security strategy and could be

developed further in a bespoke document. The United Kingdom's development of a suite of strategy documents provides a model.

- Canada must demonstrate a commitment to being "ally-worthy" in the space domain. Its place in key alliance security networks, including the Five Eyes, CSpO and NATO, must be reinforced in doctrine and with new capabilities that can be rapidly deployed. Ally-worthiness can also be demonstrated through diplomatic efforts to enhance global space governance.
- There is a real need for greater public awareness of the contemporary space environment and the national security risks it contains. This can be delivered by a combination of government outreach and work by NGOs, think tanks and other private sector endeavours.
- The Ukraine war should continue to be analyzed as an important test case for the use of counterspace capabilities and for responses to them.

Works Cited

Andrew, Christopher. 2018. *The Secret World: A History of Intelligence*. New Haven, CT: Yale University Press.

Bingen, Kari A., Kaitlyn Johnson and Makena Young. 2023. *Space Threat Assessment 2023*. A Report of the Center for Strategic & International Studies Aerospace Security Project. April. www.csis.org/analysis/space-threat-assessment-2023.

Brewster, Murray. 2023. "PM's former adviser says there's no indication Canada was invited to join AUKUS defence pact." CBC News, May 10. www.cbc.ca/news/politics/aukus-u-s-australia-u-k-nuclear-subs-canada-defence-spending-1.6837792.

Brooke-Holland, Louisa. 2024. "AUKUS pillar 2: Advanced military capabilities." Research Briefing, September 2. https://commonslibrary.parliament.uk/research-briefings/cbp-9842/.

Connolly, Rebecca. 2024. "Space surveillance and AUKUS: The power of awareness." *The Interpreter* (blog), January 19. Lowy Institute. www.lowyinstitute.org/the-interpreter/space-surveillance-aukus-power-awareness.

CSpO. 2022. "Combined Space Operations Vision 2031." https://media.defense.gov/2022/Feb/22/2002942522/-1/-1/0/CSPO-VISION-2031.PDF.

David, James E. 2015. *Spies and Shuttles: NASA's Secret Relationships with the DoD and CIA*. Gainesville, FL: University Press of Florida and the Smithsonian National Air and Space Museum. https://doi.org/10.5744/florida/9780813049991.001.0001.

Davis, Malcolm. 2019. "The Australian Defence Force and contested space." Australian Strategic Policy Institute. August. www.jstor.org/stable/pdf/resrep23071.1.pdf.

Deloitte. 2019. *New Zealand Space Economy: Its value, scope and structure*. Ministry of Business, Innovation and Employment and Deloitte Access Economics. November. www.beehive.govt.nz/sites/default/files/2019-11/Deloitte%20NZ%20Space%20Economy%20Report.pdf.

DIA. 2022. *Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion*. www.dia.mil/Portals/110/Documents/News/Military_Power_Publications/Challenges_Security_Space_2022.pdf.

Dickey, Robin. 2020. *The Rise and Fall of Space Sanctuary in U.S. Policy*. Center for Space Policy and Strategy, The Aerospace Corporation. September. https://csps.aerospace.org/sites/default/files/2021-08/Updated_Dickey_SpaceSanctuary_20200901_0.pdf.

DND. 2017. *Strong, Secure, Engaged: Canada's Defence Policy*. April 8. Ottawa, ON: DND. www.canada.ca/en/department-national-defence/corporate/reports-publications/canada-defence-policy.html.

———. 2024. *Our North, Strong and Free: A Renewed Vision for Canada's Defence*. Ottawa, ON: DND. www.canada.ca/en/department-national-defence/corporate/reports-publications/north-strong-free-2024.html.

DOD. 2020. "Defense Space Strategy Summary." June. https://media.defense.gov/2020/Jun/17/2002317391/-1/-1/1/2020_DEFENSE_SPACE_STRATEGY_SUMMARY.PDF.

———. 2024. "Commercial Space Integration Strategy." Washington, DC: DOD. https://media.defense.gov/2024/Apr/02/2003427610/-1/-1/1/2024-DOD-COMMERCIAL-SPACE-INTEGRATION-STRATEGY.PDF.

DOD and Office of the Director of National Intelligence. 2011. "National Security Space Strategy Unclassified Summary." January. https://irp.fas.org/eprint/nsss.pdf.

Eftimiades, Nicholas. 2023. "Integrating US and Allied Capabilities to Ensure Security in Space." Forward Defense Issue Brief. Atlantic Council. April. www.atlanticcouncil.org/in-depth-research-reports/issue-brief/integrating-us-and-allied-capabilities-to-ensure-security-in-space/.

Hammes, T. X. 2023. "Game-changers: Implications of the Russo-Ukraine War for the Future of Ground Warfare." Atlantic Council Scowcroft Center for Strategy and Security Issue Brief. April. www.atlanticcouncil.org/wp-content/uploads/2023/04/Game-Changers-or-Little-Change-Lessons-for-Land-War-in-Ukraine-.pdf.

Herman, Michael. 1996. *Intelligence Power in Peace and War*. Cambridge, UK: Cambridge University Press and the Royal Institute of International Affairs.

Ignatius, David. 2024. *Phantom Orbit: A Thriller*. New York, NY: Norton.

Kazuto, Suzuki. 2023. "Space Security in Japan's New Strategy Documents." Center for Strategic & International Studies, June 21. www.csis.org/analysis/space-security-japans-new-strategy-documents.

Mackenzie, Christina. 2024. "France undecided on US offer to join 'Olympic Defender' space effort." Breaking Defense, May 15. https://breakingdefense.com/2024/05/france-undecided-on-us-offer-to-join-olympic-defender-space-effort/.

Martin, Tim. 2024. "Space Force's Saltzman sees 'room' for space capabilities in AUKUS Pillar II." Breaking Defense, July 17. https://breakingdefense.com/2024/07/space-forces-saltzman-sees-room-for-space-capabilities-in-aukus-pillar-ii/.

Ministry of Defence. 2022. "Defence Space Strategy: Operationalising the Space Domain." Policy Paper. February. www.gov.uk/government/publications/defence-space-strategy-operationalising-the-space-domain.

Mortillaro, Nicole. 2024. "Federal government announces creation of National Space Council." CBC News, April 17. www.cbc.ca/news/science/budget-national-space-council-1.7176301.

Moss, Tristan. 2021. "It's not rocket science, Australia needs a stronger space strategy." *The Interpreter* (blog), November 12. Lowy Institute. www.lowyinstitute.org/the-interpreter/it-s-not-rocket-science-australia-needs-stronger-space-strategy.

NATO. 2019. "NATO's overarching Space Policy." June 27 (last updated May 30, 2024). www.nato.int/cps/en/natohq/official_texts_190862.htm.

Nautilus Institute. 2016. "Pine Gap – an introduction." February 21. https://nautilus.org/publications/books/australian-forces-abroad/defence-facilities/pine-gap/pine-gap-intro/.

Neas, Oliver. 2020. "Revealed: New Zealand's role in the new American war-fighting frontier – space." The Spinoff, January 14. https://thespinoff.co.nz/society/14-01-2020/revealed-new-zealands-role-in-the-new-american-war-fighting-frontier-space.

New Zealand Government. 2019. *Defence Capability Plan 2019*. June. Wellington, NZ: Ministry of Defence. www.defence.govt.nz/assets/publications/Defence-Capability-Plan-2019.pdf.

Patel, Neel V. 2021. "Rocket Lab could be SpaceX's biggest rival." *MIT Technology Review*, March 2. www.technologyreview.com/2021/03/02/1020212/rocket-lab-could-be-spacexs-biggest-rival-neutron-falcon-9/.

Pillai, Maya. 2016. "Dual-Use Satellite Technology." British Pugwash, May 21. https://britishpugwash.org/wp-content/uploads/2016/05/21-Maya-Pillai.pdf.

Presidency of the Council of Ministers. 2019. "National security strategy for space." Government of Italy. https://presidenza.governo.it/AmministrazioneTrasparente/Organizzazione/ArticolazioneUffici/UfficiDirettaPresidente/UfficiDiretta_CONTE/COMINT/NationalSecurityStrategySpace.pdf.

Privy Council Office. 2004. *Securing an Open Society: Canada's National Security Policy*. April. Ottawa, ON: Privy Council Office. https://publications.gc.ca/collections/Collection/CP22-77-2004E.pdf.

Public Safety Canada. 2009. "National Strategy for Critical Infrastructure." www.publicsafety.gc.ca/cnt/rsrcs/pblctns/srtg-crtcl-nfrstrctr/srtg-crtcl-nfrstrctr-eng.pdf.

Pugliese, David. 2023. "Canadian military orders space surveillance micro satellite." *SpaceNews*, March 10. https://spacenews.com/canadian-military-orders-space-surveillance-micro-satellite/.

Retter, Lucia, James Black and Theodora Ogden. 2022. *Realising the Ambitions of the UK's Defence Space Strategy: Factors Shaping Implementation to 2030*. Santa Monica, CA: RAND Corporation. February 17. www.rand.org/pubs/research_reports/RRA1186-1.html.

Roy, Eleanor Ainge. 2020. "Aiming for the stars: how New Zealand's space industry is causing turbulence." *The Guardian*, January 24. www.theguardian.com/world/2020/jan/25/aiming-for-the-stars-how-new-zealands-space-industry-is-causing-turbulence.

Secure World Foundation. 2024. *Global Counterspace Capabilities: An Open Source Assessment.* April. Broomfield, CO: Secure World Foundation. https://swfound.org/media/207826/swf_global_counterspace_capabilities_2024.pdf.

Space Development Strategy Headquarters. 2023. *Space Security Initiative.* June. www8.cao.go.jp/space/english/anpo/kaitei_fy05/enganpo_fy05.pdf.

Starling, Clementine G., Mark J. Massa, Christopher P. Mulder and Julia T. Siegel. 2021. "The Future of Security in Space: A Thirty-Year US Strategy." Atlantic Council Strategy Paper. April 11. Washington, DC: Atlantic Council. www.atlanticcouncil.org/content-series/atlantic-council-strategy-paper-series/the-future-of-security-in-space/.

Steer, Cassandra. 2021. "Australia as a Space Power: Combining Civil, Defence and Diplomatic Efforts." Policy Options Paper No. 19. Australian National University National Security College. May. https://nsc.anu.edu.au/content-centre/research/australia-space-power-combining-civil-defence-and-diplomatic-efforts.

The White House. 2023. "Joint Statement from the United States and India." Press release, June 22. https://in.usembassy.gov/joint-statement-from-the-united-states-and-india/.

Townshend, Ashley. 2023. "The AUKUS Submarine Deal Highlights a Tectonic Shift in the U.S.-Australia Alliance." Carnegie Endowment, March 27. https://carnegieendowment.org/posts/2023/03/the-aukus-submarine-deal-highlights-a-tectonic-shift-in-the-us-australia-alliance.

US Space Force. 2024. "U.S. Space Force Commercial Space Strategy: Accelerating the Purposeful Pursuit of Hybrid Space Architectures." April 8. www.spaceforce.mil/Portals/2/Documents/Space%20Policy/USSF_Commercial_Space_Strategy.pdf.

Vergun, David. 2023. "More Nations Meet to Address Space Security." DOD News, December 7. www.defense.gov/News/News-Stories/Article/Article/3610656/more-nations-meet-to-address-space-security/.

Walls, Jason. 2019. "The Defence Force $20b spending plan includes a commitment to 'space-based activities.'" *The New Zealand Herald*, June 10. www.nzherald.co.nz/nz/the-defence-force-20b-spending-plan-includes-a-commitment-to-space-based-activities/DLUYWQGEU2UTDCNI4W6XKCJKPM/.

Wark, Wesley. 2022. "Commercial Satellites Deployed in Ukraine's Defence." Opinion, Centre for International Governance Innovation, March 31. www.cigionline.org/articles/commercial-satellites-deployed-in-ukraines-defence/.

———. 2024. "The Arctic Backdoor." Wesley Wark's National Security and Intelligence Newsletter, April 24. https://wesleywark.substack.com/p/the-arctic-backdoor.

Weeden, Charity. 2018. *Strong, Secure, Engaged in a Threatened Space Domain.* Canadian Global Affairs Institute. May. www.cgai.ca/strong_secure_engaged_in_a_threatened_space_domain.

Werner, Debra. 2024. "U.S. Space Command adopts multipronged approach to prepare for 'a conflict that has never happened.'" *SpaceNews*, April 9. https://spacenews.com/u-s-space-command-adopts-multipronged-approach-to-prepare-for-a-conflict-that-has-never-happened/.

67 Erb Street West
Waterloo, ON, Canada N2L 6C2
www.cigionline.org