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Connecting Canada's Strategic Vision with Commercial Space Capabilities

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Key Points

- Canada currently lacks a comprehensive space strategy with a vision that includes civil, defence and commercial sectors and considers how to harness the innovative potential of the private sector to drive development of new capabilities for Canada, and for commercial uses at home and abroad.
- Canada's allies have national visions and strategic policies that take a whole-of-society approach, enabling greater collaboration between government and the private sector by connecting priorities to capability development.
- Growth of the global space economy is poised to accelerate in coming decades and commercial innovation is increasingly leading the way on new technologies.
- Operationalizing the National Space Council and developing a national strategy that includes a clear role for how Canada will support commercialization of new space capabilities will signal Canada's commitment and priorities to allies, partners and the space industrial base.

Introduction

Space cannot be considered an exploration activity, an economic activity, a defence activity or a social activity alone, and no country can develop all these systems alone: collaborating with others is necessary. Space impacts *everything* about human activity, including banking, telecommunications from text messages to emails, navigation, air traffic control, early warning for natural disasters and environmental protection, and so much more. Space can no longer be considered an "add-on" or an afterthought to major policy decisions: space needs to be considered from the start of major policy discussions (Jebb and Struzinski 2024).

Harnessing the power of space can help a country realize its economic, social, security and environmental ambitions. Canada has a strong legacy of developing and delivering impressive and impactful space programs. Many of those programs, however, were delivered in a different era, where governments were the only players in the space economy. A new era is upon us, where the lines between commercial, civil and defence space programs are blurred — and those lines are much less relevant for most of the space economy.

It is important to raise awareness about the current impact of space and its potential impact in the future

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on our collective quality of life here on Earth. Public imagination is often captured by space exploration. The idea of pushing humanity further into space, using the most advanced and complex technology ever developed, is understandably attractive and awe-inspiring. Space exploration is, however, only a part of the space economy. The bulk of the space sector is commercial capabilities — from the ones people use everyday without thinking about it, to dual-use and dual-purpose capabilities that provide value for Canada, for Canadians and for defence and national security. This policy brief will present a vision for what Canada can do to take a more strategic approach to the space enterprise.

The Growth of the Global Space Economy

There is considerable economic opportunity for Canada in space. The space industrial base in Canada is innovating to deliver space capabilities for customers in Canada and around the world, including communications, sensing, artificial intelligence, deep space radar, robotics and launch technologies, and leading-edge technologies for exploration.

Space capabilities supporting the quality of life on Earth are getting vastly cheaper and growing at a breakneck pace (Deloitte 2023). There were approximately 2,250 satellite orbiting Earth five years ago. That figure is estimated to be five times larger today (11,000 satellites), with growth expected to speed up. It is forecast that there will be more than nine times the current number of satellites orbiting the Earth by 2030, or 100,000 satellites (ibid.). Satellites are only part of the space economy. Satellites are launched into orbit by rockets and controlled by ground stations while in flight to keep them on time and on target. Data processing and analytics are both vital to making the data satellites collect useful for humans. The data from satellites is being used around the world every day by governments, companies, civil society, scientists and researchers, and private citizens alike for national security, logistics management, all manner of research and analysis, and consumer and entertainment services.

Global growth is expected to accelerate over the foreseeable future. In 2021, the global space industry was worth an estimated US$370 billion dollars;

by 2030, it is expected to grow by 74 percent to US$642 billion annually (Euroconsult 2022). This figure could be as high as US$2 trillion by 2040 (Deloitte 2023). Space is increasingly a domain for competition between top powers, meaning that the United States, China and Russia's increasing focus on space and the growth of their space programs will have geopolitical impacts, including for their respective allies.

Canadian Growth Areas

Canadian companies are delivering leading technologies across the spectrum of capabilities for space. Low-Earth orbit satellite communications bring the promise of higher-speed broadband to anybody who cannot access high-speed land-based broadband. Improved connectivity for remote and rural communities — especially in Canada's Northern and Indigenous communities — will enable greater participation in the digital economy, no matter where you are.

Space capabilities are also providing exciting opportunities for health services delivery. In cities and towns, high-speed broadband allows for telemedicine and remote health-care service for patients. This is very significant for patients in fly-in communities in Canada's North and Arctic. Making telemedicine accessible for people in the most remote communities will not only reduce travel and time away from family for some medical appointments, but it will also reduce greenhouse gas (GHG) emissions with a fewer number of flights from the most remote communities. Health service delivery in space will become more prominent as humans continue to explore space by returning to the Moon and possibly putting humans on Mars. With the distances and travel times involved, it will not be practical to send people in need of health care back to Earth: they will be treated where they are to provide life-saving care. This will likely involve remote health technologies, to connect physicians on Earth — or in space — with patients. Connecting machines to humans remotely also has significant potential for application on Earth, where people living far from a hospital may receive remote care using technology designed for space.

For environmental risks such as deforestation, desertification, melting arctic ice, melting snowpack, navigability of northern waterways and rising sea levels, space-based technologies provide early warning and monitoring capabilities. Satellite capabilities are being used to monitor GHG emissions to deliver reliable, timely data about the Earth's atmosphere. Over time, this means comparing across months and years to show the impacts that climate change is having. In fact, over half of the climate variables measured by the World Meteorological Organization can only be accurately captured or are best captured from space (World Economic Forum 2021).

Earth-sensing capabilities also help protect the environment through monitoring sensitive land and coastal ecosystems, deforestation and illegal fishing. Combining airborne sensing, space-based sensing and space-based communications platforms provides the capability to monitor any issue far away from populated centres and ground-based infrastructure. The same technology provides data on the moisture of watersheds and dryness of forests to provide early warning and risk models for natural disasters. Sensing capabilities will identify the highest risk areas for flood, wildfire, landslide and other hazards, allowing planners to better predict where natural disasters are more likely to occur and take the appropriate planning actions to mitigate the risk. With early warning provided by space-based sensing capabilities, planners and decision makers can take the appropriate action to prevent the worst impacts on people and communities across Canada.

If disaster does strike, space capabilities enable a more effective response. Improved space-based broadband has the potential to keep more people — such as those leaving their communities during an evacuation order or first responders travelling toward the danger — connected in times of crisis.

The Role of Government

Innovation drives the space sector and is vital to turning ideas into commercial solutions. Innovation coming from the commercial space sector is a far greater driver of new technology than relying on government-owned-and-operated programs alone. The space sector invests — on average — 18 times more in research and development for new products and solutions compared to other manufacturing sub-sectors (Space Canada 2022). This investment means that the commercial sector is generating capability faster than other sectors, especially government. With commercial capabilities available, governments can purchase services and data cheaper and faster than developing and owning capabilities themselves. For space systems that must be owned by the government, there should

be greater reliance on the space industry to turn high-level objectives into platform design and build, taking advantage of industry's commercial innovation and rapid development techniques.

Commercial capabilities are increasingly being used by government customers, establishing a trend of relying on private sector innovation over the traditional "build-own-and-operate" approach that governments have taken in the past. SpaceX's Starlink is providing the United States Air Force with satellite communications (Capaccio 2023); RADARSAT-2 provides Canada with radar imagery products for many applications; and Intuitive Machines commercially developed the Nova-C lunar for deep space exploration (Davenport 2024). Canada should expand its use of existing commercial capabilities to take maximum advantage of Canadian innovation — especially in emerging sub-sectors where commercial capabilities are leading the way and governments have a clear role. A growing list of government responsibilities — tracking GHG emissions and the impacts of climate change, tracking crops and national food security, and protecting territorial sovereignty and national security — will rely on space capabilities designed, built and operated by private sector companies (Brukardt 2022). The private sector is increasingly leading development and operations of capabilities that used to be the sole preserve of government, adding urgency for an expanded government role in supporting commercialization of new space capabilities.

While the private sector may be leading growth in the space economy, government's role remains vital. For Canada's space innovators to be successful in global markets, both the Government of Canada and the space industrial base's distinct roles should be more closely integrated. Canada currently delivers its own space programs through departments and agencies such as the Canadian Space Agency (CSA) and the Department of National Defence (DND). However, the pace of technological innovation and global demand for space solutions means that the private sector is playing a much larger role than it did in previous decades. Government still has a vital role to play, and that will mean collaborating with the private sector. At present, Canada's policies and frameworks do not adequately reflect the changing nature of the global space economy.

Canada also has an important role to play in representing Canada's space industrial base to allies and to the world — especially regarding defence space programs. The United States sees space as vital to its future. With American defence space programs, such as the Combined Space Operations Initiative, engaging allies on expanding spaceport capability for launch and on-orbit services, increasing deep space advanced radar capability, and connecting with America's space industrial base through the Commercial Space Office (Kane 2023), the United States is committed to rapidly advancing its space capabilities to meet new threats posed by adversaries. The United States has developed a Commercial Integration Strategy that provides the concept and blueprint for connecting industry to defence priorities (US Department of Defense 2024). The US Space Force developed its own strategy specifically for Space Force capabilities (US Space Force 2024). Canada has followed suit with the creation of the Commercial Integration Cell with 7 Wing (Space) of the Royal Canadian Air Force (RCAF), where Canadian space companies can engage directly with the RCAF to share information on space capabilities and threats to better inform future developments (DND 2024a).

Greater collaboration with customers to better understand requirements *before* moving to discussion about specific platforms and contracting provides significant advantage for the capability user and the space industrial base. Early and ongoing collaboration on capability requirements will drive commercialization of new technology by providing greater clarity on emerging and future defence space requirements, allowing space companies to prioritize innovation and development efforts to meet those needs. This approach is also highly beneficial for the space industrial base in Canada because it provides an "anchor client" in the Government of Canada that allows the first development of new capabilities and provides the baseline for future innovation — whether those are for service to Canada, for international customers to grow exports or both.

To fully realize Canada's potential in space, a broader strategic vision coupled with concrete actions to support the industrial base are required.

Canada's Challenge

Canada's potential for space is currently limited by two challenges. First, Canada needs a national strategic vision that connects its broader national objectives to the capabilities and innovative potential of its space ecosystem and industrial base. And it must do so in a way that recognizes the all-

encompassing impact of space on all things important to Canada, as well as the geopolitical significance and complexity of space-related matters. Second — and further to the last point — existing space policies must connect Canada and its space industrial base to opportunities with global partners and allies, most notably, to the United States and countries in the Five Eyes alliance. In short: government and the private sector in Canada often operate separately in an increasingly competitive global market where countries that collaborate with their space industrial base will outperform those that do not.

Meanwhile, Canada's space priorities are unfortunately not articulated in a single place. There is no single strategy that connects commercial, civil and defence priorities, and existing civil and defence space priorities are not well defined beyond high-level objectives. The bigger limitation is that Canada has not fully connected the commercial sector to its space ambitions.

The 2019 *Exploration, Imagination, Innovation: A New Space Strategy for Canada* focuses on government-operated civil space programs, space exploration and related projects such as health and sustainment in space, Earth observation technologies, telecommunications, and providing targeted investments to commercial operators through research and development funding programs (Innovation, Science and Economic Development 2019). The main limitation of the document is its focus on large, government-owned-and-operated programs — mainly those delivered by the CSA — and does not provide detailed costing forecasts (although that is typical of these sort of government documents). These programs are part of Canada's space enterprise, but there is not enough emphasis on commercial companies that are developing a new generation of space capabilities — typically at a fraction of the cost of programs from decades ago (Deloitte 2023). Canada has made clear commitments to Lunar Gateway and Artemis, including on Canadarm3 (Silcoff 2024), and allocated CDN$1. billion in Budget 2023 for Canada's role in the International Space Station until 2030 (CSA 2023). These are all positive developments, but the focus of the 2019 strategy is not broad enough and does not include the range of commercial capabilities and technological innovation being developed by Canada's space innovators. The focus of the 2019 strategy is how Canada will deliver its own programs, without a whole-of-society or even a whole-of-government approach that includes commercial space capabilities alongside civil and defence capabilities.

The 2022 *Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation* provides a clear approach on how the Government of Canada will harness Earth observation in a way that is collaborative and leverages commercial and international partnerships to access data and make it available for researchers and scientific purposes (Innovation, Science and Economic Development 2022). This is a positive step to support the Earth observation sector. Nevertheless, like the 2019 strategy, the 2022 approach does not have sufficient emphasis on the commercial capabilities being provided by Canada's space industrial base, nor does it properly emphasize the breadth of what Canada's space innovators can do. The commercial sector is developing world-leading technology in Earth observation including weather and ecosystem monitoring along Canada's coast, at sea and in forests, and in Canada's North. The 2022 strategy neglects to provide a meaningful role for the private sector. Earth observation should be a priority for the Government of Canada, with greater collaboration with the space industrial base to commercialize new capabilities to protect Canadians and inform decision making. There is plenty of common ground between government, industry and academic researchers to foster greater collaboration on developing Earth observation capabilities and finding new ways to analyze and interpret data to better understand changes happening on Earth.

Canada's defence policy, *Strong, Secure, Engaged,* articulates Canada's vision for national defence. Capabilities and programs, including investing in space-based surveillance assets and attracting a strong space workforce, are all listed, and references to the threat from jamming or disruption of space-based assets are also included (DND 2017). The recently released policy, *Our North: Strong and Free*, articulates a range of space programs for continental defence modernization, command and control, and Arctic satellite ground stations (DND 2024b). However, neither document includes practical guidance on how Canada's space innovators will support the development and delivery of these capabilities, or recognizes the world-leading contributions Canada's space industrial base makes and can make to defence and national strategic capabilities.

There are many defence programs identified in both defence policies, including for the North American Aerospace Defense Command (NORAD) and continental defence modernization. A significant

challenge for all defence procurement — especially for space-related defence capabilities — is the time involved in turning concepts and program requirements into successful procurement. The Government of Canada has acknowledged this, and is seeking to make enterprise-level changes to procurement for all defence programs (Koca 2024). Without the necessary speed in defence procurement, Canada stands to pay major opportunity costs in slower delivery on key defence programs. Additionally, slowdowns risk missing expenditure targets, putting Canada even further from the two percent of GDP spending required of North Atlantic Treaty Organization (NATO) members if funding lapses for large programs that are behind schedule.

Unlike Canada, the United States, the United Kingdom and Australia have all integrated commercial, civil and defence priorities into their national space strategies — including a role for their respective space industrial bases — to deliver truly national ambitions. Unless it takes a similar approach, Canada will continue to have gaps in its space policy and vision by focusing on civil and defence programs without enough integration of the commercial sector.

There is also a need to coordinate the delivery of a strategy at the national level. The United States, for example, has a National Space Council to coordinate its space strategy, with inputs from government, industry and academia. In addition to national strategy documents, the US commitment to cabinet-level council ensures regular discussion and engagement at the decision-making level. This approach sustains momentum on executing toward strategic objectives and engages leaders on making progress on space.

In Canada, Budget 2024 committed to a National Space Council to "enable the level of collaboration required to secure Canada's future as a leader in the global space race, addressing cross-cutting issues that span commercial, civil, and defence domains" (Department of Finance Canada 2024). This is an important commitment that will promote greater collaboration across the Government of Canada on all space capabilities, including commercial capabilities. If set up properly, the National Space Council will be able to leverage Canada's space industrial base, the world-class space capabilities it delivers and the highly talented and educated Canadian workforce with a track record of delivering these innovative capabilities. Including commercial capabilities in Canada's visions for space will be a massive step forward for keeping pace with what Canada's allies and partners are doing to manage their space enterprises.

What Are Canada's Allies Doing?

Canada's allies have all sought to integrate their space industrial bases into their national visions in their own ways. This is important because it shows that similar nations have all determined that there is a need to connect commercial, civil and defence priorities into a single vision for how government will enable their domestic space industrial bases and leverage innovation, research and international partnerships.

Australia has both a national civil space strategy to cover all civilian use of space and a national defence strategy. Australia's civil strategy takes an international perspective, seeking to leverage foreign investment and partnerships, fostering the acceleration of space capabilities across all sub-sectors of space and aligning government regulations and structures for that purpose. (Australian Space Agency 2019). Australia's defence space strategy focuses on core defence missions, such as enabling the Australian Defence Force to operate in contested environments and deliver on whole-of-government defence and security missions alone or with allies. It also emphasizes the need for a sustainable national space enterprise, which includes setting priorities for national space capabilities and collaborating across government and with the space industry to build and sustain those capabilities (Australian Department of Defence 2022). Australia has integrated industry into both its civil and defence space strategies, and each strategy aspires to develop the space industrial base as a tool of national power — economic, industrial and military.

The United Kingdom has developed a national space strategy that includes civil, commercial and defence components. The United Kingdom's strategy seeks to build its space industrial base and the scientific and research base that enables it; participate in space exploration missions to the Moon and Mars; and build key defence capabilities (Government of the United Kingdom 2022). Crucially, it identifies the importance of the role of the space industrial base. The strategy identifies key strengths in space that the United Kingdom will sustain into the future and presents

high-growth sub-sectors of the space economy, including emerging sub-sectors (ibid.). The policy vision presented by the United Kingdom connects the space industrial base to the national vision, and clearly articulates how the United Kingdom will support growth in existing sub-sectors and build the competitive potential of emerging sub-sectors.

The United States developed a National Space Policy in 2020 that articulates the US role in space. This policy — the result of many iterations and updates to individual policies — was developed after the re-activation of the National Space Council in 2017 by the Trump administration. The US National Space Council has bipartisan support and was continued into the Biden administration. To realize the policy's objectives, the United States explicitly commits itself to global leadership on space-related science and technology; to strengthening its space industrial base; expanding domestic launch capabilities for security over payloads; protecting critical infrastructure and space-based positioning, navigation and timing; and developing the human capital for space (The White House 2020). America's space policy clearly recognizes the need for a robust commercial space industry to meet the objectives of the federal, state and local governments, and to expand space exports to the world (ibid.). The American strategy presents a clear acknowledgement that space is a vital component of its national strategic capability, and that ongoing support across the space industrial base — including developing and fostering the best talent base possible — is essential to maintaining that capability.

Australia, the United Kingdom and the United States all recognize the importance of their respective space industrial bases as key elements of their national capability that need to be integrated into a strategic vision. Each national strategy recognizes that government has an exclusive role in setting policy and objectives, and provides the necessary tools and frameworks to realize that vision. They all present a vision for space that includes commercial, civil and defence needs, and clearly states the importance of supporting and integrating the space industrial base into that vision. These policies respect the different roles of government and industry, and seek to connect policy objectives and the innovation of the private sector for maximum national benefit. Governments have responsibility for legislation and regulatory frameworks, and these tend to be internally focused. It often takes a conscious, deliberate and sustained effort to advance externally focused policies. The three countries' approaches to space have done just that, and Canada should follow suit. Australia, the United Kingdom and United States are deepening their defence collaboration through the AUKUS security pact, and Canada has not been included in this arrangement with its longest-standing allies. Making strong investments in defence space capabilities will show Canada's allies that it is committed to contributing to coalition readiness and deterrence, while moving Canada closer to the two percent of GDP per capita spending that is the standard for NATO members. A strong and sustained commitment to delivering space capabilities could also help re-open the potential of Canada becoming part of AUKUS.

Recommendations

To claim its place in the growing global space economy, Canada should set up and operationalize the National Space Council as a central function to connect civil, defence and commercial capabilities; develop a national vision and a commercial strategy for space that includes the private sector; and expand collaboration on space with global partners and allies.

Stand Up and Operationalize the National Space Council for Success

The commitment to the creation of a National Space Council is a major step forward in enabling Canada to consider space holistically and maximizing the country's potential. The CSA is taking a leadership role in coordinating deputy minister, assistant deputy ministers and agency vice presidents across more than 20 departments and agencies.[1] This is a positive move in the right direction. However, to coordinate policy and vision at the strategic level, a ministerial-level forum for engagement is essential as it will enable decision making on Canada's space policy and have the authority to make cross-cutting policy decisions for Canada.

Operationalizing the National Space Council at the ministerial level in Canada would enable decision making on strategy and policy to provide the necessary clarity on how Canada will proceed. It will also make engagement with the private sector, academia and researchers easier, by providing a forum where strategic-level issues can be

1 See www.asc-csa.gc.ca/eng/sustainability/national-space-council.asp.

considered by decision makers. This approach will benefit the entire space ecosystem in Canada.

Develop a National Vision and Commercial Strategy for Space

Canada has an opportunity to set a clear strategic vision that presents national aspirations for space by mapping out how civil, defence and commercial space capabilities and investments can contribute to that vision. The vision should include clear priorities for what Canada intends to do in these sectors as branches of one vision.

In addition to articulating its vision for Canada's role in space, the private sector should be more directly engaged in discussing the operational and emerging capabilities that can help Canada realize this vision. Through dialogue on its objectives and capabilities, Canada can get the most out of the private sector and contribute to accelerating the commercialization of new capabilities. Canada's closest allies have articulated strategies taking this approach. Similarly, Canada's space industrial base should be integrated into a similar national Canadian strategy.

Expand Collaboration with Global Partners and Allies

Canada should identify key areas for collaboration in space with its defence and national security partners around the world. Canada's partners have ambitious plans for growing their defence enterprise, and doing so in collaboration with countries with shared security interests and values. Canada is part of NORAD, NATO and the Five Eyes, all of which rely heavily on space capabilities for ongoing operations and deterrence. The United States is engaging with its allies and partners around the world to build a network of partnerships for space (The White House 2021). This includes existing partnerships outside of the traditional NORAD, Five Eyes and AUKUS as well as expanding partnerships to include Japan and Norway as part of America's global partnership network (The White House 2023).

Through collaboration on space with its national security partners, Canada has an opportunity to expand its contribution to global peace and security, increase innovation, grow exports and deepen existing national security partnerships by identifying where Canada's space industrial base can support the needs of allies. By engaging with defence and national security partners on space, Canada can make meaningful contributions to NORAD, the Five Eyes and NATO, as well as take important steps to working with other partners. Additionally, an enhanced contribution to collective defence could put Canada on the pathway to discussions about a future role in an expanded AUKUS.

Conclusion

Canada's space industrial base has immense potential, with Canadian companies delivering world-class capabilities for commercial, civil and defence purposes, in a time of immense growth and competition. To sustain and expand its place in space, Canada should adopt a whole-of-country — or at least a whole-of-government — approach by developing an ambitious national strategic vision, articulating clear roles and objectives for the space industrial base and creating policies and programs to enable the space industrial base to contribute to these objectives. Not only would this put Canada on par with many of its allies, it would also allow Canada to leverage space as a true element of its national capability.

Canada risks falling behind in the global space economy if government and industry continue to operate as largely separate actors, and if Canada is not further embedded in the collective space-related programs of its allies. Canada cannot afford to imagine its future in space based on its previous space-related accomplishments alone. The importance of the role space capabilities play in observing our planet and the universe, sustaining our economic prosperity, improving our standard of living, and defending our sovereignty and securing our national interests requires space to be a societal priority. Space capabilities consistently improve the lives of people on Earth by expanding communications capacity, providing governments and civil society with detailed sensing data, enabling national defence and furthering greater exploration and understanding of the universe. The future of space will be competitive, and Canada needs to commit more fully to a comprehensive vision for space.

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