

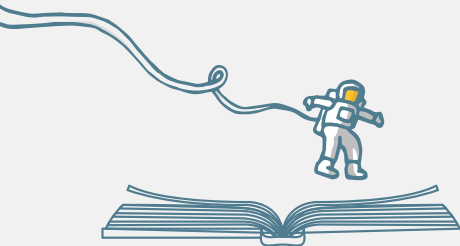
Charting Our Own Course

Launching Canada's space future



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CONTENTS

Introduction	1
A new framework for a new space age	2
Priorities for Canada's future space framework	5
Leveraging economic opportunities	5
Exploring and using space resources	9
Managing orbital debris	12
Fostering multilateralism and rules-setting	14
Engaging Canadians in space strategy	15
Conclusion	19

A satellite in space, featuring a large yellow solar panel and a blue and silver body, with Earth's blue and white clouds visible in the background.

About this paper

Prompted by the Canadian Space Agency's (CSA) call for Canadians to share their visions for Canada's future in space, Springboard Policy and Vass Bednar convened a group of public policy and technology professionals from across Canada in fall 2020. This discussion paper reflects the key themes of those discussions and highlights key issues that should be at the core of a framework for Canada's space future.

Given the collective nature of the submission, the perspectives here do not necessarily represent the individual views of all contributors but are important ideas that we believe should be considered in Canada's space policy agenda.

We believe that Canada's space policy matters for our future prosperity. As Canada's past successes have shown, if we channel efforts effectively then space exploration can improve the well-being of Canadians and Canadians can improve the future of space exploration for all.

INTRODUCTION

If Canada's future includes a role in space — and it should — then we need to expand the conversation beyond the narrow group of industry players and experts that typically participate today.

In fall 2020, the Canadian Space Agency (CSA) launched a consultation to broadly inform Canada's future approach to space exploration. The consultation comes at a critical time, with new opportunities and challenges on the horizon. Space exploration is pushing forward in a way not seen since the space race. Recently, Canada made significant commitments related to space, including signing the Artemis Accords and announcing plans for a series of joint lunar missions with the US, setting Canada up to be the second country to have an astronaut orbit the moon. But these commitments and other developments leave questions about how space will be governed, what role Canada will play, and how to ensure space's potential is realized in a way that serves Canadians and humanity at large.

In 2019, the Government of Canada introduced a new national Space Strategy. The strategy articulates a broad picture of the implications of space exploration for life on Earth and is grounded in clear principles. It has a short time horizon compared to the work of space exploration, looking back at existing policy commitments as much as it looks forward. Despite the ambition reflected in this strategy, Canada's level of funding for space activities remains at a fraction of our peers'. To rise to the occasion we need a broader, long-term framework that can mobilize all corners of Canadian society and guide our future exploration in space.

Canada must approach these opportunities with a clear agenda that advances both Canadian values and our strategic interests. That agenda should engage Canadians from all sectors and parts of the country. If Canada's future includes a role in space — and it should — then we need to expand the conversation beyond the narrow group of industry players and experts that typically participate today.

A NEW FRAMEWORK FOR A NEW SPACE AGE

Governments around the world are once more turning their attention beyond Earth's orbit, but this time the spacescape looks different.

- > Technological advancements mean an array of **new activities are possible**, with scientific, commercial, and military applications. We are venturing further and deploying new technologies, such as low-Earth orbit (LEO) satellites.
- > There are now a **diverse range of state and non-state actors** active in space. The first space race started with two countries. Now, there are many spacefaring nations around the world. Private sector actors controlled by some of the richest people on the planet are playing an increased role driving, rather than supporting, space exploration activities.
- > Technological evolution means **more is at stake**. Space touches the lives of Canadians 20 to 30 times a day. Satellites now underpin the world economy, making renewed testing of anti-satellite weapons an increased concern. The prospect of interplanetary travel makes resource extraction or colonization a distinct possibility instead of an academic issue.

Existing space policy is not equipped to navigate these changes. If advancements in technology have followed the exponential path of Moore's law, the policy and institutions to govern space have followed the more glacial path of, well, regular law.



This gap has created significant ambiguity, which at best undermines progress and at worst could fuel hostility. States and companies have differing motivations for their future activities. This could challenge efforts to cultivate space as a realm for international cooperation, rather than competition and confrontation. There are also different interpretations and disagreements over the designation of outer space as a “global commons” to be used for “peaceful purposes” and for the “benefit and interests of all countries” under the 1967 Outer Space Treaty (OST).

Space policies need to be updated to address these challenges and competing interests. The recent *Artemis Accords* reinforce and update some principles of existing treaties. But they also open a new avenue to bilateral agreements, which undermines the salience of and commitment to existing multilateral treaties and institutions. Upcoming missions include partnerships with private firms who are in some cases vocally and explicitly opposed to the values espoused in the *Artemis Accords* and previous bodies of international law.

This is a critical moment for Canada to adopt a renewed framework for space governance and build on the competitive advantages of our world-class aerospace capabilities. The benefits will not just be in terms of jobs or other economic impacts (e.g. reliance on satellite internet, relevance for life sciences). There is also an opportunity for Canada to demonstrate leadership and contribute to a renewed rules-based multilateral order, leveraging our position in the international community and building on our long history as a spacefaring nation.



It is essential that Canada ensures future frameworks address space as both a strategic national asset and shared global commons, with consideration for safety, sustainability, and fairness and equity.

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We have identified a few of the critical and interrelated issue areas that Canada should consider in developing a framework for our future engagements in space:

- > leveraging economic opportunities,
- > exploring and using space resources,
- > managing orbital debris,
- > fostering multilateralism and rules-setting, and
- > engaging Canadians in space strategy.

This discussion paper outlines each of these issue areas and highlights policy considerations and potential actions for each.

PRIORITIES FOR CANADA'S FUTURE SPACE FRAMEWORK

Leveraging economic opportunities

About the issue

Outer space is emerging as a promising area for commerce — from satellites, to launch services, to mining, and even tourism — with the global space industry expected to surge in value over the next twenty years. Private actors are keen to capitalize on these economic opportunities, with large firms particularly well-positioned to finance space activities.

Other countries have responded with new legal and regulatory frameworks to enable commercial space activities, including the US Commercial Space Launch Competitiveness Act of 2015 and Luxembourg's Law of July 20th 2017 on the exploration and use of space resources.

Canada has an opportunity to grow the economy and create jobs through the commercial space sector. Our recent *Space Strategy* focuses on strengthening space commerce including by creating a modern regulatory framework for private space activities, cementing and expanding international partnerships, starting up and scaling up space firms, and partnering with industry to make investments.

Policy considerations

CULTIVATING A COMPETITIVE ENVIRONMENT FOR CANADIAN BUSINESSES

Competition is critical for ensuring that innovative and affordable space technologies are available to both Canadian industry and government. Many of the large firms dominating the space sector thus far are not Canadian businesses. The majority of Canadian space firms are small and medium sized enterprises (SMEs). High capital costs and risks associated with space activities pose significant barriers to entry, making it more difficult for new firms to enter the sector, even with the support of programs like the Space Technology Development Program and Lunar Exploration Accelerator Program and initiatives like the Creative Destruction Lab's space stream.

Given these characteristics of the sector, it is critical that Canadian policy makers and regulators protect competition in this sector through vigorous enforcement of modernized competition law. Preventing mergers that neutralize potential competitors will help ensure that innovative technologies, particularly those that were developed using public funds, make it to market and are not acquired and then shelved. Ensuring competition in the sector will also give start-ups and smaller businesses a fair shot at bringing innovative products to market without being shut out or abused by dominant firms that wield excessive market power, a trend some commentators and investors call the "kill zone". Healthy competition will also ensure that new technologies have fair prices and can be accessed by governments through a variety of vendors.

ENSURING THE EQUITABLE DISTRIBUTION OF BENEFITS

The commercialization of space has the potential to generate wealth and create jobs, and could present unique opportunities for smaller communities. Yet, it remains to be seen who will substantially benefit from these economic gains. The current economics of space activities privilege industry dominance by ultra-wealthy companies and individuals such as Amazon's Jeff Bezos and Tesla's Elon Musk, concentrating benefits and expanding wealth inequality.

Direct economic benefits from space commerce may predominantly accrue to wealthy countries that have had greater opportunity to become early adopters. Under the OST the exploration and use of outer space is meant to be for the benefit of all states, with particular attention given to developing countries. With this in mind, Canada has an obligation to ensure that there is an equitable distribution of benefits from commercial space activities.

PROMOTING SUSTAINABLE AND HEALTHY COMMERCIAL ACTIVITIES

The expansion of the space industry may have negative environmental and health impacts on Earth. For instance, launch emissions may contribute to ozone depletion and release toxic chemicals that can persist in surface water and soil. The rise of commercial private entities in the space sector further complicates this risk, with multinational ownership structures frustrating accountability and enforcement. To be effective, regulatory frameworks and international enforcement mechanisms must be in place *before* the coming expansion of commercial space activity. Any regulatory lag that sees an attempt to respond to "facts in orbit" will be far less likely to succeed.

Potential actions

> **Modernizing competition policy:**

As the Canadian space sector grows, both policy makers and competition regulators must carefully consider how they plan to promote and foster competition in the sector. The US's and EU's current antitrust struggles with the world's largest digital firms offer us a glimpse of what could occur if we do not act to prevent the largest space companies from becoming excessively dominant. To protect competition in the space sector, and other sectors, policy makers must modernize Canada's competition policy as a tool to maintain a healthy, innovative market. This could include revisions of the Competition Act and greater resources to enforce it. Potential changes could include removing the efficiencies defense for mergers, which permits mergers that will harm competition if they lead to sufficient cost savings, like layoffs. To set the agenda for space competition policy, the Competition Bureau should host a "space enforcement summit" to engage with industry and other enforcement agencies to explore competition issues that are specific to the space sector and develop solutions to these challenges.

> **Regulatory capacity and innovation:**

While Canada and other spacefaring nations have general environmental and health regulations in place, the past decade has highlighted the risk of regulatory gaps when technology development outpaces policy development. With space technology in particular, specialized technical capacity is needed to craft appropriate technology responses. In anticipation of an expansion of commercial space activities, the CSA should work with federal departments as well as provincial governments to offer technical capacity to support their policy making and regulatory approaches to space technologies and activities. Given that these challenges affect the global commons, Canada should also support international cooperation in pursuit of best practices and standardization in regulatory approaches.

To be effective, regulatory frameworks and international enforcement mechanisms must be in place before the coming expansion of commercial space activity. Any regulatory lag that sees an attempt to respond to "facts in orbit" will be far less likely to succeed.



Recent enactment of unilateral and bilateral governance mechanisms for commercial space mining can be interpreted as efforts to respond to — or exploit — legal ambiguity.

Exploring and using space resources

About the issue

One area of potential commercial activity in outer space has generated particular controversy: the exploration and use of outer space resources or “space mining”. Although space mining is not yet commercially viable, private companies and national governments have noted the economic opportunities of exploiting resources from space bodies. Water, minerals, and other resources extracted from the moon or asteroids could fuel activities on Earth or be used in place for space activities.

Countries are beginning to develop legal and regulatory instruments to allow private companies within their jurisdiction to claim, extract, use, and sell space resources. For instance, both the US and Luxembourg have enacted national legislation that gives private actors the right to own space resources. In 2020, the US explicitly rejected the designation of space as a global commons under an Executive Order.

Canada is also beginning to support commercial exploitation of outer space resources. Mining is considered in our *Space Strategy’s* proposal to develop a modern regulatory framework for private activity. Canada has also recently signed the *Artemis Accords*, which have a particular focus on the prospect of resource exploration and extraction.

Policy considerations

ADDRESSING DISAGREEMENT AND UNCOORDINATED APPROACHES TO SPACE MINING

The legality of space mining activities remains contested. Although the OST prohibits national appropriation of outer space “by claim of sovereignty, by means of use or occupation, or by any other means”, there is ambiguity and uncertainty as to the legal right to recover and use space resources, including for commercial actors. Recent enactment of unilateral and bilateral governance mechanisms for commercial space mining can be interpreted as efforts to respond to — or exploit — legal ambiguity.

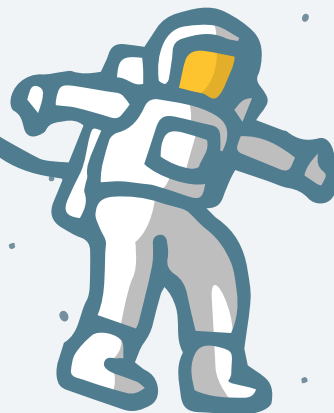
By signing the Artemis Accords, Canada may be seen as challenging a long-standing consensus that any exploration and extraction of space resources would need to occur under an international agreement. Governance systems for such agreement are in place for other global commons beyond sovereign jurisdiction such as Antarctica. These international institutional arrangements promote common interests, minimize conflicts, and ensure transparency. By contrast, national governance could risk a race to the bottom and states offering "flags of convenience."

International agreement on the legality and conditions of space mining, in combination with a coordinated approach to regulation and enforcement mechanisms, will need to be in place *before* space mining is realized. This regime should also ensure that any resource exploration and use be for the benefit of all people, not only commercial actors or residents of the home countries of those commercial actors. Fairness considerations should also consider equity for future generations.

PROMOTING SUSTAINABILITY OF SPACE RESOURCE EXTRACTION AND USE

Actions in space need to be compatible with long-term sustainability so that the outer space environment can be preserved for and equitably accessed by present and future generations. Using space resources can soften the environmental impact of space activities on Earth. But resources in outer space are exhaustible too.

The proposed "safety zones" under the *Artemis Accords* may grant commercial actors the benefits of resource exploitation without the long-term obligation of stewardship, mirroring similar issues on Earth such as "orphan" oil wells. If space mining occurs it needs to be carried out in a way that prevents over-exploitation and ensures accountability for any negative environmental impacts. Implementing sustainability mechanisms such as restrictions on resource development prior to the realization of space mining may be useful for preventing the environmental and resource scarcity challenges being experienced on Earth today.



PROTECTING SCIENTIFIC EVIDENCE AND HERITAGE

Expansive and loosely regulated commercial space mining could also result in the loss of valuable scientific data. Similarly, asteroids, the moon, and other celestial bodies may serve important natural, cultural, and historical heritage functions (e.g. the first moon landing site) and support other commercial opportunities such as space tourism. The exploitation of space resources needs to be balanced with the needs of scientific research; natural, cultural, and historic heritage; and other potential space activities.

DEVELOPING SAFE SPACE MINING PRACTICES

The poor regulation of space mining could threaten safety both in outer space and on Earth. In addition to the potential for the abandonment of equipment, space mining could create debris that could damage other space activities. This is a particular concern for potential asteroid mining as asteroids have a limited gravitational pull and may pass close to Earth. Additionally, mining asteroids could change their trajectory and create potential risks of an Earth impact emergency.

Potential actions

› **Lead the adoption of a multilateral treaty on space resources:**

Canada should make it a diplomatic priority to clarify a rules-based international regime on outer space resource exploration and use and build the necessary institutional capacity to enforce a regime that aligns with Canadian priorities and values. Canada is well positioned to lead the negotiation of such a treaty given its long history of multilateralism and previous leadership on global issues from UN peacekeeping to the *Law of the Sea*.

› **Support the development of complementary international governance mechanisms:**

Canada should advocate for international governance mechanisms that mirror approaches to mining in other global commons. This would help minimize the risk of potential conflicts and mitigate potential negative safety and sustainability externalities. This international governance regime should ensure legal accountability for any damages from space mining regardless of corporate reorganizations or changes affecting states.

- > **Encourage significance assessments of natural, cultural, and historical heritage sites in space:**
To balance competing uses of outer space resources and preserve important heritage sites, Canada should encourage the implementation of standardized significance assessments that are both publicly available and enacted prior to resource development.
- > **Establish protocols for the collection of scientific samples:**
To prevent the loss of valuable scientific data, Canada should support the establishment of standardized protocols for collection and sharing of samples prior to extraction.

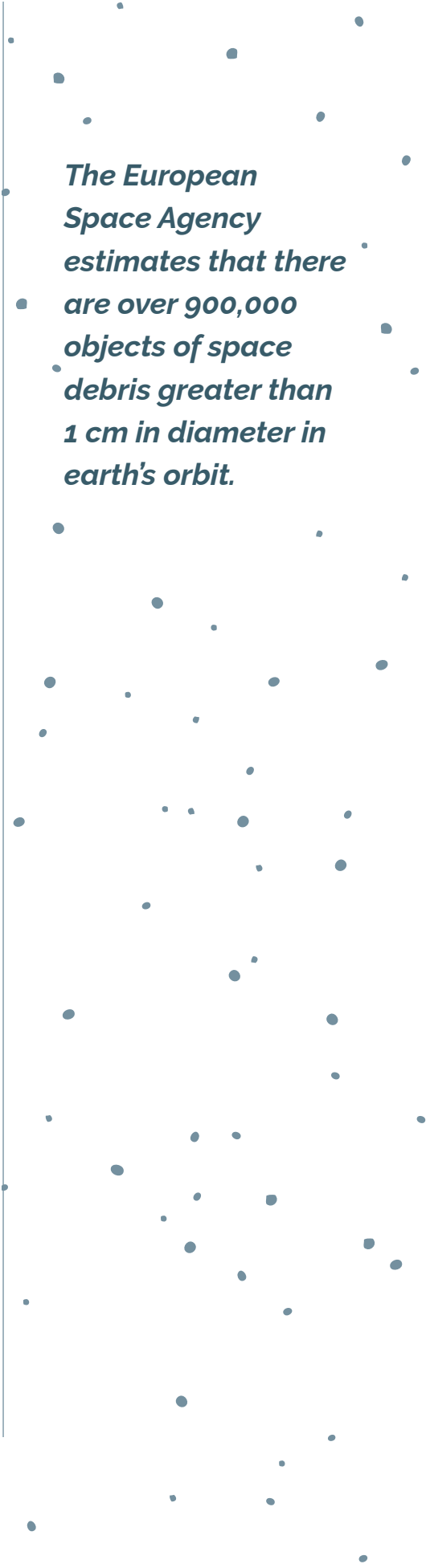
Managing orbital debris

About the issue

As more actors — both private and public — increase their activity in outer space, orbital debris or “space junk” is becoming a pressing safety and sustainability issue. Emerging activities such as space mining and the return of anti-satellite weapons have the potential to drastically increase the already critical buildup of debris.

This debris is forming an increasingly dense and uncontrollable halo around Earth that threatens our ability to operate in and exit the near-Earth orbit. Collisions between pieces of debris create even more junk, with the potential for even small pieces to generate destructive impacts. The European Space Agency estimates that there are over 900,000 objects of space debris greater than 1 cm in diameter in earth’s orbit. Further, while most orbital debris will burn up upon re-entry, some will not. This material could be dangerous and it may be difficult to predict where it will land and who is accountable for any harm caused both in space and on Earth.

While we work out who has rights to use space, we also need to figure out what responsibilities accompany those rights, including accountability for orbital debris. Canada and other countries are beginning to address the unmitigated proliferation of “space junk”



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including through the *IDAC Space Debris Mitigation Guidelines* and *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*. The *Artemis Accords* also commits signatories to planning for the safe disposal of debris. This is an area where Canada has previously shown leadership in developing shared global guidelines, but where significant risks and uncertainties remain.

Policy considerations

STRENGTHENING GOVERNANCE OF AND ACCOUNTABILITY FOR SPACE DEBRIS

Current commitments and guidelines for minimizing space debris mainly rely on goodwill and do not place an obligation on nations or private companies to limit or clean up any “space junk” that they produce. There are no financial incentives to promote adoption of responsible practices nor cost-effective means that governments and companies can adopt to remove debris. The risks are already global in nature and without intervention the issue will only grow exponentially as more actors enter the fore.

Potential actions

- **Develop binding national and international legal instruments:**
Canada should develop national rules and advocate for a complementary international agreement that places an obligation on actors to minimize and clean up any “space junk”, and provide compensation and assistance for any harms from remaining debris both in outer space and on Earth, with fines or sanctions for non-compliance.
- **Create common standards for space technologies:**
Canada should become a leader in the creation of standards that minimize the risk of orbital debris, such as high reliability rates for technologies. Adoption of these standards could be encouraged by using launch facilities and ground stations as regulatory gateways and/or through scaling insurance premiums for the space industry.

> **Encourage accurate and shared information systems:**

Canada should work to improve the accuracy of space junk identification and tracking, and promote information sharing to reduce the risk of collisions, establish more efficient carrying capacity of orbits, and quantify the impact of debris.

> **Establish an international fund:**

Canada should advocate for the creation of an international fund to finance active debris removal, such as through a vacancy tax on the unusable space orbital debris occupies.

Fostering multilateralism and rules-setting

About the issue

Many of the emerging rules for outer space exploration and use are being developed and promoted outside of the traditional channels of international law. Increasingly, the legal space is being shaped by corporations, individual states, and coalitions of select countries. For instance, the development of the *Artemis Accords* was led by the US and took shape outside of international discussions. This lack of universal international agreement and action on updates to space policies and laws mirrors the trend of declining multilateralism in other areas.

Policy considerations

DISCOURAGING FRAGMENTED AND OPPOSITIONAL SPACE GOVERNANCE

The continued unilateral and bilateral governance plays by individual or blocs of states could lead to fragmented policies, procedures, and rules. This fragmentation may lead to decreased cooperation, heightened arms races between opposing world powers, and reduced oversight for other negative externalities of space activities.

PROMOTING FAIRNESS IN RULES-SETTING

It is certainly easiest to build-consensus around a smaller group of like-minded nations. But bilateral approaches can establish practice and codify elements of space law without appropriate input and agreement from all nations. A lack of engagement with other countries, including those that do not have large enough government budgets or tech companies to act on their own, could lead to unfairness and inequality in the creation of modernized space frameworks.

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Potential actions

- › **Lead and secure multilateral negotiations and international rules-setting:**
Canada should make the establishment of strong agreement on a shared framework for the future of space governance a diplomatic priority. As a middle power with experience in space, Canada is well positioned to reduce tensions and promote a return to multilateral and rules-based international space governance. Canada has played a constructive role in facilitating multilateral approaches, for example through the United Nations Committee on the Peaceful Uses of Outer Space. To further its long history of promoting international fairness, Canada needs to ensure that all countries — from major spacefaring nations to those not presently able to operate in space — have equitable participation in negotiation and rules-setting.

Engaging Canadians in space strategy

About the issue

Broad and deep engagement with the Canadian public, particularly youth, is needed to build national pride in our achievements, generate the political capital required to resource our space agenda, develop a steady pipeline of qualified personnel to sustain and expand our innovation industries, position our nation as a leader in space, and to ensure we are accountable to future generations of Canadians.

Recently, Canada has begun to increase public engagement in our outer space efforts, particularly targeted at inspiring the next generation. For instance, under Canada's new *Space Strategy*, CSA will be launching a Junior Astronauts initiative and school visits by astronauts and other inspiring speakers. But today discussions remain targeted to a narrow group of stakeholders from the aerospace sector, with minimal transparency or engagement. For example, the independent reports that review the Remote Sensing Space Systems Act (which governs Canadian satellite activity) are available only by email request.

We need to provide ongoing opportunities in the development and oversight of Canada's space policy framework for the general public, particularly youth.

Policy considerations

INCREASING GENERAL AWARENESS AND INTEREST

While space does have the potential to inspire Canadians to pursue science and technological advancement, many are not aware of Canada's space activities and are unsure of the concrete benefits. There remains a disconnect between the actual value and impacts of space activities and perception of those benefits by the general public. To generate interest, we need to make Canadians more aware of Canada's space program and how technologies they use in their everyday lives are attached to or are a result of our discoveries and actions in space.

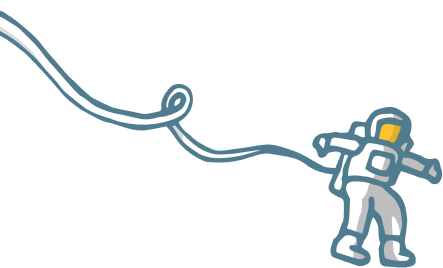
CREATING OPPORTUNITIES TO INFLUENCE SPACE POLICY

While consultations, such as CSA's present outreach to Canadians to share their vision for space, are important actions, Canadians need more consistent, dynamic, and sustained engagement. We need to provide ongoing opportunities in the development and oversight of Canada's space policy framework for the general public, particularly youth . Diversity of voices, including space startups and established players as well as other sectors and ordinary residents are essential for policy that is responsive to Canadian strengths, opportunities, and needs.

Potential actions

> **Create standing committees in the House of Commons and Senate dedicated to Canada's future in space:**

The significance and long-term nature of Canada's space future call for sustained and cooperative engagement by parliamentarians from all parties both to hold the government to account and to help craft a long-term vision. Today, space exploration and related issues fall under the purview of House and Senate committees with overly broad mandates (Industry, Science, and Technology in the House, and Social Affairs, Science, and Technology in the Senate). Given their many responsibilities, neither chamber saw any dedicated consideration of Canada's space strategy in the 42nd parliament (between 2015-2019). Dedicated standing committees focused





on space in each chamber could ensure appropriate focus and oversight. The lack of political attention to the space program, compared to other nations where agencies report directly to the head of government, has been pointed to as a reason for Canada's lower levels of investment and ambition.

› **Use deliberative democracy approaches to engage citizens in Canada's space future:**

The use of Citizens' Assemblies and reference panels are innovative approaches to bring residents into decision making to inform policy choices. Canadians have pioneered these approaches, including through Citizens' Assemblies on Electoral Reform in the 2000s, and they have since become a much more established practice both in Canada and elsewhere. Using civic lottery approaches to bring ordinary residents into shaping decisions on Canada's space future can help to build buy-in and ensure that priorities reflect the interests of all Canadians, not only current stakeholders.

› **Build a space diplomacy stream in Canada's foreign service:**

In recent years, our neighbours have famously developed military branches dedicated to space. But the issues highlighted in this discussion paper make clear that what is needed to advance Canadian and global priorities in space are effective institution building and diplomatic approaches tailored to the global goal of space exploration. A space diplomacy stream in the foreign service could build Canadian capacity to lead in the development of global institutions.

A background image of a starry night sky. In the lower-left quadrant, there is a nebula with soft, glowing clouds of pink and purple. The rest of the sky is filled with numerous stars of varying brightness and colors, including white, yellow, and blue.

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CONCLUSION

We are entering a new era of space exploration. New opportunities are on the horizon — from commercial space activities to scientific missions deeper in space than we have ever traveled before. Different actors have entered the fore with an increasing number of spacefaring nations and private sector actors.

Space has the potential to improve the lives of Canadians. Activities in this sector may create jobs, generate wealth, and deliver scientific advancements that enhance well-being. But there are obstacles to realizing these benefits. A number of issues remain, that if left unaddressed, stand in the way of ensuring that the future of space exploration is safe, sustainable, and fair and equitable:

- › While space holds real promise as a commercial sector, there are challenges to promoting a competitive environment for Canadian businesses and ensuring that benefits accrue broadly throughout society.
- › Activities such as mining are becoming a realistic possibility but disagreement and a lack of coordination abounds, compromising security and the long-term sustainability of outer space.
- › As activity increases, we also risk leaving behind large amounts of orbital debris that threaten safety both on Earth and in space.
- › Fragmented approaches and tensions are rising as traditional channels of international law are passed over for unilateral and bilateral action.

An urgent update to space policies is needed to address these issues. It is critical that Canada adopt a long-term framework for space and lead the renewal of a rules-based multilateral order that both advances our strategic interests and recognizes space as a shared global commons. To do so, we need to expand the discussion beyond the narrow group of players that typically participate today. This includes providing Canadians with opportunities to share their views, particularly youth for whom our actions today will shape the universe they inherit.

While many uncertainties abound, one thing is clear. Now is the time to chart our own course and launch Canada's future in space.

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