

Space Cooperation: Will Canada Dare to Take the Lead?

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Summary

Canada must intensify its international cooperation in outer space to remain competitive and relevant in the global arena. This strategic note explores Canada's current shortcomings in this area and proposes recommendations for improving its capabilities and influence, including (and especially) by positioning itself as a pioneer in the use of today's artificial intelligence (AI) in space activities.

With the help of its expertise in the creation and exploitation of AI, Canada has the opportunity to strengthen its international partnerships, invest in research and development, and adopt a multidisciplinary approach. In this new paradigm of access to space, Canada can consolidate its position as a leader in the exploration and exploitation of space.

Introduction

Improving Canada's international cooperation in the field of outer space, with particular emphasis on the use of artificial intelligence (AI), is crucial to strengthening its position on the world stage. Canada has made several notable contributions in this field, notably with the famous Canadarm, used in space missions since the 1980s, and the design of [Canadarm3, scheduled for 2024-2025, which will play a key role in the Lunar Gateway space station](#), the figurehead of tomorrow's space exploration. Canada's contribution to the James Webb Space Telescope, or to research using it such as the [Fine Guidance Sensor \(FGS\) or the Near-Infrared Imager and Slitless Spectrograph \(NIRISS\)](#) also illustrates its advanced technological capabilities. In addition, the [NEOSSat](#) mission, a space telescope dedicated to monitoring near-Earth objects, demonstrates Canada's commitment to space observation.

The bottom line is simple: Canada has everything it takes to position itself as a leading nation in space exploration and exploitation. However, in this quest, it needs to rely more on a multilateral approach, rather than the unilateral or bilateral partnerships that currently predominate. Instead of seeking to position itself as a global leader in all aspects of space exploration, Canada can capitalize on its specific strengths, such as artificial intelligence, to become a reference partner in these precise, carefully chosen fields. By excelling in these fields of expertise, Canada would then stand out in international collaborations and become a key player, without necessarily assuming the role of total leader. It should be noted that this decision to specialize requires rigorous resource management and a sustained commitment to maintaining this strategic position. Although potentially risky, such a targeted strategy could enable Canada to maximize its influence and competitiveness on a global scale.

However, despite its technical achievements, Canada remains largely dependent on NASA for most of its space activities, in the light of the ISS or the future [Lunar Gateway](#). This dependence limits Canada's autonomy, and often positions it in [the role of contributor rather than leader](#). Insufficient funding for Canadian space activities, compared to other [OECD countries \(ranking 22nd in 2021\)](#), hinders the full development of new technologies and initiatives. Thus, the lack of a [clear, coherent and independent long-term national strategy](#) prevents Canada from maximizing its potential in this field. One of the reasons for this dependence is limited financial resources. Although these partnerships strengthen Canada's position, they confine it to a role of secondary contributor. This short-term vision and the absence of solid partnerships with emerging nations (India, China, UAE among others) limit opportunities for collaboration and innovation.

To bridge these gaps, [Canada can fully leverage its AI capabilities](#) to strengthen its contributions and partnerships in international space missions. Canada has already begun to integrate these technologies, notably in the development of the Lunar Gateway space station, but must continue and intensify its efforts. Developing additional strategic partnerships with emerging nations and other key players in the space sector is essential if Canada is to position itself as a key expert and leader in these fields.

In short, by focusing on technological innovation (particularly AI) and strengthening its international collaborations, Canada can bridge its gaps and secure its place in global space exploration. This strategy would enable Canada to play a central role in future space missions, and ensure its international competitiveness. This strategic note will focus on three themes: Canada's current shortcomings, AI as a key asset, and four recommendations to establish Canada as a leader.

Canada's shortcomings in space exploration

Canadian government funding for space activities is well below that of many other OECD countries. In [2022-2023](#), the Canadian Space Agency's (CSA) budget was C\$329.9 million, with projections of a drop to C\$300.5 million in 2023-2024 and C\$252.5 million in [2024-2025](#). As a percentage of gross domestic product (GDP), Canada's space budget [ranks 22nd among OECD nations](#). By way of comparison, investments as a proportion of GDP by countries such as the United States, [France or Germany, and even some smaller countries](#) in terms of economic size, far outstrip Canada's financial contributions to its space program. This low percentage highlights Canada's competitive gap with

nations that invest more heavily and show greater ambition. The Minister of Industry also acknowledges that the funding strategy ensures that “[telecommunications services are reliable, innovative, competitive and, above all, affordable](#)”: a somewhat dissonant phrase in view of the ever-decreasing funding allocated to the CSA. In reality, this undisguised orientation reveals the government's limited ambition for the space sector. The consequences could have long-term implications for Canada's position on the international stage.

As a result, this budgetary weakness limits Canada's ability to develop and deploy advanced space technologies independently. This, in turn, reduces the country's potential impact on international space missions. Insufficient investment hinders innovation and the adoption of new technologies, such as AI for space exploration, and hampers Canada's international competitiveness against nations that are investing [\(economically and strategically\) massively in their space programs](#) - like the new “space nations”. As a result, Canada runs the risk of potentially losing opportunities for collaboration and participation in large-scale space projects, such as the Lunar Gateway or the Artemis II mission, without adequate financial support.

To continue, lack of investment hinders the CSA's ability to innovate and adopt new technologies, such as advanced propulsion systems, next-generation materials and autonomous landing techniques. This situation forces Canada to depend on technologies and infrastructures developed by other countries, de facto reducing its strategic and technological autonomy. As a result, Canada finds itself in an economically weak position, and cannot count on its investments to generate a return. In reality, lack of adequate funding and dependence on international partners limit Canada's influence in setting international space exploration agendas and standards. By being perceived as a minor contributor rather than a convincing standard-bearer, Canada doesn't carry as much weight in critical decisions and international negotiations, which can have long-term implications for its position in the global space arena.

Secondly, the lack of appropriate funding is also due to the absence of a coherent, long-term national space strategy. As in a vicious circle, these two limiting factors, influencing each other and at the same time, have the effect of hindering its autonomy and global influence. This strategy is primarily aimed at strengthening Canada's participation in international initiatives such as the Lunar Gateway mission, but it lacks an integrated vision for the autonomous development of the country's space capabilities. All the solutions proposed in the CSA's “[Exploration, Imagination, Innovation](#)” plan end up being development programs that are or will be part of a larger whole dominated by other spacefaring nations.

Canada thus assumes a position of follower rather than leader: the strategy put in place does not involve any vision of its own. Indeed, Canada's strong dependence on the USA and other Western international partners is reflected in [significant participation in joint projects, rather than in the development of independent missions](#). For example, the Canadarm3, while innovative and technologically excellent, is a Canadian contribution to [NASA's Artemis II mission](#). Canada's position as a secondary contributor enables us to benefit from the international influence of our allies, while avoiding risk-taking. This

strategy, understandable in many respects, does not commit the country and its companies to emancipating themselves and proposing their own projects, which is a social, industrial, economic and political loss for the country to gain. Yet Canada itself estimates that “[financial forecasts indicate that it will more than double by 2040, reaching annual revenues of \\$1,000 billion](#)”, [if these follow the same 70% progression observed between 2010 and 2020](#). This exponential growth of the global space economy contrasts sharply with Canada's cautious approach, revealing a striking dissonance between financial projections and the country's current strategy. By failing to position itself proactively in this booming sector, Canada could miss out on considerable economic and innovation opportunities.

Even more alarmingly, this [over-dependence could become a risk factor](#), especially in view of the advances in space defense being made by other countries. Furthermore, funding and support strictly limited to purely Canadian initiatives hampers the country's ability to pursue space projects independently. Canada then turns to “easy” opportunities, drastically reducing its ability to innovate and collaborate.

Following on from the previous shortcomings, Canada's relative autonomy is explained by [space partnerships maintained almost exclusively with its traditional allies](#), such as the United States and members of the European Space Agency (ESA). While these historical collaborations are beneficial, they limit the scope of Canadian partnerships to a narrow circle of technologically advanced nations. This limited approach poses two major problems.

Firstly, the lack of space partnerships with emerging nations prevents Canada from benefiting from the unique perspectives and innovations these countries can offer. Emerging nations are increasingly investing in their space programs and developing innovative technologies at often lower costs. For example, countries like [India](#) and [China](#) have made significant advances in space exploration at lower cost. Also, in terms of image on the international stage, the [United Arab Emirates' strategy](#) is one to watch closely, and collaborations with Canada in this direction could be envisaged. In short, broadening our horizons could open up mutually beneficial collaboration opportunities for Canada. Opening up to more diversified collaborations must be approached with caution in the context of global strategic rivalries. The space sector, closely linked to national security interests, imposes restrictions on partnerships with nations in direct geopolitical competition with Canada's traditional allies, such as the United States. This raises crucial issues of confidentiality and technological sovereignty, calling for a measured engagement strategy capable of reconciling security imperatives while fostering beneficial collaborations.

We must be careful, however, not to perpetuate this “follower” logic should these partnerships come into being. Canada must be in a position to contribute the expertise that is indispensable in international collaboration and negotiations, in order to secure its place as a leader.

Secondly, by focusing solely on traditional partnerships, Canada risks missing out on opportunities for influence and leadership in new space markets. As explained above, the risk for Canada is to remain the eternal runner-up. The absence of larger-scale cooperation limits Canada's ability to diversify its

collaborations and adapt to the ever-changing dynamics of the global space sector. It also reduces Canada's visibility and impact on the international stage, since partnerships with emerging nations can open up new markets and strengthen the country's global competitiveness. In other words, as well as having an impact on the country's global image, this does not encourage “new space” companies to set up long-term operations in Canada. And yet, Canada [does have one major asset](#) with which to start thinking about partnerships that match its aspirations: AI.

AI is at the heart of Canada's [academic, technological and industrial ambitions](#). Taking advantage of this technology is one way for Canada to secure a future in space exploration and exploitation. In reality, AI acts as the missing piece to fill the gaps outlined above. Despite the opportunities presented by the exploitation of this tool, the integration of AI into Canadian space projects is still marginal, even if there are [good prospects for investment, especially in research and development](#). Initiatives such as Canadarm3 and contributions to international missions demonstrate a high, but often secondary, capacity for technologies involving AI. This is partly due to a lack of investment and to the absence of a coherent national strategy for integrating AI into the space sector.

AI at the heart of the creation of Space Canada

The use of AI has been in vogue in the space sector for some time now. However, with the explosion of innovation in this field, AI is becoming a must-have for any company or nation with ambitions to continue to hold an important place for the future. With the [US vision increasingly focused on manned missions and space defense programs](#), Canada must seize the opportunity to invest in this paradigm shift and become a pillar of this new era. It is precisely in these periods of transition that it is essential to act to seize the opportunity. Canada has all the capabilities needed to meet the challenges of space exploration and exploitation. AI is becoming an indispensable part of know-how and transition, and can nurture ambitions for fairer, less unilateral cooperation.

Firstly, in the face of insufficient funding, AI can optimize the use of limited resources by automating and improving the efficiency of processes, thereby reducing operational costs. For example, AI can be used for predictive management of equipment and resources, maximizing the use of existing budgets and reducing the need for unplanned maintenance. NASA, for example, [uses AI to optimize the design of materials used on its aircraft](#), reducing costs while increasing efficiency. Becoming a pioneer in the creation of AI management tools will have a dual effect: that of guaranteeing lower costs for innovation and design, and that of saving significant amounts of time.

Secondly, in the field of technology development, AI can accelerate R&D processes by rapidly analyzing large quantities of data to identify innovative materials and optimize system designs of all kinds. For example, Model Predictive Control is a technology used to calculate rocket trajectories. This technology [provides a better understanding of aircraft behavior, thus facilitating access to space](#). With a similar approach, AI also aims to simulate complex scenarios to test new technologies efficiently before they are actually implemented, thus saving time and money. Another example is [Boeing's use of AI](#) to simulate the aerodynamics and structure of new-generation aircraft, enabling potential problems to be quickly detected and corrected before the production phase, while optimizing efficiency.

Continuing on the subject of the lack of a coherent national strategy, AI plays a crucial role in the formulation and execution of a common strategy. AI systems analyze global trends, forecast future needs and propose optimized strategic plans for the Canadian space sector. By using AI for predictive analysis, Canada can better plan its long-term space investments and initiatives, ensuring a coherent and sustainable vision.

In addition, to compensate for limited international partnerships, AI can facilitate more diversified collaborations by offering platforms for technological cooperation. For example, joint AI development projects with emerging nations could open up new avenues for collaboration and innovation. By demonstrating its expertise in AI exploitation, Canada has the opportunity to enter into partnerships with technologically advanced countries, thereby strengthening its position on the international stage. By integrating AI into its space initiatives, Canada can not only optimize its resources, accelerate technological development, increase its autonomy, formulate a coherent strategy and diversify its international partnerships, but also strengthen its competitiveness and overall influence in the global space sector.

Finally, using AI as a tool to promote multidisciplinary would also enable Canada to increase its capacity for innovation. AI can integrate fields as diverse as robotics, materials science, space biology and astrophysics. These integrations enable innovative, cross-disciplinary approaches. By fostering collaboration between different disciplines, the country is developing innovative space solutions tailored to the complex challenges of deep space exploration. This multidisciplinary approach, supported by AI, would strengthen Canada's position as a leader in space exploration, while maximizing synergies between sectors and stimulating the creativity and ingenuity needed to meet future challenges.

Four key recommendations for the government

The recommendations are designed to encourage the implementation of a Canadian-initiated international cooperation strategy, while highlighting Canada's strengths and credibility in leading this strategy.

1. Strengthening international cooperation

By expanding collaborations beyond traditional partners such as the U.S. and ESA member countries, Canada could include emerging space-faring nations such as India, China, and certain Middle Eastern countries, to strengthen both its economic and political relationships. By adopting a selective approach, Canada would prioritize collaborations with nations whose strategic interests are compatible, while preserving its traditional alliances. At the same time, positioning itself as a technology hub specializing in artificial intelligence and space robotics would attract international partners seeking advanced solutions, maximizing Canada's competitiveness in this sector.

This combination of strategies offers Canada the opportunity to gradually emancipate itself from its traditional allies, without challenging their dominance on the space scene. In this way, Canada can continue to adopt a “follower” posture, while actively preparing its future and strengthening its

capabilities for future challenges. This balanced positioning would enable us to preserve our technological sovereignty and respond to national security imperatives, while benefiting from the spin-offs of international collaborations.

On the other hand, changing from a follower's position to one of “active neutrality” would reinforce Canada's role as a reliable mediator, facilitating international collaboration without taking sides in geopolitical rivalries. By adopting this posture, Canada could attract new partners while consolidating its image as an impartial and cooperative player, able to contribute to global initiatives in a balanced and strategic manner. In terms of research and development and multidisciplinary approach, this strategy would promote the advantages of collaborating countries while enabling them to fill their own gaps.

2. Increased investment in research and development

By creating a more ambitious grant program to address the need for investment in research and development, Canada would encourage its companies and universities to propose innovative projects related to AI and space exploration. By funding applied research projects and technological prototypes, Canada will accelerate the development of new space capabilities and reduce its dependence on foreign technologies. In addition to creating a dynamic innovation ecosystem, this program would foster collaboration between the private sector and academia, creating interesting synergies to develop Canadian creativity, cross-sector cooperation and competitiveness.

Another spin-off of these programs would be the emergence of new companies and increased attractiveness for international talent. This would strengthen the “national value chain” in space exploration, and help achieve some of Canada's other major objectives outside the strict space program. These grant programs would give greater ambition to initial proposals such as the [Lunar Exploration Acceleration Program \(LEAP\) already in place](#).

3. Embracing multidisciplinary

By integrating AI as a core technology, Canada will be able to stimulate innovation in various fields essential to space exploration. AI would optimize processes, accelerate scientific discoveries and enhance technological capabilities. This approach would encourage interdisciplinary collaboration, strengthening synergies between different sectors and contributing to Canada's overall competitiveness in the space field.

By positioning AI at the heart of its space strategy, Canada can prepare to meet future challenges while consolidating its role as a leader in technological innovation. The application of AI in a variety of key fields will strengthen international collaborations. In addition, this multi-disciplinary position, in line with the economic benefits forecast to 2040, will generate considerable economic benefits for Canada. The creation of highly-skilled jobs, the strengthening of the domestic technology industry, and the attraction of international investment would also enable Canada to maintain its place on the international stage in other sectors revolving around the space domain. By anticipating the growth of

the global space economy, estimated at \$1,000 billion, Canada will be able to secure a competitive position in this rapidly expanding market: this is where the virtuous circle of a multidisciplinary approach becomes an important lever for a flourishing economy.

4. Drawing up a long-term national strategy

This strategy should include clear, measurable objectives for the next 10 to 20 years, with a focus on AI, technological autonomy and international partnerships. Such a roadmap is intended to provide coherent direction and strategic priorities for the CSA and other key players, facilitating effective planning and resource allocation. This recommendation is undoubtedly the one that allows others to build on a solid foundation: the confidence generated by a well-constructed plan would attract investors who would de facto contribute to grants; it would demonstrate to other nations that Canada is a strong ally for effective cooperation, ready to take on challenges and realize a turning point in its ambitions; it would overcome the obstacles associated with multidisciplinary research by offering greater visibility over the time and resources required, thus fostering in-depth, long-term studies.