

Space Exploration is a Non-Negotiable Investment

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AT A TOWN HALL ON MAY 26TH, 2021, the Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry, committed \$3 million of investments in lunar exploration initiatives. This pledge comes two years after Prime Minister Trudeau announced that Canada would be building Canadarm3 for the Lunar Gateway for two crewed missions to the Moon [1]. Together, these announcements signal a renewed interest in the space sector after a decade of leaving it on the back burner: a 2016 University of British Columbia-led study found that Canada had spent the least on space exploration in the G8 and funding for the CSA had been stagnant since 1999 [2]. Canadians must remain hopeful, however, as efforts are underway to reverse this trend—space technology is a promising field that generates massive return on investment.

Consider what climate change mitigation, navigation, precision agriculture, national security, and telecommunications have in common. As one might deduce from the title, space is the driving force behind these activities. While skeptics of space exploration may contend that space missions divert funding to tackle societal issues on Earth, the reality is that the two endeavours go hand in hand. Launched in 2019, the RADARSAT Constellation Mission can scan 90% of the world’s surface and visit the Arctic up to four times a day, providing ample data for maritime surveillance, ecosystem monitoring, and natural disaster response [3]. In fact, satellites are the only means of tracking 26 of the 50 Essential Climate Variables (ECVs) identified by the World Meteorological Organization, making them a valuable resource in guiding decision-making sur-

rounding climate change [4]. Space infrastructure also has transformative potential in strengthening the agricultural supply chain. With access to satellite images showing maps of soil moisture and crop productivity, farmers can manage their resources more sustainably while maximizing yields and preventing the spread of pest infestations.



Figure 1: RADARSAT Constellation (Credit: Canadian Space Agency)

The benefits of space assets extend beyond those derived from their intended operations, as space exploration is a powerful vehicle for technology transfer. Many technologies designed for use in space lend themselves to terrestrial applications in entirely different disciplines, thereby spurring innovation in ways specific, targeted research cannot. The need for impact-absorbing seats for human spaceflight led to the creation of memory foam. The voltage constraints of on-board computers spawned the invention of CMOS sensors,

which allowed mobile photography to take the world by storm [5][6]. Closer to home, Canadian robots on the ISS set precedence for surgical and diagnostic tools. In collaboration with MDA engineers who worked on Canadarm2, Synaptive Medical developed a robotic digital microscope to facilitate minimally invasive surgery in hard to reach parts of the body [7]. Furthermore, the same devices used to track astronauts’ health on the ISS can serve patients in remote regions, thus improving health care delivery [4].

Economically, Canada’s space industry contributed \$2.5 billion to the GDP and supported over 20,000 jobs in 2018. A ripple effect of contribution, for every dollar invested, space generates \$1.90 in revenue and for every job, the industry creates 2.18 jobs in adjacent high-tech industries [8]. With declining launch costs, the value of space can only increase. Morgan Stanley predicts that the space economy will nearly triple in size from \$350 billion in 2020 to 1.1 trillion USD by 2040. Up to 70% of the growth will stem from broadband Internet satellites [9]. Not only will they level the playing field for developing nations in terms of access to data, but they will also enable Internet of Things, autonomous vehicles, and other bandwidth-intensive technologies to become more feasible.

Despite its tangible economic impact, the ultimate reward of space exploration is knowledge, an invaluable and intangible asset. Humans have always had an insatiable curiosity about the unknown, which manifests as a desire to explore. By potentially holding answers to age-old questions about the origins of the human species, the formation of a small habitable planet within



Figure 2: Modus V, the robotic telescope spun out of Canadarm2, in the operating room. (Credit: Synaptive Medical)

an uninhabitable universe, and the existence of extraterrestrial life, the final frontier has infinite appeal for all generations. Funding for ambitious space projects legitimizes this appeal and inspires youth to pursue careers in STEM. Drawn by the prospect of making novel discoveries, tackling complex problems, or becoming astronauts themselves, these youth will form an educated workforce that will sustain economic growth.

The overarching conclusion of this analysis is that space plays a ubiquitous role in modern infrastructure. As a tool to address socioeconomic challenges, a source of technological spinoffs, and a sector with a growing job outlook, investing in space is investing in a bright future. Sixty years after launching the satellite Alouette 1 and cementing its place as the third country to enter the space age, Canada must continue seizing every opportunity to progress forward via the cosmos—for the interest of both national devel-

opment and humankind.



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