

2020–21  
Departmental Results Report

**Canadian Space Agency**

The Honourable François-Philippe  
Champagne, P.C., M.P.  
Minister of Innovation, Science and Industry

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## From the Minister

It is our pleasure to present the 2020–21 Departmental Results Report for the Canadian Space Agency (CSA).

In a year that was characterized by uncertainty and rapidly shifting priorities as a result of the global COVID-19 pandemic, Innovation, Science and Economic Development Canada (ISED) and its Portfolio partners remained committed in their continued efforts to meet the evolving needs of Canadians and the Canadian economy. The ISED and Portfolio Departmental Results Reports describe a number of immediate and remarkable contributions over the past year, including those that were part of Canada’s COVID-19 Economic Response Plan.



In response to the pandemic, the CSA adjusted its activities and funding to provide more immediate support to the Canadian space sector and academic institutions. These investments helped stabilize the space sector and enabled it to emerge from the pandemic in a strong position. The CSA also made considerable progress on its priorities such as the Lunar program, the RADARSAT Constellation Mission, the WildFireSat Mission and the engagement of young Canadians.

Through all these initiatives and more, we continued to deliver on our commitment to foster a dynamic and growing economy that creates jobs, opportunities and a better quality of life for all Canadians, including those from diverse backgrounds, such as women, Indigenous peoples, racialized Canadians, persons with disabilities, and LGBTQ+ groups.

We invite you to read this report to learn more about how the CSA, like ISED and its Portfolio partners, is building a strong culture of innovation to position Canada as a leader in the global economy.

The Honourable François-Philippe Champagne, P.C., M.P.  
Minister of Innovation, Science and Industry



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## Results at a glance

In 2020–21, the CSA's key priorities directly aligned with its Departmental Results Framework, program inventory, and the [Space Strategy for Canada](#)<sup>i</sup>. Advancing these priorities enabled the CSA to make progress on achieving its mandate, as well as Government of Canada commitments to and for Canadians. Each of these priorities were aligned to the [Minister of Innovation, Science and Industry's Mandate Letter](#)<sup>ii</sup>, which highlighted the overarching goals of helping Canadian businesses grow, innovate and export; supporting scientific research; and integrating scientific considerations in investment and policy choices.

The CSA's commitment to using space as a platform to provide solutions that address national and international challenges did not waver through the COVID-19 pandemic. Obstacles were overcome to continue to support Canadians, while some investments in space were re-prioritized to provide short-term funding to the Canadian space sector and academia during these strenuous times. These investments helped stabilize the space sector and are enabling Canada to emerge from the pandemic in a solid position to build a strong, sustainable, and prosperous country for all Canadians.

The following section summarizes the results achieved for the CSA's four priorities, as outlined in the 2020–21 Departmental Plan.

### Priority 1 — Lunar Program

Canada's participation in the [Lunar Gateway](#)<sup>iii</sup> helps maintain our position as a leading space-faring nation. In 2020–21, while keeping pace with the International Partners schedule for the Lunar Gateway, contracts were put in place for the first definition phases of [Canadarm3](#)<sup>iv</sup>, an artificial intelligence (AI)-enabled deep-space robotics system that will perform autonomous operations in lunar orbit.

The CSA signed the [Artemis Accords](#)<sup>v</sup> to ensure safe and sustainable space exploration in full compliance with our international obligations in October 2020. The CSA also consulted Canadians on a [framework for future space exploration activities](#)<sup>vi</sup> from November 2020 to March 2021, publishing the [What We Heard](#)<sup>vii</sup> report in July 2021, which provides an overview of the received key themes. The results will help inform Canada's national and international efforts to develop and strengthen frameworks for space exploration activities.

Meanwhile, the [Lunar Exploration Accelerator Program](#)<sup>viii</sup> (LEAP) awarded contracts and contributions to Canadian companies and universities to develop cutting-edge scientific instruments and support promising technologies with a strong commercial potential for the Lunar supply chain.

## Priority 2 — Provide data and new capabilities to other government departments through the operation of the RADARSAT Constellation Mission (RCM)

In 2020–21, the first full year of operation of the [RADARSAT Constellation Mission](#)<sup>ix</sup> (RCM) resulted in the acquisition of over 230,000 Synthetic Aperture Radar (SAR) images by 10 federal departments and agencies, representing an increase of over 360% in the number of SAR images acquired from [RADARSAT-2](#)<sup>x</sup> and RCM in comparison to 2019–20. Through its federal partnerships, the RCM has supported services in application areas ranging from ship detection, oil pollution monitoring, ice detection, coastal and land cover mapping, to geology, glaciology and volcanology, providing space-based solutions to solve daily challenges and improve the lives of Canadians.

## Priority 3 — Engage young Canadians (Junior Astronauts and CubeSat)

The CSA continued to implement the [Junior Astronauts campaign](#)<sup>xi</sup> in an effort to inspire the next generation of space explorers and get young Canadians excited about space and science. Through the campaign, the CSA engaged 60,000 youth, which led to the selection of 52 Junior Astronauts for a summer camp that provides inspirational space training by astronauts, scientists, and engineers. The camp was redesigned to a virtual format in light of the pandemic and delayed to summer 2021.

The [Canadian CubeSat Project](#)<sup>xii</sup> (CCP) continued to engage over 500 post-secondary students in real space missions and provide them with an opportunity to gain the knowledge and skills necessary to become future space experts.

## Priority 4 — WildFireSat Mission

In 2020–21, the CSA invested in the [WildFireSat](#)<sup>xiii</sup> Earth Observation (EO) mission. This initiative aims to monitor, from space, all active wildfires in Canada and support wildfire management. With the support of Natural Resources Canada (NRCan) and Environment and Climate Change Canada (ECCC), the early definition phase contracts with industry were completed. The project planning for the following phases has yielded various options to implement the mission. These options will be analyzed with key stakeholders in 2021–22.

## Canadian Space Agency’s Human and Financial Resources

The overall resources used by the CSA in 2020–21 to advance these four priorities and to deliver on its Departmental Results Framework are summarized in the table below.

2020–21 Total Actual Spending (dollars)	2020–21 Total Actual Full-Time Equivalents FTEs
330,409,653	708.7

For more information on the Canadian Space Agency’s plans, priorities and results achieved, see the “[Results: what we achieved](#)” section of this report.



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## Results: what we achieved

### Core responsibility

#### Canada in Space

The CSA coordinates the space policies and programs of the Government of Canada; ensures that other government departments and agencies have access to space data, information, and services to deliver on their mandate; plans, directs and manages projects relating to scientific or industrial space research and the development of space science and technology; promotes the transfer and diffusion of space technology to and throughout the Canadian industry; and encourages the commercial exploitation of space capabilities, technology, facilities and systems. The CSA also aims to build Canada's capacity and engage the next generation of space scientists and engineers, and provide opportunities to inspire young people to develop the required skills and to pursue studies and careers in science, technology, engineering, and math (STEM).

#### Result 1 — Space research and development advance science and technology

Canada's support for the complete research and development cycle, from inception through to commercialization, is critically important to advance science and technology and foster a dynamic and growing economy. Enabled by investments in the development of innovative space technologies required for future missions with the potential of being re-purposed on Earth, the CSA's leadership and progress in this area in 2020–21 are assessed below.

In 2020–21, while keeping pace with the International Partner schedule for the [Lunar Gateway](#)<sup>iii</sup>, contracts were put in place for the first definition phases of [Canadarm3](#)<sup>iv</sup>, an AI-enabled system that will perform autonomous robotic operations in lunar orbit. Definition phase milestones were achieved and laid the groundwork for the next phases that will be put in place in 2021–22.

The Mobile Servicing System (MSS), a sophisticated robotics suite that plays a critical role in the maintenance, resupply, and science operations of the [International Space Station](#)<sup>xiv</sup> (ISS) has met all demands and performance expectations throughout 2020–21. Continued commissioning and demonstration of MSS autonomy on the ISS will serve to prepare for the design and development of the next generation of [Canadarm3](#)<sup>iv</sup>. Studies were also put in place to define potential options for Canada's participation in human spaceflight beyond Low Earth Orbit on subjects such as artificial intelligence (AI) and augmented reality (AR) for future Canadian space robotics and hydroponic food production.

With the aim of providing space-based solutions to monitor the Earth and respond to global challenges, a feasible mission concept has been developed for [WildFireSat](#)<sup>xiii</sup>. An innovative type of infrared sensor, which includes the use of cutting-edge instrument technology, will be flown aboard the satellite. This instrument will monitor active wildfires from a satellite platform that is considerably smaller and less expensive than what has been used so far. The completion of the

feasible mission concept allows the CSA to proceed with the follow-up phases to build, test, and launch the first wildfire monitoring satellite of this kind.

The end of the design phase for the [Quantum Encryption and Science Satellite](#)<sup>xv</sup> (QEYSSat) spacecraft and ground segment, which aims to demonstrate quantum key distribution technology in order to provide Canada with ultra-secure communications, is now planned for November 2021. The delay is due to COVID-19, which has resulted in long lead times for the purchase of space-grade components.

The CSA launched another wave of [Space Technology Development Program](#)<sup>xvi</sup> (STDP) investments intended at reducing the technological uncertainties of potential future missions of interest to Canada. These investments will lead to the development of new, innovative space technologies.

Canada's [SCISAT](#)<sup>xvii</sup> mission continues to measure over 70 chemical species in the Earth's atmosphere, including ozone, ozone-depleting substances, all major greenhouse gases, and hydrofluorocarbons (HFCs). A new CO<sub>2</sub>-related data product has been made available, along with datasets for two HFC gases, thus improving the satellite's monitoring of the [United Nations Montreal Protocol](#)<sup>xviii</sup>. The data was also used to discover the chemical composition of extreme fire smoke plumes. These datasets continue to be delivered to Canadian academic and government scientists, and to international partners and scientists worldwide.

In 2020–21, the CSA's investments enabled Canadian astronomers to participate in international space missions and gain access to scientific data. With regard to planetary exploration, the [OSIRIS-REx](#)<sup>xix</sup> spacecraft is on its way back from asteroid Bennu with its precious samples on board, 4% of which will come to Canada as a result of our contribution to the mission. At the same time, the CSA continued to support the [Alpha-Particle X-ray Spectrometer](#)<sup>xx</sup> (APXS) on NASA's highly successful [Curiosity rover](#)<sup>xxi</sup> and to prepare for the launch of the [James Webb Space Telescope](#)<sup>xxii</sup> (JWST) in late 2021. In return for Canada's contribution of the Fine Guidance Sensor (FGS) and the Near Infra-Red Imager and Slitless Spectrograph (NIRISS) to this major international mission, Canadian astronomers will obtain observation time on the most powerful space telescope ever built.

Through these investments, the CSA ensured that space research and development advanced science and technology. Business Expenditures on Research and Development (BERD) in the space sector reached \$376 million in 2019, according to the most recent data available, higher than the target of \$324 million. Furthermore, by providing access to high-quality scientific data and supporting researchers, the CSA contributed to Canada's Average Relative Citation (ARC) score of space-related publications. With a score of 1.62 for the period from 2013 to 2019, Canada ranks 17<sup>th</sup> among Organisation for Economic Co-operation and Development (OECD) nations. Canada's citation score is above the average for OECD countries and the highest among G7 countries.

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## Result 2 — Canadians engage with space

Space serves as an unrivaled playground to inspire future Canadian innovators. By taking advantage of Canadians' interest in space and providing opportunities for youth to acquire the skills to pursue studies and careers in STEM, the CSA continues to support the development of the next generation of scientists, engineers, and entrepreneurs.

The CSA continued to provide Canadian professors in post-secondary institutions with the ability to engage their students in real space mission support with the [CCP](#)<sup>xii</sup>. Through this national initiative, 15 teams from across Canada were offered the unique opportunity to design, build, test, and operate their own miniature satellites, called CubeSats. Approximately 500 students have been involved so far. In 2020–21, the CSA hosted several virtual webinars for students to provide them with an occasion to learn from experts and support them in their learning to become future space experts. Finally, the majority of the teams completed their Critical Design Reviews, during which they presented the final design of their CubeSats to CSA experts.

The [Junior Astronaut campaign](#)<sup>xi</sup> strives to teach youth what it takes to be an astronaut through activities focused on scientific understanding, physical fitness, teamwork, and communication. Activities engaged 60,000 youth and led to the selection of 52 participants representing 12 provinces and territories for the Junior Astronaut camp. The camp was redesigned in light of the pandemic and was held virtually in Summer 2021. In addition, astronauts and other CSA experts gave 78 virtual presentations to youth from kindergarten to the university level in 2020–21 to share the space experience and inspire audiences to pursue interests, studies and careers in STEM.

The 2020 launch campaign of the CSA's stratospheric balloon program, [STRATOS](#)<sup>xxiii</sup>, was cancelled due to travel restrictions related to COVID-19. Academia and industry will have the opportunity to validate technologies and perform scientific experiments during the 2021 launch campaign.

The CSA continued to engage Canadians by supporting the development of space science and technology and expertise required for the future through the [Flights and Fieldwork for the Advancement of Science and Technology](#)<sup>xxiv</sup> (FAST) funding initiative. In 2020–21, the CSA completed the implementation of the grant agreements under the FAST 2019 Announcement of Opportunity. Of note, five more projects than planned were supported in an effort to respond to the academic needs in the context of the COVID-19 pandemic. In addition, the CSA provided grants to students to virtually attend the Committee on Space Research (COSPAR) conference in Winter 2021 to support the development of the next generation of space professionals in Canada.

The CSA uses social media engagements as an indicator of interest in Canada's Space Program. From April 1, 2020 to March 31, 2021, the CSA garnered 2,771,135 engagements, which surpassed the target for the year. The CSA's efforts to provide opportunities for youth to acquire the skills to pursue studies and careers in STEM resulted in 2,034 new people and organizations entering space-related fields in 2019, according to the most recent data available.

### **Result 3 — Space information and technologies improve the lives of Canadians**

Access to space data and technology is a game changer for a diverse and increasing number of activities here on Earth. Every day, Canadian and international satellites provide information and services to support maritime and space surveillance, ecosystem and environmental monitoring, natural disaster management, security and defence, as well as health. In 2020–21, the CSA continued to leverage Canada’s access to space by providing data and services to support other government departments and agencies in the delivery of their mandates.

On February 28th, 2021, [RCM<sup>ix</sup>](#) completed the 15 month-long initial operations phase and transitioned into routine operations. Over the year, more than 230,000 EO images, captured by RCM, were used by 10 federal departments and agencies. The data generated from RCM contributed to an increased quality and volume of products and services already being offered, such as monitoring land use evolution and coastal changes, mapping agriculture, measuring human activity influences on local environments, and improving Canada’s space-based capabilities to detect ships and monitor marine traffic with the use of an Automatic Identification System.

Moreover, recognizing the importance of historical data for temporal comparisons, the CSA explored options for further opening the [RADARSAT-1<sup>xxv</sup>](#) archives to the public to the greatest extent possible, and endeavored to safeguard RADARSAT-1 data through its repatriation from foreign data holdings.

Through its renewed application development initiative, now called [smartEarth<sup>xxvi</sup>](#), the CSA supported the development of innovative solutions derived from satellite data such as the protection and environmental management of the North Atlantic Right Whales (NARW) in Canadian waters. Eighteen projects were received and evaluated and five were selected by the CSA to demonstrate the contribution of space-based satellite data for enhanced stewardship of the NARWs. The projects are currently ongoing and are stimulating open collaboration as well as innovation across government, academic and industry sectors.

Canada's contribution to the first-ever global survey of surface water through the [Surface Water Ocean Topography<sup>xxvii</sup>](#) (SWOT) satellite is now complete. The CSA delivered to NASA the enabling technology for the space-based radar — three Extended Interaction Klystrons (EIK), a powerful source of microwaves required for the radar to gather high resolution surface information — in time for the rescheduled launch, now expected in late 2022. Canadian science and applications preparation continued in 2020–21 through modelling, simulations, and airborne data acquisitions.

In 2020–21, the CSA co-led with ECCC and NRCan a partnership-building effort among 17 federal departments to define the future of space-derived data capabilities in Canada, known as the Space-based Earth Observation (SBEO) initiative. This unprecedented partnership endeavor, supported by three main working groups (upstream, midstream, and downstream) led to the identification and prioritization of various issues, needs and current and potential initiatives covering the entire SBEO value chain. Canada’s SBEO capability will play a pivotal

role in studying the impacts of climate change on Earth and helping to inform future mitigation and adaptation responses.

The CSA supported a series of eight scientific experiments on the [ISS](#)<sup>xxiv</sup> and initiated work on several new studies intended to address health risks associated with long-duration spaceflights and protect astronauts' health. Data collection was completed for four of them, with the results analysis and publication currently underway. Four current and upcoming studies use the [Bio-Monitor](#)<sup>xxviii</sup>, a Canadian technology deployed in 2019, to observe and record astronauts' vital signs. These advancements in science and technology are aimed at preparing for long-duration spaceflights and are also expected to find applications on Earth in areas such as cardiovascular disease, ageing, Parkinson's disease, and health-care delivery in remote and isolated areas.

Several parallels can be drawn between the space environment and remote northern communities. The latter provides an ideal location for initial proof-of-concept of healthcare solutions, both for human spaceflight and isolated communities. In 2020–21, the CSA met with stakeholders to advance collaboration for the development of a remote/Northern demonstration site for medical devices. In addition, the CSA participated as an observer to consultations led by the National Research Council (NRC) for their [Arctic and Northern Challenge Program](#)<sup>xxix</sup>. Consultations were completed and projects are now being defined by the NRC in preparation for the launch of the Challenge in the fall of 2021. Once defined, the CSA could support relevant projects that can contribute to the advancement of remote and deep space healthcare. Finally, in collaboration with the Privy Council Office, the CSA developed a health challenge, using the Impact Canada platform, to incentivize the development of innovations to address health care challenges both in deep space and in remote communities. This challenge will launch in the fall of 2021.

The CSA's activities improve the lives of Canadians in two significant ways: first, through space science and technology that is utilized on Earth for the benefit of Canadians, and second, by delivering the data and services that Canadians need from space on a daily basis. For 2020–21, the CSA can report that 23 space technologies and applications were adapted for use on Earth or re-use in space, compared with 22 in 2019–20. A majority of the reutilization of Canadian space technologies took place in the aerospace field.

In 2020, 111 services dependent on the CSA's information were offered to Canadians, by the 17 federal departments and agencies that directly integrated space-based data in their service delivery, and by the databases made available to researchers in academia. This represents a modest increase from 109 services offered to Canadians in 2019. These services support government initiatives that address challenges on climate change, changing landscapes, the management of Canada's natural resources, innovation in the agriculture and agri-food sectors and in the management of ocean resources, as well as monitoring activities for national security purposes.

## Result 4 — Canada's investments in space benefit the Canadian economy

In 2020–21, the CSA continued to leverage investments in the space sector to foster innovation and enable Canadian innovators to take advantage of opportunities that create well-paying jobs and a flourishing economy.

Following an Announcement of Opportunity launched in the fall of 2019, more than \$24 million over three years was invested under [STDP<sup>xvi</sup>](#) to support the development of 50 commercially promising space technologies in various fields, such as wildfire detection, satellite communications, space-based AI, and space-debris detection and removal. Of note, funding was doubled in an effort to respond to industry needs in the context of the COVID-19 pandemic, allowing the support of 18 more projects than planned. Over half of these technologies will be developed by small and medium-sized enterprises (SMEs) — many being supported by the CSA for the first time — thus fostering the growth of the Canadian space sector. Finally, the STDP also contributed to the [LEAP<sup>viii</sup>](#) by supporting the development of space technologies related to lunar missions, including promising technologies with a strong commercial potential to ensure the Canadian space sector plays an important role in the highly competitive and innovative global supply chain of the expanding new space economy.

In 2020–21, the [LEAP<sup>viii</sup>](#) program also awarded contributions to support the Canadian space industry for the launch of two lunar technology payloads to the Moon by April 2024.

As part of meeting expected results for Canadian industry on [Canadarm3<sup>iv</sup>](#), the use of innovative procurement solutions was thoroughly investigated in 2020–21. The Industrial Technological Benefits (ITB) Policy, including a Value Proposition by industry, will be used for the first time in a civil space project, with the objective of providing opportunities for technology transfer and SME participation in the supply chain for Canadarm3.

The CSA continued to support the competitiveness and capacity of the Canadian space sector in the international market through the long-standing [Canada-European Space Agency \(ESA\) Cooperation Agreement<sup>xxx</sup>](#). In 2020–21, the CSA implemented investments in selected ESA programs announced by Canada during the ESA 2019 Ministerial Meeting.

The CSA reviewed the results of its first challenge to small businesses to prove the scientific and technical feasibility as well as the commercial potential of a novel idea that addresses a public-sector challenge as part of ISED's Innovative Solutions Canada initiative, in order to determine which technologies should progress to a second phase of funding. The first challenge focused on the application of artificial intelligence and big-data analytics. A second challenge to small businesses was postponed to 2021–22 as a result of the re-prioritization of activities and funding in the context of the COVID-19 pandemic. The postponement of the challenge has allowed the [STDP<sup>xvi</sup>](#) to support more projects than planned and to expand the scope of ongoing projects to support the industry.

Working in collaboration with industry and government partners, the CSA delivered a number of virtual events aimed at facilitating stronger linkages between academic and industry communities, creating business development opportunities for Canadian space companies, and



gathering business intelligence to inform decision-making. Examples include an industry day and a [Canadarm3<sup>iv</sup>](#) webinar to maximize the number of Canadian companies in the supply chain.

In 2020–21, during the COVID-19 pandemic, the David-Florida Laboratory (DFL) leveraged its unique testing solutions to perform 26 assembly, integration and testing activities to support government space missions and 12 commercial space programs.

By supporting the development, maturation, and commercialization of space technologies and services, the CSA supported the goals of ensuring that investments benefit the Canadian economy through the development of value-added services and export opportunities. According to the most recent available data, the Canadian space sector generated \$2.3 billion in exports in 2019 and employed 6,936 highly qualified people.

### **Gender Based Analysis Plus (GBA Plus)**

The space sector is a STEM-intensive field. As a result, the anticipated increase in the number of available jobs of these type is expected to more directly benefit men, given that they are more likely to have pursued studies and be employed in these areas. For example, in 2019, out of the 2,024 new people who joined the space sector, 69% were men, 26% were women and 5% were gender-fluid, non-binary, two-spirit and/or preferred not to answer.

In 2020–21, the [LEAP<sup>viii</sup>](#) and [Gateway<sup>iii</sup>](#) ([Canadarm3<sup>iv</sup>](#)) programs worked in close collaboration with Public Services and Procurement Canada (PSPC) to ensure GBA Plus considerations were being factored into the procurement approaches. As a result, requirements to report on diversity have been included in the next request for proposals to be issued by the LEAP program. For the science-related grants under LEAP, an evaluation criterion has been added to encourage universities to establish equity and diversity plans. For Canadarm3, industry partners will be required to report on gender parameters of employees working on the project.

Finally, measures were put in place to connect with youth living in locations that are hard to reach digitally. For example, the CSA, while working with many partners across the country, awarded a contract to deliver [Junior Astronauts campaign<sup>xi</sup>](#) activities across Canada, with an emphasis on Northern and remote Canadian communities.

### **Experimentation**

The five-year Lunar STEM Implementation Strategy and Plan is experimenting with new ways to reach young Canadians and encourage them to consider STEM opportunities for their studies and future careers. The development of the activities, which considered lessons learned from the [Junior Astronauts campaign<sup>xi</sup>](#), was completed in 2020–21, and their implementation is underway.

The CSA also developed the Ideas to Action and Innovation (I2A) initiative in 2020–21. I2A provided a structure to encourage innovation within the organization, as well as an internal framework for managing new ideas and experimentation. By using a bottom-up approach, the initiative prototyped and tested with a variety of solutions to problems identified by employees, and documented the lessons learned while also making them available to all employees.

## 2030 Agenda for Sustainable Development

Many of the CSA's missions and activities contribute to the achievement of the [UN SDGs](#)<sup>xxxii</sup>. In addition to providing support for over 60 applications and services to build sustainable food production systems and strengthen the capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters, [RCM](#)<sup>ix</sup> became one of the most responsive satellite systems in the virtual constellation supporting the [International Charter on Space and Major Disasters](#)<sup>xxxiii</sup>, delivering critical data to disaster management authorities to allow for a quick response to catastrophic events ([SDG 13.1](#)<sup>xxxiii</sup>).

The CSA's support of science and earth observation missions, including [SCISAT](#)<sup>xvii</sup>, [SWOT](#)<sup>xxxvii</sup> and [WildFireSat](#)<sup>xiii</sup>, contributes to advancing our understanding of climate-related hazards and natural disasters, such as the effects on air quality from wildfires and complex hydrological effects on the environment ([SDG 13.1](#)<sup>xxxiii</sup>).

The CSA is conducting studies that will help to inform Canada's potential future participation in space missions, such as NASA's [Aerosol — Clouds, Convection, Precipitation mission](#)<sup>xxxiv</sup> and Canada's Terrestrial Snow Mass Mission, that will improve our understanding of climate change science ([SDG 13.1](#)<sup>xxxiii</sup>).

Through the [CCP](#)<sup>xii</sup>, the CSA contributed to increasing the number of youth and adults who pursue education and skills development. The project, which was designed to promote the social and economic inclusion of all, involves more than 500 post-secondary students, with a roughly equal gender split ([SDG 10.2](#)<sup>xxxv</sup>).

The climate change risk analysis for the entire CSA real estate portfolio has been completed, as has the carbon-neutral qualitative study for the John H. Chapman Space Centre. These studies will help identify and prioritize the next steps to draw up the long-term plan that will allow the CSA to achieve carbon neutrality by 2050. The results of a mobility and sustainable transport study have been received, which will help identify actions to facilitate and encourage sustainable transportation among our employees. The implementation of composting at the Space Centre, an effort to reduce waste generation ([SDG 12.3](#)<sup>xxxvi</sup>) has been postponed until employees return to the workplace after the pandemic measures are lifted.

As of March 31, 2021, the composition of CSA's Executive Committee was 69% women and 31% men, supporting women's full and effective participation and equal opportunities for leadership ([SDG 5.5](#)<sup>xxxvii</sup>).



## Results achieved

Departmental results	Performance indicators	Target	Date to achieve target	2018–19 Actual results	2019–20 Actual results	2020–21 Actual results
Space research and development advances science and technology	I1: Business Expenditures in Research and Development (BERD) in the space sector	\$324M	March 31, 2021	\$363M (2017)	\$356M (2018)	\$376M (2019)
	I2: Canada's rank among OECD nations on the citation score of space-related publications	11	March 31, 2021	11 (2017)	16 (2018)	17 <sup>1</sup> (2019)
Canadians engage with space	I3: Number of new people and organizations entering space-related fields as a result of CSA funding	500	March 31, 2021	206 (2017)	1,041 (2018)	2,024 <sup>2</sup> (2019)
	I4: Number of engagements on social media related to the CSA	2,000,000	March 31, 2021	3,884,506 (2018)	3,592,089 (2019)	2,771,135 <sup>3</sup> (2020)
Space information and technologies improve the lives of Canadians	I5: Number of services offered to Canadians dependent on CSA information (such as remote sensing data, including imagery and science observations)	100	March 31, 2021	96 (2018)	109 (2019)	111 (2020)

<sup>1</sup> Canada's average relative citation score increased to 1.62 for the current reporting period (2013 to 2019) from the score of 1.59 for the previous reporting period (2012 to 2018). The decrease in ranking is due in part to the presence of a cluster of countries with very similar citation scores between the 10<sup>th</sup> and the 19<sup>th</sup> ranks, where a minor variation in citation score can have an impact of a few ranks.

<sup>2</sup> This figure is significantly higher than the previous year and the target. The number of new people in the academic sector remained relatively steady, but there was a significant increase in new people in space sector companies, which is largely attributable to improvements in CSA data collection methodology and an increase in the response rate to the CSA survey.

<sup>3</sup> A decline in the number of social media engagement in 2020–21 was expected following two consecutive years of highly successful and visible campaigns for David Saint-Jacques' mission to the ISS between December 3, 2018, and June 24, 2019. The target set for 2020–21 was surpassed.

	I6: Number of Canadian space technologies adapted for use on Earth or re-use in space	12	March 31, 2021	16 (2017)	22 (2018)	23 <sup>4</sup> (2019)
Canada's investments in space benefit the Canadian economy	I7: Number of highly qualified people in the Canadian space sector	4,250	March 31, 2021	4,302 (2017)	4,120 (2018)	6,936 <sup>5</sup> (2019)
	I8: Value of exports of the Canadian space sector	\$2B	March 31, 2021	\$2.1B (2017)	\$2.3B (2018)	\$2.3B (2019)

### Budgetary financial resources (dollars)

2020–21 Main Estimates	2020–21 Planned spending	2020–21 Total authorities available for use	2020–21 Actual spending (authorities used)	2020–21 Difference (Actual spending minus Planned spending)
273 383 417	273 383 417	393,956,456	271,954,249	(1,429,168)

### Human resources (full-time equivalents)

2020–21 Planned full-time equivalents	2020–21 Actual full-time equivalents	2020–21 Difference (Actual full-time equivalents minus Planned full-time equivalents)
401.1	391.2	(9.9)

Financial, human resources and performance information for the Canadian Space Agency's Program Inventory is available in [GC InfoBase](#)<sup>xxxviii</sup>.

<sup>4</sup> The five-year rolling average used by the CSA to set a target for this indicator is influenced by earlier years for which fewer technologies were identified. The target has been revised upward for 2021–22.

<sup>5</sup> A new definition for Highly Qualified People (HQP) became effective in 2020–21 in order to align it with the methodology used in other departments and agencies. This largely explains the increase from previous years. The CSA assesses that there would have been 4,639 HQP in 2020–21 under the old definition, which would have represented an increase of 13% from the previous year and would have been 9% above the target of 4,250 set under the old HQP definition.

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## Internal Services

### Description

Internal Services are those groups of related activities and resources that the federal government considers to be services in support of programs and/or required to meet corporate obligations of an organization. Internal Services refers to the activities and resources of the 10 distinct service categories that support Program delivery in the organization, regardless of the Internal Services delivery model in a department. The 10 service categories are:

- ▶ Acquisition Management Services
- ▶ Communication Services
- ▶ Financial Management Services
- ▶ Human Resources Management Services
- ▶ Information Management Services
- ▶ Information Technology Services
- ▶ Legal Services
- ▶ Material Management Services
- ▶ Management and Oversight Services
- ▶ Real Property Management Services

### Results

To ensure the modern, efficient, and relevant delivery of internal services, in 2020–21 the CSA continued to improve its internal processes, tools, and business models to enable the Agency to deliver on its mandate.

In 2020–21, aligned with the Integrated Investment Planning Framework, a Strategic Integration Team was created to support end-to-end integrated portfolio planning to ensure the delivery of a balanced space program aligned with recognized priorities. The CSA's 2020–25 Investment Plan was also completed and approved.

The CSA also continued to improve its performance measurement methodologies through concerted efforts with program sectors. Notably, the CSA is now able to report on the gender breakdown of the entire workforce in the Space Sector, as well as new people who joined the sector.

All known organizations operating in the Canadian space sector were contacted in order to complete the 2020 Canadian Space Sector Survey. The aggregate results will soon be made available to the public in the 2020 State of the Canadian Space Sector Annual Report.

In 2020–21, sustained actions were carried out to provide employees with the tools and resources needed in the context of remote work. This realignment of resources to respond to the pandemic resulted in a delay to the planned completion of CSA's 2020–23 Health, Safety and Well-being Strategy, which is now planned to be completed and implemented in 2021–22. The Strategic

Workforce Management Plan for 2021–24 was updated and includes tactics that will be pursued to recruit and integrate the next generation of employees.

Furthermore, the CSA explored options to better integrate systems and processes in order to gain efficiencies in human and financial resources planning. The CSA also collaborated with Public Services and Procurement Canada to advance pay system stabilization efforts.

Although the CSA's three-year departmental security plan was adjusted in light of the changing priorities stemming from the pandemic, most activities have progressed as planned.

Major studies needed to draw up the [Greening Government Strategy](#)<sup>xxxix</sup> — a long-term plan for the ecologization of government operations that will allow the CSA to achieve carbon neutrality by 2050 — were completed, as were the roll-out of waste sorting stations and the annual GHG emission inventory. The collaborative smart building project between the CSA and NRCan continued progressing according to plan.

Digital transformation advancements in 2020–21 included infrastructure improvements to enhance CSA network speed and security, the deployment of collaboration tools and equipment for optimized performance for remote work, and the strengthening of protection mechanisms in response to the increased risk linked to remote work. The CSA developed a Cybersecurity Framework and adopted a Service and Digital strategy that will guide ongoing efforts in updating its digital operations. Finally, the CSA's new Data Centre of Expertise has enabled the CSA to progress towards making its data easier to find and use.

### Budgetary financial resources (dollars)

2020–21 Main Estimates	2020–21 Planned spending	2020–21 Total authorities available for use	2020–21 Actual spending (authorities used)	2020–21 Difference (Actual spending minus Planned spending)
52,643,000	52,643,000	57,495,095	58,455,404	5,812,404

### Human resources (full-time equivalents)

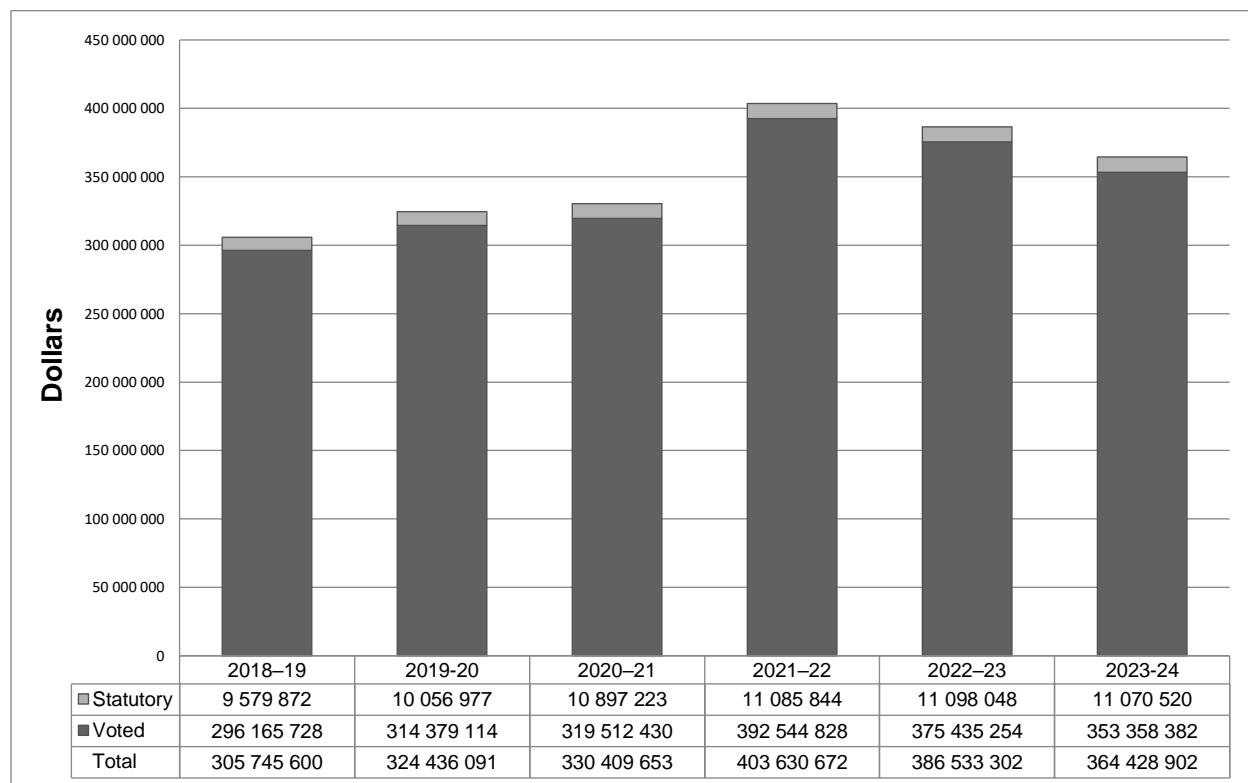
2020–21 Planned full-time equivalents	2020–21 Actual full-time equivalents	2020–21 Difference (Actual full-time equivalents minus Planned full-time equivalents)
303.1	317.5	14.4

## Analysis of trends in spending and human resources

### Actual expenditures

#### Departmental spending trend graph

The following graph presents planned (voted and statutory spending) over time.



The variances in spending outlined above are primarily attributable to specific funds allocated to the following initiatives, which were above CSA's ongoing resource allocations.

- Additional funding of \$374 million spread over six fiscal years (from 2013–14 to 2018–19) was allocated to the [RCM](#)<sup>ix</sup> (\$140 million was new funds arising from the Fiscal Framework and \$234 million was transferred from user departments to the CSA).
- As indicated in Budget 2015 and 2016 announcements, additional funding of \$30 million over four years starting in 2016–17 was authorized to maintain Canada's participation in the ESA's [Advanced Research in Telecommunications Systems](#)<sup>xi</sup> (ARTES) program.
- In accordance with Budget 2015 announcements, and with \$379 million in new funds earmarked in Budget 2016, additional funding of \$318 million over eight years beginning in 2017–18 have thus far been authorized to support activities on board the [ISS](#)<sup>xiv</sup> and to fulfill Commons Systems Operations Costs related to the extension of Canada's participation on the ISS until 2024, in accordance with international treaty obligations.

- Additional funding of \$25.1 million spread over six years starting in 2018–19 for the [QEYSSat<sup>xv</sup>](#) project.
- As indicated in Budget 2019, additional funding of \$150 million over five years starting in 2019–20 to carry out activities under the [LEAP<sup>viii</sup>](#).
- In accordance with 2019 announcements, committing 1.9 billion over 24 years for [Canadarm3<sup>iv</sup>](#) as a Canadian contribution to the NASA-led [Lunar Gateway<sup>iii</sup>](#) program, additional funding of \$27.4 million spread over four years starting in 2020–21 to undertake the first definition phase of the Canadarm3 project and STEM activities.

At the same time, the cumulative effect of reallocating unused funds to subsequent years as a result of sound management of high-risk projects, including increased technological risks, long-term development cycles, and work schedule uncertainties, has also had an impact on the CSA's spending trend in recent years.

### Budgetary performance summary for Core Responsibilities and Internal Services (dollars)

Core responsibilities and Internal Services	2020–21 Main Estimates	2020–21 Planned spending	2021–22 Planned spending	2022–23 Planned spending	2020–21 Total authorities available for use	2018–19 Actual spending (authorities used)	2019–20 Actual spending (authorities used)	2020–21 Actual spending (authorities used)
Canada in space	273,383,417	273,383,417	346,068,318	327,832,181	393,956,456	254,711,091	273,268,394	271,954,249
<b>Subtotal</b>	<b>273,383,417</b>	<b>273,383,417</b>	<b>346,068,318</b>	<b>327,832,181</b>	<b>393,956,456</b>	<b>254,711,091</b>	<b>273,268,394</b>	<b>271,954,249</b>
Internal Services	52,643,000	52,643,000	57,562,354	58,701,121	57,495,095	51,034,509	51,167,697	58,455,404
<b>Total</b>	<b>326,026,417</b>	<b>326,026,417</b>	<b>403,603,672</b>	<b>386,533,302</b>	<b>57,495,095</b>	<b>305,745,600</b>	<b>324,436,091</b>	<b>330,409,653</b>

## Actual human resources

### Human resources summary for core responsibilities and Internal Services

Core responsibilities and Internal Services	2018–19 Actual full-time equivalents	2019–20 Actual full-time equivalents	2020–21 Planned full-time equivalents	2020–21 Actual full-time equivalents	2021–22 Planned full-time equivalents	2022–23 Planned full-time equivalents
Canada in space	390.0	387.6	401.1	391.2	430.0	424.5
Subtotal	<b>390.0</b>	<b>387.6</b>	<b>401.1</b>	<b>391.2</b>	<b>430.0</b>	<b>424.5</b>
Internal Services	285.4	289.9	303.1	317.5	357.4	328.2
Total	<b>675.4</b>	<b>677.5</b>	<b>704.2</b>	<b>708.7</b>	<b>787.5</b>	<b>752.7</b>

## Expenditures by vote

For information on the Canada Space Agency’s organizational voted and statutory expenditures, consult the [Public Accounts of Canada 2020–2021](#)<sup>xli</sup>.

## Government of Canada spending and activities

Information on the alignment of the Canadian Space Agency’s spending with the Government of Canada’s spending and activities is available in [GC InfoBase](#)<sup>xxxviii</sup>.

## Financial statements and financial statements highlights

### Financial statements

The Canadian Space Agency’s financial statements (unaudited) for the year ended March 31, 2021, are available on the [departmental website](#)<sup>xlii</sup>.

## Financial statement highlights

### Condensed Statement of Operations (unaudited) for the year ended March 31, 2021 (dollars)

Financial information	2020–21 Planned results	2020–21 Actual results	2019–20 Actual results	Difference (2020–21 Actual results minus 2020–21 Planned results)	Difference (2020–21 Actual results minus 2019–20 Actual results)
Total expenses	355,965,295	355,554,364	347,401,440	(410,931)	8,152,924
Total revenues	23,825	56,204	18,750	32,379	37,454
Net cost of operations before government funding and transfers	355,941,470	355,498,160	347,382,690	(443,310)	8,115,470

Total planned expenses for 2020–21 were \$356.0 million, a slight variance of \$0.4 million compared with actual results of \$355.6 million.

2020–21 total expenses represent an increase of \$8.2 million (2.3%) compared with the previous year's total expenses of \$347.4 million. The increase is mainly due to a \$11.4 million increase in professional and special services and a \$20.7 million increase in transfer payments mainly attributable to variations in the ESA's payment schedule, combined with a \$24.3 million decrease in the acquisition of [RADARSAT-2<sup>x</sup>](#) data (imagery).

The CSA's total revenues were \$0.06 million in 2020–21 (compared with \$0.02 million in 2019–20), which represents the re-spendable portion of overall revenues of \$3.5 million. The majority of these revenues are reported under the sale of goods and services provided by the DFL (sale of goods and services to private business or other Government of Canada departments, location and use of public property, as well as other revenues).



**Condensed Statement of Financial Position (unaudited) as of March 31, 2021  
(dollars)**

Financial information	2020–21	2019–20	Difference (2020–21 minus 2019–20)
Total net liabilities	89,222,861	78,209,306	11,013,555
Total net financial assets	80,165,848	68,924,688	11,241,160
Departmental net debt	9,057,013	9,284,618	(227,605)
Total non-financial assets	1,542,287,336	1,559,168,970	(16,881,634)
Departmental net financial position	1,533,230,323	1,549,884,352	(16,654,029)

Total net liabilities of \$89.2 million consist mainly of accounts payable and accrued liabilities. These represent goods and services received at year-end but that have not yet been paid by the Agency.

The \$11.0 million (14.1%) increase in net liabilities is mainly due to a \$9.9 million increase in accounts payable and accrued liabilities. These variances are normal as payment schedules may vary from one year to another, especially those related to the ISS<sup>xiv</sup> and the ESA.

Total assets were \$1.62 billion at the end of 2020–21 (\$80.2 million in net financial assets and \$1.54 billion in non-financial assets), similar to the previous year's total of \$1.63 billion.

Non-financial assets are mainly composed of space-related assets (\$1.3 billion over \$1.54 billion or 85.6%).



## Corporate Information

### Organizational profile

**Appropriate minister:** The Honourable François-Philippe Champagne, P.C., M.P.

**Institutional head:** Lisa Campbell, President

**Ministerial portfolio:** Innovation, Science, and Economic Development

**Enabling instrument[s]:** [Canadian Space Agency Act, S.C. 1990, c.13](#)<sup>xliii</sup>

**Year of incorporation / commencement:** Established in March 1989

**Other:** The Canadian Space Agency was established in 1989. Approximately 84% of its employees work at the headquarters located at the John H. Chapman Space Centre, in St-Hubert, Quebec. The remaining personnel serve the CSA at the David-Florida Laboratory in Ottawa, Ontario and its Policy and Planning offices in Gatineau, Quebec, with officials in Houston, Washington and Paris.

### Raison d'être, mandate and role: who we are and what we do

“Raison d'être, mandate and role: who we are and what we do” is available on the Canadian Space Agency's [website](#)<sup>xliv</sup>.

For more information on the department's organizational mandate letter commitments, see the [Minister's mandate letter](#)<sup>ii</sup>.

### Operating context

Information on the operating context is available on the Canadian Space Agency's [website](#)<sup>xliv</sup>.

## Reporting framework

The Canadian Space Agency’s Departmental Results Framework and Program Inventory of record for 2020–21 are shown below.

<b>Departmental Results Framework</b>	<b>Core Responsibility: Canada in space</b>		<b>Internal Services</b>
	Departmental Result: Space research and development advances science and technology	Indicator: Business Expenditures in Research and Development in the space sector	
		Indicator: Canada's rank among OECD nations on the citation score of space-related publications	
	Departmental Result: Canadians engage with space	Indicator: Number of new people and organizations entering space-related fields as a result of CSA funding	
		Indicator: Number of engagements on social media related to the CSA	
	Departmental Result: Space information and technologies improve the lives of Canadians	Indicator: Number of services offered to Canadians dependent on CSA information	
		Indicator: Number of Canadian space technologies adapted for use on Earth or re-use in space	
<b>Program Inventory</b>	Program: Space Capacity Development		
	Program: Space Exploration		
	Program: Space Utilization		

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## Supporting information on the program inventory

Financial, human resources and performance information for the Canadian Space Agency's Program Inventory is available in [GC InfoBase](#)<sup>xxxviii</sup>.

## Supplementary information tables

The following supplementary information tables are available on Canadian Space Agency's [website](#)<sup>xliv</sup>:

- ▶ Reporting on Green Procurement
- ▶ Details on transfer payment programs
- ▶ Gender-based analysis plus
- ▶ Response to parliamentary committees and external audits

## Federal tax expenditures

The tax system can be used to achieve public policy objectives through the application of special measures such as low tax rates, exemptions, deductions, deferrals and credits. The Department of Finance Canada publishes cost estimates and projections for these measures each year in the [Report on Federal Tax Expenditures](#)<sup>xlv</sup>. This report also provides detailed background information on tax expenditures, including descriptions, objectives, historical information and references to related federal spending programs as well as evaluations and GBA Plus of tax expenditures.

## Organizational contact information

### Mailing address

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**Fax:** (450) 926-4352

**Email:** [info@asc-csa.gc.ca](mailto:info@asc-csa.gc.ca)

**Website:** <https://www.asc-csa.gc.ca>



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## Appendix: definitions

### **appropriation** (*crédit*)

Any authority of Parliament to pay money out of the Consolidated Revenue Fund.

### **budgetary expenditures** (*dépenses budgétaires*)

Operating and capital expenditures; transfer payments to other levels of government, organizations or individuals; and payments to Crown corporations.

### **core responsibility** (*responsabilité essentielle*)

An enduring function or role performed by a department. The intentions of the department with respect to a core responsibility are reflected in one or more related departmental results that the department seeks to contribute to or influence.

### **Departmental Plan** (*plan ministériel*)

A report on the plans and expected performance of an appropriated department over a 3-year period. Departmental Plans are usually tabled in Parliament each spring.

### **departmental priority** (*priorité*)

A plan or project that a department has chosen to focus and report on during the planning period. Priorities represent the things that are most important or what must be done first to support the achievement of the desired departmental results.

### **departmental result** (*résultat ministériel*)

A consequence or outcome that a department seeks to achieve. A departmental result is often outside departments' immediate control, but it should be influenced by program-level outcomes.

### **departmental result indicator** (*indicateur de résultat ministériel*)

A quantitative measure of progress on a departmental result.

### **departmental results framework** (*cadre ministériel des résultats*)

A framework that connects the department's core responsibilities to its departmental results and departmental result indicators.

### **Departmental Results Report** (*rapport sur les résultats ministériels*)

A report on a department's actual accomplishments against the plans, priorities and expected results set out in the corresponding Departmental Plan.

### **experimentation** (*expérimentation*)

The conducting of activities that seek to first explore, then test and compare the effects and impacts of policies and interventions in order to inform evidence-based decision-making, and improve outcomes for Canadians, by learning what works, for whom and in what circumstances.

Experimentation is related to, but distinct from innovation (the trying of new things), because it involves a rigorous comparison of results. For example, using a new website to communicate with Canadians can be an innovation; systematically testing the new website against existing outreach tools or an old website to see which one leads to more engagement, is experimentation.

**full-time equivalent** (*équivalent temps plein*)

A measure of the extent to which an employee represents a full person-year charge against a departmental budget. For a particular position, the full-time equivalent figure is the ratio of number of hours the person actually works divided by the standard number of hours set out in the person's collective agreement.

**gender-based analysis plus (GBA Plus)** (*analyse comparative entre les sexes plus [ACS Plus]*)

An analytical process used to assess how diverse groups of women, men and gender-diverse people experience policies, programs and services based on multiple factors including race ethnicity, religion, age, and mental or physical disability.

**government-wide priorities** (*priorités pangouvernementales*)

For the purpose of the 2020–21 Departmental Results Report, those high-level themes outlining the government's agenda in the 2019 Speech from the Throne, namely: Fighting climate change; Strengthening the Middle Class; Walking the road of reconciliation; Keeping Canadians safe and healthy; and Positioning Canada for success in an uncertain world.

**horizontal initiative** (*initiative horizontale*)

An initiative where two or more federal organizations are given funding to pursue a shared outcome, often linked to a government priority.

**non-budgetary expenditures** (*dépenses non budgétaires*)

Net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

**performance** (*rendement*)

What an organization did with its resources to achieve its results, how well those results compare to what the organization intended to achieve, and how well lessons learned have been identified.

**performance indicator** (*indicateur de rendement*)

A qualitative or quantitative means of measuring an output or outcome, with the intention of gauging the performance of an organization, program, policy or initiative respecting expected results.

**performance reporting** (*production de rapports sur le rendement*)

The process of communicating evidence-based performance information. Performance reporting supports decision making, accountability and transparency.



**plan** (*plan*)

The articulation of strategic choices, which provides information on how an organization intends to achieve its priorities and associated results. Generally, a plan will explain the logic behind the strategies chosen and tend to focus on actions that lead to the expected result.

**planned spending** (*dépenses prévues*)

For Departmental Plans and Departmental Results Reports, planned spending refers to those amounts presented in Main Estimates.

A department is expected to be aware of the authorities that it has sought and received. The determination of planned spending is a departmental responsibility, and departments must be able to defend the expenditure and accrual numbers presented in their Departmental Plans and Departmental Results Reports.

**program** (*programme*)

Individual or groups of services, activities or combinations thereof that are managed together within the department and focus on a specific set of outputs, outcomes or service levels.

**program inventory** (*répertoire des programmes*)

Identifies all the department's programs and describes how resources are organized to contribute to the department's core responsibilities and results.

**result** (*résultat*)

A consequence attributed, in part, to an organization, policy, program or initiative. Results are not within the control of a single organization, policy, program or initiative; instead they are within the area of the organization's influence.

**statutory expenditures** (*dépenses législatives*)

Expenditures that Parliament has approved through legislation other than appropriation acts. The legislation sets out the purpose of the expenditures and the terms and conditions under which they may be made.

**target** (*cible*)

A measurable performance or success level that an organization, program or initiative plans to achieve within a specified time period. Targets can be either quantitative or qualitative.

**voted expenditures** (*dépenses votées*)

Expenditures that Parliament approves annually through an appropriation act. The vote wording becomes the governing conditions under which these expenditures may be made.



## Endnotes

- <sup>i</sup> Space Strategy for Canada, <https://www.asc-csa.gc.ca/eng/publications/space-strategy-for-canada/default.asp>
- <sup>ii</sup> Minister of Innovation, Science and Industry Mandate Letter, <https://pm.gc.ca/en/mandate-letters/2019/12/13/minister-innovation-science-and-industry-mandate-letter>
- <sup>iii</sup> Lunar Gateway, <https://asc-csa.gc.ca/eng/astronomy/moon-exploration/lunar-gateway.asp>
- <sup>iv</sup> Canadarm3, <https://www.asc-csa.gc.ca/eng/canadarm3/about.asp>
- <sup>v</sup> Artemis Accords, <https://www.nasa.gov/specials/artemis-accords/index.html>
- <sup>vi</sup> Consulting Canadians on a framework for future space exploration activities, <https://www.asc-csa.gc.ca/eng/astronomy/moon-exploration/consulting-canadians-framework-future-space-exploration-activities.asp>
- <sup>vii</sup> What We Heard report, <https://www.asc-csa.gc.ca/eng/astronomy/moon-exploration/what-we-heard--report-consultation-framework-future-space-exploration-activities.asp>
- <sup>viii</sup> LEAP, <https://asc-csa.gc.ca/eng/funding-programs/programs/leap/default.asp>
- <sup>ix</sup> RCM, <https://www.asc-csa.gc.ca/eng/satellites/radarsat/default.asp>
- <sup>x</sup> RADARSAT-2, <https://www.asc-csa.gc.ca/eng/satellites/radarsat2/Default.asp>
- <sup>xi</sup> Junior Astronauts, <https://www.asc-csa.gc.ca/eng/youth-educators/junior-astronauts/default.asp>
- <sup>xii</sup> CCP, <https://asc-csa.gc.ca/eng/satellites/cubesat/what-is-the-canadian-cubesat-project.asp>
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- <sup>xiv</sup> ISS, <https://asc-csa.gc.ca/eng/iss/default.asp>
- <sup>xv</sup> QEYSSat, <https://asc-csa.gc.ca/eng/satellites/qeyssat.asp>
- <sup>xvi</sup> STDP, <https://www.asc-csa.gc.ca/eng/funding-programs/programs/stdp/default.asp>
- <sup>xvii</sup> SCISAT, <https://www.asc-csa.gc.ca/eng/satellites/scisat/default.asp>
- <sup>xviii</sup> United Nations Montreal Protocol, <https://ozone.unep.org/treaties/montreal-protocol>
- <sup>xix</sup> OSIRIS-REX, <https://www.asc-csa.gc.ca/eng/satellites/osiris-rex/default.asp>
- <sup>xx</sup> APXS, <https://www.asc-csa.gc.ca/eng/astronomy/mars/apxs.asp>
- <sup>xxi</sup> Curiosity Rover, <https://www.asc-csa.gc.ca/eng/astronomy/mars/missions/curiosity.asp>
- <sup>xxii</sup> JWST, <https://www.asc-csa.gc.ca/eng/satellites/jwst/default.asp>
- <sup>xxiii</sup> STRATOS, <https://www.asc-csa.gc.ca/eng/sciences/balloons/default.asp>
- <sup>xxiv</sup> FAST, <https://www.asc-csa.gc.ca/eng/funding-programs/programs/fast/default.asp>
- <sup>xxv</sup> RADARSAT-1, <https://asc-csa.gc.ca/eng/satellites/radarsat1/default.asp>
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- <sup>xxvii</sup> SWOT, <https://www.asc-csa.gc.ca/eng/satellites/swot.asp>
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- <sup>xxix</sup> Arctic and Northern Challenge Program, <https://nrc.canada.ca/en/research-development/research-collaboration/programs/arctic-northern-challenge-program>
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- <sup>xxxi</sup> UN SDGs, <https://sdgs.un.org/goals>
- <sup>xxxii</sup> International Charter ‘Space and Major Disasters’, <https://disasterscharter.org/en/web/guest/text-of-the-charter>
- <sup>xxxiii</sup> UN SDG 13, <https://sdgs.un.org/goals/goal13>
- <sup>xxxiv</sup> Aerosols — Clouds, Convection, Precipitation, <https://www.asc-csa.gc.ca/eng/blog/2020/12/21/why-the-a-ccp-mission-is-important-for-canadians.asp>
- <sup>xxxv</sup> UN SDG 10, <https://sdgs.un.org/goals/goal10>
- <sup>xxxvi</sup> UN SDG 12, <https://sdgs.un.org/goals/goal12>
- <sup>xxxvii</sup> UN SDG 5, <https://sdgs.un.org/goals/goal5>
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- <sup>xxxix</sup> Greening Government Strategy, <https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html>
- <sup>xl</sup> ARTES, [https://www.esa.int/Applications/Telecommunications\\_Integrated\\_Applications/ARTES/About\\_ARTES](https://www.esa.int/Applications/Telecommunications_Integrated_Applications/ARTES/About_ARTES)
- <sup>xli</sup> Public Accounts of Canada, <http://www.tpsgc-pwgsc.gc.ca/recgen/cpc-pac/index-eng.html>
- <sup>xlii</sup> CSA departmental website — Audit and evaluation, <https://www.asc-csa.gc.ca/eng/publications/ae.asp>
- <sup>xliii</sup> CSA Act, <https://laws-lois.justice.gc.ca/eng/acts/c-23.2/page-1.html>
- <sup>xliv</sup> CSA departmental website — Reports to Parliament, <https://www.asc-csa.gc.ca/eng/publications/rp.asp>

<sup>xlv</sup> Report on Federal Tax Expenditures, <https://www.canada.ca/en/department-finance/services/publications/federal-tax-expenditures.html>