Canadian Space Agency

2022–23

Departmental Plan

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Minister of Innovation, Science and Industry

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Canada

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From the Minister

On behalf of the Canadian Space Agency (CSA), it is my pleasure to present the 2022–23 Departmental Plan. As the country continues to recover from the COVID-19 pandemic, Innovation, Science and Economic Development Canada (ISED) and its portfolio will work closely with partners across Government to build a more resilient, clean and inclusive economy that benefits all Canadians.

Throughout 2022–23, the CSA will continue to implement the Canadian Space Strategy: Exploration, Imagination, Innovation, which will help ensure that Canadians are ready to take advantage of the jobs of tomorrow, while enabling our space industry and academic institutions to unleash their full potential. By contributing Canadarm3 to the Lunar Gateway, Canada secured a place in history, an astronaut flight on Artemis II, the first crewed mission to the Moon since 1972. This will make us the second country to send a human to deep space.

Recognizing social, economic and environmental priorities on Earth, the CSA's investments in Satellite Earth Observation (SEO) and the newly released SEO strategy will not only help ensure the continuity of core services for Canadians, but will also see their application in areas such as public health and infrastructure. In 2022–23, CSA's involvement in satellite missions such as the RADARSAT Constellation Mission (RCM), the Surface Water and Ocean Topography (SWOT) mission and the WildFireSat mission will help position Canada to better understand and adapt to climate change.

Together with Canadians of all backgrounds and in all regions, ISED and its portfolio will continue to build a strong culture of innovation for a resilient, sustainable and inclusive economic future.

The Honourable François-Philippe Champagne, P.C., M.P.
Minister of Innovation, Science and Industry
Minister of Innovation, Science and Industry Mandate Letter[i]

Plans at a glance

Throughout 2022–23, the CSA's focus will remain on implementing the Canadian Space Strategy: Exploration, Imagination, Innovation[ii], which was announced by the Minister of Innovation, Science and Economic Development on March 6, 2019. This strategy aims to create the right conditions for the growth of the Canadian space sector; ensure that Canada's space scientists, and scientists that use space data, are offered a rich environment in which to pursue science excellence; fully realize the benefits of space for Canadians; and ultimately help strengthen Canada's place in space. The CSA's priorities were designed to ensure Canada's investments in space contribute to tackling challenges here on Earth.

Priority 1 — Propelling space exploration through the Lunar Program

In 2022–23, the CSA will continue to lay the foundations for sustainable human and robotic exploration. Canadarm3[iii], is Canada's flagship contribution to the Lunar Gateway[iv] — a small space station in lunar orbit — and continues to build on Canada's proud heritage and leadership in space robotics. Canadarm3 will transform the future of space robotics and will earn Canada two astronaut flights to the Moon, the first of which will be on Artemis II[v].

Canada's participation in the NASA-led Artemis program will also open new commercial opportunities for Canadian industry in the new space economy. The CSA's Lunar Exploration Accelerator Program[vi] (LEAP) is designed to seize on those opportunities, create the jobs of tomorrow, and strengthen Canada's role as a reliable, competent international partner in space exploration.

Priority 2 — Adapting to climate change with space-based data

Space-based data is a vital tool in building a cleaner and greener future. It is the cornerstone on which government departments, industry, and academia rely for monitoring vulnerabilities, assessing natural disasters, and engineering cutting-edge solutions to withstand today's environmental challenges, and those to come. Adaptation supported by scientific knowledge, information and projections is essential to understanding and managing climate risks. Forecast-based action is key for preparing and responding to extreme weather events. In 2022–23, the CSA will pursue multiple Satellite Earth Observation (SEO) and climate change scientific activities. An example of these activities is the work with partners on WildFireSat[vii], a satellite equipped with infrared technology to monitor wildfires from space. In addition, the CSA will work to maximize its 250,000 images acquired annually from the RADARSAT Constellation Mission[viii] (RCM) to enhance the government's operations and services, and foster the innovative use of satellite data. To this end, the CSA will increase RCM data accessibility and exploitation. Finally, under the smartEarth[ix] initiative, the CSA will fund activities designed to develop advanced space-based products and solutions in line with Canada's sustainable development priorities and challenges.

Priority 3 —Leveraging deep-space health and food innovations

In 2022–23, the CSA will continue to leverage the innovations developed for deep-space health to deliver benefits on Earth. This work includes the planning of a demonstration site in a remote Northern community to address the common health challenges of terrestrial remote communities and crew in deep space. The CSA will also pursue the Deep Space Healthcare Challenge[x], a competition to develop new diagnostic and detection technologies for remote communities in Canada and crews on deep-space missions. The CSA will also continue to use humanity's unique space laboratory — the International Space Station[xi] (ISS) — to perform scientific experiments on human health that will bring new discoveries that can yield healthcare innovations for Canadians on Earth. The CSA will continue its contribution to the Deep Space Food Challenge[xii], which is designed to tackle challenges related to access to safe, affordable, and nutritious food.

Priority 4 — Building a resilient economy

The CSA's investments in innovative solutions, such as for Canadarm3[iii] and LEAP[vi], will contribute to the diversification of production networks, increasing the sustainability of Canada's industrial capabilities. Furthermore, investments in innovative applications under the smartEarth[ix] initiative will contribute to the advancement of Canadian capabilities in providing value-adding solutions capable of transforming space-based data into information products and services. This will enable Canada to benefit from the projected economic growth of the power of data.

Through the Space Technology Development Program[xiii] (STDP), the CSA will launch another wave of investments to support the development of Canadian industrial capabilities in the area of space technologies for the purpose of expanding the commercial potential of Canadian space companies.

For more information on the Canadian Space Agency's plans, see the "Core responsibilities: planned results and resources, and key risks" section of this plan.

Core responsibilities: planned results and resources, and key risks

This section contains information on the department's planned results and resources for each of its core responsibilities. It also contains information on key risks related to achieving those results.

Canada in Space

Description

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).

Planning highlights

This section contains detailed information on the department's planned results and resources for its core responsibility. It also contains information on key risks related to achieving those results.

Result 1 — Canada remains a leading space-faring nation

Through the CSA's leadership in space exploration, Earth observation, investments in STEM educational opportunities, and the development of the Canadian space sector, Canada is committed to remaining a leading space-faring nation and will continue to deliver the benefits of space to Canadians.

In addition to continue to provide critical robotic operations on the ISS[xi] with Canadarm2[xiv] and Dextre[xv], in 2022–23, the CSA will provide opportunities for industry and academia to perform studies and technology development. These will help define options for Canada's participation in international human exploration initiatives beyond low Earth orbit and for the eventual human exploration of Mars.

The Canadarm3[iii] Phase A contract was announced in December 2020 and will conclude in March 2022. This initial contract with the selected Canadian prime contractor has set both the initial Canadarm3 technical definition and a value proposition to be applied during subsequent development phases. The latter will help maximize the economic impact of this investment under the framework of the Industrial and Technological Benefits Policy[xvi], which aims to leverage federal procurement contracts to support job creation, innovation and economic opportunities

across the country. Canadarm3 will be a smart next-generation robotic system, building on technologies developed and proven on the ISS[xi]. Instrumental in the operations, maintenance, and utilization of the Gateway[iv] station, it will open the door for Canadian science and research on and around the Moon, and eventually extend humanity's reach outward to Mars and beyond. This investment also positions Canadian industry as a world leader in space robotics development and operations, to better establish commercial opportunity in this emerging market. In return for our participation in Gateway, NASA has committed to fly two Canadian astronauts into deep space, including one on the Artemis II[v] mission, making a Canadian the first international partner to fly to the Moon.

The CSA's investments in space astronomy and planetary exploration missions continue to provide opportunities for Canadian scientists to participate in international space missions and gain access to scientific data. After a successful launch at the end of 2021, the James Webb Space Telescope[xvii] (Webb) will be fully commissioned in 2022–23. The Canadian Near-Infrared Imager and Slitless Spectograph[xviii] (NIRISS) will enable Webb to become the very first space platform to capture images of distant galaxies and stars dating back to the early days of the universe, and to study the atmospheric composition of exoplanets orbiting distant stars. Canadian astronomers have already been allocated observation time and will be supported by grants. In addition, the CSA will continue to operate the Near-Earth Object Surveillance Satellite[xix] (NEOSSat), providing Canada with a dual use orbiting platform for advanced research, tracking, and characterization of objects orbiting Earth, including satellites, space debris and asteroids. In 2022–23, Canadian astronomers will be granted observation time on this unique platform through the NEOSSat Guest Observation Program[xx], enabling scientific research in areas such as near-Earth asteroids, comets, and exoplanets. With regards to planetary exploration, OSIRIS-REx[xxi] continues its voyage back to Earth, bringing back its precious samples due to reach Earth in September 2023. Ten years since its launch from Earth, the Alpha-Particle X-ray Spectrometer[xxii] (APXS) on NASA's Curiosity[xxiii] rover continues to operate on the surface of Mars.

The Lunar Surface Exploration Initiative (LSEI) will continue to prepare options for future Canadian contributions to human spaceflight. In 2022–23, the LSEI will aim to identify innovative ways to incentivize the private sector to develop new products and services with the ultimate objective of opening new commercial markets in space exploration. The LSEI will undertake this work via concept studies targeting a wide variety of technical areas to ensure that Canada remains a leader in future space ventures that will come with the potential for an eventual sustainable presence on the lunar surface.

In return for Canada's participation in the Lunar Gateway[iv], the CSA will also be able to contribute to international science and research efforts on the lunar orbiting outpost. In this context, the CSA will finance concept studies to prepare options for Canada's Lunar Gateway platform initial Science and Technology utilization.

The CSA continues to engage young Canadians with the Objective: Moon[xxiv] portfolio of hands-on experiences in every province and territory of Canada. These include partnerships, activities, speaker events, online resources, and targeted initiatives to ensure the participation of groups that are underrepresented in STEM. Grants and contributions will also be awarded to enable innovative ideas from post-secondary institutions, schools, and not-for-profit organizations for the development and delivery of STEM activities focused on lunar exploration topics.

Anchored in the newly released Strategy for Satellite Earth Observation (SEO) and in partnership with Environment and Climate Change Canada[xxv] (ECCC) and Natural Resources Canada[xxvi] (NRCan), the CSA will continue to co-lead a whole-of government satellite Earth observation initiative to define strategic investments, flexible programming and strong partnerships with stakeholders from across the Government of Canada as well as industry and academia. Satellite data provides a unique perspective on disasters and is an invaluable tool to save lives and mitigate damage to natural resources and private property. In 2022–23, Canada will continue to demonstrate its expertise by responding to the activations of the International Charter on Space and Major Disasters[xxvii] with data from both RADARSAT-2[xxviii] and RCM[viii], to support disaster relief efforts all over the globe.

In 2022–23, the CSA will support the advancement of Earth system science and contribute to the understanding of climate change through ongoing support of Canada's Optical Spectograph and InfraRed Imaging System[xxix] (OSIRIS) instrument onboard the Swedish Odin[xxx] satellite and the ongoing support of the SCISAT[xxxi] mission. The OSIRIS mission onboard the Odin satellite will publish a new merged dataset on ozone and update its aerosol dataset, both important atmospheric variables. The OSIRIS datasets advance Earth system science, our understanding of ozone recovery and the Earth's radiative energy budget, and are key to Canada's contributions to the United Nations (UN) Montreal Protocol[xxxii] on monitoring and healing the ozone layer. Since it was launched in 2001, OSIRIS data has been used by over 850 researchers in over 25 countries, resulting in 32 scientific discoveries.

With the objective of contributing to the safety and security of Canadians, the CSA will support 13 Sun-Earth system science research grants to analyze space data, develop new knowledge and improve predictive models of solar storms and space weather in Earth's geospace — the region of near-Earth space comprised of the thermosphere, ionosphere, and magnetosphere.

To maintain space situational awareness in support of satellite operations and contribute to the sustainability of the space environment, the CSA will continue to operate its space debris Conjunction Risk Assessment and Mitigation System (CRAMS), which provides advanced analyses and collision avoidance strategies for close approaches with Canadian satellites, as well as international and national missions, for which the CSA has established partnerships.

In 2022–23, the CSA will continue to implement the Canadian CubeSat Project[xxxiii] (CCP), which engages 15 teams from post-secondary institutions in a real space missions by designing and building their own miniature satellites. The satellites will be deployed from the ISS in the second half of 2022. The student teams will then operate their CubeSats and conduct science according to the objectives of their missions.

The stratospheric balloon program, STRATOS[xxxiv] will continue to provide Canadian academia, industry and other government departments with the opportunity to test and validate new technologies and perform scientific experiments in a near-space environment, while inspiring and training the next generation of experts. A large stratospheric balloon launch campaign will be conducted at the stratospheric balloon base in Timmins, Ontario.

Through the Flights and Fieldwork for the Advancement of Science and Technology[xxxv] (FAST) initiative, the CSA will award several grants to post-secondary institutions to support pre-mission research projects that will contribute to new scientific knowledge and space technologies, while providing hands-on experience to the next generation of space professionals in Canada.

In 2022–23, the CSA will continue the development of the Quantum Encryption and Science Satellite[xxxvi] (QEYSSat) mission which will demonstrate secure encryption key distribution over long distances using newly developed quantum key distribution technology through a laser link. This new disruptive technology will provide Canadians with more secure communications and position its industry and academia for future opportunities.

By providing access to high-quality scientific data and supporting researchers, the CSA will contribute to science excellence and help maintain Canada's 13th position in international ranking among Organisation for Economic Co-operation and Development (OECD) nations with respect to the average relative citation score of space-related publications.

Result 2 — Space information and technologies improve the lives of Canadians

To take real action in adapting to climate change, access to space data and technology are a game changer for many domains here on Earth. Every day, Canadian satellite information and services are mobilized in all corners of the globe to support maritime surveillance, space surveillance, ecosystem monitoring, environmental monitoring, natural disaster management, security and defence, as well as healthcare. The CSA adopts a whole-of-government approach for access to space data, information, and services and encourages the development of space technologies that can be used on Earth or reused in space.

The CSA will continue advancing the High-altitude Aerosols, Water vapour and Clouds (HAWC) capability studies in collaboration with ECCC[xxv] and the HAWC university consortium. HAWC is the proposed Canadian contribution to NASA's Atmosphere Observing

System[xxxvii] (AOS) mission that will make unprecedented observations of aerosols, clouds, convection and precipitation. It will deliver critical measurements to support extreme weather prediction, climate modelling, as well as air quality and disaster monitoring (volcanic plumes, wildfire smoke and damaging precipitation).

In 2022–23, the CSA will continue to operate the RADARSAT Constellation Mission RCM[viii] in order to meet the requirements for Government of Canada users, industry, academia and international partners. Work will continue with government departments, regulatory organizations, and user communities to increase RCM data access, to augment RCM data services through the vetting process and to maintain the support of existing services to Canadians. Greater access to this data will allow more value-added companies to develop applications and services for Canadians, fostering research and discoveries from academic institutions and strengthening international collaboration. Taking full advantage of the 14 years of RADARSAT-2[xxviii] archived data, projected to reach 1 million images in 2022, the CSA will continue to support government departments by providing RADARSAT-2 data and processing services.

The CSA will report on the exploratory work for RCM[viii]'s successor, under the Earth Observation Service Continuity (EOSC) initiative, setting the foundations for the next phase of investigation in 2022–23. Combining key Canadian industrial capabilities with world class heritage, this significant effort in technology research and development will enhance our understanding of future possibilities, while promoting Canadian innovation. Strategic industrial capabilities and technical leadership will be leveraged through conceptual studies to determine the feasibility of suitable alternatives and address the government's future needs.

In line with the Open Government Directive, the CSA will gradually repatriate long-time series of RADARSAT-1[xxxviii] data archived on foreign servers and develop a multi-year solution to process the data and make it more accessible to Canadians. The repatriation of RADARSAT-1 archives will increase the capacity for historical analysis, particularly to support climate change research.

The CSA will continue to work with the Canadian Forest Service[xxxix], the Canadian Centre for Mapping and Earth Observation[xl] and ECCC[xxv] to initiate the preliminary system definition phase of WildFireSat[vii], an innovative satellite to monitor wildfires. The joint team will plan the use of mission data to produce and disseminate wildfire monitoring products for the use of forest fire management, smoke forecasting and carbon emission monitoring and reporting.

Now that Canada has delivered its contribution to the Surface Water and Ocean Topography[xli] (SWOT) hydrological science satellite, the CSA is focusing on the use of the data to be generated after it is launched — currently planned for late 2022. The data gathered by the SWOT satellite will be provided to scientists at Fisheries and Oceans Canada[xlii], ECCC[xxv], several

Canadian universities and partners in the UK and France. The intent, in combination with oceanographic and hydrological models, is to improve coastal and water-related services in Canada such as forecasts of currents, storm surges and floods. Research is being conducted in the Atlantic waters off the coast of Newfoundland and Labrador, in the St. Lawrence River, in the lakes and rivers of Quebec, Ontario, Saskatchewan, Alberta and the Northwest Territories, and in the Pacific waters off the coast of British Columbia.

In 2022–23, the CSA will recommend options for Digital Earth Canada (DEC), which has been proposed as a Canadian Earth observation exploitation platform that could provide an integrated, collaborative and virtual environment. EO and non-EO data, tools, computing power, and EO derived products and applications are brought together to enable federal, provincial and territorial departments, industry and academia, to fully access and exploit EO data, spur innovation, and generate economic benefits.

The CSA continues to meet its obligations to operate Canadian robotics and support science on the ISS[xi] aimed at reducing health risks for astronauts during long-term missions. A number of scientific experiments will be conducted on the ISS in 2022–23 including: Vection[xliii], Wayfinding[xliv], Vascular Aging[xlv], SANSORI, CARDIOBREATH, and SpaceHealth, which will study neurological, ocular and cardiovascular risks. Furthermore, science opportunities will be offered to perform research on space health risks, through data and sample mining, research models in laboratory, and spaceflight analogue environments, in order to complement studies performed on the ISS.

The definition phases for a new astronaut health protocol aimed at mitigating the effects of spaceflight on the human body will be completed, which could translate into guidelines for sedentary conditions for people on Earth. The CSA will work with partners to launch collaborative research and development initiatives with the health and biomedical sector, and to undertake the planning of a demonstration of healthcare solutions in a remote Northern and Indigenous community. To this end, in collaboration with the Privy Council Office[xlvi] (PCO), the CSA will continue its work in 2022–23 on the Deep Space Healthcare Challenge[x], a competition to develop new diagnostic and detection technologies for remote communities in Canada and crews on deep-space missions. The CSA will also collaborate with NASA and PCO, to bring innovative food production technologies to space and to Earth through the Deep Space Food Challenge[xii]. Designed to confront the triple challenge of ensuring adequate access to safe, affordable, and nutritious food, the Challenge will help the CSA in developing reliable food systems while ensuring their environmental sustainability, the lowering of greenhouse gases (GHG) emissions, and the adaptableness to climate change.

In 2022–23, it is expected that 120 services will be offered to Canadians by the various federal departments and agencies that use space data to deliver on their mandates. The services are varied and touch many different fields, such as agriculture, land use, climate, atmosphere, oceans

and inland waters, among others. It is also expected that 25 space technologies for use on Earth or re-use in space will result from the CSA's present and past investments.

Result 3 — Canada’s investments in space benefit the Canadian economy

In 2022–23, the CSA will continue to use its unique position in the space sector as a vantage point to foster innovation while enabling Canadian innovators and entrepreneurs to take advantage of growth opportunities, creating highly sought-after jobs that strengthen, diversify, and make the Canadian economy more resilient. The CSA will work to increase collaboration to ensure that small and medium enterprises (SME), start-ups and academia are able to collaborate and access technical, scientific and business expertise to support their growth.

Through the STDP[xiii] funding initiative, the CSA will launch another wave of investments to support the development of Canadian industrial capabilities in space technologies in order to expand the commercial potential of Canadian space companies. Through LEAP[vi], the CSA will continue to help SMEs develop new technologies to be used and tested in lunar orbit and on the Moon's surface in fields such as artificial intelligence (AI), robotics, and health. This will help Canadian enterprises, including SMEs, capture their market share of the developing lunar economy. LEAP will also support the development of the Canadian lunar science community with grant funding through announcements of opportunities.

Through LEAP, Canadian space missions to send robotic rovers and science instruments will be kicked off. The definition phase for an expected launch in 2025–26 of a lunar rover will start in 2022–23. Furthermore, CSA will support Canadian organizations applying under NASA’s Payloads and Research Investigations on the Surface of the Moon[xlvii] (PRISM) request for information, which provides the potential for up to two Canadian science instruments to obtain a flight to the Moon.

Support for Canadian innovators that wish to go into business, grow their companies, and bring their innovations to market will be upheld through the Innovative Solutions Canada (ISC) program[xlviii]. The CSA will fund the development of prototypes of its first ISC challenge, which focuses on applying AI and big-data analytics to space-related technologies and applications, and announce the projects selected as part of its second ISC challenge, which focus on space exploration-related technologies.

Through the smartEarth[ix] initiative’s Enabler track, the CSA will continue to fund 38 Canadian companies to increase the commercial and export potential for Canadian space-based applications. Seventeen of them will be financed through the announcement of opportunity Bridging the Information Gap with Space-Based Analytics[xlix], with the specific objective of helping the sector capitalize on the data revolution, developing the necessary capabilities to better adapt to the current transformations in the digital marketplace, while the other aims to stimulate capacity development, answering national sustainable development challenges and

priorities. The remaining 21 companies will be funded through the announcement of opportunity Canadian Downstream Space Sector Delivering on Canada's Better Future[l], which aims to support the development of advanced space-based products and solutions in line with national EO challenges and sustainable development priorities. These initiatives will ensure Canadian downstream sector growth, positioning, and competitiveness, which will help secure and maintain highly qualified personnel in the space sector.

The CSA will continue to support the competitiveness and capacity of the Canadian space sector on the international market through the long-standing Canada -European Space Agency (ESA) Cooperation Agreement[li]. In November 2022, Canada and ESA member states will announce new investments during the ESA's Ministerial Council meeting. Investments in selected ESA programs will allow Canadian industry to participate in world-class missions in Earth observation, satellite communications, exploration and technology development.

The CSA's David Florida Laboratory[lii]'s (DFL), a world class provider of testing facilities and services will continue to support the Canadian space sector for assembly, integration, and testing, while the CSA's investments seek to ensure that the Canadian space sector is supported during the ongoing impacts from COVID-19.

As such, in 2022–23, it is expected that the Canadian space sector will contribute at a level of $2.3 billion to Canada's gross domestic product (GDP) and maintain 9,000 jobs in Canada.

Gender-based analysis plus (GBA Plus)

The CSA is headquartered on the traditional and unceded territory of the Kanien'kehà:ka (People of the Flint) (Mohawk Nation), which is part of the Haudenosaunee (People of the Longhouse) Confederacy and recognizes the significant contributions of Indigenous peoples and communities to STEM and the studies of the stars. Acknowledging that the majority of employees working in STEM fields are men, the CSA will continue to include specific provisions in its contracts and grant and contribution agreements to encourage the hiring of a diverse workforce. In 2022–23, the CSA will also continue implementing the action plan set out in the Evaluation of the implementation of GBA Plus at the Canadian Space Agency[liii], which was published in June 2021 to further integrate GBA Plus into its internal processes and decision-making.

The CSA will continue to implement its 2021–24 Employment Equity, Diversity and Inclusion Action Plan[liv], which sets out specific activities to achieve representativeness of designated groups within its workforce by 2024.

The CSA is focused on ensuring that the awe-inspiring nature of space is accessible to all young Canadians. In 2022–23, the CSA will continue to reduce systemic barriers to participation by specifically targeting underrepresented groups in its STEM outreach and education initiatives. With the Objective: Moon[xxiv] portfolio, young Canadians in every province and territory of

Canada will have the opportunity to engage in hands-on, interactive learning experiences about lunar exploration. Partnerships, activities, speaker events, online resources and targeted initiatives will ensure the participation of groups underrepresented in STEM. Grants and contributions will also be awarded to inspire ingenious ideas from post-secondary institutions, schools and not-for-profit organizations across the country for the development and delivery of STEM activities with a lunar exploration focus.

United Nations' (UN) 2030 Agenda for Sustainable Development and the UN Sustainable Development Goals

The CSA's scientific and satellite missions contribute to the achievement of the UN Sustainable Development Goals (SDG) in multiple ways. SEO missions such as SCISAT[xxxi], SWOT[xli], WildFireSat[vii], OSIRIS on Odin[xxx] and projects under the smartEarth[ix] initiative will strengthen resiliency and adaptability to climate-related hazards and natural disasters (SDG 13.1[lv]). RCM[viii]'s Earth observation data will help ensure sustainable food production systems and strengthen our capacity to adapt to climate change, extreme weather, drought, flooding, and other disasters (SDG 2.4[lvi]). Furthermore, through its Open Data Strategy as well as its bilateral and multilateral engagements, the CSA enhances international cooperation and knowledge sharing in science, technology, and innovation (SDG 17.6[lvii]).

Scientific missions and activities, such as the space-based health experiments conducted on the ISS[xi], will contribute to advancing technologies that will increase access to quality essential healthcare services in remote communities (SDG 3.8[lviii]). Moreover, in 2022–23, the CSA will pursue activities seeking to create novel production technologies or systems that require minimal inputs and maximize safe, nutritious and palatable food outputs. In fact, many CSA programs and activities, such as smartEarth[ix] and the Deep Space Food Challenge[xii] have the potential to benefit remote communities and to contribute to the implementation of resilient agricultural practices in an effort to strengthening capacity for adaptation to climate change and extreme weather (SDG 2.4[lvi]).

Initiatives such as LEAP[vi] and STDP[xiii] have the potential to help ending poverty (SDG 1.2[lix]) by contributing to higher levels of economic productivity through diversification, technological upgrading, and innovation (SDG 8.2[lx]), and by supporting job creation, entrepreneurship and innovation (SDG 8.3[lx]).

Finally, through the Objective: Moon[xxiv] activities and the CCP[xxxiii], the CSA contributes to increasing the number of youth and adults who pursue education and skills development (SDG 4.4[lxi]). Both initiatives are designed to empower and promote the social, economic, and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion, or economic or other status (SDG 10.2[lxii]).

Experimentation

In 2022–23, the group responsible for the management of the CSA's experimentation activities will continue to implement the initiative From Ideas to Results to Innovation and will experiment with a framework to generate ideas in a bottom-up approach as well as organize and implement the second annual challenge of this initiative. The addition of ambassadors within the CSA's various sectors will mobilize and empower our personnel to experiment with different ways of doing things on a daily basis. In addition, the CSA will continue to adapt to the realities of the work environment by experimenting with a hybrid work mode.

Key risks

In a rapidly evolving context, the lack of qualified resources, coupled with difficulties in filling positions with individuals with the appropriate profile, could reduce the CSA's capability to deliver on its results. To mitigate this risk, the CSA will support the ongoing implementation of a next-generation integration strategy, and on the future of work. In addition, if the CSA does not sufficiently embrace innovation in supporting the space sector, it could translate into an inability to meet stakeholders' expectations and missed opportunities for both the CSA and stakeholders. To mitigate this risk, among other initiatives, the CSA will support the ongoing implementation of a Strategy on Service and Digital, and will continue to lead the whole-of government Satellite Earth Observation initiative to define strategic investments and flexible programming. Risk mitigation actions are monitored regularly through an internal process.

The Canada in Space core responsibility will continue to be subject to risks from COVID-19 in 2022–23. The CSA is in regular communication with the space sector to ensure a full comprehension of the impacts of the COVID-19 pandemic. The CSA will maintain its engagement to monitor impacts through the end of the pandemic and the economic recovery period so that firms can maintain their capabilities.

Planned results for Canada in Space

The following table shows, for Canada in Space, the planned results, the result indicators, the targets and the target dates for 2022–23, and the actual results for the three most recent fiscal years for which actual results are available.

Departmental result	Departmental result indicator	Target	Date to achieve target	2018–19 actual result	2019–20 actual result	2020–21 actual result
Canada remains a leading space-faring nation	Ranking of Canadian Government civil space budget as a share of GDP among OECD and BRIC nations	27	March 31st, 2023	N/A — New indicator	N/A — New indicator	27 (2020)
	Canada's Rank among OECD nations on the citation score of space-related publications	13[1]	March 31st, 2023	13 (2017)	16 (2018)	17 (2019)
Space information and technologies improve the lives of Canadians	Number of services offered to Canadians dependent on CSA space data	120	March 31st, 2023	96 (2018)	109 (2019)	111 (2020)
	Number of Canadian space technologies adapted for use on Earth or re-use in space	25	March 31st, 2023	16 (2017)	22 (2018)	23 (2019)
Canada's investments in space benefit the Canadian economy	Number of employees in the Canadian space sector	9,000	March 31st, 2023	9,942 (2017)	9,567 (2018)	10,541 (2019)
	Value of GDP of the Canadian space sector	$2.3B	March 31st, 2023	$2.3B (2017)	$2.5B (2018)	$2.5B (2019)

The financial, human resources and performance information for the Canadian Space Agency's program inventory is available on GC InfoBase[lxiii].

[1] 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 since 2019-20 is due in part to the presence of a cluster of countries with very similar citation scores between the 10th and the 19th ranks, where a minor variation in citation score can have an impact of a few ranks.

Planned budgetary spending for Canada in Space

The following table shows budgetary spending for 2022–23, as well as planned spending for that year and for each of the next two fiscal years.

2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
329,883,029	329,883,029	300,528,357	252,521,192

Planned human resources for Canada in Space

The following table shows, in full-time equivalents, the human resources the department will need to fulfill this core responsibility for 2022–23 and for each of the next two fiscal years.

2022–23 planned full-time equivalents	2023–24 planned full-time equivalents	2024–25 planned full-time equivalents
415.6	412.9	410.0

Financial, human resources and performance information for the Canadian Space Agency's program inventory is available on GC InfoBase[lxiii].

Internal services: planned results

Description

Internal services are the services that are provided within a department so that it can meet its corporate obligations and deliver its programs. There are 10 categories of internal services:

- management and oversight services
- communications services
- legal services
- human resources management services
- financial management services
- information management services
- information technology services
- real property management services
- materiel management services
- acquisition management services

Planning highlights

To support effective project management and informed decision-making, in 2022–23, the CSA will implement its latest Investment Governance Monitoring Framework (IGMF), improve the tools available to project managers, and undertake a review of the Organizational Project Management Capacity Assessment. To ensure that the CSA's projects are safe and their risks are managed, the Agency's Safety & Mission Assurance processes will continue to be optimized and better integrated with other project management systems.

In 2022–23, the three-year Departmental Security Plan will be finalized and the work on next one will begin with the objective of mitigating the main organization risks with departmental security. The CSA will also continue its real property asset maintenance strategy, including major infrastructure refits, to ensure and prolong optimal operations of its facilities in support of the agency's mandate and its long-term greening government targets. In addition, the CSA will continue its pilot project with NRCan[xxvi] to optimize building operations, generate energy savings, and reduce GHG emissions in its head office, as well as begin planning the deployment of the CSA's carbon-neutral strategy.

The implementation of the 2021–24 Workforce Management Strategic Plan will continue in order for the organization to become a sought-after employer: the CSA is committed to adopting stimulating and engaging practices while fostering the development of skills and success of its employees — regardless of their demographic or social characteristics. Transformative results are expected through these four strategic objectives:

- Attract and retain talented people and build a diverse and inclusive workforce.

- Foster learning, leadership and the development of future talent and skills.
- Maintain and promote organizational health, wellness and a sound workplace.
- Create a culture of innovation that focuses on people.

The CSA will also continue its digital transformation efforts by modernizing its infrastructure and tools, so as to optimize the hybrid work environment and facilitate employee mobility. Adopting cloud solutions will make information technologies more responsive to employees' needs. Moreover, the CSA will provide greater flexibility, openness, accessibility and user-friendliness by updating its digital operations and developing its digital strategy. The CSA aims to provide its workforce with a suite of accessible, modern, and secure cloud-based tools for enhanced productivity, collaboration and automation. The Digital Center of Expertise will also enable the CSA to advance the activities needed to develop a new data-based governance and culture.

Planned budgetary spending for internal services

The following table shows, for internal services, budgetary spending for 2022–23, as well as planned spending for that year and for each of the next two fiscal years.

2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
58,395,350	58,395,350	55,690,300	57,969,550

Planned human resources for internal services

The following table shows, in full-time equivalents, the human resources the department will need to carry out its internal services for 2022–23 and for each of the next two fiscal years.

2022–23 planned full-time equivalents	2023–24 planned full-time equivalents	2024–25 planned full-time equivalents
408.4	400.4	399.5

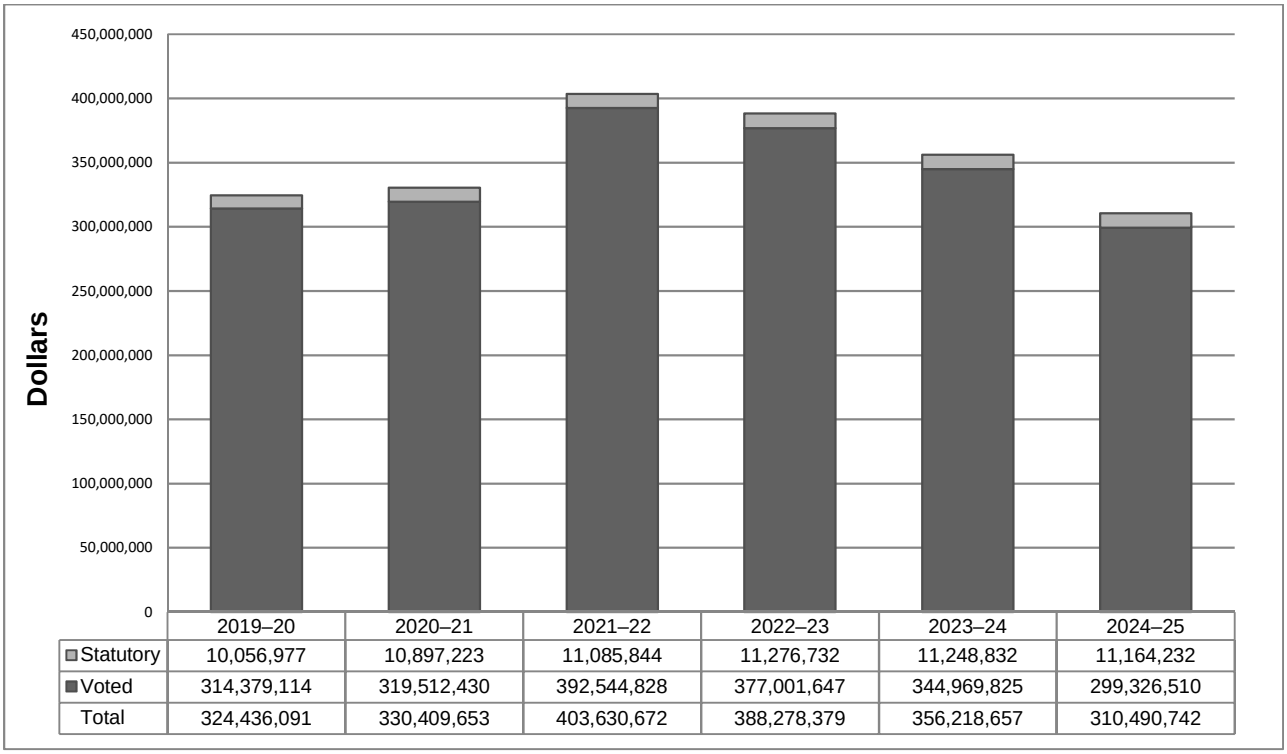
Planned spending and human resources

This section provides an overview of the department's planned spending and human resources for the next three fiscal years and compares planned spending for 2022–23 with actual spending for the current year and the previous year.

Planned spending

Departmental spending 2019–20 to 2024–25

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



	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
Statutory	10,056,977	10,897,223	11,085,844	11,276,732	11,248,832	11,164,232
Voted	314,379,114	319,512,430	392,544,828	377,001,647	344,969,825	299,326,510
Total	324,436,091	330,409,653	403,630,672	388,278,379	356,218,657	310,490,742

Budgetary planning summary for core responsibilities and internal services (dollars)

The following table shows information on spending for each of the Canadian Space Agency's core responsibilities and for its internal services for 2022–23 and other relevant fiscal years.

Core responsibilities and internal services	2019–20 actual expenditures	2020–21 actual expenditures	2021–22 forecast spending	2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Canada in Space	272,610,925	271,954,249	346,069,680	329,883,029	329,883,029	300,528,357	252,521,192
Subtotal	272,610,925	271,954,249	346,069,680	329,883,029	329,883,029	300,528,357	252,521,192
Internal Services	51,825,166	58,455,404	57,560,992	58,395,350	58,395,350	55,690,300	57,969,550
Total	324,436,091	330,409,653	403,630,672	388,278,379	388,278,379,	356,218,657	310,490,742

The variance in planned spending between 2022–23 and 2024–25 is mainly attributable to the net decrease of investments in Canada's participation on the ISS[xi] until 2024, on the Mars Sample Return[lxiv], as well as in LEAP[vi] and in Canadarm3[iii] which were announced in the 2019 budget. It is noteworthy that the CSA's project and mission funding profile varies from year to year, depending on the status of each mission, which has an impact on expenditures, forecast spending and planned spending.

Planned human resources

The following table shows information on human resources, in full-time equivalents (FTEs), for each of the Canadian Space Agency's core responsibilities and for its internal services for 2022–23 and the other relevant years.

Human resources planning summary for core responsibilities and internal services

Core responsibilities and internal services	2019–20 actual full-time equivalents	2020–21 actual full-time equivalents	2021–22 forecast full-time equivalents	2022–23 planned full-time equivalents	2023–24 planned full-time equivalents	2024–25 planned full-time equivalents
Canada in Space	387.6	391.2	439.0	415.6	412.9	410.0
Subtotal	387.6	391.2	439.0	415.6	412.9	410.0
Internal Services	289.9	317.5	346.2	408.4	400.4	399.5
Total	677.5	708.7	785.2	824.0	813.3	809.5

The variance in the number of FTEs since 2019-20 is mainly due to the additional resources required to fill certain gaps and priorities, including:

- New departmental requirements for internal services, such as setting up a data expertise centre, results-based accountability, a new service and experimentation group, increase human resource capacity and policy resets
- Increased investments to recruit the next generation of public servants, which includes the student programs
- Additional changes as a result of the Canadarm3[iii] mission, which includes new obligations such as those stemming from the new Policy on Service and Digital

Estimates by vote

Information on the Canadian Space Agency's organizational appropriations is available in the 2022–23 Main Estimates[lxv].

Future-oriented condensed statement of operations

The future-oriented condensed statement of operations provides an overview of the Canadian Space Agency's operations for 2021–22 to 2022–23.

The forecast and planned amounts in this statement of operations were prepared on an accrual basis. The forecast and planned amounts presented in other sections of the Departmental Plan were prepared on an expenditure basis. Amounts may therefore differ.

A more detailed future-oriented statement of operations and associated notes, including a reconciliation of the net cost of operations with the requested authorities, are available on the Canadian Space Agency's website[lxvi].

Future-oriented condensed statement of operations for the year ending March 31, 2023 (dollars)

Financial information	2021–22 forecast results	2022–23 planned results	Difference (2022–23 planned results minus 2021–22 forecast results)
Total expenses	567,254,207	559,813,153	(7,441,054)
Total revenues	232,426	650,926	418,500
Net cost of operations before government funding and transfers	567,021,781	559,162,227	(7,859,554)

Expenses

Total expenses, estimated on an accrual basis, are planned to be $559,813,153 in 2022–23, a slight decrease of $7,441,054 (-1.3%) from the 2021–22 forecast.

Expenses are mainly related to amortization, professional and special services, salaries and fringe benefits and transfer payments. Expenses include planned spending presented in this Departmental Plan as well as expenses not mentioned, such as amortization, services provided without charge by other government departments, severance benefits and vacation pay liability adjustments.

Revenues

Total revenues are projected to be $2,146,991 in 2022–23. Most of these revenues are generated from the sale of goods and services, such as testing services provided at DFL[lii] and are not respendable. The CSA's respendable revenues are projected to be $650,926 and represent revenues from Crown Assets Disposal.

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 Industry Development

Enabling instrument: Canadian Space Agency Act, S.C. 1990, c.13[lxvii]

Year of incorporation/commencement: Established in March 1989

Other: The Canadian Space Agency was established in 1989. The Agency's headquarters is located at the John H. Chapman Space Centre, in St.-Hubert, Quebec. Other CSA workplaces include the David-Florida Laboratory in Ottawa, Ontario; the Policy and Planning offices in Gatineau, Quebec; and liaison offices in Houston, Washington, and Paris.

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

Information on the Canadian Space Agency's raison d'être, mandate and role is available on the Canadian Space Agency's website[lxvi].

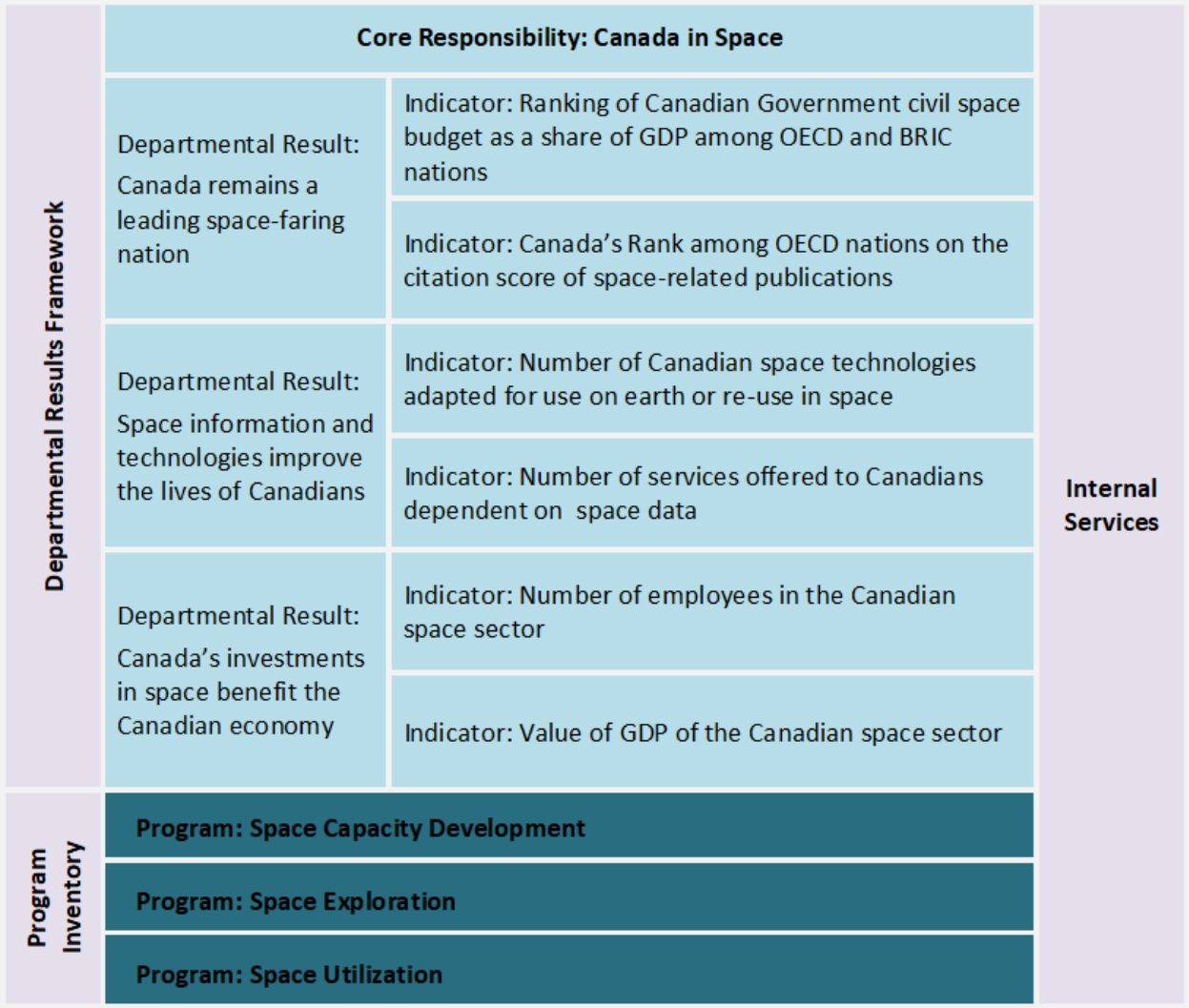
Information on the Canadian Space Agency's mandate letter commitments is available in the Minister's mandate letter[i].

Operating context

Information on the operating context is available on the Canadian Space Agency's website[lxvi].

Reporting framework

The Canadian Space Agency's approved departmental results framework and program inventory for 2022–23 are as follows.



In 2022–23, to align the CSA's Departmental Results Framework (DRF) results to the Space Strategy for Canada[ii], a new departmental result "Canada remains a leading space-faring nation" and its respective indicators are added to support the core responsibility Canada in Space. With the same objective, the result "Canadians engage with space" was removed.

Supporting information on the program inventory

Supporting information on planned expenditures, human resources, and results related to the Canadian Space Agency's program inventory is available on GC InfoBase[lxiii].

Supplementary information tables

The following supplementary information tables are available on the Canadian Space Agency's website[lxvi]:

- Departmental Sustainable Development Strategy/Reporting on Green Procurement
- Details on transfer payment programs
- Gender-based analysis plus

Federal tax expenditures

The Canadian Space Agency's Departmental Plan does not include information on tax expenditures that relate to its planned results for 2022–23.

Tax expenditures are the responsibility of the Minister of Finance. The Department of Finance Canada publishes cost estimates and projections for government-wide tax expenditures each year in the Report on Federal Tax Expenditures[lxviii]. This report provides detailed information on tax expenditures, including objectives, historical background and references to related federal spending programs, as well as evaluations, research papers and gender-based analysis plus.

Organizational contact information

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Website: https://www.asc-csa.gc.ca[lxix]

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 document that sets out a department's priorities, programs, expected results and associated resource requirements, covering a three-year period beginning with the year indicated in the title of the report. Departmental Plans are tabled in Parliament each spring.

departmental result (résultat ministériel)

A change that a department seeks to influence. 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 factor or variable that provides a valid and reliable means to measure or describe progress on a departmental result.

departmental results framework (cadre ministériel des résultats)

A framework that consists of the department's core responsibilities, departmental results and departmental result indicators.

Departmental Results Report (rapport sur les résultats ministériels)

A report on a department's actual performance in a fiscal year against its plans, priorities and expected results set out in its Departmental Plan for that year. Departmental Results Reports are usually tabled in Parliament each fall.

experimentation (expérimentation)

The conducting of activities that explore, test and compare the effects and impacts of policies and interventions in order to inform decision-making and improve outcomes for Canadians. Experimentation is related to, but distinct from, innovation. Innovation is the trying of something new; experimentation involves a rigorous comparison of results. For example, introducing a new

mobile application to communicate with Canadians can be an innovation; systematically testing the new application and comparing it against an existing website or other tools to see which one reaches more people, 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. Full-time equivalents are calculated as a ratio of assigned hours of work to scheduled hours of work. Scheduled hours of work are set out in collective agreements.

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

An analytical tool used to support the development of responsive and inclusive policies, programs and other initiatives; and understand how factors such as sex, race, national and ethnic origin, Indigenous origin or identity, age, sexual orientation, socio-economic conditions, geography, culture and disability, impact experiences and outcomes, and can affect access to and experience of government programs.

government-wide priorities (priorités pangouvernementales)

For the purpose of the 2022-23 Departmental Plan, government-wide priorities are the high-level themes outlining the Government's agenda in the 2021 Speech from the Throne: **building a healthier today and tomorrow; growing a more resilient economy; bolder climate action; fighter harder for safer communities; standing up for diversity and inclusion; moving faster on the path to reconciliation and fighting for a secure, just, and equitable world.**

horizontal initiative (initiative horizontale)

An initiative in which 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.

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 up to the expected result.

planned spending (dépenses prévues)

For Departmental Plans and Departmental Results Reports, planned spending refers to those amounts presented in the 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 a department and that focus on a specific set of outputs, outcomes or service levels.

program inventory (répertoire des programmes)

An inventory of a department's programs that describes how resources are organized to carry out the department's core responsibilities and achieve its planned results.

result (résultat)

An external 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

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