Canadian Space Agency

2017–18

Departmental Results Report

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Minister of Innovation, Science and Economic Development

Catalogue Number: ST96-14E-PDF
ISSN: 2561-150X

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Minister's message

The Honourable Navdeep Bains
Minister of Innovation, Science and Economic Development

I am pleased to present the 2017–18 Departmental Results Report for the Canadian Space Agency.

Over the past year, through integrated work across the various organizations of the Innovation, Science and Economic Development Portfolio, the Government of Canada worked very hard to improve Canada's global competitiveness while creating jobs, nurturing growth and strengthening our country's middle class.

In 2017-18, the Portfolio continued to implement the Innovation and Skills Plan to promote innovation and science, including support for scientific research and the commercialization of research and ideas. The Plan also encourages Canadian small businesses to grow, scale-up, and become more productive, more innovative and more export-oriented. An important area of this work included promoting increased tourism in Canada and the creation of new opportunities in our tourism sector. The Plan's overarching aim to position Canada as an innovation leader has been the driving focus of the Portfolio's programs.

Throughout 2017–18, the Canadian Space Agency (CSA) continued to work with the Canadian space sector and international stakeholders to identify new opportunities for Canada. CSA-enabled data was critical in 2017–18 not only for other government departments and agencies but international partners as well. The CSA also worked to address challenges with the Canadian Space Sector in order to ensure competitiveness that will drive economic growth, support talent and develop technologies.

Through deep collaborations and inclusive partnerships, the Innovation, Science and Economic Development Portfolio organizations have embarked on a shared journey to stronger, cleaner and more inclusive economic competitiveness that benefits all Canadians. This report documents the contributions that the Canadian Space Agency is making towards this important work.

Results at a glance

This section presents key achievements related to the Canadian Space Agency's (CSA) three programs as outlined in the 2017–18 Departmental Plan.[i]

Space Data, Information and Services

In 2017–18, the CSA delivered 30,478 RADARSAT-2[ii] images to the Government of Canada (GoC) and other customers and continued to work closely with other government departments to develop innovative technologies using space-based Earth Observation (EO) data.

A total of 43 GoC programs in 11 departments and agencies used CSA-enabled EO data to provide services to Canadians in 2017–18. Four programs at the Department of Fisheries and Oceans and one program at Public Safety Canada benefitted from new applications of EO data.

The CSA completed the assembly of the second and third satellites of the RADARSAT Constellation Mission[iii] (RCM), the successor to RADARSAT-2, which will ensure data continuity and broaden operational use. The RCM project supports Canada's Innovation and Skills Plan[iv] by encouraging the development of technologies that will drive the next wave of innovation and maintain Canada's leadership in space.

Space Exploration

In 2017–18, the CSA continued to fulfill its international obligations on the International Space Station[v] (ISS) and provided Canadian universities with opportunities to conduct life science experiments using this unique microgravity environment.

The CSA also supported research and operation of the Alpha Particle X-ray Spectrometer[vi] science instrument on the United States of America's Curiosity Rover, the Ultra Violet Imaging Telescope (UVIT) on India's ASTROSAT[vii] space telescope and the BRITE[viii] nanosatellite constellation. These activities were aligned with the overarching goal of the Minister of Science, which is to support scientific research. As a result of CSA investment, Canadian researchers produced a total of 226 publications in the space exploration field in 2017–18.

In 2017–18, a total of three technologies developed for use in space generated social benefits on Earth. For example, in October 2017 a private company began marketing a robotic digital microscope used in delicate surgical procedures.

Future Canadian Space Capacity

The CSA contributed to Canada's Innovation and Skills Plan[iv] by supporting people, technologies and companies in the space sector. As outlined in the State of the Canadian Space Sector Report 2016, which was released in July 2018, the space sector employed 9,883 full-time equivalents (FTEs) who contributed to the strategic and sustained use of space.

The CSA launched the Canadian CubeSat Project[ix] in April 2017, which is a unique opportunity to engage post-secondary students in a real space mission and encourage them to develop science, technology, engineering and mathematics (STEM) skills to prepare them for the jobs of tomorrow.

In 2017–18, the CSA also experimented with a new funding approach for the Space Technology Development Program[x] (STDP) by earmarking approximately 18% of the budget for small organizations, an investment of $3.4M. In total, the CSA invested over $31M, through the STDP, for the development of space technologies and supporting innovation that will encourage growth in the Canadian space sector. The most recent data of the Canadian space sector outlines that the Canadian space sector invested a total of $254M in research and development.

Financial and Human Resources

2017–18 Total Actual Spending	2017–18 Total Actual Full-Time Equivalents FTEs)
353,457,987	654.0

For more information on the CSA's plans, priorities and results achieved, see the "Results: what we achieved" section of this report.

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

Raison d’être

The Canadian Space Agency is committed to leading the development and application of space knowledge for the benefit of Canadians and humanity.

Mandate and role

The mandate of the Canadian Space Agency[xi] (CSA) is “to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians.”

The CSA is delivering on its mandate in collaboration with Canadian industry, academia, Government of Canada organizations, and other international space agencies or organizations.

The founding legislation that received Royal Assent in 1990 attributed four main functions to the CSA:

- Assist the Minister to coordinate the space policies and programs of the Government of Canada;
- Plan, direct, manage and implement programs and projects relating to scientific or industrial space research and development and the application of space technology;
- Promote the transfer and diffusion of space technology to and throughout Canadian industry; and,
- Encourage commercial exploitation of space capabilities, technology, facilities and systems.

For more general information about the department, see the “Supplementary information” section of this report. For more information on the department’s organizational mandate letter commitments, see the Minister’s mandate letter.[xii]

Operating context and key risks

Operating context

Canada's space sector is made up of a wide range of participants who develop and use space assets, capabilities and data. These interdependent groups are drawn from across government, industry and academia, and perform key functions in the space ecosystem. The Canadian space sector also exists against a dynamic backdrop of new uses for efficient space-based services, enhanced commercial opportunities and expanded international collaborations in an increasingly global competitive environment.

New applications, players, and commercial Opportunities

Many federal departments and agencies rely on space-based data to deliver on their mandates, and many others are seeking to do so in the near future. Existing and planned space-based services help provide crucial evidence-based information which informs government decision making. Space-based data also supports critical government operations, including safety and security, and climate change and environmental monitoring.

Acknowledging the potential of space, the number of countries investing in their own space programs has increased significantly in the last few years – growing from 37 countries in 2003 to 80 in 2016. This increased global activity means that Canada is operating in a competitive environment. Globally, we see the space sector evolving due to the democratization of space, driven by the miniaturization of various space technologies, and the deployment of smaller satellites and satellite constellations, which is driving down costs. This has transformed how space business is conducted, with more opportunities and more competitiveness.

To fully develop its growth potential and seize opportunities to join international space projects, the Canadian space sector needs to keep pace with this rapidly evolving context. As global innovation leads to the development of disruptive technologies, Canadian space companies are refocusing their efforts on new commercial opportunities by offering innovative space solutions. In line with the Innovation and Skills Plan, the CSA supports the development of people and innovative technologies, while offering demonstration opportunities to help Canada's space industry maintain and enhance its competitive edge.

The International Agenda

For countries like Canada, activities must be carried out in partnership with other space-faring nations using innovative and affordable technologies to tackle some of the most pressing global issues, such as climate change.

The CSA makes directed investments in key technologies, flight opportunities and innovative projects that ensure the Canadian space sector remains relevant in a dynamic international context.

To ensure alignment between the CSA's initiatives and the missions planned by partner agencies or pursued by the commercial space sector globally, the CSA is a key player in international collaborations and international committees, such as the Global Space Exploration Committee and the Committee on EO. The CSA also works closely with the National Aeronautics and Space Administration (NASA) and builds on its unique partnership with the European Space Agency (ESA) to leverage space investments, as well as to maintain open access to European markets for Canadian space companies and academia.

Key risks

In a rapidly evolving context, with diverse needs and a lengthy time frame to develop space assets, there was a risk that gaps would occur between stakeholders' expectations and the CSA's provision of products and services. To mitigate that risk, the CSA held extensive consultations with other Canadian government departments, academia, industry and international partners before selecting scientific and technological areas to support. The CSA also applied its project management and governance expertise to closely monitor the construction phase of the RCM to ensure that the project remained on schedule. Keeping to the project schedule helps ensure GoC organizations have access to EO data necessary to deliver their mandates.

A second risk pertained to space capacity in academia and industry. The Canadian space sector, especially small and medium enterprises (SMEs), remained reliant on continued research and development investments to increase existing growth opportunities and seek new ones. In 2017–18, the CSA experimented with a new funding approach for the STDP[x] to enhance the ability of Canadian space firms, particularly SMEs, to grow and respond to opportunities. The CSA also worked with Canadian industry to create partnership opportunities with international space vehicle providers.

The challenges associated with developing and implementing disruptive technologies and participating in space missions in collaboration with multiple partners represented another major source of uncertainty. The international aspect of most projects conducted by the CSA added to these challenges and exposed the CSA to risks related to scheduling and cost overruns. In order to mitigate those risks, the CSA continued to implement an improved governance model, streamlined project management processes and implemented new financial monitoring tools.

The risks associated with technological challenges, capacity of the space sector and potential gaps in fulfilling Canada's future needs are intrinsically related. In order to tackle those issues in a holistic manner, the CSA, in close collaboration with the Space Advisory Board[xiii], conducted extensive consultations with various stakeholders in the Canadian space sector. The CSA also adopted innovative practices to better use performance information in decision making. As such, new tools have been developed to better take into consideration past and expected results in all investment decisions. These initiatives allow the CSA to better align its resources with priorities,

assess the effectiveness of its work and report on the progress made in achieving results for Canadians.

Key risks

Risks	Risk response strategy	Link to the department's Programs	Link to mandate letter commitments or to government-wide and departmental priorities
Gap between stakeholders' expectations and the CSA's provision of products and services Because of a possible interruption of missions in progress, insufficiency of infrastructure or personnel in place, delays in project implementation or changes in stakeholders' requirements and priorities, there is a risk of a gap between the partners' expectations and the data and services provided by the CSA; this may affect the achievement of expected outcomes.	In 2017–18, the CSA implemented the following responses to ensure the risk was mitigated: Ongoing consultations with federal departments and agencies, industry and the academic community regarding long-term requirements; Ongoing consultations during preliminary project phases regarding operational requirements; Assessment of the development of small satellite capabilities with the objective of providing timely and more focused space solutions; Optimal management of the allocation of RADARSAT-2 data portion of the GoC's credit to ensure all federal government user needs are met within the constraints of the overall allocation; Monitoring of space objects and taking collision-avoidance measures in order to minimize the risk of serious damage to the RADARSAT-2 spacecraft; Negotiation of agreements with international and commercial entities to ensure uninterrupted availability of data; State-of-the-art project management practices for the RCM, ensuring timely delivery of the operational system; and Ongoing consultations with departments and industry regarding data exploitation applications that respond to information needs. All measures contributed to maintaining the risk at an acceptable level, while extensive consultation held with various stakeholders of the space sector is expected to contribute to further reducing risks in the future.	Space Data, Information and Services	Supporting other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.

Risks	Risk response strategy	Link to the department's Programs	Link to mandate letter commitments or to government-wide and departmental priorities
Space sector capacity Canada's space sector capacity may be at risk in the face of the arrival of new international players, uncertain investment levels and potential technology development issues. A decrease in this capacity could make it insufficient to meet Canada's future requirements, including necessary partnerships for maintaining Canada's position in the space field.	In 2017–18, the CSA took the following actions in order to mitigate this risk. Continuous updating of space technology capacity in Canada and internationally; Promoting partnerships between the Canadian private sector and the academic community; Ongoing monitoring of and reporting on Canadian space sector conditions; and Maintaining partnerships with foreign space agencies, academia and industry with the objective of creating opportunities for participation in international missions. All measures contributed to maintaining the risk at an acceptable level.	Space Exploration Future Canadian Space Capacity	Supporting scientific research and helping Canadian businesses grow, innovate and export. Supporting other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.
Unexpected technological challenges Unexpected technological challenges and changing requirements induced by the development of technologies in partnerships may lead to scheduling issues or cost increases.	In order to mitigate this risk, in 2017–18, the CSA took the following actions. Maintaining an active presence within the international coordination forum; Including various mission opportunities and collaboration alternatives at the planning stage Reducing technological uncertainty by implementing technology development activities early in the project; Assessing project risks and allocation of a financial margin based on the impact of the risk and probability levels; Implementing improved project management methodologies; and Establishing governance that emphasizes open and timely communication with central agencies and the Minister. All measures contributed to maintaining the risk at an acceptable level.	Space Exploration Space Data, Information and Services	Supporting scientific research and helping Canadian businesses grow, innovate and export. Supporting other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.

Results: what we achieved

Programs

Space Data, Information and Services

Description

This Program includes the provision of space-based solutions (data, information and services) and the progression of their utilization. It also serves to install and run ground infrastructure that processes the data and operates satellites. This Program utilizes space-based solutions to assist Government of Canada (GoC) organizations in delivering growing, diversified or cost-effective programs and services within their mandates, which are related to key national priorities, such as sovereignty, defence, safety and security, resource management, environmental monitoring and the North. It also provides academia with data required to perform its own research.

The services delivered through this Program are rendered, and the data and information are generated and processed, with the participation of the Canadian space industry, academia, GoC organizations, national and international organizations, such as: foreign space agencies, not-for-profit organizations, as well as provincial and municipal governments. This collaborative effort is formalized under national and international partnership agreements and contracts or contributions.

Results

This section presents key achievements against the commitment of Space Data, Information and Services Program as outlined in the 2017–18 Departmental Plan.[i]

In 2017–18, the CSA continued to deliver EO data by providing efficient and effective management of the RADARSAT-2[ii] data allocation to GoC departments and agencies. The CSA also supported opportunities for the effective use and reuse of archived RADARSAT-1[xiv] imagery. In 2017–18, 30,478 RADARSAT-2 images and 314 archived images were delivered to GoC and other customers.

The CSA made progress with the RCM.[iii] The assembly of the second and third satellites was completed in the third quarter of 2017–18, and tests for the ground infrastructure (Primary Control Facility) began as planned in the fourth quarter of 2017–18. The constellation is scheduled to be launched in fall 2018 with the objective of ensuring data continuity and broadening operational use. The three-satellite configuration of the RCM will provide multiple daily captures of Canada's vast territory, as well as the capability to observe a specific point of over 90% of the world's surface. It will also include an automatic identification system (AIS), improving Canada's space-based capabilities to detect ships and manage marine traffic. The RCM will support Canada's Innovation and Skills Plan[iv] by encouraging the development of technologies that will drive the next wave of innovation and maintaining Canada's leadership in space-based maritime

surveillance, climate change monitoring, land use evolution, coastal change, urban subsidence and human impacts on local environments.

The CSA continued to support the operation of the Maritime Monitoring and Messaging Microsatellite[xv] (M3MSat) mission, launched in 2016. This spacecraft provides AIS data for use in research related to the optimization of this type of data and valuable flight heritage to test innovative technologies before full deployment.

The CSA and Agriculture and Agri-Food Canada addressed the current gaps and future needs for RADARSAT agriculture applications. Seven universities and institutions across the country were selected to receive a total of $800,435 to develop new applications and innovative technologies, such as precision agriculture using imagery from Canada's RADARSAT-2[ii] satellite.

In close partnership with the Public Health Agency of Canada and international partners such as the World Health Organization, the CSA co-led an international workshop entitled "One Earth – One Health[xvi] – Contribution of EO to Public Health Practices." The event held on June 21, 2017, brought together worldwide leaders and experts in EO and public health. Five themes were identified and prioritized: vulnerable populations, mosquito-borne diseases, tick-borne diseases, water contamination, air quality and pandemics. This event strengthened national and international cooperation and will contribute to support the development of future innovative solutions and position Canada as a leader in this emerging space domain.

Four programs at the Department of Fisheries and Oceans (DFO) as well as one program of Public Safety Canada (PSC) benefitted from new applications of EO data in 2017–18. These results are well over the average target of one new program per year and represent an exceptional advancement in the adoption of space-based solutions to deliver more diversified and cost-effective services to Canadians. For example, enhanced remote sensing processes by the Canadian Hydrographic Service resulted in more accurate mapping of shorelines and detecting of changes to the littoral zone in the north, and the use of RADARSAT-2[ii] data by the Emergency Prevention/Mitigation program at PSC resulted in improved flood mapping during emergency responses and operations. In 2017–18, a total of 43 GoC programs in 11 departments and agencies used CSA-enabled EO data to provide services to Canadians.

In the context of the International Charter on Space and Major Disasters, the CSA also delivered RADARSAT-2[ii] images in response to 31 of the 45 disaster events to affected countries in 2017–18, helping mitigate the effects of disasters on human life and property.

With the view of offering future capacity to support GoC in the delivery of its mandate, the CSA continued work on the Surface Water and Ocean Topography[xvii] (SWOT) mission, an international mission involving NASA and France's Centre national d'études spatiales (CNES), which is planned to be launched in 2021. The CSA completed the manufacturing of and successfully held the Test Readiness Review for the extended interaction klystron (EIK) in March 2018. The EIK is

a component of a high-power amplifier and is part of the Canadian contribution to the mission. This contribution will secure privileged access to SWOT data, which will be of great value to Environment and Climate Change Canada for hydrological and meteorological monitoring and forecasting, and to DFO for ocean science studies.

In collaboration with Defense Research and Development Canada, the CSA successfully repaired the Near-Earth Object Surveillance Satellite[xviii] (NEOSSat) mission which continues to operate by performing space-based observations of man-made objects orbiting around Earth and monitoring asteroids approaching Earth.

In 2017–18, the CSA also continued to provide support to three Canadian science teams by investing $2.4M in the area of Sun-Earth System Science and the measurement of pollution in the atmosphere to support the operation and data production of the Atmospheric Chemistry Experiment on Canada's SCISAT[xix] satellite, the Measurement of Pollution in the Troposphere[xx] (MOPITT) instrument on the NASA Terra satellite, and the Optical Spectrograph and Infra-Red Imaging System[xxi] (OSIRIS) on the Swedish Odin satellite. Furthermore, twelve science teams from across the country were selected to receive a total of $880,250 to analyze data from Canadian atmospheric satellites and instruments to advance our understanding of physical and chemical processes of Earth's atmosphere and to improve computational models.

These investments have and will continue to contribute to Canada's strategy for monitoring atmospheric pollutants, greenhouse gases and hydrofluorocarbons (HFCs) from space, which will in turn provide important information that will contribute to international initiatives such as the Montreal Protocol, Intergovernmental Panel on Climate Change assessments and the Paris Agreement.

The variance between actual and planned FTEs of the Space Data, Information and Service program is mainly due to retirement as well as planned positions not being staffed by year end.

Results achieved

Expected results	Performance indicators	Target	Date to achieve target	2017–18 Actual results	2016–17 Actual results	2015–16 Actual results
1. GoC organizations offer more diversified or cost-effective programs and services due to their utilization of space-based solutions.	1. Number of new GoCs programs offering more diversified or efficient services.	1	31 March 2018	5	1	1

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned spending	2017–18 Total authorities available for use	2017–18 Actual spending (authorities used)*	2017–18 Difference (Actual spending minus Planned spending)
115,240,643	115,240,643	156,407,684	105,497,130	(9,743,513)

* Total authorities available are higher than planned spending because they include supplementary authorities obtained in the course of the year. These funds have been re-allocated for spending in future years.

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2017–18 Actual full-time equivalents	2017–18 Difference (Actual full-time equivalents minus Planned full-time equivalents)
114.6	105.9	(8.7)

Space Exploration

Description

This Program provides valuable Canadian science, signature technologies and qualified astronauts to international space exploration endeavours. This Program contributes to the Government of Canada's Science and Technology Strategy. It fosters the generation of knowledge as well as technological spinoffs that contribute to a higher quality of life for Canadians. It generates excitement within the population in general and contributes to nation-building. This Program appeals to the science and technology communities. It is targeted mostly towards Canadian academia and international space exploration partnerships. Canadian industry also benefits from the work generated within this Program.

This Program is delivered with the participation of foreign space agencies and Government of Canada (GoC) organizations. This collaborative effort is formalized under international partnership agreements, contracts, grants or contributions.

Results

This section presents key achievements against the commitment of the Space Exploration Program as outlined in the 2017–18 Departmental Plan.[i]

The fourth Canadian astronaut recruitment campaign was successfully completed, and two new astronauts were presented to Canadians by the Prime Minister on Parliament Hill on July 1, 2017, during Canada 150 celebrations. A Gender-Based Analysis Plus (GBA+) approach was adopted at the very start of the campaign. This was the first time such an analysis was made for an astronaut recruitment campaign. It was very useful and all assessment requirements were examined through the GBA+ lens.

In 2017–18, David Saint-Jacques'[xxii] training for his mission on the ISS[v] progressed as planned and he is currently scheduled to launch on a Soyuz spacecraft in December 2018.

The CSA continued to fulfill its international obligations on the ISS, which Canada has committed to fulfill until 2024, including the operations of the Mobile Base System[xxiii] (MBS), the support to astronauts' spacewalk activities using the Canadarm2[xxiv], Dextre[xxv] and the replacements of the MBS cameras. As part of these efforts, the unexpected failure of the latching mechanism on one of the two Latching End Effectors (LEEs) and further degradation of the snare cables forced the replacement of both of Canadarm2's LEEs in order to regain full system capabilities. It is of note that the LEEs had been in operation for 17 years, significantly exceeding their expected life of 10 years. The CSA was able to complete this critical work within its existing funds by reprioritizing other activities.

By fulfilling those obligations, the CSA gains access to the ISS, which provides Canadian universities and industry with opportunities to conduct life science experiments using the unique microgravity environment of the ISS. During the reporting period, five Canadian investigations were performed on the ISS: MARROW[xxvi] and TBone[xxvii] (musculoskeletal risks and effects on bones), Vascular Echo[xxviii] (hypogravity-associated risks and cardiovascular effects), At Home in Space[xxix] (human behaviour and performance risks and psychosocial effects) and Radi-N2[xxx] (risks and effects from radiation). Investigations in health and life sciences aim to understand and mitigate health risks associated with human adaptation to space flight with the objective of enabling long-duration human expeditions in low Earth orbit and deep space.

In addition to answering the needs of human space exploration, research performed in space contributed to improving the well-being and quality of life of Canadians. For example, MARROW studied the adverse effects of space flight on blood cell formation mechanisms in the bone marrow and Vascular Echo revealed an accelerated stiffening of the arteries and insulin resistance after exposure to the space environment. These findings shed new light on similar effects and health risks observed on Earth that are associated with aging, a sedentary lifestyle or immobility.

In the area of planetary science, the Alpha Particle X-ray Spectrometer[vi] (APXS) science instrument, which is Canada's contribution to the Curiosity Rover, has been operating since Curiosity landed on Mars in August 2012 and continues to provide data to Canadian scientists. It has accumulated over 100 days of operations on the Martian surface since operations began. The CSA's contribution of the APXS instrument to the Curiosity Rover provides Canada with a prominent role on the mission's executive science team and gives scientists data to better understand the composition of Martian rocks.

In 2017–18, the CSA supported science investigations in the space astronomy field and the operation of the UVIT on India's ASTROSAT[vii] space telescope. The data obtained helps astronomers understand the evolution of galaxies and star clusters. The CSA also supported a one-year mission extension for the Canadian team on the BRITE[viii] nanosatellite constellation, which provides a unique capability to monitor the brightest stars over long periods of time.

As a result of CSA investments, Canadian researchers added a total of 226 publications to the body of scientific knowledge in 2017–18, which is a decrease from the average of 269 publications over the last five years (2012–13 to 2016–17) and below the target for 2017–18. The decrease in publications is directly related to the operational status of space projects currently being funded by the CSA. For example, significant investments have been made in the James Webb Space Telescope which has not been launched, therefore impacting data availability and publications.

Canada is a lead partner, along with NASA and ESA, in the James Webb Space Telescope[xxxi] project, a major space telescope scheduled for launch in 2021. By virtue of the CSA's contribution, Canadian astronomers will have guaranteed access to 5% of the observing time of the Space

Telescope. In 2017–18, the CSA continued to support the integration of two of the most critical components into the Optical Telescope Assembly of the James Webb Telescope: the Fine Guidance Sensor and the Near-InfraRed Imager and Slitless Spectrograph with unique capabilities for finding the earliest and most distant objects in the universe's history and detecting the thin atmosphere of small, habitable, Earth-like planets.

NASA's OSIRIS-REx[xxxii] spacecraft, carrying Canada's contribution, the Laser Altimeter, continued to travel towards the asteroid Bennu. Regular check-outs were performed in 2017–18, and results indicate that the Altimeter is in good health and will be ready to operate when the spacecraft reaches Bennu in late 2018. The contribution of the Laser Altimeter will entitle Canada to own 4% of the returned asteroid sample after it comes back to Earth in 2023.

Canadian contributions to space exploration endeavours also generate social and economic benefits on Earth such as the robotic digital microscope that was marketed in October 2017. It is a highly flexible instrument adept at aiding in delicate surgical procedures performed in a uniquely challenging environment. In total, in 2017–18, knowledge and know-how acquired through space exploration endeavours were used in the development of three technologies to be used on Earth.

The CSA also continued the development of the Dextre Operated Camera[xxxiii] (DOC) throughout the fiscal year and work on the design phase began in August 2017. The DOC will provide an increased inspection capability of the ISS and will improve the existing space vision capability thus positioning Canadian industry for future space exploration opportunities. In 2017–18, one technology developed for the Canadian ASTRO-H Metrology System (CAMS) was reused for the ESA Proba-3 mission. The Proba-3 mission is dedicated to technology and technique demonstrations for highly precise satellite formation flying.

In response to the latest evaluation of the ISS operations recommendation to assess options for increasing the commercialization and transfer of technologies from the ISS Program to other areas, in 2017–18, the CSA initiated consultations with companies, universities and other government departments to explore the creation of a Canadian robotics network that would be inclusive of space robotics.

The CSA's investments and missions in 2017–18, provided opportunities to Canadian industry to develop critical technology solutions to meet national or international mission requirements that will benefit Canadians. It also enabled Canadian scientists to play prominent roles in support of the overall science mission objectives which advances knowledge resulting in publications that will have an impact in Canada and the world.

The variance between actual and planned FTEs of the Space Exploration program is mainly due to the reallocation of resources to astronaut David Saint-Jacques' mission to the ISS and the astronaut recruitment campaign, as well as new positions resulting from the additional funding to support ISS activities until 2024 –25.

Results achieved

Expected results	Performance indicators	Target	Date to achieve target	2017–18 Actual results	2016–17 Actual results	2015–16 Actual results
1. Expansion of advanced scientific knowledge acquired through space exploration endeavours.	1. Number of peer-reviewed scientific publications, reports and conference proceedings using space exploration information and produced by researchers (sciences and technology) in Canada.	275	31 March 2018	226	196	299
2. Multiple use and applications of knowledge and know-how acquired through space exploration endeavours	1. Number of terrestrial applications of knowledge and know-how acquired through space exploration endeavours.	3	31 March 2018	3	1	7
	2. Number of space re-utilizations of knowledge and know-how acquired through space exploration endeavours.	1	31 March 2018	1	1	1

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned spending	2017–18 Total authorities available for use	2017–18 Actual spending (authorities used)*	2017–18 Difference (Actual spending minus Planned spending)
96,455,420	96,455,420	111,865,328	101,602,306	5,146,886

* Total authorities available are higher than planned spending because they include supplementary authorities obtained in the course of the year. These funds have been re-allocated for spending in future years.

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2017–18 Actual full-time equivalents	2017–18 Difference (Actual full-time equivalents minus Planned full-time equivalents)
152.7	166.9	14.2

Future Canadian Space Capacity

Description

This Program attracts, sustains and enhances the nation's critical mass of Canadian space specialists, fosters Canadian space innovation and know-how, and preserves the nation's space-related facilities capability. In doing so, it encourages private-public collaboration that requires a concerted approach to future space missions. This Program secures the nation's strategic and ongoing presence in space in the future and preserves Canada's capability to deliver internationally renowned space assets for future generations. It is targeted at Canadian academia, industry and youth, as well as users of Canadian space solutions (Government of Canada (GoC) organizations) and international partners.

This Program is conducted with the participation of funding agencies, GoC organizations along with government facilities and infrastructure, foreign space agencies, not-for-profit organizations and provincial governments. This collaborative effort is formalized under contracts, grants, contributions or national and international partnership agreements.

Results

The Future Canadian Space Capacity Program contributed to all three priority areas of Canada's Innovation and Skills Plan[iv] by supporting people, technologies and companies in the space sector.

In 2017–18, the CSA experimented with a new funding approach for the STDP[x] by earmarking $3.4M in contributions (approximately 18% of the budget) for small organizations (up to 50 employees) which resulted in one-third (10 out of 30) of the organizations receiving funding from the STDP for the first time. A follow-up with all applicants showed that earmarking funding for SMEs was one of the strengths of this funding opportunity and that the earmarked funding for this category should be increased.

In total, the CSA invested over $31M through the STDP to support new projects for the development and maturation of 53 space technologies, supporting innovation for the growth of the Canadian space sector. These multi-year investments benefitted 33 Canadian organizations, including 26 SMEs, that shared nearly $19M of funds or 59% of the total investment, thus contributing to the Innovation and Skills Plan objective by helping Canadian businesses grow and compete globally. Technologies supported ranged from autonomous rover navigation and remote operation of robotic arms assisted by virtual reality to medical systems using artificial intelligence and carbon emission measurement. More information on projects supported by the STDP can be found on the CSA's website.[x]

As per the State of the Canadian Space Sector Report 2016, the most recent available data, the total monetary value of Canadian space sector R&D investments remained stable at $254M

compared to 2015 (1% decrease) and exceeded the target of $160M by 59% ($94M) outlined in the 2017–18 Departmental Plan. The monetary value of R&D investments fluctuates from year to year (e.g., $146M in 2014), and the target is therefore impacted by the rolling average.

In 2017–18, the CSA explored various initiatives to help reduce the gap between space R&D and commercialization and to support scale-up and growth of space companies. The CSA held forums and networking sessions throughout the year to encourage space and non-space sectors to seize new opportunities. Outreach sessions were delivered to SMEs as part of a joint collaboration between the CSA and the Canadian Intellectual Property Office to educate SMEs on the importance of intellectual property (IP) (e.g., basics, IP strategy and commercialization, and IP in government procurement) and to offer a dialogue platform on ways to improve technology transfer.

The CSA also offered industry and academia various platforms to advance space readiness levels in science and technology. A pre-space demonstration opportunity to use stratospheric balloons was provided to the Canadian space sector as part of STRATOS[xxxiv] during the Austral 2017 Stratospheric Balloon Campaign held in Alice Springs, Australia. Five Canadian prototypes were tested and validated in a near-space environment during that campaign. Access to stratospheric balloon flights – which emulate space radiation, temperature, and atmospheric pressure – is made possible through the CSA's collaboration with the CNES. Two microgravity flights were also carried out in 2017–18, during which six Canadian experiments and prototypes were tested. These parabolic flights, which replicate microgravity conditions, are made available to the Canadian space sector through the CSA's agreement with the National Research Council Canada. Lastly, the CSA conducted a series of field tests to replicate scenarios of a lunar sample return mission as part of the Lunar Exploration Analogue Deployment[xxxv] in order for scientists and engineers to gain knowledge and hands-on experience.

Finally, the CSA managed the Canada / ESA Cooperation Agreement,[xxxvi] which allows the Canadian space industry to take part in ESA programs and provides new business opportunities on the European market. Following exhaustive engagement with industry, academia and other government departments to analyze programs proposed by ESA, the CSA determined Canada's optimal investment and contributed a total of $25M to ESA programs. In response to the latest evaluation of the ESA cooperation agreement, and in collaboration with Global Affairs Canada and Public Services and Procurement Canada, the CSA also held an information session in September 2017 to communicate the implications of the Canada-European Union Comprehensive Economic and Trade Agreement (CETA) to the Canadian space industry.

The most recent data of the Canadian space sector outlines that FTEs remained stable with 9,883 FTEs employed in the space sector and contributed to the strategic and sustained use of space in 2016, compared to 9,927 in 2015 (0.5% decrease). Of those 9,883 FTEs, 4,085 were highly

qualified personnel (HQP), who have strengthened the critical mass of Canada's space specialists who can stimulate space innovation and expertise.

In 2017–18, the CSA supported the development of the workforce of tomorrow by working with universities, industry and partners. In total, 44 post-secondary institutions received $3.7M of R&D initiative funds to advance science knowledge, develop new technologies and develop HQP in STEM. These investments will help ensure that the Canadian space sector becomes more productive, innovative and export-oriented.

In April 2017, the CSA launched the Canadian CubeSat Project,[xxxvii] a unique opportunity to engage post-secondary professors and their students in a real space mission. As part of this initiative, 15 post-secondary student teams from various institutions across Canada were selected to design, build, launch and operate their own CubeSat, a miniature satellite, with a science or technology demonstration experiment on board. Funding awarded by the CSA to winning teams ranged from $200,000 to $250,000 per team.

In November 2017, the CSA also published an Announcement of Opportunity worth $6M under its Flights and Fieldwork for the Advancement of Science and Technology Funding Initiative[xxxviii] to support space-related research in Canadian post-secondary institutions. Results will be released in fall 2018.

Throughout 2017–18, upgrades were made to the David Florida Laboratory[xxxix] (DFL) thermal and structural qualification facilities, while the complete refurbishment of the Antenna Test Facility 2 – an anechoic chamber – will continue in 2018–19. This major overhaul and refit of the DFL are part of the Infrastructure Accelerated Refit project, which could not be completed in 2017–18 in order to accommodate the highly critical schedule related to the development of the RCM. The DFL offers assembly, integration and testing facilities to the Canadian space industry and academia.

By supporting people, technologies and companies in the space sector, the Future Canadian Space Capacity Program contributed to the space community's (academia, industry and government) ability to contribute to the sustained and strategic Canadian use of space.

The variance between actual and planned FTEs in the Future Canadian Space Capacity Program is mainly due to hiring resulting from the junior engineering program as well as the hiring of students.

Results achieved

Expected results	Performance indicators	Target	Date to achieve target	2017–18 Actual results	2016–17 Actual results	2015–16 Actual results
1. Canada holds a space community (academia, industry and government) able to contribute to the sustained and strategic Canadian use of space.	1. Number of FTE in the Canadian space sector.	10,000 FTE	31 March 2018	9,883 FTE	9,927 FTE	4,226 HQP[1]
	2. Monetary value of the Canadian space sector R&D investments.	$160 M	31 March 2018	$254 M	$256 M	$146 M[2]

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned spending	2017–18 Total authorities available for use	2017–18 Actual spending (authorities used)*	2017–18 Difference (Actual spending minus Planned spending)
87,170,086	87,170,086	88,849,722	86,057,723	(1,112,363)

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2017–18 Actual full-time equivalents	2017–18 Difference (Actual full-time equivalents minus Planned full-time equivalents)
103.4	114.5	11.1

Information on the Canadian Space Agency's lower-level programs is available in the GC InfoBase.[xl]

[1] Before 2016–17, the number of HQP was used instead of number of FTEs. This change was introduced to better monitor the overall capacity within the Canadian space sector. The number of HQP is still monitored as a sub-indicator of the Canadian space sector's capacity.

[2] See page 21 for the explanation of variance.

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: Management and Oversight Services; Communications Services; Legal Services; Human Resources Management Services; Financial Management Services; Information Management Services; Information Technology Services; Real Property Services; Materiel Services; and Acquisition Services.

Results

The CSA continued to build on its knowledge of the Canadian space sector and the opportunities and challenges facing its growth and competitiveness. In 2017–18, the CSA worked with the Department of ISED to continue to support the Minister's Space Advisory Board. The CSA also facilitated industry relations outreach which resulted in greater dialogue between Canadian space companies and international partners as well as raised awareness of the implementation of CETA.

The CSA strengthened its oversight by reviewing the framework used to report on results as per Treasury Board Secretariat's (TBS) new Policy on Results and by developing new tools to better take into consideration past and expected results in all investment decisions. The CSA also published its 2015 State of the Canadian Space Sector Report in July 2017 and released two evaluations in October 2017: Evaluation of the EO[xli] business line and the Evaluation of the Space Expertise and Proficiency[xlii] sub-program.

In order to ensure modern, efficient and relevant delivery of internal services, in 2017–18, the CSA continued the implementation of its various renewal initiatives to create an efficient organization that will allow the CSA to meet the challenges ahead:

- The CSA made progress on its three-year people management strategy by delivering strategic initiatives and planned operational activities to ensure a healthy, safe, diverse and inclusive workplace that promotes the development of the full potential of employees and attracts and retains talented individuals.

- In 2017–18, the CSA developed its Information Technology (IT) Plan. The plan was approved by the CSA's President and submitted to TBS in April 2018. The main actions outlined in the Information Management Strategy were completed in March 2018. Both plans aim to effectively and efficiently manage the information resources of business value and the IT applications according to their criticality and life cycle in order to support the CSA's mandate.

- Security-related infrastructure upgrades at the John H. Chapman Space Centre were completed, and activities to raise staff awareness on the importance of safety issues were performed. This contributed to mitigating key corporate security risks.

The variance of $5M in the Budgetary financial resources table below is mainly due to salary increases related to the ratification of collective agreements which expired in 2014–15 as well as any related retroactive payments.

By aligning its business processes and its activities to better adapt to its evolving environment, the CSA contributed to the Blueprint 2020 initiatives that call for a world-class public service that is recognized as having the best people working together with citizens, making smart use of new technologies and achieving the best possible outcomes with efficient, interconnected and nimble processes, structures and systems. The CSA also contributed to support the Government's results-driven commitment to Canadians, and to improve the use of evidence, data, and lessons learned in program innovation and decision making.

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned spending	2017–18 Total authorities available for use	2017–18 Actual spending (authorities used)*	2017–18 Difference (Actual spending minus Planned spending)
54,943,762	54,943,762	63,883,835	60,300,828	5,357,066

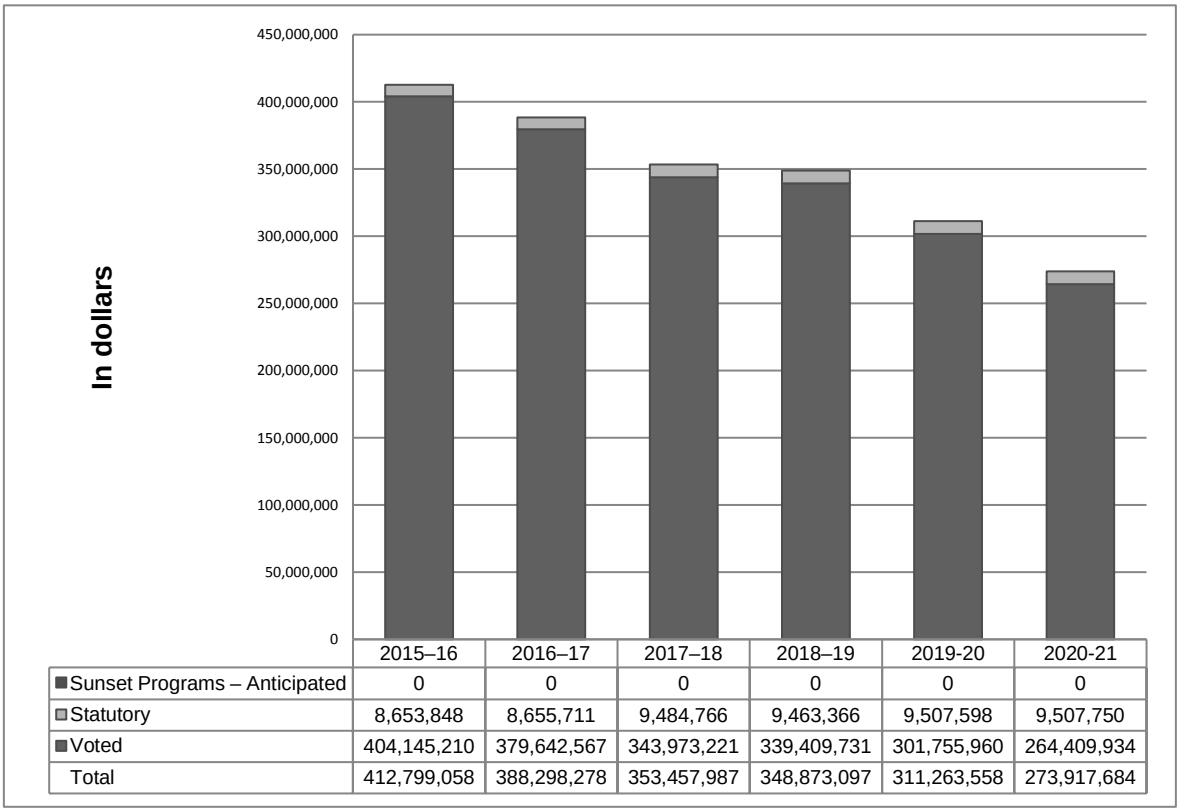
Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2017–18 Actual full-time equivalents	2017–18 Difference (Actual full-time equivalents minus Planned full-time equivalents)
263.9	266.7	2.8

Analysis of trends in spending and human resources

Actual expenditures

Departmental spending trend graph



	2015–16	2016–17	2017–18	2018–19	2019-20	2020-21
Sunset Programs – Anticipated	0	0	0	0	0	0
Statutory	8,653,848	8,655,711	9,484,766	9,463,366	9,507,598	9,507,750
Voted	404,145,210	379,642,567	343,973,221	339,409,731	301,755,960	264,409,934
Total	412,799,058	388,298,278	353,457,987	348,873,097	311,263,558	273,917,684

The variances in spending outlined above are mainly attributable to specific funding allocated to the following initiatives, over the CSA's regular budget. The cumulative impact of re-allocation of unused funds to subsequent years (re-profiling) resulting from sound management of high-risk projects, with high technology risks, long-term development cycle, and uncertainties with work schedules, also impacted the CSA's spending trend over the past years.

- Budget 2010 allocated $397M to the CSA over five fiscal years (2010–11 to 2014–15) to develop the RCM. An additional $374M over six fiscal years (2013–14 to 2018–19) was allocated for the RCM ($140M was new funding from the Fiscal Framework and $234M was transferred from user government departments to the CSA).
- The CSA's contribution to the Budget 2012 Strategic Operating Review was a little less than $25M for 2013–14 and just under $30M ongoing beginning in 2014–15.
- Additional funding and expenditure authority of $12M was authorized during 2014–15 for two years in order to provide enhanced space-based AIS data services.

- Additional funding and expenditure authority of $8M over two years (2015–16 and 2016–17) was authorized for the M3MSat project due to the increased cost of the launch provider and associated launch delay.
- Additional funding of $10M over two years (2015–16 and 2016–17) was authorized to perform accelerated infrastructure upgrades and repairs at the DFL in line with the 2014 Economic Action Plan – Federal Infrastructure announcements.
- Additional funding of $10M through the re-profiling of funds from the Fiscal Framework to 2016–17 was authorized for the provision of value-added satellite reports/images for humanitarian needs.
- In line with Budget 2015 and Budget 2016 announcements, additional funding of $30M over four years starting in 2016–17 was authorized for Canada's continued participation in ESA's Advanced Research in Telecommunications Systems program.
- As per Budget 2015 announcements and relying on up to $379M in new funding made available in Budget 2016, additional funding of $164M over eight years starting in 2017–18 was authorized to support ISS activities until 2024–25.
- Additional funding of $8M was received in 2017–18 from Budget 2016 related to safety improvements at the John H. Chapman Space Centre, as well as the purchase and installation of absorber material for the DFL Bay 2 Anechoic Chamber.

Budgetary performance summary for Programs and Internal Services (dollars)

Programs (or Core Responsibilities) and Internal Services	2017–18 Main Estimates	2017–18 Planned spending	2018–19 Planned spending	2019–20 Planned spending	2017–18 Total authorities available for use	2017–18* Actual spending (authorities used)†	2016–17 Actual spending (authorities used)†	2015–16 Actual spending (authorities used)†
Space Data, Information and Services	115,240,643	115,240,643	120,985,280	100,152,398	156,407,684	105,497,130	170,632,929	209,187,061
Space Exploration	96,455,420	96,455,420	102,767,153	83,564,848	111,865,328	101,602,306	92,310,988	96,419,798
Future Canadian Space Capacity	87,170,086	87,170,086	77,341,264	78,585,904	88,849,722	86,057,723	79,004,716	61,804,033
Subtotal	**298,866,149**	**298,866,149**	**301,093,697**	**262,303,150**	**357,122,734**	**293,157,159**	**341,948,633**	**367,410,892**
Internal Services	54,943,762	54,943,762	47,779,400	48,960,408	63,883,835	60,300,828	46,349,645	45,388,166
Total	**353,809,911**	**353,809,911**	**348,873,097**	**311,263,558**	**421,006,569**	**353,457,987**	**388,298,278**	**412,799,058**

The variances in spending outlined above are mainly attributable to specific funding allocated to the following initiatives, over the CSA's regular budget. The cumulative impact of re-profiling resulting from sound management of high-risk projects, also impacted the CSA's spending trend over the past years.

- $397M over five years (2010–11 to 2015–16) outlined in Budget 2010 in order to develop the RCM under the Space Data, Information and Services Program.
- An additional $374M over six years (2013–14 to 2018–19) allocated for the RCM from the Fiscal Framework transfers from other government departments to the CSA.
- As per Budget 2015 announcements and relying on up to $379M in new funding made available in Budget 2016, additional funding of $164M over eight years starting in 2017–18 was authorized to support ISS activities until 2024–25.

Actual human resources

Human resources summary for Programs and Internal Services (full-time equivalents)

Programs and Internal Services	2015–16 Actual full-time equivalents	2016–17 Actual full-time equivalents	2017–18 Planned full-time equivalents	2017–18 Actual full-time equivalents	2018–19 Planned full-time equivalents	2019–20 Planned full-time equivalents
Space Data, Information and Services	102.6	104.6	114.6	105.9	113.0	109.6
Space Exploration	154.8	151.1	152.7	166.9	167.1	167.1
Future Canadian Space Capacity	87.2	105.9	103.4	114.5	110.2	110.2
Subtotal	344.6	361.6	370.7	387.3	390.3	386.9
Internal Services	246.8	252.4	263.9	266.7	271.2	271.2
Total	591.4	614.0	634.6	654.0	661.5	658.1

The variance between actual and planned FTEs of the Space Data, Information and Service program is mainly due to retirement as well as planned positions not being staffed by year end.

The variance between actual and planned FTEs of the Space Exploration program is mainly due to the reallocation of resources to astronaut David Saint-Jacques' mission to the ISS and the astronaut recruitment campaign, as well as new positions resulting from the additional funding to support ISS activities until 2024 –25.

The variance between actual and planned FTEs in the Future Canadian Space Capacity Program is mainly due to hiring resulting from the junior engineering program as well as the hiring of students.

Expenditures by vote

For information on the Canadian Space Agency's organizational voted and statutory expenditures, consult the Public Accounts of Canada 2017–2018.[xliii]

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 the GC InfoBase.[xl]

Financial statements and financial statements' highlights

Financial statements

The Canadian Space Agency's financial statements (unaudited) for the year ended March 31, 2018, are available on the CSA'website.[xliv]

Financial statements' highlights

The financial highlights presented below are intended to serve as a general overview of the Canadian Space Agency's financial position and operations. More detailed information is provided in the CSA's financial statements available online in the section on Departmental Results Reports (DRRs),[xliv] which are prepared using an accrual accounting basis. Below are explanations for the variances in each major grouping based on the most significant factors that affected each grouping during 2017–18.

Condensed Statement of Operations (unaudited) for the year ended March 31, 2018 (dollars)

Financial information	2017–18 Planned results*	2017–18 Actual results	2016–17 Actual results†	Difference (2017–18 Actual results minus 2017–18 Planned results)	Difference (2017–18 Actual results minus 2016–17 Actual results)
Total expenses	326,547,500	353,808,683	341,383,133	27,261,183	12,425,550
Total revenues	28,004	10,281	35,825	(17,723)	(25,544)
Net cost of operations before government funding and transfers	326,519,496	353,798,402	341,347,308	27,278,906	12,451,094

Total planned expenses for 2017–18 were $327M, an understatement of $27M compared to actual results of $354M. The variance between planned and actual expenses is mainly due to the acquisition of machinery and material category such as RADARSAT-2 data (imagery) purchases, being higher than projected ($18M), as well as salaries and employee benefits expenses, being higher than projected ($11M).

In 2017–18, total expenses were $354M, a $12M increase over the previous year's total expenses of $341M. The increase is mainly due to a $12M increase in salaries and employee benefits expenses resulting from an increase in the number of FTE employees combined with the signing of the collective agreements.

The CSA's total revenues were $0.01M in 2017–18 ($0.03M in 2016–17). For the purpose of this report, this amount represents the respendable part of the revenues which are 0.1% of the CSA's generated revenues of $10M. This remained stable from 2016–17. The majority of these revenues are reported under the sale of goods and services provided by the DFL, i.e., sale of goods and services to private business or other GoC departments, location and use of public property, as well as Other revenues (penalties revenues).

Condensed Statement of Financial Position (unaudited) as of March 31, 2018 (dollars)

Financial information	2017–18	2016–17	Difference (2017–18 minus 2016–17)
Total net liabilities	100,562,706	104,184,547	(3,621,841)
Total net financial assets	93,515,843	98,091,348	(4,575,505)
Departmental net debt	7,046,863	6,093,199	953,664
Total non-financial assets	1,571,107,197	1,571,031,200	75,997
Departmental net financial position	1,564,060,334	1,564,938,001	(877,667)

Total net liabilities of $101M are mostly made up of accounts payable and accrued liabilities represented by $90M (89.9%). These represent goods and services received at year-end but that have not been paid by the Agency. Some of the most significant liabilities recorded at year-end are for the ISS, under the Space Exploration Program; and for the RCM, under the Space Data, Information and Services Program.

The $4M decrease in net liabilities ($101M for 2017–18 compared to $104M for 2016–17) is mainly due to a $4M decrease in accounts payable and accrued liabilities. These variations are normal as payment schedules may vary from one year to another, especially those related to the ISS, the RCM and ESA under the Future Canadian Space Capacity Program.

Total assets were $1.7B at the end of 2017–18 ($94M of net financial assets and $1.6B of non-financial assets), a $5M (0.3%) decrease compared with the previous year's total of $1.7B.

Non-financial assets are mainly composed of space-related assets ($1.4B or 88%).

Supplementary information

Corporate information

Organizational Profile

Minister of Innovation, Science and Economic Development:
The Honourable Navdeep Bains, P.C., M.P.

Institutional Head:
Sylvain Laporte, President

Ministerial Portfolio:
Innovation, Science and Economic Development

Enabling Instrument(s):
Canadian Space Agency Act, S.C. 1990, c. 13

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.

Reporting framework

The Canadian Space Agency Strategic Outcome and Program Alignment Architecture of record for 2017–18 are shown below:

1. Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.

- 1.1 Program: Space Data, Information and Services
  - 1.1.1 Sub-Program: Earth Orbit Satellite Missions and Technology
    - 1.1.1.1 Sub-Sub-Program: Earth Observation Missions
    - 1.1.1.2 Sub-Sub-Program: Communications Missions
    - 1.1.1.3 Sub-Sub-Program: Scientific Missions
  - 1.1.2 Sub-Program: Ground Infrastructure
    - 1.1.2.1 Sub-Sub-Program: Satellite Operations
    - 1.1.2.2 Sub-Sub-Program: Data Handling
  - 1.1.3 Sub-Program: Space Data, Imagery and Services Utilization Development
    - 1.1.3.1 Sub-Sub-Program: Earth Observation Data and Imagery Utilization
    - 1.1.3.2 Sub-Sub-Program: Communications Services Utilization
    - 1.1.3.3 Sub-Sub-Program: Scientific Data Utilization

- 1.2 Program: Space Exploration
  - 1.2.1 Sub-Program: International Space Station (ISS)
    - 1.2.1.1 Sub-Sub-Program: International Space Station Assembly and Maintenance Operations
    - 1.2.1.2 Sub-Sub-Program: International Space Station Utilization
  - 1.2.2 Sub-Program: Exploration Missions and Technology
    - 1.2.2.1 Sub-Sub-Program: Space Astronomy Missions
    - 1.2.2.2 Sub-Sub-Program: Planetary Missions
    - 1.2.2.3 Sub-Sub-Program: Advanced Exploration Technology Development
  - 1.2.3 Sub-Program: Human Space Missions and Support
    - 1.2.3.1 Sub-Sub-Program: Astronaut Training and Missions
    - 1.2.3.2 Sub-Sub-Program: Operational Space Medicine
    - 1.2.3.3 Sub-Sub-Program: Health and Life Sciences

1.3 Program: Future Canadian Space Capacity
- 1.3.1 Sub-Program: Space Expertise and Proficiency
- 1.3.2 Sub-Program: Space Innovation and Market Access
  - 1.3.2.1 Sub-Sub-Program: International Market Access
  - 1.3.2.2 Sub-Sub-Program: Enabling Technology Development
- 1.3.3 Sub-Program: Qualifying and Testing Services

1.4 Internal Services

Supporting information on lower-level programs

Supporting information on lower-level programs is available on the GC InfoBase.[xl]

Supplementary information tables

The following supplementary information tables are available on the CSA'website.[xliv]

- Details on transfer payment programs of $5M or more
- Evaluations
- Internal audits
- Response to parliamentary committees and external audits
- Status report on projects operating with specific Treasury Board approval
- Status report on transformational and major Crown projects

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.[xlv] This report also provides detailed background information on tax expenditures, including descriptions, objectives, historical information and references to related federal spending programs. The tax measures presented in this report are the responsibility of the Minister of Finance.

Organizational contact information

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Website : http://www.asc-csa.gc.ca

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.

Departmental Plan (plan ministériel)

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

Departmental Results Report (rapport sur les résultats ministériels)

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

evaluation (évaluation)

In the Government of Canada, the systematic and neutral collection and analysis of evidence to judge merit, worth or value. Evaluation informs decision making, improvements, innovation and accountability. Evaluations typically focus on programs, policies and priorities and examine questions related to relevance, effectiveness and efficiency. Depending on user needs, however, evaluations can also examine other units, themes and issues, including alternatives to existing interventions. Evaluations generally employ social science research methods.

experimentation (expérimentation)

Activities that seek to explore, test and compare the effects and impacts of policies, interventions and approaches, to inform evidence-based decision-making, by learning what works and what does not.

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+) (analyse comparative entre les sexes plus [ACS+])

An analytical approach used to assess how diverse groups of women, men and gender-diverse people may experience policies, programs and initiatives. The "plus" in GBA+ acknowledges that the gender-based analysis goes beyond biological (sex) and socio-cultural (gender) differences. We all have multiple identity factors that intersect to make us who we are; GBA+ considers many other identity factors, such as race, ethnicity, religion, age, and mental or

physical disability. Examples of GBA+ processes include using data disaggregated by sex, gender and other intersecting identity factors in performance analysis, and identifying any impacts of the program on diverse groups of people, with a view to adjusting these initiatives to make them more inclusive.

government-wide priorities (priorités pangouvernementales)

For the purpose of the 2017–18 Departmental Results Report, those high-level themes outlining the government's agenda in the 2015 Speech from the Throne, namely: Growth for the Middle Class; Open and Transparent Government; A Clean Environment and a Strong Economy; Diversity is Canada's Strength; and Security and Opportunity.

horizontal initiative (initiative horizontale)

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

Management, Resources and Results Structure (structure de gestion, des ressources et des résultats)

A comprehensive framework that consists of an organization's inventory of programs, resources, results, performance indicators and governance information. Programs and results are depicted in their hierarchical relationship to each other and to the Strategic Outcome(s) to which they contribute. The Management, Resources and Results Structure is developed from the Program Alignment Architecture.

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 up to the expected result.

planned spending (dépenses prévues)
For Departmental Plans and Departmental Results Reports, planned spending refers to those amounts that receive Treasury Board approval by February 1. Therefore, planned spending may include amounts incremental to planned expenditures 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.

priority (priorité)
A plan or project that an organization 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 Strategic Outcome(s) or Departmental Results.

program (programme)
A group of related resource inputs and activities that are managed to meet specific needs and to achieve intended results and that are treated as a budgetary unit.

Program Alignment Architecture (architecture d’alignement des programmes)
A structured inventory of an organization’s programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.

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.

Strategic Outcome (résultat stratégique)

A long-term and enduring benefit to Canadians that is linked to the organization's mandate, vision and core functions.

sunset program (programme temporisé)

A time-limited program that does not have an ongoing funding and policy authority. When the program is set to expire, a decision must be made whether to continue the program. In the case of a renewal, the decision specifies the scope, funding level and duration.

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

i 2017-18 CSA Departmental Plan, http://asc-csa.gc.ca/eng/publications/dp-2017-2018.asp

ii RADARSAT-2, http://www.asc-csa.gc.ca/eng/satellites/radarsat2/Default.asp

iii RADARSAT Constellation Mission, http://www.asc-csa.gc.ca/eng/satellites/radarsat/Default.asp

iv Innovation and Skills Plan, https://www.ic.gc.ca/eic/site/062.nsf/eng/home

v International Space Station, http://www.asc-csa.gc.ca/eng/iss/default.asp

vi Alpha Particle X-ray Spectrometer, http://www.asc-csa.gc.ca/eng/astronomy/mars/curiosity.asp

vii ASTROSAT, http://www.asc-csa.gc.ca/eng/sciences/astrosat.asp

viii BRITE, http://www.asc-csa.gc.ca/eng/satellites/brite/default.asp

ix Canadian CubeSat Project, http://www.asc-csa.gc.ca/eng/satellites/cubesat/default.asp

x STDP, http://www.asc-csa.gc.ca/eng/funding-programs/programs/stdp/default.asp

xi Canadian Space Agency's mandate, http://www.asc-csa.gc.ca/eng/about/mission.asp

xii. The Minister's mandate letter, https://pm.gc.ca/eng/minister-innovation-science-and-economic-development-mandate-letter

xiii Space Advisory Board, https://www.ic.gc.ca/eic/site/ad-ad.nsf/eng/h_ad03983.html

xiv RADARSAT-1, http://www.asc-csa.gc.ca/eng/satellites/radarsat1/Default.asp

xv M3MSat, http://asc-csa.gc.ca/eng/satellites/m3msat/default.asp

xvi One Earth – One Health Workshop, https://crss-sct.ca/conferences/csrs2017/one-earth-one-health-workshop/

xvii SWOT, http://www.asc-csa.gc.ca/eng/satellites/swot.asp

xviii NEOSSat, http://www.asc-csa.gc.ca/eng/satellites/neossat/default.asp

xix SCISAT, http://www.asc-csa.gc.ca/eng/satellites/scisat/default.asp

xx MOPITT, http://asc-csa.gc.ca/eng/satellites/mopitt.asp

xxi OSIRIS, http://asc-csa.gc.ca/eng/satellites/odin.asp

xxii David Saint-Jacques, http://www.asc-csa.gc.ca/eng/missions/expedition58-59/default.asp

xxiii MBS, http://www.asc-csa.gc.ca/eng/iss/mobile-base/default.asp

xxiv Canadarm2, http://www.asc-csa.gc.ca/eng/iss/canadarm2/default.asp

xxv Dextre, http://www.asc-csa.gc.ca/eng/iss/dextre/default.asp

xxvi MARROW, http://www.asc-csa.gc.ca/eng/sciences/marrow.asp

xxvii TBone, http://www.asc-csa.gc.ca/eng/sciences/tbone.asp

xxviii Vascular Echo, http://www.asc-csa.gc.ca/eng/sciences/vascular.asp

xxix At Home in Space, http://www.asc-csa.gc.ca/eng/sciences/at-home-in-space.asp

xxx Radi-N2, http://www.asc-csa.gc.ca/eng/sciences/radi-n2.asp

xxxi James Webb Space Telescope, http://www.asc-csa.gc.ca/eng/satellites/jwst/default.asp

xxxii OSIRIS-Rex, http://www.asc-csa.gc.ca/eng/satellites/osiris-rex/default.asp

xxxiii DOC, http://www.asc-csa.gc.ca/eng/iss/dextre/dextre-operated-camera.asp

[xxxiv] STRATOS, http://asc-csa.gc.ca/eng/sciences/balloons/default.asp

[xxxv] LEAD, http://asc-csa.gc.ca/eng/rovers/mission-simulations/lunar-exploration-analogue-deployment.asp

[xxxvi] Canada / ESA Cooperation Agreement, http://www.asc-csa.gc.ca/eng/funding-programs/canada-esa/default.asp

[xxxvii] Canadian CubeSat Project, http://www.asc-csa.gc.ca/eng/satellites/cubesat/default.asp

[xxxviii] FAST, http://asc-csa.gc.ca/eng/funding-programs/programs/fast/default.asp

[xxxix] DFL, http://www.asc-csa.gc.ca/eng/laboratories-and-warehouse/david-florida/default.asp

[xl] GC InfoBase, https://www.tbs-sct.gc.ca/ems-sgd/edb-bdd/index-eng.html#start

[xli] Earth Observation Evaluation, http://www.asc-csa.gc.ca/eng/publications/er-1516-0202.asp

[xlii] Space Expertise and Proficiency, http://www.asc-csa.gc.ca/eng/publications/er-1617-0201.asp

[xliii] Public Accounts of Canada 2017–2018, http://www.tpsgc-pwgsc.gc.ca/recgen/cpc-pac/index-eng.html

[xliv] CSA Departmental Results Report, http://www.asc-csa.gc.ca/eng/publications/rp.asp

[xlv] Report on Federal Tax Expenditures, http://www.fin.gc.ca/purl/taxexp-eng.asp