# Canadian Space Agency

2017–18

**Departmental Plan**

# Supplementary Information Tables

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# Details on transfer payment programs of $5 million or more

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| Name of transfer payment program | Contributions under the Canada/European Space Agency (ESA) Cooperation Agreement. |
| Start date | March 28, 2012 (ratification of the latest Agreement);<br>September 20 2012 (approval of the revised Terms & Conditions )<br>June 2016 (approval of revised Terms and Conditions) |
| End date | December 31, 2019 (end date of the latest Agreement). |
| Type of transfer payment | Contribution |
| Type of appropriation | Annually through Estimates. |
| Fiscal year for terms and conditions | The revised Terms & Conditions for the contributions, under the 2012–19 Cooperation Agreement, were approved on September 20, 2012. |
| Link to department's Program Inventory | Program 1.3 Future Canadian Space Capacity<br>Sub-Program 1.3.2 Space Innovation and Market Access<br>Sub-Sub-Program 1.3.2.1 International Market Access |
| Description | Enhance Canadian industry's technological base and provide access to European markets for value-added products and services in the fields of Earth observation (EO), telecommunications and generic technological activities; foster the participation of Canadian academia and make possible the demonstration of Canadian space technologies in European microgravity and space exploration missions and programs. This is achieved through a financial contribution by the CSA to ESA optional programs. |
| Expected results | Result: Canadian investments through the ESA Agreement allow Canadian industry to access the European market. |

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| | Performance Indicator: Canadian industrial return coefficient (Ratio between the actual value of contracts awarded by ESA to Canadian organizations and the ideal value of contracts awarded by ESA to Canadian organizations).<br><br>Result: The Canadian industry has access to flight opportunities for its space technologies/components.<br><br>Performance Indicator: Number of technologies or components developed by Canadian industry which have been space qualified and/or have acquired flight heritage through Canada's participation in ESA programs. |
| Fiscal year of last completed evaluation | 2015–16 |
| Decision following the results of last evaluation | The CSA is preparing for the next renewal of the Agreement in 2019: recommendations of the 2015 Program evaluation will be taken into considerations during that process. |
| Fiscal year of planned completion of next evaluation | 2020–21 |
| General targeted recipient groups | Canadian space sector firms, universities and not-for-profit research organizations. |
| Initiatives to engage applicants and recipients | The CSA will continue to actively consult the Canadian space sector (industry and academia) and Government of Canada organizations as part of the program selection process. |

## Planning Information (dollars)

| Type of transfer payment | 2016–17 Forecast spending | 2017–18 Planned spending | 2018–19 Planned spending | 2019–20 Planned spending |
|---|---|---|---|---|
| Total contributions | 23,545,179 | 36,648,000 | 31,518,000 | 32,531,000 |
| **Total program** | 23,545,179 | 36,648,000 | 31,518,000 | 32,531,000 |

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| Name of transfer payment program | Class Grant and Contribution Program to Support Research, Awareness and Learning in Space Science and Technology |
| Start date | October 1, 2009 |
| End date | N/A – Ongoing program |
| Type of transfer payment | Grant and Contribution |
| Type of appropriation | Annually through Estimates |
| Fiscal year for terms and conditions | 2009–10 |
| Link to department's Program Inventory | Program 1.1 Space Data, Information and Services<br>Sub-Program 1.1.1 Earth Orbit Satellite Missions and Technology<br>Sub-Sub-Program 1.1.1.3 Scientific Missions<br>Sub-Program 1.1.2 Ground Infrastructure<br>Sub-Sub-Program 1.1.2.2 Data Handling<br>Sub-Program 1.1.3 Space Data, Imagery and Services Utilization Development<br>Sub-Sub-Program 1.1.3.1 Earth Observation Data and Imagery Utilization<br><br>Program 1.2 Space Exploration<br>Sub-Program 1.2.1 International Space Station<br>Sub-Sub-Program 1.2.1.2 International Space Station Utilization<br>Sub-Program 1.2.2 Exploration Missions and Technology<br>Sub-Sub-Program 1.2.2.1 Space Astronomy Missions<br>Sub-Program 1.2.3 Human Space Missions and Support<br>Sub-Sub-Program 1.2.3.3 Health and Life Sciences<br><br>Program 1.3 Future Canadian Space Capacity<br>Sub-Program 1.3.1 Space Expertise and Proficiency<br>Sub-Program 1.3.2 Space Innovation and Market Access<br>Sub-Sub-Program 1.3.2.2 Enabling Technology Development |
| Description | This program supports knowledge development and innovation in the CSA's priority areas while increasing the awareness and participation of Canadians in space-related disciplines and activities. The program |

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| | has two components: a) Research and b) Awareness and Learning.<br><br>The Research component aims to support the development of science and technology; foster the continual development of a critical mass of researchers and highly qualified people in Canada; and support information gathering and space-related studies and research pertaining to Canadian Space Agency priorities.<br><br>The Awareness and Learning component aims to provide learning opportunities to Canadian students in various space-related disciplines; to support the operations of organizations dedicated to space research and education; and to increase awareness of Canadian space science and technology among Canadian students and their participation in related activities. It should be noted that the CSA conducted a review of all of its programs. As a result of this review, the CSA no longer financially supports initiatives under the Awareness and Learning component aimed at elementary and secondary school students. |
| Expected results | Research Component<br><br>Result #1: Increased knowledge from research projects in priority space S&T areas.<br><br>Performance Indicator: Number of new and ongoing space science and technology initiatives (Announcement of Opportunity) and projects.<br><br>Performance Indicator: Number of completed space science and technology initiatives (Announcement of Opportunity) and projects.<br><br>Performance Indicator: Number of highly qualified personnel (research team) involved in space science and technology initiatives and projects.<br><br>Result #2: Maintained and/or increased space focus in universities, post-secondary institutions, and not-for-profit and for-profit organizations.<br><br>Performance Indicator: Number of universities, post-secondary institutions and not-for-profit and for-profit organizations involved in |

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| | financed projects.<br><br>Result #3: Partnerships established and/or sustained.<br><br>Performance Indicator: Number and type of new partnerships created and sustained.<br><br>Performance Indicator: Number of research partnerships (national and international).<br><br>Result #4: Partners' contributions leveraged.<br><br>Performance Indicator: Number of agreements leveraged funding.<br><br>Performance Indicator: Proportion of leveraged funds vs. grant/contribution funds.<br><br>Result #5: Access to international collaboration for Canadian organizations.<br><br>Performance Indicator: Number of agreements leveraged by international funding. |
| Fiscal year of last completed evaluation | N/A |
| Decision following the results of last evaluation | N/A |
| Fiscal year of planned completion of next evaluation | 2021–22 |
| General targeted recipient groups | Eligible recipients for Grants: Canadian citizens or permanent residents of Canada, Canadian universities and post-secondary institutions, not-for-profit organizations established and operating in Canada and not-for-profit international research organizations or a cluster formed by a combination of the above.<br><br>Eligible recipients for Contributions: Canadian universities and post-secondary institutions, for-profit and not-for-profit organizations established and operating in Canada, and not-for-profit international research organizations or a cluster formed by a combination of the |

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| | above. |
| Initiatives to engage applicants and recipients | Since January 2012, an initiative to engage recipients has been undertaken through an automated annual follow-up of projects. The Agency has extended this initiative in order to establish a dialogue with potential applicants and recipients through the CSA website.<br><br>Consultations, presentations to and discussions with the academic and industrial communities as well with other potential recipient groups are ongoing. |

## Planning Information (dollars)

| Type of transfer payment | 2016–17 Forecast spending | 2017–18 Planned spending | 2018–19 Planned spending | 2019–20 Planned spending |
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| Total grants | 9,540,883 | 11,317,000 | 8,590,000 | 8,432,000 |
| Total contributions | 12,855,438 | 13,001,000 | 13,627,000 | 14,442,000 |
| **Total program** | **22,396,321** | **24,318,000** | **22,217,000** | **22,874,000** |

# Status Report on Transformational and Major Crown Projects

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| **Project name** | RADARSAT Constellation Mission (RCM) |
| **Description** | The RADARSAT Constellation Mission (RCM) is the next generation of Canadian Earth observation (EO) radar satellites. RADARSAT-1 was launched in 1995 and continued its operation until March 2013. RADARSAT-2, developed by the private sector in partnership with the Government of Canada (GoC), was launched in 2007 for a seven-year mission, but given its current performance, it is expected to remain operational for several more years. Canada has established itself as a leading global supplier of C-band satellite radar data for EO. The successor mission to RADARSAT-2, the RCM will maintain the leadership and position of Canadian industry in space radar technology and value-added product markets.<br><br>The RCM is comprised of three identical satellites. The launch of the constellation is planned for 2018. With a constellation, the time between successive imaging of a specific point on Earth is significantly reduced from 24 to four days. The creation of a three-satellite constellation will increase the frequency of available information, as well as the reliability of the system, making it better suited to the requirements of operations of both public and private users.<br><br>The scope of the RCM Major Crown Project includes the requirement definition, design, development, manufacturing, integration, testing and launch of the satellites as well as the design, development, manufacturing and installation of the associated ground segment. One year of operation of the three-satellite constellation is also included as well as an application development program.<br><br>The RCM will provide reliable data in all weather and illumination conditions in support of federal departments' operations and mandates in areas such as maritime surveillance, disaster management, environmental monitoring and natural resource management. The satellite constellation will provide average daily coverage capacity of most of Canada and its surrounding waters. In the North, the |

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| | constellation will provide two to three times daily coverage capacity of the Arctic and the Northwest Passage.<br><br>In support of the maritime surveillance requirements of federal departments, the RCM is the principal data source envisaged for wide-area surveillance of Canada's remote areas and marine approaches. Only satellite data can offer regular cost-effective information to task ships and aircraft in order to intercept suspicious vessels.<br><br>The daily coverage of marine areas will also support fisheries monitoring, ice and iceberg monitoring, pollution monitoring, and integrated ocean and coastal zone management. The RCM's maritime surveillance capabilities also support Canadian sovereignty and security. The RCM satellites will be able to capture ship-originated Automatic Identification System (AIS) signals from space. The combination of space-based radar images and AIS signals will provide a powerful surveillance capacity over Canada's maritime approaches and elsewhere in the world.<br><br>In support of disaster management, both in Canada and around the world, the RCM will provide critical and timely data to support disaster mitigation, warning, and response and recovery activities, while helping Canada meet its obligations with respect to international disaster relief. The types of disasters for which RCM data will be used for monitoring and relief purposes include floods, oil spills, volcanic eruptions, earthquakes and hurricanes.<br><br>In support of environmental monitoring, the RCM will provide data for wide-area change detection in order to provide support for activities such as water monitoring, wetlands mapping, coastal change monitoring and changes in the permafrost in northern Canada. RCM data will contribute to the production of more accurate weather forecasts and warnings pertaining to marine conditions, winds, severe storms and floods.<br><br>In support of natural resource management, RCM data will be a critical source of information to monitor the changing state of Canada's agricultural areas, forests and wildlife habitats. RCM data will also be used in the mining and energy sectors for resource exploration |

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| | operations to ensure that critical infrastructure is monitored properly for safety and integrity.<br><br>In addition, the RCM will sustain the development of Canadian high-technology design and manufacturing capabilities and the integration of satellite data into information products and services. Canada's space and geomatics industries will benefit from better positioning in international markets and privileged access to data deemed essential by many international users. |
| **Project outcomes** | This Major Crown Project (MCP) contributes to Program 1.1 Space Data, Information and Services, which includes the provision of space-based solutions 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 and cost-effective programs and services within the purview of their respective mandates, each 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 contribution of the MCP to the program objectives is measured through the Performance Measurement Framework (PMF) (i.e. Program Alignment Architecture (PAA) results and performance indicators).<br><br>Program 1.1 Space Data, Information and Services<br><br>Result: Government of Canada (GoC) organizations offer more diversified or cost-effective programs and services due to their utilization of space-based solutions.<br><br>Performance Indicator #1: Number of new GoCs programs offering more diversified or efficient services.<br><br>Sub-Program 1.1.1 Earth Orbit Satellite Missions and Technology<br><br>Result: GoC organizations are using space-based data to deliver their mandate. |

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| **Industrial benefits** | The RCM is expected to generate significant industrial benefits in the space and Earth Observation sectors, such as employment, economic growth and improved productivity. Investments in RCM also support the growth of small and medium-sized companies as well as Canadian capabilities in terms of infrastructure and services.<br><br>The prime contract includes a requirement for 70% Canadian content, excluding launch services and sub-systems for which there are no suppliers available in Canada. As of March 31, 2016 this corresponds to a Canadian content requirement of $418.9 million. For the same period, the CSA had provided the Canadian industry with funding of more than $487.1 million to carry out work resulting directly from the design of the RCM MCP, thus, surpassing the requirement.<br><br>The prime contract also requires that 3.5% of the 70% Canadian content be subcontracted in the Atlantic Canada region. For the same period, the actual Atlantic Canada content was $16.1 million, slightly higher than the requirement of $14.7 million.<br><br>The prime contract includes reporting obligations and performance measurements as well as financial penalties for not meeting the minimum Atlantic Canada content requirement. |
| **Sponsoring department** | Canadian Space Agency (CSA) |
| **Contracting authority** | Public Services and Procurement Canada (PSPC) |
| **Participating departments** | Agriculture and Agri-Foods Canada<br><br>Canadian Coast Guard<br><br>Environment and Climate Change Canada<br><br>Canadian Ice Service<br><br>Fisheries and Oceans Canada Indigenous and Northern Affairs Canada |

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| | Global Affairs Canada<br><br>Indigenous and Northern Affairs Canada<br><br>Innovation, Science and Economic Development Canada<br><br>National Defence and the Canadian Armed Forces<br><br>Natural Resources Canada<br><br>Parks Canada<br><br>Public Safety Canada<br><br>Royal Canadian Mounted Police<br><br>Statistics Canada<br><br>Transport Canada |
| **Prime contractor** | MDA Systems Ltd. (a division of MacDonald, Dettwiler and Associates), Richmond, British Columbia |
| **Major subcontractors** | Tier 1 Major Sub-Contractors:<br><br>- MDA Montreal, Ste-Anne-de-Bellevue, Quebec<br><br>- Magellan Aerospace, Winnipeg, Manitoba<br><br>- MDA, Halifax, Nova Scotia<br><br>- SpaceX, Hawthorne, California, USA<br><br>- Airbus Defence and Space, United Kingdom<br><br>- Honeywell Aerospace, United Kingdom<br><br>Tier 2 and Tier 3 Canadian Subcontractors:<br><br>- Stelia Aerospace North America, Lunenburg, Nova Scotia |

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| | - IMP Group, Halifax, Nova Scotia<br><br>- DRS, Ottawa, Ontario<br><br>- Mecachrome, Mirabel, Quebec<br><br>- Maya, Montreal, Quebec |
| **Project phase** | Phase D – Implementation |
| **Major milestones** | Phase A: Requirement Definition (March 2008)<br><br>Phase B: Preliminary Design (March 2010)<br><br>Phase C: Detailed Design Review (November 2012)<br><br>Phase D: Launch satellite #1, #2, and #3 (2018)<br><br>Phase E1: Operations (part of MCP) (2020)<br><br>Phase E2: Operations (not part of MCP) (2026) |
| **Progress report and explanation of variances** | On December 13, 2004, the Domestic Affairs Committee of Cabinet granted approval-in-principle to a 10-year program to implement a RADARSAT Constellation Mission (RCM) aimed at addressing the operational needs of users from the public and private sectors in relation to Canadian sovereignty and marine surveillance, environmental monitoring and change detection, and disaster management. The RCM would be government owned and operated.<br><br>On June 6, 2005, Treasury Board granted Preliminary Project Approval (PPA) for the RCM and expenditure authority for the Project Initial Planning and Identification (i.e. Phase A). During Phase A, feasibility studies were completed, user requirements were defined, and risk mitigation activities and options analysis for the bus and payload were carried out. The initial scope of work for Phase A was completed in December 2006. Phase A was then extended to allow additional technical risk reduction activities to continue during the period prior to the Phase B contract award. This was completed in March 2008. |

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| | In March 2007, Treasury Board approved a revised Preliminary Project Submission to proceed to Phases B and C. Following a competitive Request for Proposal (RFP) process, Public Services and Procurement Canada (PSPC) obtained authority to enter into negotiations with MDA, the prime contractor, and awarded the contract for Phase B in November 2008. The Preliminary Design (i.e. Phase B) was completed in March 2010. The contract for Phase B was subsequently amended to include the detailed design (i.e. Phase C).<br><br>A second revised PPA was approved by Treasury Board in December 2010. The purpose of this revised PPA was to provide additional expenditure authority to include the procurement of long-lead items during Phase C and also to include a technology demonstration for Automatic Identification System (AIS) payloads, funded by the Department of National Defence.<br><br>The final review of the overall mission-level system detailed design, the Mission Critical Design Review (CDR), was conducted in November 2012. A selected set of activities, such as completing the design qualification activities and the procurement of long-lead items, were pursued under Phase C and were completed in March 2015. These selected activities were scheduled to be completed in March 2014 but were delayed due to technical difficulties encountered during the building of the qualification models. The delay has no impact on the project.<br><br>Treasury Board granted Effective Project Approval for the RCM in December 2012, which provides expenditure and contracting authorities to complete the project and carry out the first year of RCM operations (Phases D and E1). The contract was awarded on January 9, 2013. Since contract award, planning activities have been completed and major milestones achieved to initiate the implementation phase of the satellites and associated ground system.<br><br>In 2013, a Deputy Ministers' Governance Committee on Space (DMGCS) was established to provide oversight, coordination and accountability on the RCM MCP. The DMGCS reports to the Minister of Innovation, Science and Economic Development and provides strategic direction while making timely decisions to address issues and risks that |

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| | could affect the success of the MCP.<br><br>Work in FY 2016–17 is progressing towards completion of the first satellite and delivery of major elements for integration of the second and third satellites. It is planned to have all three satellites built and all environmental tests completed in FY 2017–18. During this fiscal year, it is also planned to complete integration of all elements of the ground segment at CSA headquarters in Saint-Hubert, Quebec, finalize all government-furnished equipment, and have satellite operations personnel ready for an anticipated launch in FY 2018–19. |

| **Project name** | James Webb Space Telescope (Webb) |
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| **Description** | The James Webb Space Telescope (Webb) is a joint international mission involving National Aeronautics and Space Administration (NASA), the European Space Agency (ESA) and the CSA. The mission concept is for a large field-aperture telescope to be located 1.5 million km from Earth. Like Hubble, the Webb will be used by the astronomy community to observe targets ranging from objects within our solar system to the most remote galaxies which can be seen during their formation in the early universe. The science mission is centred on the quest to understand our origins:<br><br>• Observing the very first generation of stars to illuminate the dark universe when it was less than one billion years old;<br><br>• Understanding the physical processes that have controlled the evolution of galaxies over cosmic time and, in particular, identifying the processes that led to the assembly of galaxies within the first four billion years after the Big Bang;<br><br>• Understanding the physical processes that control the formation and early evolution of stars in our own and other nearby galaxies; and<br><br>• Studying the formation and early evolution of proto-planetary disks, and characterizing the atmospheres of isolated planetary mass objects.<br><br>The Webb is scheduled for launch in 2018. Webb instruments will be designed to work primarily in the infrared range of the electromagnetic spectrum, with some capability in the visible range. The Webb will have a large mirror, 6.5 metres in diameter and a sun shield that will be the size of a tennis court once deployed in outer space.<br><br>Canada is providing the Fine Guidance Sensor (FGS) and the Near-Infra-Red Imager and Slitless Spectrometer (NIRISS). The FGS is integral to the attitude control system of the Webb, and consists of two |

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| | fully redundant cameras that will report precise pointing information. Canadian expertise in this area was established previously with the successful fine error sensors for the former Far Ultraviolet Spectroscopic Explorer (FUSE) mission. Packaged with the FGS but functionally independent, the NIRISS covers the 0.7 to 5 micrometer spectral range. NIRISS provides a specialized capability for surveys of objects such as primeval galaxies, for the study of transiting planetary systems and for high-contrast imaging applications such as the detection of extra-solar planets.<br><br>With COM DEV Canada as prime contractor, the James Webb Space Telescope-FGS Major Crown Project consists of the design, development, testing and integration into the spacecraft, launching and commissioning of the FGS and NIRISS. By participating in this leading-edge international space exploration mission, the CSA is actively promoting Canadian scientific expertise and innovative, advanced space technologies.<br><br>The National Research Council's Herzberg Astronomy and Astrophysics (NRC Herzberg) is a key Government of Canada (GoC) partner for activities related to the development of science instruments and distribution of telescope data. In return for its overall investment in the Webb Telescope, Canada will obtain a minimum of 5% of the time on this unique space telescope.<br><br>Already, the news of Canada's involvement in this international space exploration mission is inspiring youth, educators and amateur astronomers, and rallying members of Canada's world-renowned astrophysics community. |
| **Project outcomes** | This MCP contributes to Program 1.2 Space Exploration which provides valuable Canadian science, signature technologies and qualified astronauts to international space exploration endeavours. It fosters the generation of knowledge as well as technological spin-offs that contribute to a higher quality of life for Canadians. 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 |

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| | generated within this Program. The contribution of the MCP to the program objectives is measured through the Performance Measurement Framework (PMF) (Program Alignment Architecture (PAA) results and performance indicators).<br><br>Program 1.2 Space Exploration<br><br>Result #1: Expansion of advanced scientific knowledge acquired through space exploration endeavours.<br><br>Performance Indicator #1: Number of peer-reviewed scientific publications, reports and conference proceedings using space exploration information and produced by researchers (sciences and technologies) in Canada.<br><br>Result #2: Multiple use and applications of knowledge and know-how acquired through space exploration endeavours.<br><br>Performance Indicator #1: Number of terrestrial applications of knowledge and know-how acquired through space exploration endeavours.<br><br>Performance Indicator #2: Number of space re-utilizations of knowledge and know-how acquired through space exploration endeavours.<br><br>Sub-Program 1.2.2 Exploration Missions and Technology<br><br>Result #1: Technological know-how is acquired through Space Exploration endeavors (Astronomy and Planetary).<br><br>Performance Indicator #1: Proportion of the CSA missions/solutions/instruments that met their mission performance requirements at acceptance review and/or at commissioning.<br><br>Result #2: Canada maintains a strategic positioning which supports its capacity to influence space exploration missions and decision-making processes in key international space exploration forums.<br><br>Performance Indicator #1: Number of CSA sponsored highly qualified personnel (HQP) nominated on the International Space Exploration |

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| | decision bodies.<br><br>Result #3: CSA's participation in space exploration missions provides access to scientific data about the Solar System and the Universe.<br><br>Performance Indicator #1: Number of CSA's sponsored space astronomy and planetary missions providing data to Canadian scientific community. |
| **Industrial benefits** | As of March 31, 2015, the CSA had funded close to $146 million of work for Canadian industry from the JWST-FGS Major Crown Project. Most of the direct industrial benefits from the construction of the Webb-FGS and NIRISS system will accrue to Ontario. |
| **Sponsoring department** | Canadian Space Agency |
| **Contracting authority** | Public Services and Procurement Canada (PSPC) for the Canadian Space Agency |
| **Participating departments** | NRC Herzberg Astronomy and Astrophysics<br><br>Innovation, Science and Economic Development (ISED) |
| **Prime contractor** | - COM DEV Canada, Ottawa, Ontario |
| **Major subcontractors** | - Teledyne, USA<br>- Corning Netoptix, USA<br>- IMP Aerospace Avionics, Canada<br>- ABB Bomem, Canada<br>- MDA, Canada<br>- INO, Canada<br>- BMV, Canada<br>- CDA Intercorp, USA |

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| | - ESTL, Europe<br>- Bach Research Corporation, USA<br>- Materion, USA<br>- Camcor, Canada |
| **Project phase** | Phase D – Implementation |
| **Major milestones** | Phase A: Requirement Definition (2004)<br><br>Phase B: Preliminary Design (May 2005)<br><br>Phase C: Detailed Design (September 2008)<br><br>Phase D: Manufacturing/Assembly, Integration/Testing, Pre-launch preparations, Launch/System Commissioning (March 2019)<br><br>Phase E: Operations (part of MCP) (2024) |
| **Progress report and explanation of variances** | In March 2004, Treasury Board granted Preliminary Project Approval for Phases B, C and D. In December 2006, before the completion of Phase C, detailed design of the FGS, the CSA requested increased expenditure authority to complete the project. In February 2007, the Treasury Board granted Effective Project Approval (EPA) and the project became a Major Crown Project (MCP).<br><br>In March 2007, the first Critical Design Review (CDR) for the guidance function of the FGS revealed technical issues. During the preparation of the system-level CDR, new issues became apparent. The technical issues needed to be addressed.<br><br>In December 2007, Treasury Board granted a revised EPA after project costs had raised significantly due to technical issues by the end of Phase C, the detailed design phase.<br><br>In 2010, NASA discovered that the infrared detectors, extremely sensitive cameras capable of “seeing” light produced by heat, were showing signs of performance degradation due to a design fault. Following investigation, NASA concluded that all detectors, including |

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| | the four procured by Canada, needed to be replaced. In effect, two years after their acceptance by the project, the detectors started to show the same degradation. NASA initiated an improvement project with Teledyne Scientific & Imaging LLC to address the design issue causing the degradation.<br><br>In 2011–12, work continued on hardware and software development. COMDEV Canada worked on the Proto Flight Model (PFM) which successfully completed a very stringent environmental test campaign during which the instrument was subjected to cryogenic temperatures over a period of 80 continuous days. Teledyne Scientific & Imaging LLC completed the detector design improvements and, pursuant to testing successfully addressed the degradation issues. NASA then initiated the procurement process for new detectors for the Webb Mission; the acquisition of the detectors for the FGS/NIRISS was under the responsibility of the CSA.<br><br>The FGS Engineering Test Unit (ETU) was integrated into the NASA Goddard Space Flight Center (GSFC) test set-up and underwent system-level testing with the other science instrument engineering units. The integration test onto the Integrated Science Instrument Module (ISIM) of the Webb Telescope was successfully conducted. A technical issue surfaced with a component, the Tunable Filter Instrument (TFI), which triggered the need for a change in the design approach and led to the design and development of the Near-Infrared Imager and Slitless Spectrograph (NIRISS). This new instrument relied on existing components of the old TFI but used a different approach to cover the light spectrum required for the science mission.<br><br>On July 30, 2012, the PFM FGS/NIRISS was delivered to NASA GSFC. On November 15, 2012, the PFM FGS/NIRISS was officially accepted by NASA following the successful completion of post-delivery functional tests. The FGS/NIRISS was the first instrument officially accepted by NASA as part of the James Webb Space Telescope project.<br><br>As to the procurement of the four new detectors for FGS/NIRISS, the CSA and NASA agreed on cost sharing: NASA would manage the procurement with Teledyne Scientific & Imaging LLC until the detectors |

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| | are completed at which point they would be procured off-the-shelf by the CSA (through PWGSC).<br><br>In August 2013, NASA initiated a cryogenic test campaign with the Integrated Science Instrument Module (ISIM). The test was completed in November 2013, and the FGS/NIRISS performed as expected.<br><br>The second cryogenic test campaign was conducted in 2014–15 as the integration and test activities at NASA with ISIM continued. As well, in 2014, the FGS/NIRISS detectors were replaced after the completion of the second cryogenic test campaign.<br><br>The launch date for the Webb is currently planned for October 2018.<br><br>In 2007, when the project obtained Treasury Board approval for the revised EPA, the anticipated mission launch date was May 2013. Following a re-planning exercise conducted by NASA, the launch date was slipped to October 2018, extending the project life by 5.5 years. There was an associated cost increase in the mission's integration and test phase, due to NASA having originally underestimated the work needed for this phase. The scope of work remaining to be completed for this project is as follows:<br><br>Although the flight instrument has now been delivered, the project is still in the implementation phase where support must be provided for the integration of the FGS/NIRISS to the spacecraft, for the launch activities and for the spacecraft commissioning activities.<br><br>With all the integration and test activities at NASA having been delayed and the duration of these activities revised under the NASA re-plan, the CSA and COM DEV are required to provide direct engineering post-delivery support to NASA for FGS/NIRISS and to the Webb mission commissioning activities from 2014 up until April 2019.<br><br>Official mission operations will commence after the completion of the telescope's commissioning, six months after its launch. The Webb Telescope operations center will be located in the Space Telescope Institute in Baltimore, Maryland, in the United States. Canadian scientists will be on location to directly support the operations of the FGS and NIRISS throughout the mission's operations. The operations |

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| | will also be supported by engineering staff in order to be able to address technical issues if and when they occur to ensure the functionality of Canada's instruments.<br><br>Ultimately this remaining scope of work and the extension of the mission schedule resulted in cost increases that could not be absorbed by the 2007 project authorities. As well, PWGSC needed contractual authorities for acquiring the new detectors under a sole-source contract with a US supplier. As a result, the CSA prepared a new submission to Treasury Board addressing the issues above. The submission was approved in February 2014. Treasury Board granted a revised EPA of $169.9 million (excluding taxes).<br><br>In January 2016, NASA completed the third and final cryogenic test campaign of ISIM at NASA's GSFC. During this test campaign, the FGS/NIRISS performed as expected, thus successfully closing the final performance verification of Canada's contribution to the Webb. In March 2016, NASA entered the next level of spacecraft integration and testing with the joining of ISIM and the Optical Telescope Element to form the OTIS (Optical Telescope element and Integrated Science instrument module).<br><br>The environmental test campaign for OTIS has started in late 2016 at NASA's GSFC with vibration and acoustic testing and will conclude in the summer of 2017 with a 93-days long cryogenic test. In the fall of 2017 the OTIS will be delivered to Northrop Grumman (NASA's prime contractor for the Webb) for integration with the Spacecraft and the Sunshield, and will start the final Observatory-level ambient, vibration and shock tests in preparation for launch in 2018. |

# Upcoming Internal Audits for the coming fiscal year

| Title of internal audit | Internal audit type | Status | Expected completion date |
|---|---|---|---|
| Ground Infrastructure Management Framework | Management Framework | Planned | June 2017 |
| Occupational Health and Safety | Compliance / Management Framework | Planned | September 2017 |
| Management framework of Space Astronomy Missions (1.2.2.1) and Planetary Missions (1.2.2.2) Programs | Management Framework | Planned | December 2017 |

The Risk-Based Audit Plan is presently under revision; therefore, one audit that has not yet been identified may be added to the list for fiscal year 2019–20.

## Upcoming evaluations over the next five fiscal years

| Fiscal year (of the planned date for deputy head approval of the evaluation report) | Title of the evaluation | Completion of last evaluation | Link to department's Program Inventory | Planned spending associated with the program(s) evaluated (dollars) |
|---|---|---|---|---|
| 2016–17 | Space Astronomy and Planetary Missions | Never evaluated | 1.2.2.1 Space Astronomy Missions<br>1.2.2.2 Planetary Missions | 9,054,743 |
| 2016–17 | Earth Observation Missions, Earth Observation Data and Imagery Utilization, and Ground Infrastructure | 2012 | 1.1.1.1 Earth Observation Missions<br>1.1.2.1 Satellite Operations<br>1.1.2.2 Data Handling<br>1.1.3.1 Earth Observation Data and Imagery Utilization | 223,273,624 |
| 2017–18 | Space Expertise and Proficiency | Never evaluated | 1.3.1 Space expertise and Proficiency | 11,900,100 |
| 2017–18 | Scientific Missions, Science Data Utilization, Ground Infrastructure, including CASSIOPE | 2014 (CASSIOPE) | 1.1.1.3 Scientific Missions<br>1.1.2.1 Satellite Operations<br>1.1.2.2 Data Handling<br>1.1.3.3 Scientific Data Utilization | 10,087,589 |

| Fiscal year (of the planned date for deputy head approval of the evaluation report) | Title of the evaluation | Completion of last evaluation | Link to department's Program Inventory | Planned spending associated with the program(s) evaluated (dollars) |
|---|---|---|---|---|
| 2017–18 | Communications Missions, Communications Services Utilization and Ground Infrastructure, including M3MSat | Never evaluated | 1.1.1.2 Communications Missions<br>1.1.2.1 Satellite Operations<br>1.1.2.2 Data Handling<br>1.1.3.2 Communications Services Utilization | 10,984,066 |
| 2017–18 | Human Space Missions and Support and the International Space Station Utilization | Never evaluated | 1.2.3.1 Astronaut Training and Missions<br>1.2.3.2 Operational Space Medicine<br>1.2.3.3 Health and Life Sciences<br>1.2.1.2 International Space Station Utilization | 20,807,287 |
| 2018–19 | Advanced Exploration Technology Development | 2014 | 1.2.2.3 Advanced Exploration Technology Development | 9,358,282 |
| 2019–20 | Qualifying and Testing Services | 2014 | 1.3.3 Qualifying and Testing Services | 6,382,590 |
| 2019–20 | International Market Access | 2015 | 1.3.2.1 International Market Access | 31,241,603 |

| Fiscal year (of the planned date for deputy head approval of the evaluation report) | Title of the evaluation | Completion of last evaluation | Link to department's Program Inventory | Planned spending associated with the program(s) evaluated (dollars) |
|---|---|---|---|---|
| 2020–21 | International Space Station Assembly and Maintenance Operations | 2016 | 1.2.1.1 International Space Station Assembly and Maintenance Operations | 73,743,944 |
| **Total organizational spending** | Not applicable | Not applicable | Not applicable | 406,833,828 |

The above mentioned list of planned evaluations is based on CSA's Departmental Evaluation Plan for 2016-17 to 2020-21. Changes may occur following approval of CSA's Departmental Evaluation Plan for 2017-18 to 2021-22.

The evaluation of the 1.3.2.2 Sub-Sub-Program Enabling Technology Development concluded in June 2016. The planned date for deputy head approval of the next evaluation report will be determined in the Departmental Evaluation Plan for 2017-18 to 2021-22.

According to the Departmental Evaluation Plan 2016-17 to 2020-21, the evaluation of the Class Grant and Contribution program was to conclude in 2016-17. The revised planned date for deputy head approval will be determined in the Departmental Evaluation Plan 2017-18 to 2021-22.