

**CANADIAN SPACE AGENCY
2009-2010 DEPARTMENTAL PERFORMANCE REPORT**

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3.3.1) Sources of Non-Respendable Revenue

Non-Respendable Revenue (\$ in millions)

Program Activity	Actual Revenue 2007-2008	Actual Revenue 2008-2009	2009-2010			
			Main Estimates	Planned Revenue	Total Authorities	Actual Revenue
Space Based Earth Observation						
Royalty Revenues	4.0	3.9	N/A	0.7	N/A	1.1
Miscellaneous Revenues	0.0	0.2	N/A	0.0	N/A	0.0
Space Science and Exploration						
Miscellaneous Revenues	0.0	0.1	N/A	0.0	N/A	0.0
Satellite Communications						
Royalties from Intellectual Property	0.1	0.0	N/A	0.0	N/A	0.0
Generic Technological Activities in support of EO, SE and SC						
Testing Facilities and Services of the David Florida Laboratory	3.2	2.6	N/A	1.0	N/A	1.7
Royalties from Intellectual Property	0.0	0.0	N/A	0.0	N/A	0.1
Internal Services						
Miscellaneous Revenues	0.0	0.0	N/A	0.0	N/A	0.4
Total Non-Respendable Revenue	7.3	6.8	N/A	1.8	N/A	3.2

Note: Due to rounding, figures may not add up to totals shown.

3.3.2) User Fees Reporting

User Fee: Fees charged for the processing of access to information requests filed under the *Access to Information Act* (ATIA)

Fee Type: Other products and services (O)

Fee-Setting Authority: *Access to Information Act*

Date Last Modified: 1992

Performance Standards: Response provided within 30 days following receipt of request; the response time may be extended pursuant to section 9 of the *ATIA*. Notices of extension are to be sent within 30 days after receipt of request. The [Access to Information Act](#) provides fuller details.

Performance Results: The Canadian Space Agency (CSA) received 12 new requests for access to information and processed an additional two that were outstanding from the previous period, for a total of 14. CSA routinely waives fees in accordance with TBS guidelines. The response time was within time limits in 71% of the requests.

(\$ in thousands)					
2009-2010			Planning Years		
Forecast Revenue	Actual Revenue	Full Cost	Fiscal Year	Forecast Revenue	Estimated Full Cost
0.1	0.1	83.8	2010-2011	0.1	85
			2011-2012	0.1	85
			2012-2013	0.1	85

Other Information: The CSA collects user fees for information requests in accordance to the *Access to Information Act*. The total user fees collected in 2009-2010 are for application fees. There was no need to charge for preparation and search fees.

3.3.3) Status Report on Projects operating with specific Treasury Board Approval

Program Activity/Project (\$ in millions)	Original Estimated Total Cost [1]	Revised Estimated Total Cost [2]	Actual Cost Total [3]	2009-2010				Expected date of close-out [4]
				Main Estimates	Planned Spending	Total Authorities	Actual	
Space Base Earth Observation								
RADARSAT-2 MCP (EPA)	242.1	433.6	417.8	0.7	0.7	0.1	0.1	2010-2011
CHINOOK MCP (PPA)[5]	105.5	105.5	6.2	-	-	-	-	TBD
RADARSAT CONSTELLATION MCP (PPA)	600.0	600.1	62.9	40.3	40.3	39.4	39.4	2016-2017
Science and Exploration								
ALPHA PARTICLE X-RAY SPECTROMETER (EPA) (APXS)	8.6	9.6	9.3	0.1	0.1	0.3	0.3	2011-2012
JAMES WEBB SPACE TELESCOPE MCP (EPA) (JWST)	49.3	144.9	126.1	23.6	23.6	27.7	27.7	2013-2014
MARS PHOENIX (EPA)	21.5	28.6	28.1	-	-	0.3	0.3	2009-2010
NEAR EARTH OBJECT SURVEILLANCE SATELLITE (EPA) (NEOSSAT)	5.4	8.4	5.2	1.6	1.6	2.1	2.1	2010-2011
ULTRA-VIOLET IMAGING TELESCOPE (EPA) (UVIT)	5.3	5.9	5.7	0.9	0.9	1.0	1.0	2010-2011
Satellite Communication								
MARITIME MONITORING AND MESSAGING MICRO- SATELLITE (EPA) (M3MSAT)	5.4	7.0	1.8	1.7	1.7	1.3	1.3	2011-2012

[1] Very first Treasury Board Expenditure Authority decision for total project cost.

[2] Most recent Treasury Board Expenditure Authority decision for total project cost.

[3] All expenditures to date including the current year.

[4] Fiscal year.

[5] Project under redefinition.

3.3.4) Status Report on Major Crown/Transformational Projects

RADARSAT-2

1- Description

RADARSAT-2 is the next generation synthetic aperture radar (SAR) Canadian Earth Observation satellite. Launched in December 2007, RADARSAT-2 provides all weather day and night coverage of the entire globe in support of security and sovereignty, fishing, shipping, oil and gas exploration, offshore drilling, mapping and ocean research. Equipped with a C-band radar system, it is the first fully commercial SAR satellite to offer multi-polarization, an important aid in identifying a wide variety of surface features and targets. It also has the capability to image right on left with a resolution down to three meters and to access an area of 800 kilometres on either side. This translates into a new range of products and services, which contributes valuable new information on natural resources and the global environment.

The RADARSAT-2 Major Crown Project (MCP) was carried, in partnership with MacDonald, Dettwiler and Associates (MDA), for the design, development, testing, deployment and operations of a space-borne SAR satellite to provide global coverage of terrestrial phenomena as a follow-up to RADARSAT-1. The current estimated total cost from CSA's budget is \$418.1 million.

RADARSAT-2's design and construction improves upon RADARSAT-1, with new capabilities to ensure Canada's continued leadership in the satellite remote sensing global marketplace and to maintain and further enhance a commercial industrial satellite remote sensing industry in Canada.

2- Project Phase

RADARSAT-2 MCP was closed-out in May 2010.

3- Leading and Participating Departments and Agencies

Sponsoring Agency: Canadian Space Agency

Contracting Authority for the CSA/MDA Master Agreement: Canadian Space Agency

Participating Departments: Natural Resources Canada (Canada Centre for Remote Sensing)
 Environment Canada
 Industry Canada
 Fisheries and Oceans
 National Defence
 Foreign Affairs
 International Trade
 Agriculture Canada

4- Prime and Major Sub-Contractors

Prime Contractor: - MacDonald, Dettwiler and Associates (MDA)	- Richmond, British Columbia
Major Sub-Contractors: - EMS Technologies (now MacDonald, Dettwiler, and Associates) - Alenia Aerospazio - AEC Able Engineering Co. - RADARSAT International (RSI) (now MacDonald, Dettwiler and Associates) - STARSEM	- Ste-Anne-de-Bellevue, Quebec - Rome, Italy - Goletta, California - Richmond, British Columbia - Baikonur, Kazakhstan

5- Major Milestones

The major milestones on MCP, by phase, were the following:

Phase	Major Milestones	Date
A and B	Requirement Definition	June 1999
C	System Design	May 2002
D	Sub-system Construction Integration and Testing Pre-launch Preparations Launch/Commissioning complete	September 2005 January 2007 July 2007 December 2007 April 2008
E	Operations	2008 to 2015

6- Project Outcome

RADARSAT-2 is managed under the Space Based Earth Observation Program Activity and contributes to a single overarching outcome: the benefits of activities involved in Earth Observation from space serve Canadian users in the fields of environment, resource and land-use management, and security and sovereignty. This result is measured by:

1. Proportion of active missions relative to the total number of missions supported by Canada in the EO priority areas.
2. Number of applications developed as a result of CSA's participation in space missions and/or support to projects/activities in EO considered "operational" from program standards.
3. Number of uses of EO data as a result of CSA's participation in space missions and/or support to projects/activities in EO.

The performance appears in the CSA Departmental Performance Report. For more performance information, go to the electronic version "Analysis of Program Activities by Strategic Outcome – Detailed Performance Information" at the following address:

<http://www.asc-csa.gc.ca/asc/eng/resources/publications/default.asp#parliament>

An evaluation of the RADARSAT-2 MCP was completed in 2009. To learn more about it, go to: <http://www.asc-csa.gc.ca/pdf/mcp-5702-7823.pdf>

7- Progress Report and Explanations of Variances

In June 1994, the government directed the CSA to develop an arrangement with the private sector for the development and operation of a RADARSAT follow-on program to maintain continuity of data following RADARSAT-1. In February 1998, following a formal Request for Proposal, the firm MDA was selected to construct and operate RADARSAT-2.

In December 1998, the CSA and MDA signed a Master Agreement for the RADARSAT-2 mission, under a firm price agreement in which the government contribution was \$225 million, in exchange for data. MDA was to invest \$80 million. The Master Agreement between the CSA and MDA was updated in January 2000 to reflect changes in the schedule and the latest cost estimates. The firm MDA is responsible for spacecraft operations and business development, while the CSA is responsible for arranging the launch and maintaining the long-term national archive of RADARSAT-2 data. The CSA will also provide an additional "in-kind" contribution of certain assets, plus the services of its David Florida Laboratory (DFL) and the National Research Council Canada (NRC) Institute of Aerospace Research Laboratory for spacecraft integration and testing.

In November 1998, Treasury Board (TB) approved the RADARSAT-2 Major Crown Project with a funding envelope of \$242.2 million. In March 2000, TB approved an increase of \$47.1 million to cover the cost of changing bus suppliers, required by U.S. government restrictions imposed on the U.S. bus supplier at that time, and an increase of \$12.3 million for upgrades to existing satellite ground station infrastructures. In June 2000, TB approved an increase of \$108 million to cover the cost of procuring a commercial launch as a result of NASA withdrawing from the agreement to provide launch for RADARSAT-2 in exchange for data, as it did for RADARSAT-1. In June 2001, TB approved an increase of \$6 million to cover the cost of critical modifications to be made to the RADARSAT-2 spacecraft in order to accommodate a potential future tandem mission with RADARSAT-3 which evolved to become RADARSAT Constellation Mission.

The development of the RADARSAT-2 satellite was completed at a slower pace than planned. Delays encountered by the main contractor and sub-contractors in the production of some of the satellite components have resulted in a significant delay in the assembly, integration and testing of the spacecraft. The Extendible Support Structure (ESS), one of the primary spacecraft sub-systems, was delivered to the Assembly, Integration and Test (AI&T) site at the DFL in October 2003. The Solar Arrays and the Bus were delivered to DFL in April and May 2004, respectively. The SAR antenna was delivered in September 2005. The assembly, integration and test of the RADARSAT-2 spacecraft at the DFL, along with the operations-preparations activities at the CSA in St-Hubert were successfully completed in September 2007. RADARSAT-2 was launched on December 14, 2007 and associated commissioning activities were completed by the end of April 2008. As a result, the necessary procedures and tools were developed to provide fully operational order desk services to the Government of Canada clients with regard to order handling, data acquisition planning, data archiving and web-based reporting on the client usage of the RADARSAT-2 SAR payload.

The additional costs to complete the construction and launch of RADARSAT-2 were at the main contractor's expense. However, these additional delays required that the CSA RADARSAT-2 project office remained operational to cover the remaining activities until project close-out. The necessary funding to cover all additional expenditures for the CSA is from within the project risk funding envelope and associated project authorities. With RADARSAT-2 being fully operational and the government departments making regular use of the data, the CSA prepared the closure of the RADARSAT-2 MCP and submitted to TB in March 2010.

8. Industrial Benefits

Significant industrial benefits in the space and Earth observation sectors are expected from this next-generation satellite system. The RADARSAT-2 project generates employment growth in the Canadian knowledge-based economy, mostly from export sales, and spurs the growth of small- and medium-sized businesses as the Canadian infrastructure and services industry continues to grow.

A major objective of this project was to build on the SAR data and value-added markets established with RADARSAT-1 to strengthen the Canadian industry's position as a supplier of SAR-related technology, systems and value-added products and services.

Specifically, manufacturing potential and competitiveness is encouraged in Canadian industry in the areas of phased array antenna design/manufacture, high performance receiver/transmitter design and manufacture, and enhanced structure design. Moreover, opportunities will be created for the export of ground station systems. The new capabilities also make new applications possible, creating new and expanded markets for data sales and value-added products.

At completion in 2007, the CSA had funded \$236.66 million worth of work to Canadian industry directly attributable to the RADARSAT-2 MCP. Direct industrial benefits from the construction of RADARSAT-2 have benefited several regions of Canada. The regional distribution of direct industrial benefits is shown in the following table.

**Regional Distribution of RADARSAT-2 Contracts to Canadian Industry
(at project completion)**

Program	British Columbia	Prairie Provinces	Ontario	Quebec	Atlantic Provinces	Total Canada
RADARSAT-2	59.1%	0.3%	10.2%	29.9%	0.5%	100%

Note: Due to rounding, decimals may not add up to totals shown.

**Summary of Non-Recurring Expenditures (\$ in millions)
(at project completion)**

Program	Current Estimated Total Expenditure	Actuals at March 31, 2010	Future Years
RADARSAT-2	417.8	417.8	0.0

RADARSAT Constellation

1- Description

The RADARSAT Constellation is the follow-on to RADARSAT-1 and RADARSAT-2. RADARSAT-1 was launched in 1995 and is still operating. RADARSAT-2, developed in partnership with the private sector, was launched in 2007 for a seven-year mission. Canada has established itself as a leading global supplier of C-band satellite radar data. The RADARSAT Constellation will enhance this leadership and position Canadian industry in technology and value-added product markets.

The RADARSAT Constellation is designed as a scalable constellation of three small satellites. The satellites will be launched in 2014 and 2015. With a constellation, the time between successive imaging of the same part of the Earth (revisit time) is significantly reduced. 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 operational requirements of Departments. In the event of a satellite failure, the other satellites can continue to provide a reduced level of service. The lower cost of satellites facilitates the replacement of individual satellites and makes the system scalable.

The scope of the RADARSAT Constellation Major Crown Project (MCP) includes the design, development manufacture, integration, test and launch of the satellites plus the design, development, manufacture and installation of the associated ground segment. One year of operation of the 3-satellite constellation is also included as well as an applications development program.

The RADARSAT Constellation will provide all-weather day and night data in support of three main user areas: maritime surveillance, environment and resources monitoring, and disaster management. The three satellite constellation will provide more accurate data than its predecessors with an average daily coverage of Canada and its surrounding waters. Coverage will increase significantly in Canada's North.

In support of maritime surveillance requirements of Environment Canada, Department of National Defence, Department of Fisheries and Oceans, Canadian Coast Guard and Transport Canada, the RADARSAT Constellation is the principal data source envisaged for wide area surveillance of Canada's remote areas and sea lanes. Only satellite data can offer regular cost effective coverage to task ships and aircraft to intercept suspect vessels. The daily coverage of marine areas will also support fisheries monitoring, ice and iceberg monitoring, pollution monitoring and integrated ocean and coastal zone management.

In support of environment and resources monitoring for Natural Resources Canada, Environment Canada, Parks Canada and Agriculture and Agri-foods Canada, the RADARSAT Constellation will be a critical source of information for agriculture, forestry and wildlife habitat. The Constellation will also provide medium resolution data for wide area change detection, supporting water quantity monitoring, wetlands mapping and coastal change monitoring.

In support of disaster management, both in Canada and globally, the RADARSAT Constellation can provide high resolution, all-weather (3 m) imagery of most places in the world on a daily basis. This data is critical to disaster mitigation, warning, response and recovery. Disaster types supported include flood monitoring and relief, oil spills, changes in the permafrost in northern Canada, volcano and earthquake warning and hurricane monitoring.

In addition, the RADARSAT Constellation develops 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 increased access to data and privileged positioning on international markets to data essential to many international users.

The RADARSAT Constellation will provide C-band SAR data continuity to existing RADARSAT users, including the Canadian Ice Service, which relies on SAR data to support safe shipping in Canada.

2- Project Phase

RADARSAT Constellation MCP completed the preliminary design in March 2010.

3- Leading and participating Departments and Agencies

Sponsoring Agency:	Canadian Space Agency
Contracting Authority:	Public Works and Government Services Canada
Participating Departments:	Natural Resources Canada Environment Canada National Defence Foreign Affairs and International Trade Industry Canada Fisheries and Oceans Agriculture and Agri-foods Canada Transport Canada Public Security Indian and Northern Affairs Canada Parks Canada

4- Prime and Major Sub-Contractors

Prime Contractor:	
- MacDonald, Dettwiler and Associates (MDA)	- Richmond, British Columbia
Major Sub-Contractors:	
- MacDonald, Dettwiler and Associates	- Ste-Anne-de-Bellevue, Quebec
- Magellan Aerospace, Bristol Aerospace	- Winnipeg, Manitoba
- COM DEV International Ltd.	- Cambridge, Ontario
- MacDonald, Dettwiler and Associates	- Halifax, Nova Scotia

5- Major Milestones

The major milestones on MCP, by phase, are the following:

Phase	Major Milestones	Date
A	Requirement Definition	March 2009
B	Preliminary Design	March 2010
C	Detailed Design	January 2012
D	Launch satellite #1 Launch satellite #2 Launch satellite #3	August 2014 April 2015 June 2016
E1	Operations (part of MCP)	September 2017
E2	Operations (not part of MCP)	2017 to 2023

6- Project Outcomes

RADARSAT Constellation is managed under the Space Based Earth Observation Program Activity and will contribute to a single overarching result: the benefits of activities involved in Earth Observation from space serve Canadian users in the fields of environment, resource and land-use management, and security and sovereignty. This result is measured by:

1. Proportion of active missions relative to the total number of missions supported by Canada in the EO priority areas.
2. Number of applications developed as a result of CSA's participation in space missions and/or support to projects/activities in EO considered "operational" from program standards.
3. Number of uses of EO data as a result of CSA's participation in space missions and/or support to projects/activities in EO.

Performance is monitored in the CSA Departmental Performance Report. For more performance information, go to the electronic version "Analysis of Program Activities by Strategic Outcome – Detailed Performance Information" at the following address:

<http://www.asc-csa.gc.ca/asc/eng/resources/publications/default.asp#parliament>

7- Progress Report and Explanation of Variances

On December 13, 2004, the Domestic Affairs Committee of Cabinet granted approval-in-principle to a ten-year, \$600 million program to implement a RADARSAT Constellation aimed at addressing user needs in relation to Canadian sovereignty and marine surveillance, environmental monitoring and change detection, and disaster management. The RADARSAT Constellation is to be government-owned and operated.

In Budget 2005, the CSA was provided with an additional \$110.9 million over five years (2005-2006 to 2009-2010). Combined with a further \$89.1 million from the CSA's reference levels, a total of \$200 million was identified for CSA to work with the Canadian space industry on the development of the next generation of advanced radar remote sensing satellites. This funding covers Phases A (Initial Planning and Identification Phase) through C (Detailed Definition Phase) of the RADARSAT Constellation Project, but is insufficient for building and operating the satellites.

On June 6, 2005, Treasury Board (TB) granted Preliminary Project Approval (PPA) for the RADARSAT Constellation and expenditure authority for the Project Initial Planning and Identification Phase A at a substantive cost estimate of \$13 million (excluding GST). Phase A sought to finalize feasibility studies, define user requirements, payload and bus options for the mission, and reduce technology risks for the antenna, transmit/receive modules, and sensor electronics.

The Phase A work started in July 2005 and 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.

A revised PPA TB Submission to proceed to Phases B and C was approved in March 2007. In December 2006, Public Works and Government Services Canada (PWGSC) initiated a competitive Request for Proposal (RFP) process to identify a prime contractor for the RADARSAT Constellation project (i.e., for Phases B/C/D of the space segment and a portion of the ground segment) and negotiate a contract for Phases B and C with the winning prime contractor, MDA. The contract for Phase D would follow successful completion of Phases B and C, obtaining the necessary funding and the granting of Effective Project Approval (EPA) from TB. In September 2008, PWGSC obtained authority to enter into a contract with MDA. Negotiations for Phase B were completed in October 2008 and the contract for Phase B was awarded to MDA in November 2008. Phase B was completed in March 2010. The contract for Phase B was amended to include the scope of Phase C which will continue until January 2012. Budget 2010 approved continuation of the RCM program by allocating \$497 million over 5 years, \$100 million of which will come from CSA's Reference Levels.

8- Industrial Benefits

Significant industrial benefits in the space and Earth observation sectors are expected from the RADARSAT Constellation program. It is expected to generate employment growth in the Canadian knowledge-based economy and spur the growth of small and medium-sized businesses as the Canadian infrastructure and services industry continues to grow. As of March 2010, the CSA has funded \$52 million worth of work to Canadian industry directly attributable to the RADARSAT Constellation MCP.

CSA's overall regional distribution targets will apply to the project on a "best efforts" basis. The prime contract also includes a requirement for 70% Canadian content, excluding launch services. Since Canadian Space Program spending is relatively low in Atlantic Canada, a minimum requirement of 3.5% of the total Canadian content will apply for that region. The prime contract includes reporting obligations and performance measures as well as financial penalties for not meeting the minimum Atlantic Canada content. CSA will continue to work closely with Industry Canada and Atlantic Canada Opportunities Agency to monitor regional distribution achievements and to support the prime contractor in the delivery of the given targets.

Regional Distribution of RADARSAT Constellation Contracts to Canadian Industry (as of March 31, 2010)

Program	British Columbia	Prairie Provinces	Ontario	Quebec	Atlantic Provinces	Total Canada
RADARSAT Constellation	30.2%	11.8%	19.8%	35.0%	3.2%*	100%

*Note: This represents 4.3% of the Canadian content target of 70%.

Summary of Non-Recurring Expenditures (\$ in millions) (as of March 31, 2010)

Program	Current Estimated Total Expenditure	Actuals at March 31, 2010	Future Years
RADARSAT Constellation	145.9	62.9	83.0

James Webb Space Telescope (JWST)

1-Description

The James Webb Space Telescope (JWST) is a joint mission of National Aeronautics and Space Administration (NASA), European Space Agency (ESA), and the CSA. The mission concept is for a large filled-aperture telescope located 1.5 million km from Earth. Like Hubble, the JWST will be used by the astronomy community to observe targets that range from objects within our Solar System to the most remote galaxies, which are seen during their formation in the early universe. The science mission is centered on the quest to understand the origin of life, and specifically aimed at:

- Observing the very first generation of stars to illuminate the dark universe when it was less than a billion years old.
- 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 4 billion years after the Big Bang.
- Understanding the physical processes that control the formation and early evolution of stars in our own and other nearby galaxies.
- Studying the formation and early evolution of proto-planetary disks, and characterizing the atmospheres of isolated planetary mass objects.

The JWST is scheduled for launch in 2014. JWST instruments will be designed to work primarily in the infrared range of the electromagnetic spectrum, with some capability in the visible range. JWST will have a large mirror, 6.5 meters in diameter and a sunshield the size of a tennis court that will both fold up and open once in outer space.

Canada is providing the Fine Guidance Sensor (FGS) and Tuneable Filter Imager (TFI). The FGS is integral to the attitude control system of JWST, and consists of two fully redundant cameras that will report precise pointing information of JWST. Canadian expertise in this area has been established with the successful fine error sensors for the Far Ultra Violet Spectroscopic Explorer (FUSE) mission. Packaged with the FGS but functionally independent, the TFI is a unique, narrow-band camera with imaging capability. For example, it will allow astronomers to search for extrasolar planets through a technique called *coronagraphy*, which means that the light from a star will be blocked out so that astronomers can see what is in the star's neighbourhood.

The JWST-FGS MCP, in partnership with the firm COM DEV International Ltd., consists of the design, development, integration and testing and integration into the spacecraft, launch and commissioning of the FGS and TFI.

By participating in this leading-edge international space exploration mission, the CSA is actively promoting Canadian scientific expertise and innovative, advanced space technologies. The National Research Council's Herzberg Institute of Astrophysics is a key Government of Canada partner for activities related to the development of science instruments and distribution of telescope data.

In return for its overall investment in the JWST, Canada will obtain a minimum of 5% of the time on this unique space telescope. 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.

2- Project Phase

The JWST-FGS Major Crown Project (MCP) is currently in phase D Integration and Testing.

3- Leading and Participating Departments and Agencies

Sponsoring Agency: Canadian Space Agency

Contracting Authority: Public Works and Government Services
Canada for the Canadian Space Agency

Participating Departments: NRC's Herzberg Institute of Astrophysics
Industry Canada

4- Prime and Major Sub-Contractors

Prime Contractor: - COM DEV International Ltd.	- Ottawa, Ontario
Major Sub-Contractors: - Teledyne - Corning Netoptix - IMP Aerospace Avionics - ABB Bomem - MDA - INO - CDA - ESTL	- U.S. - U.S. - Canada - Canada - Canada - Canada - U.S. - Europe

5- Major Milestones

The major milestones, by phase, are the following:

Phase	Major Milestones	Date
A	Requirement Definition	2003-2004
B	Preliminary Design	August 2004 to May 2005
C	Detailed Design	July 2005 to September 2008
D	Manufacturing/Assembly; Integration/Testing; Pre-launch preparations, Launch/System Commissioning	May 2007 to December 2015
E	Operations	2014-2015 to 2018-2019

Note: The MCP terminates with the completion of Phase D.

6- Project Outcome

The JWST-FGS MCP is managed under the Space Science and Exploration Program Activity and will contribute to a single overarching result: Participation in Canadian and international missions expands the scientific knowledge base made available to Canadian academia and research and development communities in the areas of astronomy, space exploration and solar-terrestrial relations, as well as in physical and life sciences. This result is measured by:

1. Proportion of active missions relative to the total number of missions supported by Canada in the space science and exploration priority areas.
2. Number of scientific instruments and technological applications developed as a result of CSA's participation in space missions and/or support to projects/activities in space science and exploration.
3. Number of peer-reviewed papers produced in academia and the R&D community in Canada recognizing CSA's support through its participation in space missions and/or support to projects/activities in space science and exploration.

Performance is monitored in the CSA Departmental Performance Report. For more performance information, go to the electronic version "Analysis of Program Activities by Strategic Outcome – Detailed Performance Information" at the following address: <http://www.asc-csa.gc.ca/asc/eng/resources/publications/default.asp#parliament>

7- Progress Report and Explanation of Variances

In March 2004, Treasury Board (TB) gave Preliminary Project Approval for Phases B, C and D at an indicative cost of \$67.2 million. In December 2006, before the completion of the detailed design of the FGS, the CSA requested increased expenditure authority to complete the project. TB granted Effective Project Approval for a substantive total cost estimate of \$98.4 million in February 2007 with the condition "that the Canadian Space Agency provide reports to TB at the completion of Phases C and D of the JWST project which include up-to-date information on the project scope, costs, schedule and risks". At the same time, the project became a MCP.

The first Critical Design Review (CDR), held in March 2007, for the guider function of the FGS, did reveal some technical issues, which required additional effort to resolve. This Review took place after the Effective Project Approval (EPA) received in February 2007. After this first CDR, with the focus now turning toward the preparation of the system level CDR, new issues became apparent requiring additional analysis. Testing of the Tunable Filter Imager prototype also revealed technical issues that needed to be addressed.

During this transition between the completion of the detailed design phase (Phase C) and the initiation of the manufacturing phase (Phase D) the project faced the prospect of a significant cost growth and therefore required the CSA to return to TB to amend its Effective Project Approval (EPA) for the JWST MCP. The current estimated total cost for the Definition and Implementation phases is now \$134.7 million. On December 2007, TB granted a revised Effective Project Approval. Manufacturing, integration and test of the FGS will be completed during Fiscal Year 2010-2011.

Over the last period, the project has been very busy with the hardware and software development. COM DEV International Ltd., the prime contractor for the JWST Fine Guider Sensor (FGS) project, has been working on the FGS Engineering Test Unit (ETU) and Proto Flight Model (PFM).

On the ETU, a major achievement has been the successful completion of the cryogenic detector alignment test in August 2009 at CSA David Florida Laboratory (DFL) test facilities. This milestone paved the way towards the highly anticipated environmental test campaign where the FGS ETU was subjected to environmental conditions replicating launch, transition to its operation site and operations. These tests started at DFL in the fall of 2009 and should be completed early in fiscal year 2010-2011 with a shipment review planned at the beginning of May. The ETU will then be delivered to NASA Goddard Space Flight Center.

On the PFM side, COM DEV International Ltd. has received the flight components and proceeded with the integration steps. The PFM is planned to be delivered to NASA Goddard Space Flight Center in 2011.

8- Industrial Benefits

As of March 31, 2010, the CSA has funded \$71.97 million worth of work to Canadian industry directly attributable to the JWST-FGS MCP. Direct industrial benefits from the construction of the JWST-FGS and TFI system will benefit central regions of Canada. Although there is no regional distribution requirement for this project, the following table provides an approximate distribution:

Regional Distribution of JWST Contracts to Canadian Industry (as of March 31, 2010)

Program	Ontario	Quebec	Atlantic Provinces	Total Canada
JWST-FGS and TFI	86.0%	11.6%	2.4%	100%

Summary of Non-Recurring Expenditures (\$ in millions) (as of March 2010)

Program	Current Estimated Total Expenditure	Actuals at March 31, 2010	Future Years
JWST-FGS and TFI	144.9	126.1	18.8

3.3.5) Details on Transfer Payment Programs (TPPs)

Contribution to European Space Agency (ESA)	
Start date: January 1, 2000	End Date: December 31, 2010
Description	
<p>Enhance Canadian industry's technological base and provide access to European markets for value added products and services in the field of Earth Observation (EO) and Telecommunications, allow the participation of Canadian academia and make possible the demonstration of Canadian space technologies in European Science and Exploration missions.</p>	
Strategic Outcome	
<p>Canada's presence in space meets the needs of Canadians for scientific knowledge, space technology and information.</p>	
Expected Results (Program Activities Level)	
Space Based Earth Observation:	
<p>The benefits of activities involved in Earth Observation from space serve Canadian users in the fields of environment, resource and land-use management, and security and sovereignty.</p>	
Space Science and Exploration:	
<p>Participation in Canadian and international missions expands the scientific knowledge base made available to Canadian academia and R&D communities in the areas of astronomy, space exploration and solar-terrestrial relations, as well as in physical and life sciences.</p>	
Satellite Communications:	
<p>State-of-the-art systems and applications are developed to satisfy the needs of the Canadian government and population in order to ensure that Canada remains a world leader in satellite communications.</p>	
Generic Technological Activities in support of Earth Observation, Space Science and Exploration, and Satellite Communications:	
<p>Canada's industrial technological capabilities can meet the needs of future space missions and activities.</p>	
Expected Accomplishments	
<p>Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under the following EO programs: EOEP, GMES Service Element, and GMES Space Component.</p>	
<p>Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under the following Telecommunications programs: ARTES 1, 3, 4, 5, 8 and GalileoSat.</p>	

Growing utilization of data obtained from ESA on markets and Earth Observation and Telecommunications technologies as strategic information for government departments, agencies and industries in Canada.

Demonstration of space-qualified technologies and products developed by Canadian firms for the space exploration markets via our participation to Europe's space exploration program Aurora.

Development of new alliances and/or strengthening of established alliances between Canadian and European companies, to diversify Canada's international space partnerships and complement its long-standing relationship with the U.S.

Actual Accomplishments

Several technologies and skills have been developed and improved through the participation of Canadian companies in ESA programs. Some businesses have integrated these technologies into products, allowing them to sell these products in other than European markets. In addition to generating revenues, the development and improvement of space technologies also created or maintained specialized jobs. In addition, specialized skills were created in the areas of space hardware, ground segment, and space technology applications.

The program served to boost the visibility of Canada in European markets. Canadian contractors see the ESA Contribution program as a means of cultivating business relationships. The program also fosters regional development and access to other markets by virtue of the successes of companies in Europe. Furthermore, Canada expanded its knowledge and technology in fields such as weather and ice movement forecasting, Earth Observation data, satellite communications technologies, environmental monitoring and security.

Canada's participation to the ESA program has provided flight opportunities of Canadian technologies on-board ESA's SMOS and Proba-2 satellites both launched on November 2, 2009.

(\$ in millions)	Actual Spending 2007-2008	Actual Spending 2008-2009	Planned Spending 2009-2010	Total Authorities 2009-2010	Actual Spending 2009-2010	Variances
Space Based Earth Observation (EO)	7.3	7.4	9.2	9.2	6.0	3.2
Space Science and Exploration (SE)	6.9	8.2	10.1	10.1	8.8	1.3
Satellite Communications (SC)	13.7	10.9	9.6	9.6	7.6	2.0
Generic Technological Activities (GTA) in support of EO, SE and SC	7.3	8.3	10.7	10.7	8.0	2.7
Total Contributions	35.2	34.9	39.6	39.6	30.4	9.1
Total Program Activities	35.2	34.9	39.6	39.6	30.4	9.1

Comment on Variances

Several factors explain the year-to year fluctuations in spending as well as the yearly variation between program activities under Canada/ European Space Agency (ESA) programs: the budgetary cycle of ESA differs from the one of Canada, the cash flow requirements of ESA programs which Canada is participating in (the budget requirements vary with the project's delivery phase), the slippage in the disbursements for Canada/ESA programs (the programs and associated contracts to industry are delivered by ESA; hence, CSA has no control on actual project implementation), the potential cost increases in development programs, as well as the inflation rate and exchange rate fluctuations.

Consequently, the positive variance of \$9.1 million in 2009-2010 mainly corresponds to the risk funds re-profiled to future years arising from the sound management of this Program. The variances are in accordance with the objectives and terms and conditions of the 2000-2009 Canada/ESA Cooperation Agreement.

Significant Audit and Evaluation Findings and URL (s) to the Last and/or Evaluation

Canada is well thought of by Europeans, as the 30 years of cooperation between ESA and Canada clearly demonstrate. Canadian companies have made a significant contribution to the many technologies developed in the areas of Earth Observation and Satellite Communications.

Several businesses have developed business relationships with Europe thanks to the Agreement, and all stakeholders in the program agree that these relationships could continue, provided that Canada maintains its financial contribution to ESA. Canadian businesses have cultivated alliances with each other to benefit from or facilitate access to European markets through ESA programs under the Agreement.

The program helps diversify and open markets and contributes to the achievement of objectives under the Canadian Space Strategy respecting Earth Observation and Satellite Communications. However, it does not lead to the transfer of technologies as much as to the exchange of information on technologies.

Small and medium-sized companies have difficulty taking part in ESA programs and require greater support, not only to access these markets, but also to develop expertise so that they can continue doing business in these markets after their initial participation in ESA programs.

Source: Evaluation of the Canada/ESA Cooperation Agreement

www.asc-csa.gc.ca/eng/publications/er-0405-0202.asp

Notes:

- Due to rounding, figures may not add to totals shown.
- This table details contribution programs with funding in excess of \$5 million per annum.

Class Grant and Contribution Program to support Research, Awareness and Learning in Space Science and Technology

Start date: October 1, 2009

End Date: March 31, 2014

Description

The program is comprised of two components: a) Research; and, b) Awareness and Learning.

The research component aims to support the development of science and technology; foster the continuing development of a critical mass of researchers and highly qualified people in Canada; and, support information-gathering, studies and research related to space relevant to the priorities of the Canadian Space Agency.

The awareness and learning component aims to increase awareness of Canadian space science and technology among Canadian youth and educators and their participation in related activities; provide learning opportunities to Canadian students and physicians in various space-related disciplines; and support the operations of organizations dedicated to space research and education.

Strategic Outcome

Canada's presence in space meets the needs of Canadians for scientific knowledge, space technology and information.

Expected Results (Program Activities Level)

Space Based Earth Observation:

The benefits of activities involved in Earth Observation from space serve Canadian users in the fields of environment, resource and land-use management, and security and sovereignty.

Space Science and Exploration:

Participation in Canadian and international missions expands the scientific knowledge base made available to Canadian academia and R&D communities in the areas of astronomy, space exploration and solar-terrestrial relations, as well as in physical and life sciences.

Satellite Communications:

State-of-the-art systems and applications are developed to satisfy the needs of the Canadian government and population in order to ensure that Canada remains a world leader in satellite communications.

Generic Technological Activities in support of Earth Observation, Space Science and Exploration, and Satellite Communications:

Canada's industrial technological capabilities can meet the needs of future space missions and activities.

Expected Accomplishments

1. Research Component

Increased knowledge from research projects in priority space science and technology areas.

Maintained and/or increased space focus in universities, post-secondary institutions, and not-for-profit organizations.

Partnerships established and/or sustained.

Access to international collaboration for Canadian organizations.

2. Awareness and Learning component

Awareness

Increased availability and use of the space theme in learning opportunities and materials related to science and technology.

Learning

Post-secondary level and physicians will have increased knowledge and skills in space-related disciplines.

Actual Accomplishments

Actual accomplishments will be reported in 2010-2011 after the first a full year of implementation.

(\$ in millions)	Actual Spending 2007-2008	Actual Spending 2008-2009	Planned Spending 2009-2010	Total Authorities 2009-2010	Actual Spending 2009-2010	Variances
Space Awareness and Learning (AL) Total Contributions	0.2	0.3	0.3	0.3	0.3	0.0
Space Based Earth Observation (EO)	1.6	0.3	0.3	0.3	0.9	0.5
Space Science and Exploration (SE)	0.4	2.4	2.1	4.1	3.9	1.8
Space Awareness and Learning (AL)	0.5	0.7	0.8	0.8	0.6	(0.2)
Generic Technological Activities (GTA) in support of EO, SE and SC	0.2	0.4	0.5	0.5	0.4	(0.1)
Total Grants	2.7	3.8	3.7	5.7	5.7	2.0
Total TPPs	2.9	4.1	4.0	6.0	6.0	2.0

Notes:

- Due to rounding, figures may not add to totals shown.
- This transfer payment program was not presented in the RPP 2009-2010 since the planned spending was under \$5 million.
- New Terms and Conditions have been approved by TB in 2009-2010 in order to broaden the scope of the program and increase funding.

Comment on Variances

Not applicable in 2009-2010.

Significant Audit and Evaluation Findings and URL (s) to the Last and / or Evaluation

Not applicable in 2009-2010.

The summative evaluation of the previous Class Grant and Contribution Program was completed in 2009. To learn more about it, go to :

<http://www.asc-csa.gc.ca/eng/publications/ar-0570-2745.asp>

3.3.6) Response to Parliamentary Committees and External Audits

Response to Parliamentary Committees
No recommendation was received in 2009-2010.
Response to the Auditor General
No recommendation was received in 2009-2010.
External Audits
The Office of the Comptroller General conducted on horizontal audit on Contracting and Monitoring Information Systems (2009). The CSA's response to this audit is reported in the Follow-up on Management Action Plans for Audits (2010): http://www.asc-csa.gc.ca/pdf/management-2010.pdf

3.3.7) Internal Audits and Evaluations

1. Name of Internal Audit	2. Type	3. Status	4. Completion Date	5. Electronic Link to Report
Audit of the Corporate Risk Management Framework	Management Framework	Completed	2010-01-05	http://www.asc-csa.gc.ca/pdf/ar-0809-0104.pdf
Audit of Systems and Data Security	Management Framework	Completed	2010-03-01	http://www.asc-csa.gc.ca/pdf/ar-0910-0105.pdf
Audit of Information Technology Planning and Development Risks	Management Framework	Completed	2010-03-01	http://www.asc-csa.gc.ca/pdf/ar-0910-0104.pdf
Audit of Information Technology Dependence	Management Framework	Completed	2010-03-01	http://www.asc-csa.gc.ca/pdf/ar-0910-0103.pdf
Audit of the Values and Ethics Management Framework	Management Framework	Completed	2010-03-01	http://www.asc-csa.gc.ca/pdf/ar-0809-0103.pdf
Management Action Plans Follow-up for Internal Audit	Management Framework	Completed	2010-03-31	http://www.asc-csa.gc.ca/pdf/management-2010.pdf

1. Name of Evaluation	2. Program Activity	3. Type	4. Status	5. Completion Date	6. Electronic Link to Report
Evaluation of RADARSAT-2 Major Crown Project	Earth Observation	Summative	Completed	2010-01-08	http://www.asc-csa.gc.ca/pdf/mcp-5702-7823.pdf