



# **CANADIAN SPACE AGENCY**

**Performance Report  
For the period ending  
March 31, 2007**

## **SECTION 2:**

**Analysis of Program Activities by Strategic Outcome**

***- Detailed Performance Information -***



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## SECTION 2: ANALYSIS OF PROGRAM ACTIVITIES BY STRATEGIC OUTCOME

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### 2.1 HOW TO READ THE DETAILED ANALYSIS

**Program Activity:** For this level, the information is reported against final results and performance indicators. The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005. This performance report provides either baseline information or a progress report made since the year 2005-2006.

**Program Sub-Activity:** For this level, intermediate results and performance indicators are still being developed and therefore will first appear in the 2008-2009 RPP.

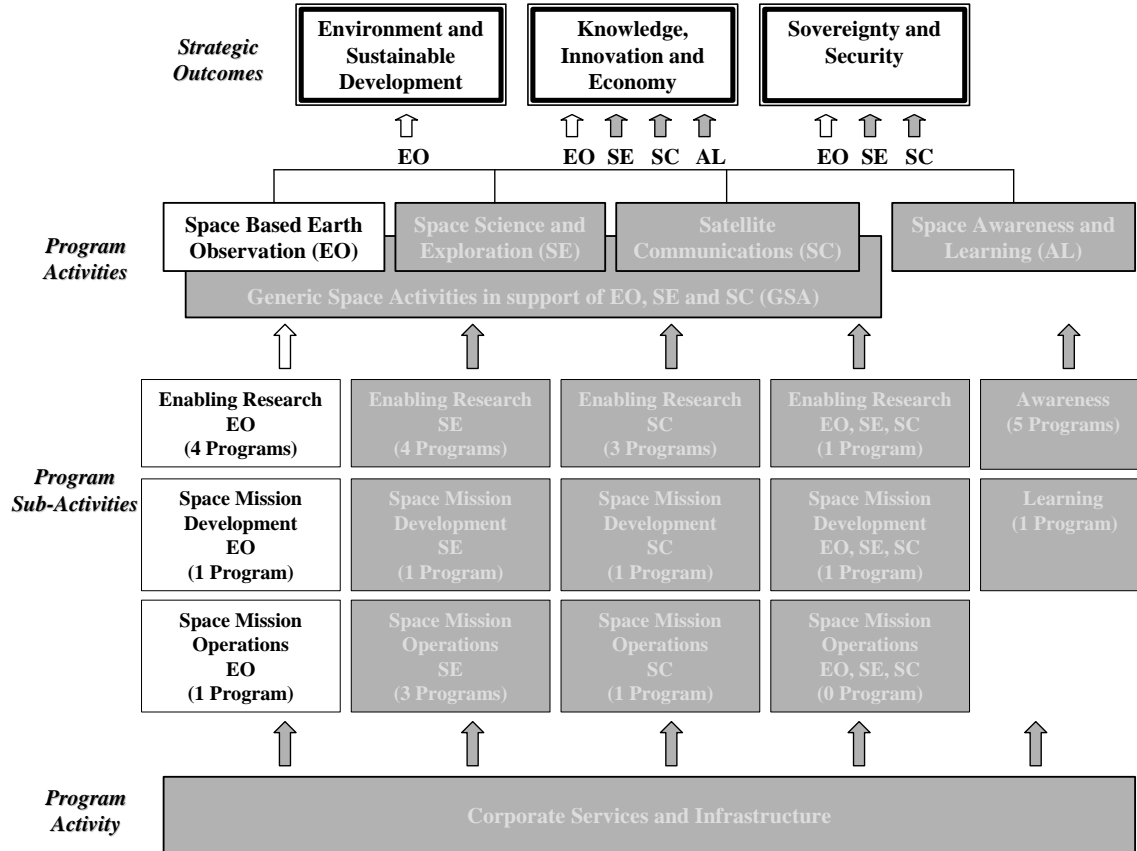
**Program Sub-Sub-Activity:** For this level, the information is reported yearly against immediate results and performance indicators. A performance evaluation will take place in 2009.

**Performance Analysis:** Every year a performance analysis is completed for each level of the PAA. This analysis provides contextual, complementary or methodological, as well as financial and human resources information.

**Highlights of Main Accomplishments:** For each Program Sub-Activity, examples of achievements are selected from the array of projects and activities carried out by the CSA and its industry, academic and government partners, as outlined in the corresponding Report on Plans and Priorities.

## 2.2 SPACE BASED EARTH OBSERVATION

### PROGRAM ACTIVITY: SPACE BASED EARTH OBSERVATION (EO)



**Priority:** Develop and operationalize the use of Space Based Earth Observation for the benefit of Canadians.

**Performance Status:** 83% (15/18) of the targets were met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005.

**SPACE BASED EARTH OBSERVATION**

**PROGRAM ACTIVITY PERFORMANCE MEASUREMENT**

**Expected Result**

Delivery, directly or in partnership, of Space Based EO data, products and services in response to operational and scientific user requirements in the field of Environment, Resource and Land Use Management, Security and Foreign Policy, supported by access capacity development.

<b>Indicators</b>	<b>Performance</b>
1. Number of RADARSAT operational users and applications.	<p>Commercial users have utilized a total of 30,970 frames with 17 different domains of application; 10 Federal Government departments have used a total of 6,755 frames.</p> <p>Alaska Satellite Facilities (ASF) have processed a total of 55,815 frames. The National Oceanic and Atmospheric Administration (NOAA) and the National Ice Center (NIC) are the ASF's largest clients.</p>
2. Number of active missions supported directly or indirectly by Canada.	A total of 7 active missions and 12 missions in development were supported directly or indirectly.
3. Growth in federal government departments and agency budgets allocated to the exploitation of Space Based EO data, derived information and services in the fields of the Environment, Resource and Land Use Management, Security and Foreign Policy.	There were 10 federal government departments using RADARSAT EO data in 2006-2007, compared to only 5 the previous year.
4. Number of hits on the Canadian Geospatial Data Infrastructure (CGDI) related to CSA sponsored (directly and/or indirectly) scientific and operational missions.	During fiscal year 2006-2007, the Discovery Portal of GeoConnexion received an average of 3,909 visitors per month requesting an average of 379,530 pages per month for an estimated yearly total of 47, 000 visitors and 4.6 million pages.

## Performance Analysis

### Indicator 1

RADARSAT data can be ordered through 4 different order desks. A total of 6,755 frames were processed at the Canadian government order desk located at CSA and the Canadian Ice Services located at Environment Canada.

The number of 10 departments does not take into account branches and divisions that are part of these departments (i.e. Canada Centre for Remote Sensing (CCRS), Canadian Forest Services (CFS), Geological Survey of Canada (GSC) are three branches of Natural Resources Canada). The largest government user of RADARSAT data is still the Canadian Ice Service of Environment Canada for ice monitoring activities. Environment Canada (EC), the Canadian Coast Guard (CCG), Transport Canada (TC), Department of National Defence (DND) and Fisheries and Oceans (DFO) are coordinating their efforts to implement ISTOP (Integrated Satellite Tracking of Polluters). By doing so, they have been more effective and have reduced their cost by sharing RADARSAT data acquired to monitor the targeted area. ISTOP became fully operational in 2006-2007. RADARSAT data are also used successfully for applications related to crop monitoring, ship detection, wetland mapping, ocean windfield mapping, oil spill, soil subsidence and soil movement monitoring, disaster monitoring and, especially, flood monitoring.

The Alaska Satellite Facilities (ASF), handling data requests from the U.S. Governments as part of the U.S. allocation of the RADARSAT Mission, processing a total of 55,815 frames during the 2006-2007 period. The main areas of application for the frames processed by ASF are for sea ice monitoring, 40%, wind speed determination, 10%, geological hazards, 25% and scientific research, 25%.

MacDonald Dettwiler and Associates (MDA) Geospatial Services Inc. (GSI) is responsible for the commercial sale of RADARSAT data. A total of 30,970 frames were sold by MDA for telemetry and commercial use through 5,283 orders in 2006-2007. Europe is the largest market, accounting for 41%, followed by Canada with 31 % and the U.S. with 12%. The Far East follows closely with 10%. Ship detection is the main application accounting for 32% of the frames, followed closely by applications related to the environment at 29%. Cartography at 10%, ice monitoring 9%, defence applications at 7%, and oil pollution at 5% are second in importance. These numbers do not include the frames ordered by Canadian government departments and agencies or processed at the Alaska Satellite facilities for the U.S. government.

### Indicator 2

<b>Missions</b>	<b>Status</b>	<b>Fields</b>
CloudSat (2006)	In operation	Environment
ERS-2 (2005)	In operation	Environment, Resource and Land Management
ESA- ENVISAT	In operation	Environment, Resource and Land Management
MOPPITT (1999)	In operation	Environment
OSIRIS (2001)	In operation	Environment

RADARSAT-1 (1995)	In operation	Environment, Resource and Land Management, Security and Foreign Policy
SCISAT (2003)	In operation	Environment
RADARSAT-2 (2007-2008)	In development	Environment, Resource and Land Management, Security and Foreign Policy
RSAT-Constellation (2012)	In development	Environment, Resource and Land Management, Security and Foreign Policy
PROBA-2 (2007)	In development	Environment
AQUARIUS (2009)	In development	Environment
CHINOOK (2010)	In development	Environment
SMOS (2008)	In development	Environment
SWARM (2010)	In development	Environment
ADM/AEOLUS (2009)	In development	Environment
EarthCARE (2013)	In development	Environment
CRYOSAT (2009)	In development	Environment
GOCE (2007)	In development	Environment
ESA SENTINEL –1 (2011)	In development	Environment, Resource and Land Management, Security and Foreign Policy

### Indicator 3

An increasing number of departments are using RADARSAT data. The largest users are still the Canadian Ice Center of Environment Canada, Natural Resources Canada, Fisheries and Oceans, Agriculture and Agri-Food Canada, National Defence and the Canadian Space Agency. It is worth noting that 4 other departments were repeat users of RADARSAT data during the 2006-2007 period — Parks Canada, the National Research Council, the Canadian Nuclear Safety Commission and Public Safety and Emergency Preparedness Canada. Last year, a total of 5,703 processed image frames were provided to federal departments and agencies. This year, a total of 6,755 processed image frames were provided for them.

It has been impossible to establish an operational budget baseline for federal government departments and agencies as a whole. However, discussions are currently taking place among the government departments and agencies under the leadership of PWGSC, to consolidate the purchase of EO data for the government departments as a whole. If negotiations are successful, information on all EO data purchases, not just RADARSAT data, by Canadian government departments will be provided starting in 2008-2009.

### Indicator 4

Data on the number of hits on the Canadian Geospatial Data Infrastructure (CGDI) related to CSA sponsored scientific and operational missions were not provided on time because of major changes to the GeoConnections WEB last year and informatics' deficiencies. During the coming year, CSA will work with CGDI to review and develop a more reliable, accurate and measurable indicator. In the meantime, GeoConnections has been able to provide us with some monthly statistics from their Discovery Portal, which connects databases with CSA supported missions.



2006-2007 - Financial Resources (\$ in millions)		
Planned	Total Authorities	Actual Spending
124.0	112.0	66.4
2006-2007 - Human Resources (FTEs)		
Planned	Total Authorities	Actual
76.2	Not applicable	70.1

The programs under this Program Activity are divided into three Sub-Activities: Enabling Research, Space Mission Development and Space Mission Operations.

### **ENABLING RESEARCH – EARTH OBSERVATION**

Four Earth Observation Enabling Research Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- EO Mission Concepts – Objective:** Assume leadership and provide support in research and development of new space mission concepts leading to the realization of CSA or international EO space missions.

#### **EXPECTED RESULT:**

Mission Feasibility and Concept studies by industry, government and academia, enabling CSA decisions on future EO space missions of interest to Canada.

Indicators	Performance
1. Feasibility studies and mission and payload concept studies are initiated and completed (Target: 1 initiated and/or completed); and,	<p><b>Target Met:</b> 2; 1 study completed and 1 study initiated.</p> <p><b>Precisions:</b> Final review of RADARSAT-Constellation phase A was held in November 2006 and the Preliminary System Requirements Review of the Hyperspectral study with Italy was held in March 2007.</p>
2. New Missions developed (Phase 0/A) and successfully retained for implementation (Phase B, C, D) (Target: 1).	<p><b>Target Met:</b> 1 mission retained for implementation.</p> <p><b>Precisions:</b> RADARSAT-Constellation received approval to move onto phase B/C in March 2007.</p>

**PERFORMANCE ANALYSIS:**Indicators 1 and 2

According to Treasury Board's approved Project Management and Approval Framework phase 0/A relates to the feasibility study and preliminary system requirement review. Phases B, C and D relate to preliminary design definition, detailed design definition and manufacture and acceptance implementation. Together they correspond to project development phases.

Source: CSA's Project Management Guidelines, internal document only in English.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
6.8	11.1
2006-2007 - Human Resources (FTEs)	
Planned	Actual
5.6	15.4

**2- European Space Agency (ESA) Programs in EO – Objective:** Through key international partnerships, enhance the Canadian industry's technological base and provide access to European market for value-added products and services in the field of EO.

**EXPECTED RESULT:**

Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under EO Programs.

Indicators	Performance
1. Canadian industrial returns in ESA optional programs in EO. (Target: 0.80 or higher.)	<p><b>Target Met:</b> 1.21 return ratio attained.</p> <p><b>Precisions:</b> A major contributor to this high level is the large contract awarded to a Canadian company for the supply of electric field instruments for the Swarm Earth Explorer Mission.</p>

**PERFORMANCE ANALYSIS:**

The return coefficient corresponds to the ratio between the actual number of weighted contracts given to a country and the ideal number of contracts to be given to that country according to existing rules. Canadian industrial returns are by Program Activity. The EO optional programs are: ENVISAT, EOEP (Earth Observation Envelope Program)/EOPP (Earth Observation Preparatory Program), Earth Watch GMES (Global Monitoring for Environment and Security), TerraSar (EO Optional Programs). The Overall Canadian industrial return pertains to all ESA mandatory programs. The Overall Industrial Return Coefficient Indicator is 1.16.

Source: European Space Agency Council. Paris, Agency Key Performance Indicators. ESA/IPC (Dec. 2006) 13 rev. 2, document only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
12.4	9.9
<b>2006-2007 – Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
Nil	Nil

**3- Science Programs for EO – Objective:** Coordinate the Canadian EO scientific community in order to pursue world-class research space missions to advance our knowledge of the Earth's atmosphere and of global climate-change phenomena.

**EXPECTED RESULT:**

Opportunities identified for Canadian scientists to advance understanding and scientific knowledge of atmospheric environment through the use of space-based observations.

<b>Indicators</b>	<b>Performance</b>
1. Number of scientific publications/reports/conference proceedings acknowledging CSA funding (Target: 50);	<b>Target Met: 64</b>
2. Number of Highly Qualified Personnel (HQP) involved in the program (Target: 130);	<b>Target Met: 154</b>
3. Number of operating or approved space science research missions (Target: 6);	<b>Target Met: 6</b>
4. Number of scientific research projects supporting the development of future space science research missions (Target: 5);	<b>Target not Met: 4</b> <b>Precisions:</b> Delays in releasing "Announcement of Opportunities" due to decision to harmonize process between CSA sectors.

5. Number of scientific presentations (Target: 100);	<b>Target Met:</b> 112
6. Number of research partnerships (nationally and internationally) (Target: 15); and,	<b>Target Met:</b> 21 <b>Precisions:</b> Targeted efforts by the CSA to build a large and diverse network of national and international partners were successful.
7. Number of awards granted under Space Science Grants and Contributions Program (Target: 5).	<b>Target Met:</b> 9 <b>Precisions:</b> With additional grants and contributions funds becoming available, four new grants have been awarded through the Space Science Enhancement Program 2006 Competition.

**PERFORMANCE ANALYSIS:**

Indicators 1, 2, 3 and 5

Many space science missions are currently producing excellent results. Adequate levels of funding greatly helped, in this case, exceeding targets. CSA funds are highly leveraged by funds provided by universities and the National Sciences and Engineering Research Council of Canada (NSERC).

Indicator 2

The term Highly Qualified Personnel (HQP) includes undergraduate, graduate and postdoctoral fellows, as well as research assistants, research associates, faculty and non-faculty staff.

Indicator 3

Funded activities are supporting instrument control, data validation and processing for 6 operating missions: MOPITT, OSIRIS, SCISAT, RADARSAT-1, ENVISAT and CloudSat.

Source: CSA is producing a report based on data collected from an annual survey with scientists currently funded by the Space Science Program.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
3.3	1.9
<b>2006-2007 – Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
6.5	2.6

**4- EO Application Development Programs – Objective:** Enhance Canada's ground receiving and data processing systems, and develop and demonstrate EO data value-added applications for commercial use and for Canadian government operations.

**EXPECTED RESULT:**

Increasing the use of EO data in public and private sectors through the development and demonstration of applications.

Indicators	Performance
1. Number of new EO applications operationally used (Target: 20); and,	<p><b>Target Met:</b> 25</p> <p><b>Precisions:</b> 18 EO Application Development Programs (EOADP) and 7 Government Related Initiatives Programs (GRIP).</p>
2. Number of new field of applications using EO data (Target: 8).	<p><b>Target Met:</b> 16</p> <p><b>Precisions:</b> Agriculture, Atmosphere, Energy, Fisheries, Forestry, Geology, Land, Natural Disaster, Oceans and Coasts, Transportation, Security, Snow and Ice, Survey and Mapping, Water and two other unspecified fields.</p>

**PERFORMANCE ANALYSIS:**Indicator 1**EOADP** (Earth Observation Application Development Program)

In the 52 completed EOADP projects tallied in 2006-2007, 40 different technologies were identified, 18 of which were deemed to have applications that were operationally used. Products were deemed operationally used based on a survey of companies.

**GRIP** (Government Related Initiatives Program)

Of the 34 completed GRIP projects tallied in 2006-2007, 7 were identified as being applications operationally used by GRIP Program Authorities, of which 3 are new this year.

Indicator 2

The number of new fields of application is actually the number of fields of applications for the 25 new operationally used EO applications identified by indicator 1. The list is exhaustive and is likely to include all possible future fields.

Source: Performance Indicators for EO Application Development Programs (2006-2007) by Hickling, Arthurs, Low Technology Management, Strategy and Economics, internal document only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
13.6	15.6
<b>2006-2007 – Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
9.7	9.8

**Highlights of Main Accomplishments – Enabling Research (EO)**

- Finalized user and mission requirements and the initial system concept for a three-satellite synthetic aperture radar mission (SAR-Constellation) as follow-on to RADARSAT-2, and improvement of the satellite revisit time.
- The Preparatory Program for the use of RADARSAT-2 continued. This program will generate several Requests for Proposals from industry, pilot and demonstration projects within the government, as well as opportunities targeting the university research community and international partners for the use of a Canadian government data allocation valued at \$445 million.

- Launched in April 2006, NASA's CloudSat mission measured the global properties of clouds for the first time in order to improve climate-change forecasts. The mission has already performed more than 162 million vertical profiles of clouds and provided more than 6 terabytes of data for the international science community to improve climate models and weather forecasting. The mission is expected to continue to provide high-quality data throughout the year. A very successful validation campaign in the Great Lakes region took place during the winter season as part of an agreement with NASA and in collaboration with the Meteorological Service of Canada (MSC). Analysis results are expected to have a significant impact on numerical weather prediction models.
- As part of the Earth Observation for Sustainable Development of Forests program, a Canada-wide forest map is being used to support the completion of the National Forest Inventory and as a baseline for international greenhouse gas reporting activities. These five-year long initiatives started in 2002 and are co-funded by the CSA and the Canadian Forest Service in collaboration with other government departments, the ten provinces and three territories, and several universities across Canada.
- A Coordinated Earth Observation Marine Surveillance project (CEOMS) was implemented in 2006 to provide an exhaustive understanding of EO needs and requirements for Government of Canada marine surveillance and security operational stakeholders.
- Through seven EO application development projects, Canada supported the TIGER initiative, intended to demonstrate the usefulness of space based Earth observation for water management applications in Africa.
- As part of the CSA-Mekong River Commission collaboration, a Canadian team delivered a WEB portal consisting of customized applications focusing on wetland monitoring and image acquisition in the context of flood forecasting and management.
- The CSA, in conjunction with the United States Geological Survey (USGS) and NASA, has initiated an international initiative to stimulate new research into the monitoring of subsidence processes in New Orleans using RADARSAT-1 in SAR imagery in an effort to gain advanced expertise and increase capacity building in preparation for future missions like RADARSAT-2 and the RADARSAT-Constellation Mission.
- Canada ensured its commitment, as an official member of the International Charter on Space and Major Disasters, to use EO satellites in response to disasters. The CSA regularly contributes RADARSAT data and strategic EO-derived information products upon charter activation.

- Canadian companies, through Canada's participation in ESA Programs, developed advanced space-borne instruments and user-oriented applications in fields such as aquaculture, forestry and subsidence, global wetland and polar monitoring. For example Canadian scientific teams contributed to an Electric Field Instrument (EFI) for the Swarm Earth Explorer mission and to the calibration and validation activities of the Earth Explorer Soil Moisture and Ocean Salinity (SMOS) mission.
- The CSA will continue technology development and explore partnerships for a hyperspectral Earth Observation mission. The CSA and the Italian Space Agency are working together to evaluate a potential hyperspectral mission. Hyperspectral data would allow for the identification of terrestrial features with greater accuracy than the current spaceborne sensors.

## **SPACE MISSION DEVELOPMENT – EARTH OBSERVATION**

One EO Space Mission Development Program, with a combination of accomplishments, demonstrates how the expected result outlined below was measured and attained.

**1- EO Projects – Objective:** Ensure the development, delivery and commissioning of space-qualified systems for EO missions through effective project, quality and engineering management.

<b>EXPECTED RESULT:</b>
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EO projects' deliverables meet mission objectives and user expectations.
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<b>Indicators</b>	<b>Performance</b>
1. Safety and Mission Assurance (S&MA) and Configuration Management (CM) requirements are identified and met for each project (Targets: Guidelines are completed and implemented on all projects phase A to E);	<p><b>Target Met:</b> All projects (phases A to E) have S&amp;MA and CM.</p> <p><b>Precisions:</b> S&amp;MA and CM participated in 3 active EO projects in Phases B, C and D.</p>
In accordance with Treasury Board approved Project Approval and Management Framework (PAMF):	
2. Mission objectives and user requirements are met at critical steps of the projects (Target: 90% satisfaction);	<p><b>Target not Met:</b> 88% satisfaction rate.</p> <p><b>Precisions:</b> The 88% client satisfaction rate is an increase from the previous survey result of 82%.</p>
3. Project cost is maintained within authorized levels (Target: 75% of projects delivered on time and on budget); and,	<p><b>Target not Met:</b> 64%</p> <p><b>Precisions:</b> 64% of project milestones were</p>



	delivered on time. The milestones that were not met was a result of technical difficulties and delays in the start of projects. However, 100% of EO project costs, however, were maintained within authorized levels for all projects.
4. Risks are identified and mitigated for each project (Target: Up to 75% of risk budget is used).	<b>Target Met:</b> 8% of risk budget used.

**PERFORMANCE ANALYSIS:**

Indicator 1

According to Treasury Board approved Project Management and Approval Framework phases B, C and D relate to preliminary design definition, detailed design definition and manufacture and acceptance implementation. Together they correspond to project development phases.

Indicator 2

Space Programs conducted a client survey. The survey was conducted through 33 interviews with missions' managers; project managers or directors general over 15 projects ranging from phases A to E. The interviews were carried out in April and May 2007 and lasted from 45 to 60 minutes. Only the results from the 17 mission managers and project managers were considered in establishing the satisfaction rate. The other interviews were used to polish improvement recommendations. During the course of the survey/interviews, information pertaining to the various services provided by the Space Programs Branch was gathered as a means of providing valuable insight into problem areas or issues related to project management services and processes that might need to be addressed. This information will also be used as a means of striving for improved performance results in subsequent years.

Indicator 3

Source: Annual Table of Projects Milestones, internal document only in English.

Indicator 4

The project risk matrix is reviewed monthly at each project review and discussed in more detail during Space Program Risk Committee meetings, which take place three times a year.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
68.0	12.2
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
9.9	10.0

## Highlights of Main Accomplishments – Space Mission Development (EO)

- The assembly, integration and test of the RADARSAT-2 spacecraft was completed on time at the David Florida Laboratory, along with the operation preparation activities at CSA St. Hubert, Quebec, and the launch campaign in Baikonur, Kazakhstan. Launch on a Soyuz rocket was rescheduled to November 2007. The initial phase of the commissioning of RADARSAT-2 should be completed by February 2008. Equipped with advanced technologies, RADARSAT-2 will be the first commercial radar satellite to offer multi-polarisation (an important aid in identifying a wide variety of surface features and targets), produce images with a resolution of down to 3 metres, and access an area of 800 kilometres to either side of the sub-satellite track.
- The CSA continued to develop the Chinook mission, which will use a small satellite bus and carry two experiments: SWIFT (Stratospheric Wind Interferometer for Transport studies), designed to help scientists better understand the global atmospheric circulation and thus provide the means to validate complex climate and weather models, and ARGO (Atmosphere Research with GPS Occultation) to measure humidity levels in the lower troposphere, temperature in the stratosphere, and electron density perturbation in the ionosphere. The three-year mission is currently planned for 2013-2016.
- Conceptual design and technology development work on the RADARSAT-Constellation program, the follow-on program to RADARSAT-2, continued through 2006-2007. As well, a two-stage RFP process was initiated through PWGSC for the award of a contract for preliminary and detailed design. The RADARSAT-Constellation will provide all weather up to twice daily, with day and night coverage of Canadian territory and will also provide up to twice daily coverage of most of the world. Three small satellites will be flown in the configuration of a constellation. The launch of the first satellite is planned for mid-2012, followed by the other two satellites in 2013 and 2014.

## **SPACE MISSION OPERATIONS – EARTH OBSERVATION**

One EO Space Mission Operations Program, with a combination of accomplishments, demonstrates how the expected result outlined below was measured and attained.

**1- EO Mission Operations – Objective:** Operate the space and ground segments for EO mission operations.

<b>EXPECTED RESULT:</b>
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EO Space Mission Operations meet user/client needs as per mission requirements.
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Indicators	Performance
1. System performance, as per mission requirements and resources (Target: 90%); and,	<p><b>Target Met:</b> More than 90%.</p> <p><b>Precisions:</b> Average performance for RADARSAT-1 was maintained at over 95%.</p>
2. Volume of data acquired or delivered as per mission requirements and resources (Targets: 350 Gbytes of SCISAT-1 and 20,000 SAR minutes of RADARSAT-1).	<p><b>Target Met:</b> More than 350 Gbytes.</p> <p><b>Target Met:</b> More than 20,000 SAR minutes.</p> <p><b>Precisions:</b> More precisely, a total of 769 Gbytes of SCISAT-1 science data and a total of 57,314 minutes of SAR data from RADARSAT-1 were acquired.</p>

**PERFORMANCE ANALYSIS:**

Indicator 1

System performance is measured in terms of the percentage of data requests that were planned and subsequently executed by the spacecraft payload and received.

Source: CSA's Mission Management Office / Database Management (MMO/DBM), internal document only in English.

Indicator 2

Target 1: SCISAT instruments exceeded expectations. Benchmarks are based on the Science Principal Investigator expectations. Broken down by scientific instruments, the total of 769 Gbytes delivered to customers is as follows: FTS: 651 GBytes; Imager: 95 Gbytes; and MAESTRO: 23 Gbytes.

Target 2: The benchmark target of RADARSAT-1 image data as the number of SAR on time minutes was exceeded to attain a total of 57,314 minutes of SAR data collected.

Sources: CSA's Mission Operations Center System (MOC) (target 1); CSA's Mission Management Office / Database Management (MMO/DBM) (target 2), internal document only in English.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
17.7	13.5
2006-2007 – Human Resources (FTEs)	
Planned	Actual
30.0	20.3

## Highlights of Main Accomplishments – Space Mission Operations (EO)

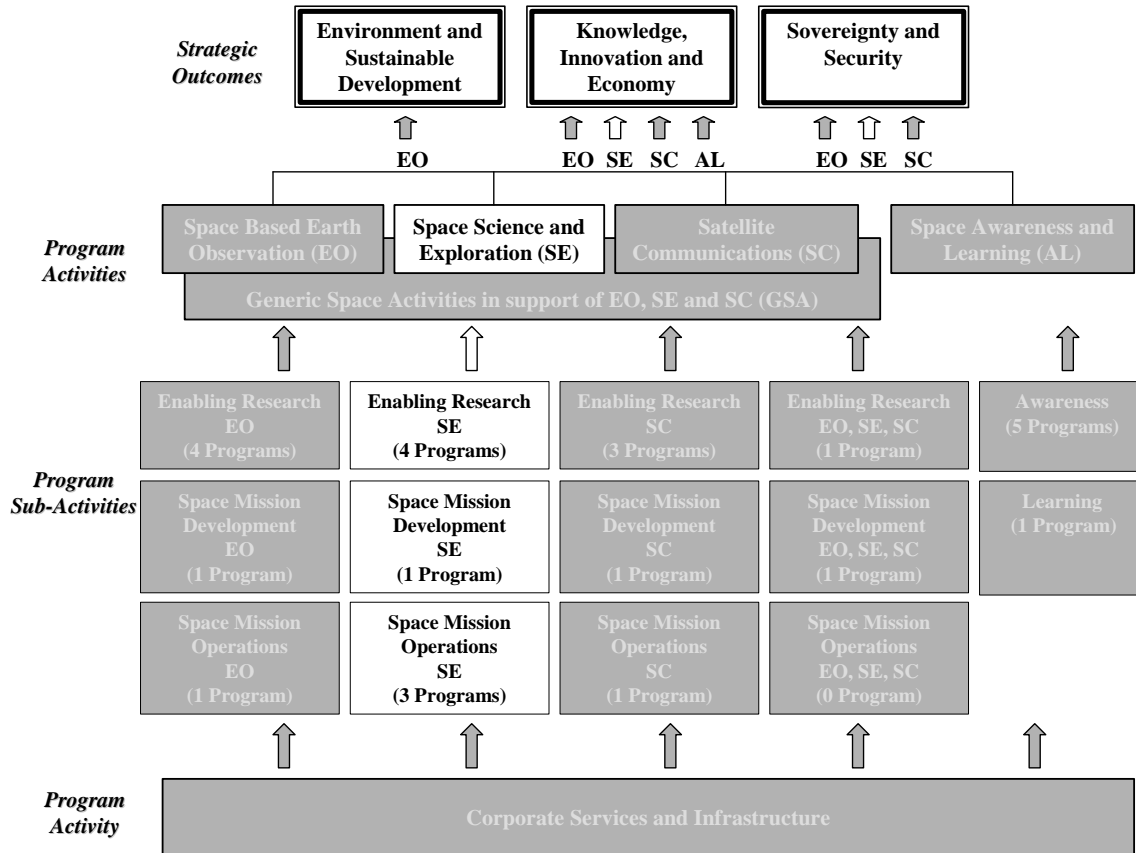
- RADARSAT-1 operations continued with the same level of high performance for satellite reliability and image production, ensuring the supply of data until full commissioning of RADARSAT-2 in early 2007. A contingency plan is in place to prescribe the use of foreign sensors as backup to RADARSAT-1 in order to continue to meet the needs of operational users until RADARSAT-2 data become available. Ongoing operation of RADARSAT-1 provides useful information for both commercial and scientific users in such fields as disaster management, interferometry, agriculture, cartography, hydrology, forestry, oceanography, ice studies and coastal monitoring.
- Three major Canadian science instruments are currently orbiting Earth and collecting environmental data: MOPITT, OSIRIS and SCISAT. MOPITT, which is aboard the NASA Terra satellite, contributes to our understanding of the sources and pathways of atmospheric pollutants. OSIRIS, which is on-board the Swedish Odin satellite, measures the concentration of various gases in the stratosphere, allowing our scientists to make a significant contribution to the understanding of the ozone depletion processes. SCISAT, launched in August 2003 and operated by the CSA, measures numerous trace gases, thin clouds and aerosols in the stratosphere to help enhance our understanding of climate, pollutants behaviour and other important atmospheric processes.
- The exploitation of data from the ENVISAT satellite is near completion and considered a real success. Use of the data by the scientific teams led to further cooperation between Belgium and Canada. A final report is due in June 2007.

To learn more about Earth Observation, go to:

<http://www.space.gc.ca/asc/eng/satellites/default.asp?page=observation>

## 2.3 SPACE SCIENCE AND EXPLORATION

### Program Activity: SPACE SCIENCE AND EXPLORATION (SE)



**Priority:** Understand the solar system and the universe, expand our knowledge on the constituent elements and origins of life, and strengthen a human presence in space.

**Performance Status:** 86% (24/28) of the targets were met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005.

**SPACE SCIENCE AND EXPLORATION**

**PROGRAM ACTIVITY PERFORMANCE MEASUREMENT**

**Expected Result**

Increased participation in Canadian and international opportunities in order to expand the scientific knowledge base available to Canadian academia and R&D communities in:

- 1) Astronomy, Space Exploration and Solar-Terrestrial Relation; and,
- 2) Physical and Life Sciences.

<b>Indicators</b>	<b>Performance</b>
1. Number of participations in Canadian and international space science missions.	A total of 6 new missions in 2006-2007; 1 mission related to Astronomy (17%) and 5 to Physical and Life Sciences (83%).
2. Rate of successful missions (Total or partial successful Canadian missions/total missions with Canadian participation).	This year, 9 of a total of 33 missions reached launched, data production or completed status for an impressive success rate of 27%.
3. Number of peer-reviewed papers over the next three years published in world-class scientific journals as a result of the CSA's participation in Canadian and international missions (papers featuring Canadian academia and/or R&D community).	A total of 711 peer-reviewed papers, featuring Canadian academia and/or R&D community, were published in 2006-2007 in Space Astronomy and Exploration, Solar-Terrestrial Relation, and Physical and Life Sciences.

## Performance Analysis

### Indicator 1

Missions	Status	Field
FUSE (1999)	Objectives met/in operation	Astronomy
ICE-First (2004)	Objectives met/completed	Life Science
MOST (2003)	Objectives met/in operation	Astronomy
WISE (2005)	Objectives met/completed	Life Sciences
MATROSHKA-R (2006)	Objectives met/in operation	Operational Space Medicine
BLAST (2007)	Objectives met/completed	Astronomy
THEMIS (2007)	Launched in 2007.	Solar-Terrestrial Relation
MVIS (2006-07)	Ready to launch	Physical Sciences
CCISS (2007)	In operation	Life Sciences
* ELERAD (2006)	In operation	Life Sciences
PMDIS/TRAC (2006)	In operation	Life Sciences
APXS (2009)	In development	Planetary Exploration
* BISE (2009)	In development	Life Sciences
* Cambium (2009)	In development	Life Sciences
CASSIOPE-ePOP (2008)	In development	Solar-Terrestrial Relation
CIMEX (2009)	In development	Physical Sciences
eOSTEO (2007)	In development	Life Sciences
EOEP/SWARM (2009)	In development	Solar-Terrestrial Relation
Herschel-HIFI/Spire (2008)	In development	Astronomy
ICAPS (2010)	In development	Physical Sciences
IVIDIL (2008)	In development	Physical Sciences
JWST-FGS (2013)	In development	Astronomy
PHOENIX (2007)	In development	Planetary Exploration
NEOSSAT (2009)	In development	Planetary Exploration
* NEQUISOL (2010)	In development	Physical Sciences
* Planck (2008)	In development	Astronomy
SCCO (2007)	In development	Physical Sciences
UVIT-ASTROSAT (2008)	In development	Astronomy
* Vascular (2009)	In development	Life Sciences
EVARM	Under review	Life Sciences
Insect Habitat	Under review	Life Sciences
MIMBU/ATEN	Under review	Solar-Terrestrial Relation
ORBITALS	Under review	Solar-Terrestrial Relation

(Year) = Actual or projected launch

\* = New missions in 2006-2007

## Performance Analysis

### Indicator 2

For the purpose of this indicator, a mission is considered partly or totally successful when the status reads as: objective met, in operation, completed or launched. Analysis of the last three fiscal year, starting April 1, 2004 and ending on March 31, 2007, shows an overall mission success rate of 27% (9 out of 33) when all initiated missions are taken into account. Last year, this same method of calculation would have shown a mission success rate of 12% (3 out of 24). It is important to note however that all successful missions have met or are in the process of meeting their mission objectives.

### Indicator 3

This year, 711 peer-reviewed papers, featuring Canadian academia and/or R&D community, were published in Space Astronomy and Exploration, Solar-Terrestrial Relation, and Physical and Life Sciences. A breakdown of the information by field: Space Astronomy (393), Planetary Exploration (17), Solar-Terrestrial Relation (161), Physical Sciences (57) and Life Sciences (83). The 2005-2006 DPR indicated 83 papers. The actual total should have read 482 papers. The difference is due to improved publication monitoring.

<b>2006-2007 - Financial Resources (\$ in millions)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual Spending</b>
133.2	149.6	130.0
<b>2006-2007 - Human Resources (FTEs)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual</b>
191.9	Not applicable	175.4

**The programs under this Program Activity are divided into three Sub-Activities: Enabling Research, Space Mission Development and Space Mission Operations.**

### **ENABLING RESEARCH – SPACE SCIENCE AND EXPLORATION**

Four Science and Exploration Enabling Research Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- SE Mission Concepts – Objective:** Assume leadership and provide support in enabling research and development of new space mission concepts leading to the realization of CSA or international SE missions.



**EXPECTED RESULT:**

Mission Feasibility and Concept studies by industry, government and academia, enabling CSA decisions on future SE space missions of interest to Canada.

Indicators	Performance
1. Feasibility studies and mission and payload concept studies are initiated and completed (Target: 1); and,	<b>Target not Met: 0</b> <b>Precisions:</b> The mission payload concept Request for proposal was postponed to 2007-2008.
2. New missions developed (Phase 0/A) and successfully retained for implementation (Phase B, C, D) (Target: No new mission for 2006-2007).	<b>Target Met:</b> No new mission. <b>Precisions:</b> Next year's target will aim at one. Phase A for ORBITALS mission received approval in November 2006 and will seek approval for Phase B next year.

**PERFORMANCE ANALYSIS:**

No performance analysis is required.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
0.7	2.6
2006-2007 - Human Resources (FTEs)	
Planned	Actual
3.1	3.1

**2- ESA Programs in SE – Objective:** Through key international partnerships, allow the participation of Canadian academia and the demonstration of Canadian space technologies in European SE missions.

**EXPECTED RESULT:**

Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under SE programs.

Indicators	Performance
1. Canadian industrial returns in ESA optional programs in SE (Target: 0.80 or higher).	<b>Target not Met:</b> 0.72 return ratio attained. <b>Precisions:</b> Slow ramp-up of Aurora, Exomars, and ELIPS-2 programs continued.

**PERFORMANCE ANALYSIS:**

Funding was added to the Aurora Preparatory activity during the year, which helped to lower the return, as more money now becomes available to be returned to Canada. This is a temporary situation as it is anticipated that there will be more opportunities for contracts than funding available for this program.

The return coefficient corresponds to the ratio between the actual number of weighted contracts given to a country and the ideal number of contracts to be given to that country according to existing rules. Canadian industrial returns are by Program Activity. The SE optional programs are Aurora, Exomars, and ELIPS-2. The Overall Canadian industrial return pertains to all ESA mandatory programs. The Overall Industrial Return Coefficient Indicator is 1.16.

Source: European Space Agency Council. Paris, Agency Key Performance Indicators. ESA/IPC (Dec. 2006) 13 rev. 2, internal document only in English.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
5.7	5.8
2006-2007 - Human Resources (FTEs)	
Planned	Actual
Nil	Nil

**3- SE Programs – Objective:** Coordinate the Canadian SE community in order to pursue world-class research space missions to advance our knowledge of basic physical and chemical processes, the near-Earth space environment and Earth's electromagnetic field, our solar system, the universe and its evolution, as well as the adaptation of humans and other life forms in the weightless environment.

**EXPECTED RESULT:**

Identified opportunities for Canadian scientists to advance SE understanding and scientific knowledge through CSA, national and international research missions.

Indicators	Performance
1. Number of scientific publications/ reports/conference proceedings acknowledging CSA funding (Target: 200);	<b>Target Met:</b> 711 <b>Precisions:</b> Many space science missions are currently producing excellent results.
2. Number of Highly Qualified Personnel (HQP) involved in the program (Target: 470);	<b>Target Met:</b> 530

3. Number of operating or approved space science research missions (Target: 20);	<b>Target Met:</b> 33
4. Number of scientific research projects supporting the development of future space science research missions (Target: 60);	<b>Target not Met:</b> 48  <b>Precisions:</b> Delays in releasing "Announcements of Opportunity" have occurred due to decisions to harmonize the process between CSA sectors.
5. Number of scientific presentations (Target: 400);	<b>Target Met:</b> 514
6. Number of research partnerships (nationally and internationally) (Target: 78); and,	<b>Target Met:</b> 113  <b>Precisions:</b> Targeted efforts by the Space Science sector to build a large and diverse network of national and international partners were successful.
7. Number of awards granted under the Space Science Grants and Contributions Program (Target: 11).	<b>Target Met:</b> 37  <b>Precisions:</b> With additional grant and contribution funds becoming available, 14 new grants have been awarded through the Space Science Enhancement Program 2006 Competition and 18 new grants through the Canadian Analog Research Network (CARN) program.

**PERFORMANCE ANALYSIS:**Indicators 1, 2, 3 and 5

Many space science missions are currently producing excellent results. Adequate levels of funding greatly helped, in this case exceeding targets. CSA funds are highly leveraged by funds provided by universities and the National Sciences and Engineering Research Council of Canada (NSERC).

Indicator 2

The term Highly Qualified Personnel (HQP) includes undergraduate, graduate and postdoctoral fellows, as well as research assistants, research associates, faculty and non-faculty staff.

Source: CSA is producing a report based on data collected from an annual survey with scientists currently funded by the Space Science Program.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
17.4	8.1
2006-2007 - Human Resources (FTEs)	
Planned	Actual
24.3	19.7

**4- Human Space Flight Expertise – Objective:** Maintain a trained, experienced and versatile Astronaut Corps to meet the needs of the Canadian space science and human exploration community and while doing so increase access to space opportunities for Canadian scientists.

**EXPECTED RESULT:**

Continue to develop and maintain human space flight expertise to meet the requirements of the CSA's space science and human exploration programs.

Indicators	Performance
1. Canadian astronauts are qualified on all flight vehicles such as Shuttle, Soyuz and ISS (Targets: 4 on Shuttle, 2 on Soyuz and 1 on ISS);	<p><b>Target Met:</b> 5 on Shuttle  <b>Target Met:</b> 2 on Soyuz  <b>Target Met:</b> 1 on ISS</p> <p><b>Precisions:</b> All three targets have been met and one exceeded with five astronauts instead of four being fully qualified to fly on all vehicles.</p>

2. Canadian Astronauts are recruited according to recruitment plan (Target: no activities for 2006-2007); and,	<b>Target Met:</b> 1 <b>Precisions:</b> Some basic training development is projected for 2007-2008.
3. Number of space flights and missions in which Canadian Astronauts participate (Target: 1).	<b>Target Met:</b> 1 <b>Precisions:</b> The STS-115 mission with Canadian astronaut, Steven MacLean, was a great success.

**PERFORMANCE ANALYSIS:**

No performance analysis is required.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
0.6	1.8
2006-2007 - Human Resources (FTEs)	
Planned	Actual
Nil	6.0

**Highlights of Main Accomplishments – Enabling Research (SE)**

- A series of national and international workshops was conducted and a series of Announcements of Opportunity for concept and advanced studies was released in order to develop the next generation of scientific and instrumentation ideas for inclusion in future Canadian and/or international space science missions.
- The CSA continued the program of international analog opportunities in planetary exploration utilizing Canada's unique northern environment (e.g., Houghton crater on Devon Island, Nunavut, as a site analogous to the Moon and Mars). Scientific research carried out helped us better understand the history of our own planet while preparing us for robotic and human exploration of the solar system.
- The CSA continued the partnership with the European Space Agency (ESA) on the European planetary exploration program (Aurora) and established a partnership with ESA relating to their European Life and Physical Sciences Program (ELIPS-2). The CSA's participation in this program positions our scientific and industrial partners in future scientific and technological developments.

- An announcement of opportunity was prepared to engage Canadian scientists in "low mass, low volume" research on-board ISS and other free-fall platforms. The idea is to develop a repertoire of science on the shelf to take advantage of all available flight opportunities.
- The CSA continued to develop and maintain human space flight expertise to meet the requirements of the CSA's space sciences and human exploration programs. Astronaut Steve McLean flew on STS-115 in September 2006 and then completed post flight tours and briefings while astronaut Dave Williams was preparing intensely for his upcoming space shuttle flight on STS-118. All active Canadian astronauts are qualified as missions' specialists on the Space Shuttle. Two out of six Canadian astronauts are qualified as flight engineers on the Soyuz spacecraft.
- The CSA has completed preparations for an eventual astronaut recruitment campaign, but such recruitment has not been planned since no new flight opportunities, over and above those currently existing, have been acquired.
- The Canadian Astronaut Office has continued to use space-analog facilities (e.g. Aquarius underwater habitat/Haughton-Mars) to further scientific knowledge, develop scientific and medical technologies, develop mission operation concepts and train crew and support personnel. Astronaut David Williams was the commander of NEEMO 9 Expedition to the Aquarius underwater habitat in April 2006.
- As part of the Shuttle-based ISS Assembly and Maintenance mission STS-115/12A, Canadian Astronaut Steve MacLean successfully performed one space walk (extra-vehicular activities) to install solar panels to increase the capability of the ISS to generate power to support science and operational activities.
- Efforts were made to include a study of cardiovascular adaptation to the space environment though the STS-118/13A mission with Canadian Astronaut Dave Williams. The mission was postponed to 2007.
- Collaboration with Russia on two ISS studies; one to study astronaut/cosmonaut performance reliability and skill dynamics during long-term space flights, and the other to study astronaut radiation exposure. This collaboration is ongoing.
- Evaluate cross-cultural training requirements for the ISS environment: Canada has undertaken a study in collaboration with international partners.
- Discussions with the German Space Agency, DLR (Deutsches Zentrum für Luft und Raumfahrt) on a joint mission that would demonstrate robotic on-orbit servicing capability were put on hold by DLR's senior management. By then, the CSA had completed its inputs to the mission requirements document and conducted several feasibility studies. The CSA will not invest any more effort in this mission until the DLR redefines it.

## **SPACE MISSION DEVELOPMENT – SPACE SCIENCE AND EXPLORATION**

One Science and Exploration Space Mission Development Program, with a combination of accomplishments, demonstrates how the expected result outlined below was measured and attained.

**1- SE Projects – Objective:** Ensure the development, delivery and commissioning of space-qualified systems for SE missions through effective project, quality and engineering management.

<b>EXPECTED RESULT:</b>
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SE projects' deliverables meet mission objectives and user expectations.
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<b>Indicators</b>	<b>Performance</b>
1. Safety and Mission Assurance (S&MA) and Configuration Management (CM) requirements are identified and met for each project (Targets: Guidelines are completed and implemented on all projects phase A to E);	<p><b>Target Met:</b> All projects (phases A to E) have S&amp;MA and CM.</p> <p><b>Precisions:</b> SM&amp;A and CM participated in 6 active SE projects in Phases B, C and D.</p>
In accordance with Treasury Board approved Project Approval and Management Framework (PAMF):	
2. Mission objectives and user requirements are met at critical steps of the projects (Target: 90% satisfaction);	<p><b>Target not Met:</b> 88% satisfaction rate.</p> <p><b>Precisions:</b> The 88% client satisfaction rate is an increase from the previous survey result of 82%.</p>
3. Project cost is maintained within authorized levels (Target: 75% of projects delivered on time and on budget); and,	<p><b>Target Met:</b> 81%</p> <p><b>Precisions:</b> 81% of project milestones were delivered on time. The milestones that were not met was a result of technical difficulties, primarily on JWST and PHOENIX. 100% of SE project costs were maintained within authorized levels.</p>
4. Risks are identified and mitigated for each project (Target: up to 75% of risk budget is used).	<p><b>Target Met:</b> 34% of risk budget used.</p>

**PERFORMANCE ANALYSIS:**Indicator 1

According to Treasury Board approved Project Management and Approval Framework phases B, C and D relate to preliminary design definition, detailed design definition and manufacture and acceptance implementation. Together they correspond to project development phases.

Indicator 2

Space Programs conducted a client survey. The survey was conducted through 33 interviews with missions' managers, project managers or directors general over 15 projects ranging from phases A to E. The interviews were carried out in April and May 2007 and lasted from 45 to 60 minutes. Only the results of the 17 mission managers and project managers were considered to establish the satisfaction rate. The other interviews were used to polish improvement recommendations. During the course of carrying out the survey/interviews, information pertaining to the various services provided by the Space Programs Branch was gathered as a means of providing valuable insight into problem areas or issues related to project management services and processes that might need to be addressed. This information will also be used as a means of striving for improved performance results in subsequent years.

Indicator 3

Source: Annual Table of Projects Milestones, internal document only in English.

Indicator 4

The project risk matrix is reviewed monthly at each project review and discussed in more detail during Space Program Risk Committee meetings, which taking place three times a year.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
48.2	46.5
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
19.7	23.5

**Highlights of Main Accomplishments – Space Mission Development (SE)**

- Canada's contribution to NASA's Phoenix mission, an on-board meteorological station (MET), has undergone final testing at the CSA's David Florida Laboratory in Ottawa and been delivered to NASA in preparation for a launch scheduled for August 2007. The MET will play an important role during the mission by providing basic scientific knowledge of the Martian atmosphere. This program will also include benefits for Canada in science and industrial competitiveness. This project demonstrates how effective the CSA is at leveraging international cooperation and partnership to ensure Canadian science and technology remain at the forefront of space exploration.



- The Enhanced Polar Outflow Probe (ePOP) mission, now integrated with the CASSIOPE Mission Contribution Program, is scheduled for launch in late 2008. It will probe the upper atmosphere and ionosphere region where solar variability exerts influence on global change in various time scales. The scientific data collected by ePOP will help scientists understand particle exchange and energy coupling processes between the Earth's atmosphere and space environment.
- The CSA has completed the preliminary design of the UVIT Detector Subsystem to be provided for the Indian Space Research Organization (ISRO) for the UltraViolet Imaging Telescope (UVIT) on-board the ISRO ASTROSAT satellite. The ASTROSAT mission is scheduled for launch no earlier than 2008. CSA participation will guarantee 5% of the observing time for Canadian scientists and obtain ASTROSAT astronomic data.
- The CSA has completed the detail design of the Alpha Particle X-ray Spectrometer (APXS) for NASA's Mars Science Laboratory. The Canadian contribution will help scientists to determine the chemical composition of various soil, dust and rock samples. The Mars Science Laboratory mission is scheduled for launch in 2009.
- The CSA is upgrading the existing Enhanced OSTeoporosis Experiments in Orbit (eOSTEO) design to be flown on a Foton spacecraft in partnership with ESA. The flight equipment has been delivered to ESA. The science experiment will study and quantify bone-cell activity and evaluate anti-osteoporosis treatments. The launch is scheduled for 2007, and this mission will provide Canadians with scientific benefits through the three Canadian experiments it contains.
- Canada continued its participation in the James Webb Space Telescope (JWST), a major facility-class space observatory to be launched in 2013. The JWST is a successor to the highly successful Hubble Space Telescope (HST). Canada is responsible for the design and construction of the Fine Guidance Sensor (FGS), a critical element of the mission, which ensures the very precise pointing of the telescope and the provision of simultaneous images for the international astronomical community. In February 2007, the Treasury Board approved an increased contribution of \$30 million over a ten-years period, increasing fund allocation from \$67 to \$98 million through a \$4.2 billion increase in the full project cost, from \$1.8 to \$5 billion (U.S.). Through the CSA's contribution, Canadian astronomers will have guaranteed access to 5% of the observing.
- The HIFI Local Oscillator Source Unit (LSU), which is Canada's contribution to the Herschel Space Observatory, a European Space Agency (ESA) satellite, with an on-board telescope, has been delivered and is being integrated and tested at the system level. The mission will be launched in 2008. The Herschel satellite will carry an infrared telescope and three scientific instruments, one of which is a high-resolution spectrometer, the Heterodyne Instrument for the Far Infrared

(HIFI). Herschel will allow scientists to address key science questions such as how galaxies were formed in the early universe and how stars have been forming throughout the history of the universe.

- The NEOSSat mission, a joint CSA-DND (Department of National Defence) mission, is a combination of the Near Earth Space Surveillance (NESS) and the High Earth Orbit Surveillance (HEOS) projects. It is expected that 50% of NEOSSat time will be used to observe the inner portion of the solar system to discover, track and study asteroids and comets. The other 50% of the operating time will be used to track satellites in high-Earth orbit to update the orbit parameters of known satellites flying over Canadian territory. NEOSSat has received full approval to proceed with the design, building, and testing of the spacecraft, which is scheduled for launch at the end of 2009.
- Working with the Malaysian Space Agency and NASA, CSA was able to transform a purely educational payload into an educational/science payload. By replacing some ordinary *C. elegans* (a tiny worm that is one of the most commonly used model organisms) with mutant worms with a known defect in their genetic repair mechanism, a Canadian scientist is using the opportunity to better understand the possible damage caused by space radiation at one of its most vulnerable targets, the genetic material inside cells. The first sample of worms has been returned to Earth for analysis while the second batch is expected in August 2007.
- An international workshop on bone research in space was hosted by the CSA in June 2006, followed up by a symposium attended by over 300 scientists as part of the International Osteoporosis Federation Conference. The workshop brought together scientists to exchange research and results and forge partnerships, while the symposium was an opportunity to demonstrate that life sciences in space can return valuable scientific data that may not be achievable on Earth.

## **SPACE MISSION OPERATIONS – SPACE SCIENCE AND EXPLORATION**

Three Science and Exploration Space Mission Operations Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- International Space Station (ISS) – Objective:** Provide required CSA operations, training and engineering services to the ISS Program.

### **EXPECTED RESULT:**

CSA robotics operations and engineering services meet ISS Program (ISSP) and Canadian Space Station Program (CSSP) stakeholders' expectations in accordance with the Intergovernmental Agreement (IGA) and the Memorandum of Understanding with NASA.

Indicators	Performance
1. Percentage of active participation of the CSSP team in the various multi-lateral boards and panels managing the ISSP (Target: 95%);	<p><b>Target Met:</b> More than 95%.</p> <p><b>Precisions:</b> The target was exceeded with a 100% rate of participation.</p>
2. Rate of availability of Ops Centre (Target: 99%);	<p><b>Target Met:</b> More than 99%.</p> <p><b>Precisions:</b> Availability even surpassed target at time.</p>
3. Rate of training delivered vs training requested (Target: 95%);	<p><b>Target Met:</b> More than 95%.</p> <p><b>Precisions:</b> The target was exceeded with a 100% response rate to requests.</p>
4. Percentage of MSS system(s) and operational support availability for planned and unplanned events (Target: 95%);	<p><b>Target Met:</b> 95%</p> <p><b>Precisions:</b> The CSA delivered all necessary products and support services in accordance with any agreed NASA schedule.</p>
5. Percentage of software and flight products delivered as required/scheduled (Target: 95%); and,	<p><b>Target Met:</b> More than 95%.</p> <p><b>Precisions:</b> The target was exceeded with all software and flight products delivered 100% at the agreed times.</p>
6. Rate of payload operational support availability for planned and unplanned events (Target: 100%).	<p><b>Target Met:</b> 100%</p> <p><b>Precisions:</b> All integration, certification and operational activities were completed in support of two specific projects: PMDIS/TRAC which is now in orbit and being operated as part of the ISS payload complement, and MVIS which is integrated into the ESA Columbus laboratory and waiting to be launched.</p>

**PERFORMANCE ANALYSIS:**Indicator 1

Active participation in ISS multilateral program meetings and boards allows Canada to position the CSA in the ISS management structure and ensures proposals and decisions are determined accordingly to Canada's delivery capacity and are properly communicated to all partners.

Source: International Space Station Program Control Boards and Panels:  
<http://iss-www.jsc.nasa.gov/nwo/ppco/cbp/web/> document only in English.

Indicators 3, 5 and 6

Achievements are monitored against set requirements and certified by NASA counterparts.

Indicators 2 and 4

Systems availability is measured in system response time during operational activities as required by NASA counterparts.

Source for Indicator 2: Remote Commanding Monthly Availability Report;  
 Source for Indicator 4: Internal weekly Mission Operations Reports.  
 Internal documents only in English.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
53.1	56.7
2006-2007 - Human Resources (FTEs)	
Planned	Actual
115.1	100.5

**2- SE Mission Operations – Objective:** Operate the space and ground segment for SE mission operations.

**EXPECTED RESULT:**

SE Space Mission Operations meet mission objectives and user/client expectations.

Indicators	Performance
1. Sponsoring organization's requirements for payload projects are met at critical steps of the operation (Target: 100%).	<b>Target Met:</b> 100%

**PERFORMANCE ANALYSIS:**

Two objectives were met. PMDIS/TRAC is now in orbit and being operated on the ISS; MVIS is integrated into the ESA Columbus laboratory at KSC and awaits launch to the ISS.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
0.6	4.1
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
Nil	1.1

**3- Human Space Flight Missions Support – Objective:** Manage human space flight missions assigned to the Canadian Astronaut Corps to optimize returns of scientific data and on-orbit operational knowledge.

**EXPECTED RESULT:**

Ensure and maintain Canadian Astronauts' health and safety for space flight missions.

<b>Indicators</b>	<b>Performance</b>
1. Number of activities targeted at maintaining Astronauts' Health and Safety (Target: 2); and,	<b>Target Met: 2</b>
2. Percentage of participation in ISS medical boards, panels and working groups (Target: 100%).	<b>Target Met: 100%</b>

**PERFORMANCE ANALYSIS:**Indicator 1

Significant achievements were noted in the Advanced Astronaut Medical Support (ADAMS) project, including the completion of a comprehensive needs and capacities study and the publication of a strategic plan. The CSA Shuttle Contingency Plan was integrated with Public Safety Canada and Transport Canada Space Shuttle Contingency plans.

Source: Contract with Ontario TeleNorth.

Indicator 2

All required meetings were attended and conferences have been supported. Active participation in the ISS multilateral program meetings and boards allows Canada to position the CSA in the ISS management structure and ensures proposals and decisions are determined accordingly to Canada's delivery capacity and are properly communicated to all partners.

Source: Weekly reports on Operational Space Medicine (OSM) activities to be available next year, internal documents only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
2.1	2.2
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
11.3	9.9

**Highlights of Main Accomplishments – Space Mission Operations (SE)**

- As part of the Canadian Space Station Program (CSSP), a ground control capability was implemented for Canadarm2, which will allow for movement of the robotic arm by personnel on the ground without involvement of the on-orbit crew. This new capability will free up crew time for science and provide greater operational flexibility for the International Space Station (ISS) operations team. Ground control development will be progressively expanded for the Mobile Servicing System (MSS) to allow for more efficient use of the Special Purpose Dexterous Manipulator (Dextre) robot when it is launched in early 2008.
- The development and the end-to-end testing of MSS-4 and MSS-5 software on the Dextre were completed. The design and development of training material and operational procedures for Dextre also continued throughout the year. The development and end-to-end testing of the MSS-5.1 software were completed.

The requirements phase of the MSS-6 software load destined to be the flight software for HTV was completed and work to build and test the software was initiated.

- The CSA fulfilled its responsibilities related to MSS operations, which comprise maintaining MSS hardware and software, performing repair and overhaul work on MSS hardware, operating MSS training facilities in Canada, planning and supporting operations of MSS missions, and conducting operations in conjunction with the NASA Houston flight control room from the Remote-Multi-Purpose Support Room (RMPSR), an operational facility in St. Hubert, Quebec. In 2006-2007, the RMPSR was scheduled by NASA to support MSS activities for a total of 6,066 hours, plus 552 hours of simulation support.
- CSA delivered 12 weeks of training (MSS&ESC) at CSA facilities to NASA and international partners; 6 astronauts, 7 CAPCOMs, 6 mission controllers, 9 CSA operations engineers and 15 real-time operations personnel were fully qualified. In addition 36 weeks were spent in development of new course material in support of SPDM and maintenance of current MSS course material. This represents 100% of the agreed ISS program requirements.
- Development of the PMDIS/TRAC (Perceptual-Motor Deficits in Space/Test of Reaction and Adaptation Capabilities) experiment was completed and the hardware was successfully integrated and launched aboard the Space Shuttle Discovery in early December 2006. PMDIS/TRAC, the first experiment to use the Canadian ISS allocation rights, has been successfully performed on orbit since it first arrived on board the ISS in December during Mission STS-116/12A.1. A total of 3 PMDIS crew experimental sessions have been completed and 21 TRAC crew sessions over the past months. The last 2 PMDIS crew sessions are planned for early August 2007. At that time, the experiment hardware will be packaged and prepared for its return flight to Earth during Mission STS 119/15A.
- Operations for the Microvariability and Oscillations of Stars (MOST) micro-satellite space telescope, launched in June 2003, continued with additional significant science results expected from this innovative mission. Since launch, the MOST science team and collaborators have published 28 referred papers, with 9 more papers currently under review. Major astronomical discoveries suggest that long-held theories on the formation and aging of the Sun and other stars need to be reconsidered.
- Canadian scientists continue to obtain data from our participation in NASA's Far UltraViolet Space Explorer (FUSE) mission (launched in 1999) and from the Canadian Geospace Monitoring (CGSM). CGSM is an array of ground-based geophysical instruments, which are working with NASA's mid-explorer (MIDEX) through a mission called THEMIS launched in 2007. Through a modest contribution of \$1.5 million per year, Canadian scientists are full partners in this U.S. \$400 million mission.

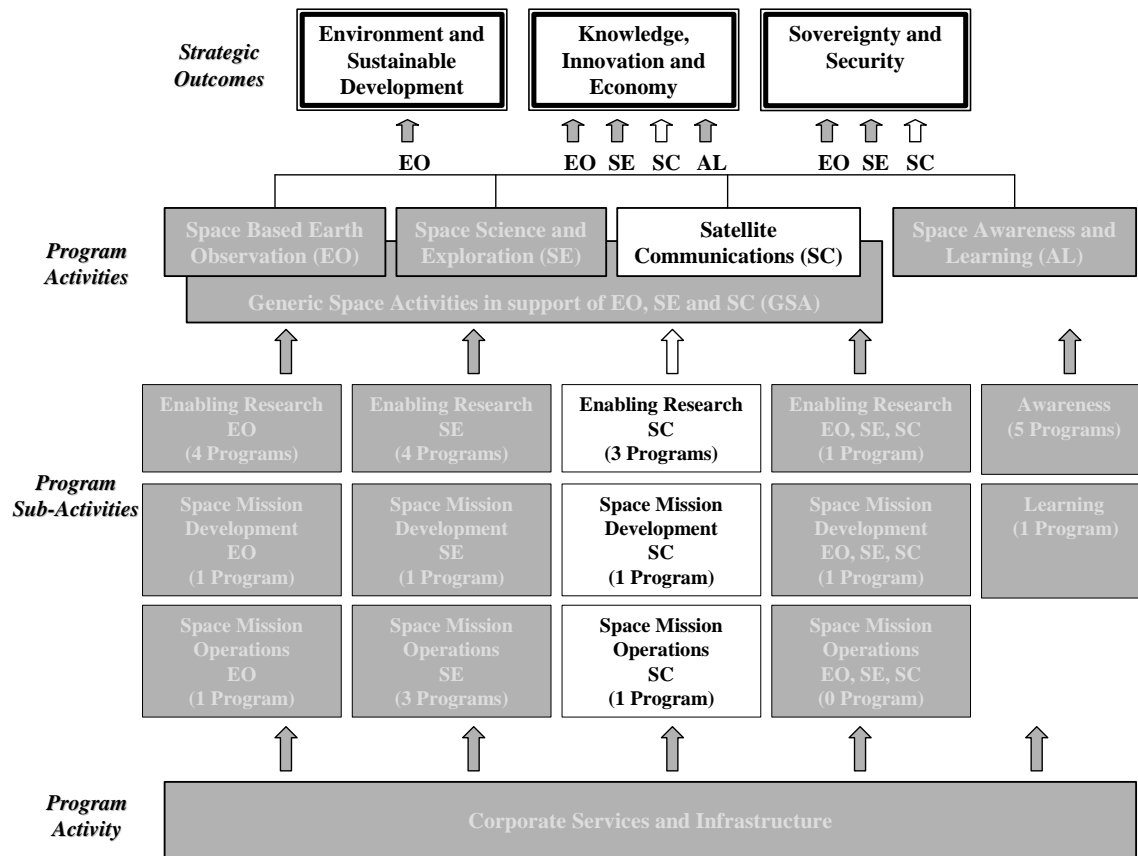
- In the absence of the NASA Space Shuttle program, the Osteoporosis Experiments in Orbit (OSTEO) was accommodated with an enhanced system (eOSTEO) in order to fly on-board an ESA unmanned science mission scheduled for launch in September 2007. Three Canadian scientific teams are participating in eOSTEO.
- The CSA continued to support the Microgravity Vibration Isolation Sub-system (MVIS) delivered to ESA for integration into the Fluid Science Laboratory, which will be flown aboard their Columbus module. The integration of the flight and engineering models of the unit have all been completed. Testing was completed and ESA accepted the MVIS system for final integration aboard the Columbus laboratory to be launched in December 2007 on Space Shuttle STS-122/1E. The final version of the engineering model software was delivered and tested in Naples, Italy. The CSA also supported flight preparations and participated in crew training.
- A study report was produced for the Advanced Astronaut Medical Support (ADAMS) identifying solutions to the delivery of health care on future long duration exploration-class missions, health care needs and solutions for space missions, overlaps with terrestrial remote medicine and capacity within Canada to meet those needs (industry, academic, government) was published in July 2006.

To learn more about Space Science and Exploration, go to:  
<http://www.space.gc.ca/asc/eng/sciences/default.asp> and,  
<http://www.space.gc.ca/asc/eng/exploration/default.asp>



## 2.4 SATELLITE COMMUNICATIONS

### Program Activity: SATELLITE COMMUNICATIONS (SC)



**Priority:** Provide all Canadians with the means to participate in and fully benefit from the global information age.

**Performance Status:** 78% (7/9) of the targets were met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005.

<b>SATELLITE COMMUNICATIONS</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result 1</b>	
Increased access for Canadians to state-of-the-art communications systems and services to meet their social and economic needs.	
<b>Indicators</b>	<b>Performance</b>
1. Gap between current capabilities and future needs of Canadians for satellite communications and available or expected system capacity.	Baseline performance information will be available in the 2007-2008 DPR based on needs analysis currently taking place.
2. Percentage of coverage over Canada by satellite and ground systems in place for commercial and governmental usage.	Near 100% coverage over Canada for commercial usage.  Demonstration and trial campaign for the provision of government service to northern and remote communities is progressing well and is expected to be completed in March 2008.
3. Utilization rate of Anik F2 Ka-band payload and in particular the service delivery utilizing the \$50 million Government Ka-band capacity credit.	Anik F2 now has 52,000 customer subscribers (basic service equivalents) in Canada in addition to the commercial services offered by Telesat to corporations.  The demonstration and trial campaign for the provision of government services to northern and remote communities using Government of Canada Capacity Credit are progressing well and are expected to be completed in March 2008.

## **Performance Analysis**

### Indicator 1

In 2007-2008, the CSA will undertake studies on communications satellite service needs and opportunities, from which baseline data will be drawn to measure the gap between current capabilities and future needs of Canadians.

### Indicator 2

The CSA has deployed hubs in Vancouver and Winnipeg to demonstrate Ka-band applications and services using Anik F2's four northern beams. In conjunction with the existing infrastructure, nine Ka-band terminals were obtained to demonstrate institutional services and applications in the Canadian North. This ongoing trial campaign, scheduled to be completed by March 2008, will yield a comprehensive assessment of Ka-band performance in the four northern beams. Initiatives to upgrade the reliability and quality of service of the existing proof-of-concept services are expected to be undertaken in 2007-2008.

### Indicator 3

The number of modems installed to date is about 32,000 with a growing rate of 50-70 terminals per day. Based on Telesat's 4 tiers of service, this number translates into about 52,000 customer subscribers (also referred as basic service equivalents). The baseline performance of 52,000 subscribers for Anik F2 represents a commercial take-up rate higher than originally anticipated (the original take-up rate was estimated at 3,000 new basic service equivalents per month, which for the 11-month of service (May 2005 - March 2006) would equate to 33,000 basic service equivalents). Note that the maximum of 150,000 basic service equivalents available for Government use equates to a total of approximately 100 Mbps access for 11 years (ending in April 2015). Additional performance information on Anik F2 commercial take-up, such as number of communities served and type of applications and services used will be available once the operating upgrade by National Satellite Initiative (NSI) is up and running.

Through its support of Anik F2, the Government of Canada has secured a Government Capacity Credit access worth \$50 million over 11 years starting in May 2005. Industry Canada has transferred this Capacity Credit to the National Satellite Initiative (NSI) to support the Government's connectivity agenda for remote and underserved northern rural communities. So far, the Government of Canada Capacity Credit (GoC CC) access for Anik F2 has only been used for validation testing and concept demonstration purposes, resulting in a low rate of utilization since May 2005. The CSA is investigating implementation solutions to meet these requirements in 2007-2008.

### Expected Result 2

Better use of space communications, search and rescue, and global navigation satellite systems and applications to improve the efficiency and effectiveness of other government departments in delivering services to Canadians.

Indicators	Performance
1. Number of joint studies and projects between the CSA and other government departments in the field of satellite communications, navigation and search and rescue.	A second joint study was conducted in 2006-2007 on Global Navigation Satellite Systems (GNSS) opportunities specific to the transportation sector.

### Performance Analysis

A first joint study, undertaken in 2005-2006 in cooperation with the Department of National Defence, Natural Resources Canada and Industry Canada, looked at the importance of GNSS technology to Canada and identified some of the country's strengths and opportunities. The analysis was based on the input of over 100 representatives from government, industry and academia.

A second joint study, undertaken in 2006-2007 in cooperation with Transport Canada, has shown that many sectors within the transportation sector can benefit greatly from GNSS services.

A review of the federal government GNSS governance model was recommended in both studies. To this end, CSA will consult with the other government departments involved in the two studies to organize a joint workshop to address this issue.

2006-2007 - Financial Resources (\$ in millions)		
Planned	Total Authorities	Actual Spending
32.3	29.9	29.3
2006-2007 - Human Resources (FTEs)		
Planned	Total Authorities	Actual
11.0	Not applicable	10.2

**The programs under this Program Activity are divided into three Sub-Activities: Enabling Research, Space Mission Development and Space Mission Operations.**

**However, no Space Mission Operations are mentioned in this report since CSA is not operating communication satellite.**

**ENABLING RESEARCH – SATELLITE COMMUNICATIONS**

Three Satellite Communications Enabling Research Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- SC Mission Concepts – Objective:** Assume leadership and provide support in research and development of new space mission concepts leading to the realization of CSA or international SC missions.

**EXPECTED RESULT:**

Mission Feasibility and Concept studies by industry, government and academia, enabling CSA decisions on future Satellite Communications' space missions of interest to Canada.

Indicators	Performance
<p>1. Feasibility studies and mission and payload concept studies are initiated and completed. (Target: 1); and,</p>	<p><b>Target Met:</b> Two initiated.</p> <p><b>Precisions:</b> <u>Anik G1 Payload Concept Study:</u> A definition study, which may lead to a major mission on Telesat's Anik G1, was under preparation with an expected start in June 2007.</p> <p><u>Polar Communications Feasibility Study:</u> A study on the possibility of providing satellite communications using polar orbiting satellites covering the entire Canadian North was under preparation for a Request For Proposal in August 2007.</p>
<p>2. New missions developed (Phase 0/A) and successfully retained for implementation (Phase B, C, D) (Target: 0 for 2006-2007).</p>	<p><b>Target Met:</b> 1 new mission retained for implementation.</p> <p><b>Precisions:</b> The M3Msat mission was approved in 2006-2007 by the Department of National Defence and CSA as a joint Microsat mission for maritime monitoring and messaging.</p>

## PERFORMANCE ANALYSIS:

### Indicator 1

Anik G1: With over a year of successful Ka-band operations on Anik F2, the world's first satellite to provide commercial broadband services, Telesat has already initiated planning to ensure continuity of existing services, introduce enterprise services, and to meet the expected growth in demand for interactive broadband. Anik G1 is being planned as the first satellite in the new series and will be a dedicated Ka-band satellite providing very high capacity for two-way broadband services over North America. To this end, in December 2006, Telesat approached the CSA with a proposal for collaboration similar to the Anik F2 Payload Demonstration. CSA is therefore anticipating contracting out, in 2007, a detailed definition study into a piggyback demonstration payload that will be flown on Anik G1. This study would first quantify the future needs of government departments and agencies and would then define the specific technologies proposed to meet the identified demands and thus warranting demonstration aboard Anik G1.

Polar Communications: To provide reliable communications services and pre-operational meteorological data in Canada's Great North, with 100% coverage, and augment current and future Canadian GEO communications capabilities, CSA is looking into a Polar Communications Mission using a constellation of satellites in HEO (Molniya type) or LEO orbits. Moreover, to take advantage of the unique observation point over the Arctic region, the mission would, as a secondary objective, obtain and feed into the Numerical Weather Prediction Model (NWPM) highly temporal (ideally every 15 minutes) meteorological data 60° to the North Pole in order to significantly improve the accuracy of weather forecasting in Canada and make a Canadian contribution to the international meteorological community. To this end, the CSA is planning on contracting out a study in 2007 to fully investigate the feasibility and tangible merits of the Polar Communications and Weather concept.

### Indicator 2

M3Msat: The Maritime Monitoring and Messaging Micro-Satellite (M3MSat) mission will place a micro-satellite at LEO to demonstrate the utility of collecting Automatic Identification System (AIS) data using a space-based platform. AIS is a maritime self-reporting network intended to improve safety at sea by having all ships greater than 300 tonnes continually transmit their location over VHF. This project will demonstrate the utility of a space-based AIS receiver by providing maritime operators with "near-ground truth" data for vessels transmitting class A data, as well as characterizing and mapping radio frequency interference for AIS frequency bands on a global scale. A joint project between CSA and the Department of National Defence, M3Msat will benefit from the work established and lessons learned from the NEOSSat mission. The outcome will also be used to support risk reduction activities for the RADARSAT-Constellation Mission (RCM) related to an AIS secondary payload. With the program now having been approved, the next step for the CSA is to investigate the best procurement approach to follow.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
2.8	Nil
2006-2007 - Human Resources (FTEs)	
Planned	Actual
Nil	Nil

**2- ESA Programs in SC – Objective:** Through key international partnerships, enhance the Canadian industry's technological base and provide access to European markets for value-added products and services in the field of SC.

**EXPECTED RESULT:**

Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under SC programs.

Indicators	Performance
1. Canadian industrial returns in ESA optional programs in Satellite Communications. (Target: 0.80 or higher).	<p><b>Target Met:</b> 1.0 return ratio attained in all ARTES programs and 0.91 return ratio attained in the GalileoSat program.</p> <p><b>Precisions:</b> This has been an active period for ESA in awarding contracts to Canadian companies. Targets in both ARTES and GalileoSat programs were met.</p>

**PERFORMANCE ANALYSIS:**

The return coefficient corresponds to the ratio between the actual number of weighted contracts given to a country and the ideal number of contracts to be given to that country according to existing rules. Canadian industrial returns are by Program Activity. The SC optional programs are: ARTES and GalileoSat. The Overall Canadian industrial return pertains to all ESA mandatory programs. The Overall Industrial Return Coefficient Indicator is 1.16.

ARTES programs brought a return of 100%, with all our available funding used by ESA to award contracts to Canadian companies. Demand for bid support from the Canadian industry still greatly exceeds the available Canadian funding at ESA.

For the Galileosat program, 91% of our available funding was used by ESA to award contracts to Canadian companies for space and ground segment infrastructure. Particular attention will be paid to this program in 2007-2008 in order to have ESA award additional work to Canadian companies with the objective of obtaining a 100% return.

The ESA GNSS Evolution program was approved during the period. This program will enable Canadian companies to participate in research and development activities leading to the next generation of the Galileo GNSS constellation.

In addition, ESA and major European operators were notified of a significant Canadian funding commitment to support Canadian involvement in the Alphasat large platform demonstration program during the period. The final selection of a winning payload is still under consideration by ESA and will be announced in May 2007.

Source: European Space Agency Council. Paris, Agency Key Performance Indicators. ESA/IPC (Dec. 2006) 13 rev. 2, internal document only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
8.3	11.0
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
Nil	Nil

**3- SC Application Development Programs – Objective:** Enhance Canada's ground segment telecommunications technologies, develop and demonstrate SC applications for commercial use and Canadian government operations.

**EXPECTED RESULT:**

Development and demonstration of SC applications for private and public sector clientele and the support and development of ground segment telecommunication technologies.

<b>Indicators</b>	<b>Performance</b>
1. Number of new or improved applications (Target: 0); and,	<b>Target Met.</b> <b>Precisions:</b> Two programs, TITAN and STAR were approved by CSA but were not funded.
2. Number of operational engagements (Target: 0).	<b>Target Met.</b> <b>Precisions:</b> TITAN and STAR programs approved but not funded. Will be re-submitted for funding support in 2007-2008.



**PERFORMANCE ANALYSIS:**

Definition of two programs, TITAN and STAR, have been prepared and presented to the CSA Executive Committee. The two programs were well received but could not be started due to the unavailability of funding for new initiatives in 2006-2007.

Source: Internal document only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
0.6	Nil
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
Nil	Nil

**Highlights of Main Accomplishments – Enabling Research (SC)**

- The CSA supported the new development of the Middle Earth Orbit Search & Rescue (MEOSAR) Transponder Engineering Qualification Model (EQM). This will enable Canada to be ready for international flight opportunities on Global Navigation Satellite Systems constellations such as GPS or Galileo.
- A Processor Hub that provides expanded access to Ka-band users and government services in the North was developed by the CSA and its industry partners, in a Telesat Teleport in Winnipeg.
- Canada's participation in European Space Agency (ESA) programs allowed our industry to access forward-looking studies on new telecommunications services; develop new technologies, equipment and applications in multi-media, optical inter-satellite and mobile communications; and demonstrate satellite-based communications services such as interactive communications services for remote communities and disaster management. For example, Canadian companies:
  - Developed a Short Messaging Service System for the Galileo program to support missions in emergency services and an Automatic Identification System for monitoring marine traffic, including text messaging, fleet management, and inventory tracking/management on a global scale;
  - Completed studies on Medium Earth Orbit Local User Terminals (MEOLUT) and developed improved processing algorithms for ground stations and local user terminals to allow Search and Rescue to provide near instantaneous positions as well as significantly improved detections; and,

- With the ESA project for on-board autonomy (PROBA) mission, demonstrated new concepts in the field of optical communications technology for ultra-fast and reliable exchange of information within the satellite components.

**SPACE MISSION DEVELOPMENT – SATELLITE COMMUNICATIONS**

One Satellite Communications Space Mission Development Program, with a combination of accomplishments, demonstrates how the expected result outlined below was measured and attained.

**1- SC Projects – Objective:** Ensure the development, delivery and commissioning of space-qualified systems for SC missions through effective project, quality and engineering management.

**EXPECTED RESULT:**

SC projects' deliverables meet mission objectives and user expectations.

Indicators	Performance
1. Safety and Mission Assurance (S&MA) and Configuration Management (CM) requirements are identified and met for each project (Targets: Guidelines are completed and implemented on all projects phase A to E);	<b>Target Met:</b> One project currently in Phase D, had S&MA and CM.
In accordance with Treasury Board approved Project Approval and Management Framework (PAMF):	
2. Mission objectives and user requirements are met at critical steps of the projects (Target: 90% satisfaction);	<b>Target not Met:</b> 88% satisfaction rate.  <b>Precisions:</b> The 88% client satisfaction rate is an increase from the previous survey result of 82%.

<p>3. Project cost is maintained within authorized levels (Target: 75% of projects delivered on time and on budget); and,</p> <p>4. Risks are identified and mitigated for each project (Target: Up to 75% of risk budget is used).</p>	<p><b>Target not Met:</b> 60%</p> <p><b>Precisions:</b> 60% of project milestones were delivered on time. The milestones that were not met was the result of technical difficulties and delay in start of projects. However, 100% of SC project costs were maintained within authorized levels for all projects.</p> <p><b>Target Met:</b> 49% of risk budget used.</p>
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**PERFORMANCE ANALYSIS:**

<p><u>Indicator 1</u></p> <p>According to Treasury Board approved Project Management and Approval Framework, phases B, C and D relate to preliminary design definition, detailed design definition and manufacture and acceptance implementation. Together they correspond to project development phases.</p> <p><u>Indicator 2</u></p> <p>Space Programs conducted a client survey. The survey was conducted through 33 interviews with missions' managers, project managers or directors general over 15 projects ranging from phases A to E. The interviews were carried out in April and May 2007 and lasted from 45 to 60 minutes. Only the results of the 17 mission managers and project managers were considered to establish the satisfaction rate. The other interviews were used to polish improvement recommendations. During the course of the survey/interviews, information pertaining to the various services provided by the Space Programs Branch was gathered as a means of providing valuable insight into problem areas or issues related to project management services and processes that might need to be addressed. This information will also be used as a means of striving for improved performance results in subsequent years.</p> <p><u>Indicator 3</u></p> <p>Source: Annual Table of Projects Milestones, internal document only in English.</p> <p><u>Indicator 4</u></p> <p>The project risk matrix is reviewed monthly at each project review and discussed in more detail during the Space Program Risk Committee meetings, taking place three times a year.</p>
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<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
20.5	18.3
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
11.0	10.1

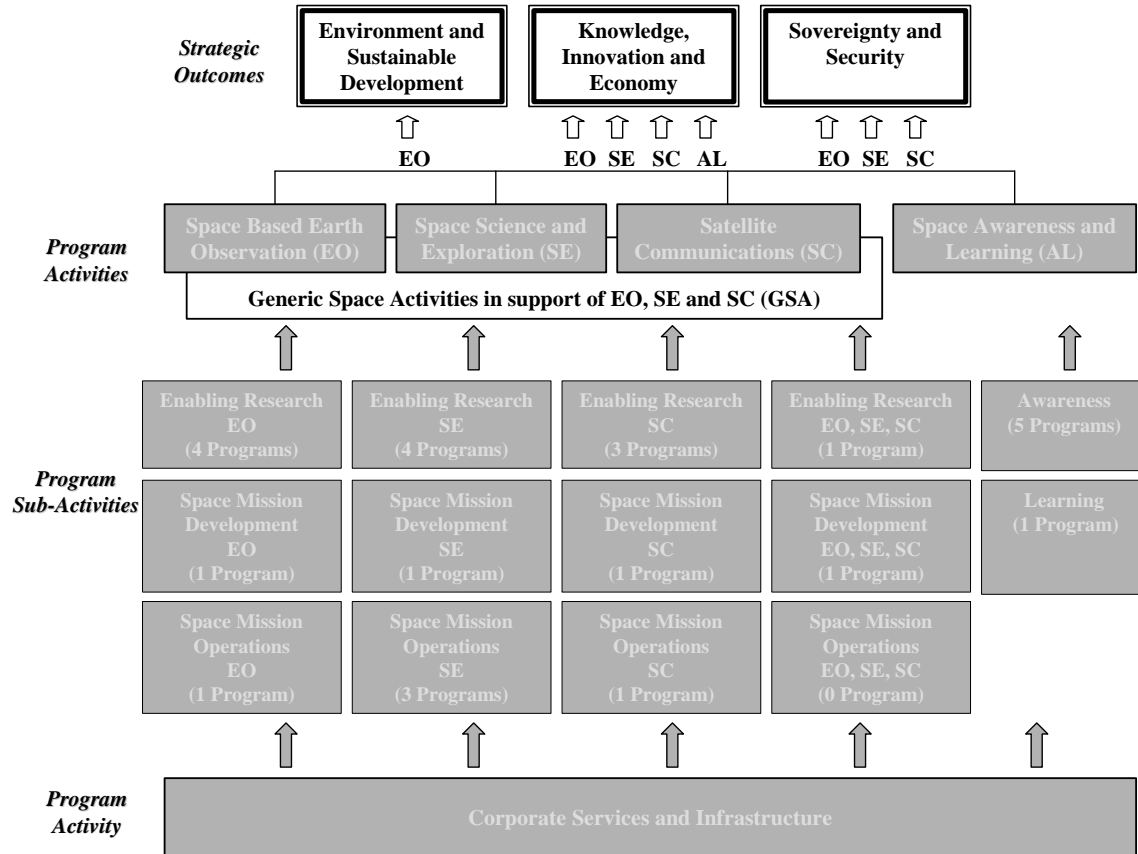
### **Highlights of Main Accomplishments – Space Mission Development (SC)**

- In 2004-2005, as part of the CASSIOPE Mission Contribution Program, the CSA initiated the development and demonstration of the Cascade telecommunications payload on a small satellite bus. Cascade is the precursor of a communications satellite constellation that will help position Canadian industry on the international market, both as a supplier of advanced components and as a service provider of high-volume, high-data-rate telecommunications. Canadian companies continued to manufacture the Cascade payload and prepared for assembly, integration and test on the spacecraft. The project completion was delayed due to problems with the development of critical components and the move of the launch date from December 2007 to November 2008. After detailed reviews of all the mission components, the schedule and milestones were modified to fit the new project schedule and launch date and the cash flow projections were adjusted accordingly.

To learn more about Satellite Communications, go to:  
<http://www.space.gc.ca/asc/eng/satellites/default.asp>

## 2.5 GENERIC SPACE ACTIVITIES IN SUPPORT OF EO, SE AND SC

**Program Activity: GENERIC SPACE ACTIVITIES IN SUPPORT OF EO, SE AND SC (GSA)**



**Priority:** Provide leadership, coordination or support to Earth Observation (EO), Space Science and Exploration (SE), and Satellite Communications (SC) Program Activities through generic technology research and space-qualification activities.

**Performance Status:** 86% (6/7) of the targets were met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005.

**GENERIC SPACE ACTIVITIES IN SUPPORT OF EO, SE AND SC**

**PROGRAM ACTIVITY PERFORMANCE MEASUREMENT**

**Expected Result**

Innovative space technologies, techniques, and design and test methodologies in response to advanced developments required for future space missions and activities.

<b>Indicators</b>	<b>Performance</b>
1. Number of technologies supported through one of the generic R&D programs used in a space mission or activity.	From the 31 projects that ended in 2006-2007, a total of 4 technologies were chosen for future space missions and 3 technologies were integrated into commercial products.
2. Number of space missions making use of the David Florida Laboratory (DFL).	Six of the CSA's space missions were supported by DFL in 2006-2007.
3. Number of peer-reviewed papers as a result of CSA generic technology R&D programs.	A total of 67 peer-reviewed papers, written by CSA's scientists and engineers, as a result of 2 CSA generic technology R&D programs.

**Performance Analysis**

Indicator 1

Harmonized performance measurement indicators for 2 Space Technology Programs – the Space Technology Research Program (STRP) and the Space Technology Development Program (STDP) – demonstrated that 1 technology was chosen out of 11 STRP projects for future space missions and that 3 technologies were chosen out of 20 STDP completed projects for future space missions; 3 technologies were integrated into commercial products for an impressive total of 23 % of new technology used.

Indicator 2

In addition to the 6 space missions, David Florida Laboratory also supported 3 technology development projects – the International Space Station (ISS), CANDARM1 and the Microsat Bus – and 5 commercial projects.

Indicator 3

Harmonized performance measurement indicators for 2 Space Technology Programs – Space Technology Research Program (STRP) and Space Technology Development Program (STDP) – demonstrated that the scientific research community does not use publications to share early findings with its peers in order to protect industrial secrecy and know-how.

<b>2006-2007 - Financial Resources (\$ in millions)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual Spending</b>
44.3	49.2	47.2
<b>2006-2007 - Human Resources (FTEs)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual</b>
146.0	Not applicable	116.1

**The programs under this Program Activity are divided into three Sub-Activities: Enabling Research, Space Mission Development and Space Mission Operations.**

**However, no Space Mission Operations are mentioned in this report, since CSA is not carrying out generic operation activities.**

**ENABLING RESEARCH – GENERIC SPACE ACTIVITIES IN SUPPORT OF EO, SE, AND SC**

One Generic Enabling Research Program, with a combination of accomplishments, demonstrates how the expected results outlined below were measured and attained.

**1- Generic Space Technology Supporting Earth Observation, Science and Exploration, and Satellite Communications – Objective:** Assume leadership and provide support in research and development of space-related high-risk technologies leading to the realization of CSA or international EO, SE, and SC missions.

**EXPECTED RESULT 1:**

Development and transfer of advanced space technologies by industry, government and academia, in support of EO, SE, and SC activities of interest to Canada.

<b>Indicators</b>	<b>Performance</b>
1. Number of publications (Targets: Implement the measurement system and improve target of overall number of publications);	<p><b>Target Met:</b> Measurement system implemented.</p> <p><b>Precisions:</b> Out of 31 projects that ended in 2006-2007, 71 publications were written.</p>
2. Number of patents (Target: Implement the measurement system);	<p><b>Target Met:</b> Measurement system implemented.</p> <p><b>Precisions:</b> Out of 31 projects that ended in 2006-2007, 9 technologies were the subject of a patent application (29%).</p>

<p>3. Number of technologies brought to higher readiness levels to advance technological capacity (Targets: Implement the measurement system and define target for overall number); and,</p>	<p><b>Target Met:</b> Measurement system implemented.</p> <p><b>Precisions:</b> Out of 31 projects that ended in 2006-2007, 22 technologies increased in maturity (71%).</p>
<p>4. Number of technologies chosen for future space missions and/or commercial products by industries (Targets: Define and implement the measurement system).</p>	<p><b>Target Met:</b> Measurement system implemented.</p> <p><b>Precisions:</b> Out of 31 projects that ended in 2006-2007, 4 technologies were chosen for future space missions and 3 technologies were integrated into commercial products.</p>

**PERFORMANCE ANALYSIS:**

Harmonized performance indicators measurement for Space Technology Research Program (STRP) and Space Technology Development Program (STDP) in 2006-2007 provides interesting elements of comparison.

Indicator 1

STRP published 46 conference papers, 19 journal papers, 1 book chapter and 4 technical reports (not peer-reviewed) out of 11 projects (an impressive average of 6 publications per project). STDP published only 1 peer – reviewed publication for 20 projects. In conclusion, the industry does not use publications to share early findings with its peers in order to protect industrial secrecy and know-how.

Indicator 2

STRP: Out of 11 projects that ended in 2006-2007, 8 patent applications were filed. Two patents, filed in 2005-2006, were granted in 2006-2007; STDP: Out of 20 projects that ended in 2006-2007, 1 technology was the subject of a patent application.

Indicator 3

STRP: Out of 11 projects that ended in 2006-2007, 3 technologies increased in maturity. STDP: Out of 20 projects that ended in 2006-2007, 19 technologies increased in maturity.

Some 71% of R&D projects that were completed in 2006-2007 demonstrated an increase in technology maturity levels indicating progress toward set objectives. It is of interest to note that 49 highly skilled positions were maintained or created in relation to the 20 projects that ended in 2006-2007.



Indicator 4

STRP: Out of 11 projects that ended in 2006-2007, 1 technology was chosen for future space missions; STDP: Out of 20 projects that ended in 2006-2007, 3 technologies were chosen for future space missions; 3 technologies were integrated into commercial products.

Indicator 1 to 4

CSA Space Technology managers have undertaken a review of program delivery and governance, including a performance measurement framework review. The results of the work will be reflected in the 2007-2008 DPR in the form of improved performance indicators.

Sources: Space Technology Research Program (STRP) 2006-2007 Achievements; Annual STDP Performance Indicators Values Report, internal documents only in English.

**EXPECTED RESULT 2:**

Successful development and demonstration of advanced technologies, systems, components or studies provided for in the contracts awarded to Canadian firms under ESA Programs.

<b>Indicators</b>	<b>Performance</b>
1. Overall Canadian industrial return on ESA mandatory programs (General Budget, GSTP) (Target: 0.80 or higher).	<b>Target Met:</b> 1.57 return ratio attained. <b>Precisions:</b> Canadian return on ESA mandatory programs has held steadily above 100%.

**PERFORMANCE ANALYSIS:**

The return coefficient corresponds to the ratio between the actual amount of weighted contracts given to a country and the ideal amount of contracts to be given to that country according to existing rules. Canadian industrial returns are by Program Activity. The mandatory program is: General Support Technology Program (GSTP). The Overall Canadian industrial return pertains to all ESA mandatory programs. The Overall Industrial Return Coefficient Indicator is 1.16.

Source: European Space Agency Council. Paris, Agency Key Performance Indicators. ESA/IPC (2006) 13 rev. 2.

**EXPECTED RESULT 3:**

Increased number of university scientists and engineers with Ph.D's and/or Master's degrees with research experience addressing real space problems faced by industry and/or government institutions.

Indicators	Performance
1. Number of partnership projects involving industry, universities and the CSA (Target: 3).	<b>Target not Met: 2</b>

**PERFORMANCE ANALYSIS:**

Selection criteria are very strict and therefore only 2 partnerships qualified this year. One 3-year award to the University of Calgary at \$30,000/year, and one 3-year award to Ryerson University at \$12,500/year.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
37.6	40.5
2006-2007 - Human Resources (FTEs)	
Planned	Actual
103.5	76.8

**Highlights of Main Accomplishments – Enabling Research - Generic Space Activities in support of EO, SE, and SC**

- A first step toward implementing a technology plan took place: the implementation of a mission database that will include all future potential missions with their technology requirements. The detailed concept for the mission database was completed in February and the implementation started in March. The mission database will enter into operation in fall 2007. In parallel, a first technology planning exercise was done for space exploration in consultation with CSA partners. This exercise resulted in a roadmap of technologies to be developed to support space exploration.
- Through the Space Technology Development Program (STDP), the CSA continues to enhance Canada's space capabilities by awarding technology R&D projects to industry and research organizations on a competitive basis. A Request for Proposal (RFP) is issued each year. STDP supports all thrusts of the CSA and also looks after generic technologies, which are of common interest to a variety of space missions. For example, Canadian organizations:
  - investigated critical technologies to reduce the risks of project implementation of the RADARSAT- Constellation mission;
  - advanced technology research in active vision system technologies to maintain Canada's leadership and leading edge in this field and to prepare for upcoming missions in exploration and/or on-orbit servicing;

- advanced research in subsurface acquisition and drilling technologies in support of Canada's potential participation in space exploration missions; and,
- developed innovative technologies related to sensors and instruments for monitoring of the atmosphere.
- Through the Space Technology Research Program (STRP) the CSA developed high-risk space technologies and maintained in-house technical capabilities. STRP conducts long-term advanced R&D projects that meet the criteria of excellence and relevance in support of the implementation of Canadian space activities. For example in 2006-2007, the program included the development of:
  - novel navigation techniques that enhance autonomy of planetary explorations;
  - next generation radar antenna for Earth Observation and surveillance missions;
  - data processing techniques that improve the sharpness of optical images taken from satellites; and,
  - 15-kg class nanosatellites that will demonstrate spacecraft flying in formation.
- The transfer and commercialization of space technologies and their applications to other sectors of the economy enhanced Canada's industrial competitiveness. This is being achieved by managing the CSA portfolio of patents and intellectual property licenses and by conducting commercialization assessments.
- The Research Partnership Program and the collaboration program with the Natural Sciences and Engineering Research Council of Canada (NSERC) were launched to foster closer industry/university collaboration in space research and development.

**SPACE MISSION DEVELOPMENT – GENERIC SPACE ACTIVITIES IN SUPPORT OF EO, SE, AND SC**

One Generic Space Mission Development Program, with a combination of accomplishments, demonstrates how the expected result outlined below was measured and attained.

**1- David Florida Laboratory (DFL) supporting the Canadian Space Program –**

**Objective:** Provide world-class space qualification services on a national scale, including facilities and expertise in support of the Canadian Space Program and international EO, SE and SC missions.

**EXPECTED RESULT 1:**

Development, provision of expertise and supply of space qualification services, functional and environmental testing of space hardware primarily for CSA sponsored programs and projects, and subsequently to the Canadian space industry and other private and public sector clients.

Indicators	Performance
1. Percentage of satisfied clients (Target: 95%).	<b>Target Met:</b> 99% of clients satisfied.

**PERFORMANCE ANALYSIS:**

During the fiscal year, 81 client feedback surveys were distributed and 21 completed surveys were returned, representing a 25% return rate. Minor issues were identified and addressed as part of DFL's ongoing quality improvement program and in consultation with our clients.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
6.6	6.7
2006-2007 - Human Resources (FTEs)	
Planned	Actual
42.5	39.2

**Highlights of Main Accomplishments – Space Mission Development – Generic Space Activities in support of EO, SE, and SC**

- The David Florida Laboratory provided world-class, cost-effective environmental space qualification services for the assembly, integration and testing of spacecraft systems and sub-systems for all of the CSA's programs. Over the course of the past fiscal year, a total of 30 separate users availed themselves of the facilities and services offered by the DFL. A total of 186 tests were performed in support of CSA programs and projects and Canada's tele-communications industry, namely:

- RADARSAT-2, International Space Station (ISS), Phoenix Mars Mission, Cascade/ePOP, eOSTEO, Canadarm1, Quicksat, INMARSAT, Microsat Bus; and,
- Commercial Programs: Skynet 5, SICRAL 1B, SatLite, MUOS, and OrbComm.

To learn more about Generic Space Technology Supporting Earth Observation, Space Science and Exploration, and Satellite Communications, go to:

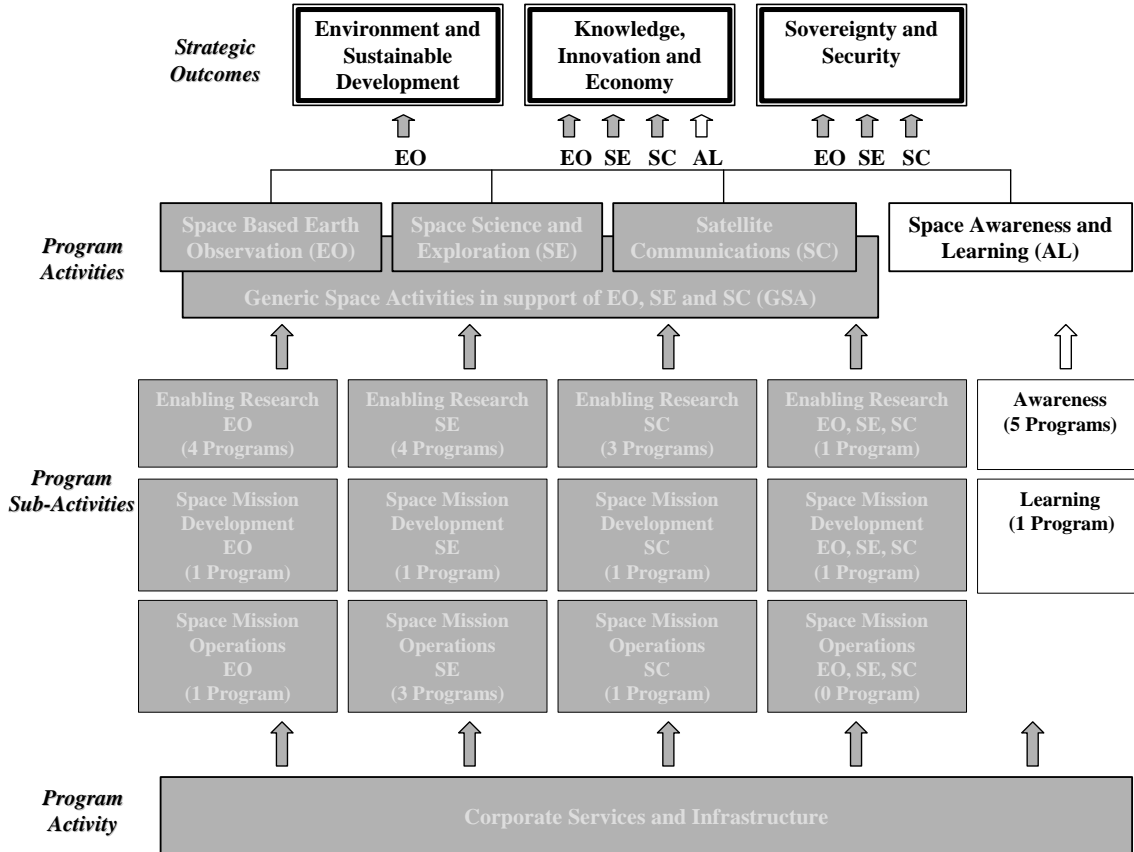
<http://www.space.gc.ca/asc/eng/industry/technology.asp>

To learn more about the David Florida Laboratory, go to:

<http://www.space.gc.ca/asc/eng/df/default.asp>

## 2.6 SPACE AWARENESS AND LEARNING

### Program Activity: SPACE AWARENESS AND LEARNING (AL)



**Priority:** Further public understanding and engagement with regards to space-related issues, ultimately leading to improvement in the scientific literacy of Canadians.

**Performance Status:** 87% (14/16) of the targets were met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

The first Program Activity performance evaluation will take place in 2010. The five-year evaluation horizon corresponds with the approval of the Canadian Space Strategy by the Government of Canada in February 2005.

**SPACE AWARENESS AND LEARNING**

**PROGRAM ACTIVITY PERFORMANCE MEASUREMENT**

**Expected Result**

Increase public awareness of Canada's activities in space and the space benefits that positively affect the quality of life of Canadians.

<b>Indicators</b>	<b>Performance</b>
1. Awareness of Canadians measured by telephone survey every three years.	<p>Survey conducted in early 2005.</p> <p>Results indicate that 46% of respondents are aware of the Canadian Space Agency as champion of space activities and that 19% of respondents have moderate knowledge of Canada's space activities. Next survey to be conducted in 2008-2009.</p>

**Performance Analysis**

The survey was conducted with the general public to assess awareness, knowledge, and attitudes toward Canada's space program and related activities. The survey was administered by phone to 1,628 Canadian adult residents, on February 4 to 11, 2005. Based on a sample of this size, the overall results can be considered to be accurate within +/- 2.5%, 19 times out of 20.

Several results contribute to determining levels of awareness. Other than the two results cited above, the following could also be considered:

- 47% identified Earth-related benefits that flow from Canada's space program;
- 67% cited images when thinking about Canada's involvement in space;
- 71% believed Canadians are proud of our activities in space, and that Canadian success in advanced space technologies contributes to our knowledge-based economy, innovation, and economic competitiveness; and,
- 65% felt that our space activities inspire youth in science and engineering.

Some 80% of Canadians surveyed think it is important for Canada to continue to have a space program and be active in the development of advanced technologies and science related to space.

Respondents were asked to rate the importance of a number of benefits that result from investment in the Canadian Space Program. A strong majority viewed all potential benefits as important. Some 90% felt that monitoring the Earth for natural disasters is an important benefit, followed closely by monitoring our oceans, forests, wetlands and farmlands (88%), and new medical discoveries (87%). As well, significant numbers attributed importance to better telecommunications (83%) and leadership in robotics (81%). Benefits that also received strong responses included advancing humankind's knowledge (74%), enhancing Canada's international reputation (71%), and exploring the solar system (67%).

2006-2007 - Financial Resources (\$ in millions)		
Planned	Total Authorities	Actual Spending
5.9	5.2	4.1
2006-2007 - Human Resources (FTEs)		
Planned	Total Authorities	Actual
25.4	Not applicable	21.6

The programs under this Program Activity are divided into two Sub-Activities: Awareness and Learning.

### **AWARENESS**

Two Awareness Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- Strategic Communications – Objective:** Ensure positioning of the CSA and information supporting the Awareness and Learning program.

#### **EXPECTED RESULT 1:**

Targeted audience is reached through outreach activities.

Indicators	Performance
1. Number of persons from the targeted audiences reached (Targets: Implement speakers bureau engagement strategy and establish a benchmark).	<p><b>Target Met:</b> Speaker bureau strategy implemented and benchmark established.</p> <p><b>Precisions:</b> The implementation of the Speakers Bureau strategy began. A total of 153 events in 10 provinces and territories took place, reaching approximately 37,000 Canadians.</p>



**PERFORMANCE ANALYSIS:**Indicator 1

An evaluation conducted at a key Speakers Bureau event, "Tremblant sous les étoiles", showed participant feedback to be positive. Participants in the survey indicated the desire to continue learning more about space on their own, a key objective of the Awareness and Learning Strategy.

Of these outreach events, 68 featured scientists, engineers and specialists working at the CSA and 85 featured Canadian astronauts as speakers. About 25,000 people were reached through astronaut events, while another 64,000 were reached through recorded astronaut messages.

A partnership with the Canadian Library Association through the Library of Parliament led to a national essay competition among Canadian youth in support of Canadian Astronaut Steve MacLean's STS-115 mission.

Source: Internal documents.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
0.5	0.5
<b>2006-2007 – Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
2.6	3.1

**2- Media Relations and Information Services – Objective:** Position information through the media and the Web.

**EXPECTED RESULT 1:**

Information is present in the media, particularly on television.

<b>Indicators</b>	<b>Performance</b>
1. Quantity of media initiatives that resulted in coverage, particularly on television. (Target: Total of 11 events: At least 2 events for Space Science, 2 events for Space Exploration, 2 events for Earth Environment, 1 event for Space Tech., 1 event for Awareness and Learning and 3 to be determined during the year).	<b>Target Met:</b> 23 events.

**PERFORMANCE ANALYSIS:**

CSA carried out the following media initiatives:

4 surrounding STS-121 Space Exploration mission;  
 8, related to STS-115 Space Exploration mission;  
 4, on Space Exploration Neemo 9;  
 4, related to Space Science CloudSat, THEMIS, BLAST, PMDIS; and,  
 3, on Awareness and Learning, namely, MOU between the CSA and Alberta, the Teachers' Conference, and the announcement of the badge for STS-118 mission at McGill University.

42% of all media coverage was from TV broadcast outlets. More than 20 formal press releases and 40 media advisories produced and over 20 significant media events.

During that period, the CSA received 794 requests from the media and in response its spokespersons conducted 700 interviews.

Major broadcast outlets in both official languages carried the STS-115 downlink media event, with 200 participating students across the nation.

Source: Internal documents.

**EXPECTED RESULT 2:**

Canadians visit the Canadian Space Agency Web site.

Indicators	Performance
1. Number of Canadian visits (Target: Sustain or increase visits to the CSA Web site).	<p><b>Target Met:</b> 58% increase.</p> <p><b>Precisions:</b> The number of hits in 2006-2007 totalled 2.6 millions. This represents a 58% increase compared with last year 1.7 million hits.</p>

**PERFORMANCE ANALYSIS:**

Space missions contribute significantly to the popularity of the CSA's Web Site. What is interesting to know however, besides the number of hits, is the actual number of individuals visiting CSA's Web site.

In 2006-2007, the number of visitors to the CSA's Web site rose from 700,000 to 970,000. A significant increase generated in part by the STS-115 space mission as well as by new award-winning interactive features, such as virtual visits to the Canadian Space Agency and the David-Florida Laboratory.

Source: Internal documents.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
1.1	0.8
2006-2007 - Human Resources (FTEs)	
Planned	Actual
6.0	6.1

**3- Creative Services, Marketing and Exhibitions – Objective:** Position information through direct-marketing activities.

**EXPECTED RESULT 1:**

Target audience has access to information through products and publications.

Indicators	Performance
1. Number of products and publications distributed through different communications channels (Targets: Identify key channels and products and establish a benchmark).	<p><b>Target Met:</b> Channels identified and benchmark established.</p> <p><b>Precisions:</b> A total of 350,000 products/publications were delivered to the general public, schools and science centres by mail, e-mail and on-site handouts.</p>

**PERFORMANCE ANALYSIS:**

This year, key products were:

- The 20th Anniversary of Human Space Flight exhibit continued its journey across the country through science centers and museums.
- Apogée: CSA's electronic publication produced 6 editions for posting on the Web and distribution to its 3,500 subscribers, an increase of 14% over last year's 3,000.
- The number of subscribers to EO Express, a bi-weekly e-bulletin, increased by more than a thousand.

Source: Internal documents.

**EXPECTED RESULT 2:**

Target audience has access to information through outreach activities with partners (conferences and fairs).

Indicators	Performance
1. Number of persons from targeted audiences having access to information (Target: Establish a benchmark, evaluate and adjust indicator).	<p><b>Target Met:</b> Benchmark established.</p> <p><b>Precisions:</b> Of the 350,000 products /publications distributed, a portion was as a result of 750 requests from Canadians.</p>

**PERFORMANCE ANALYSIS:**

Since each request varied in terms of size and need, this indicator does not provide sufficient value-added information the way it is currently formulated. It will therefore either be significantly modified or eliminated for the 2007-2008 DPR.

Source: Internal document.

2006-2007 - Financial Resources (\$ in millions)	
Planned	Actual Spending
1.7	0.7
2006-2007 - Human Resources (FTEs)	
Planned	Actual
5.0	5.2

**4- Astronaut Awareness Tours – Objective:** Increase awareness of the Canadian Space Program (CSP) through proactive public appearances by Canadian astronauts throughout Canada.

**EXPECTED RESULT 1:**

Canadians are reached by awareness activities conducted by a Canadian Astronaut.

Indicators	Performance
1. Number of participants reached/astronaut days invested (Target: Establish a benchmark);	<p><b>Target Met:</b> Benchmark established.</p> <p><b>Precisions:</b> Approximately 25,000 persons reached through 54 day-events; an average of 466 participants reached per day-event.</p>
2. Number of events/astronaut days invested (Target: 60 events for 55 days of astronauts);	<p><b>Target Met:</b> 74 event s/ 54 astronaut days.</p> <p><b>Precisions:</b> 84 % of events (62) were visits and 16% videoconferences (12).</p>

3. Number of provinces and territories visited (Target: 6 provinces and 1 territory); and,	<b>Target Met:</b> 9 provinces, 1 territory and Nunavut.
4. Percentage of accepted requests (Target: Approximately 50%).	<b>Target not Met:</b> 38%  <b>Precisions:</b> Of the 197 requests, 74 were accepted.

**PERFORMANCE ANALYSIS:**

Indicators 1 and 2

The establishment of a benchmark of 466 persons reached by astronaut day-events will facilitate future years' analysis, including the ratio of people reached in-person as compared to those reached remotely.

Indicator 3

The provinces and territories were: Quebec, Ontario, Alberta, B-C, Manitoba, Saskatchewan, Nova-Scotia, New-Brunswick, Newfoundland and the Northwest Territories.

Indicator 4

Some 74 events were supported by astronauts out of a total of 197 requests received, demonstrating how a 38% acceptance rate is more realistic than a 50% target.

Source: Internal documents.

<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
0.2	0.2
<b>2006-2007 - Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
Nil	Nil

**Highlights of Main Accomplishments – Awareness**

The major communications activities focused on the following:

- Promotion of mission Canadian Astronaut, Steve MacLean's STS-115 mission during which he performed one space-walk. The STS-115 mission generated 367 interviews, producing more than 46 hours of radio coverage and more than 59 hours of TV coverage. Daily print media carried 2,071 articles on the mission.

- Other major media events and campaigns during the year were: STS-121, Neemo 9, CloudSat, Themis, Blast, PMDIS, Educator's Conference, Canadian Astronaut Dave Williams' STS-118 space mission announcement and patch unveiling.
- The 20th Anniversary of Human Space Flight exhibit continued its journey across the country, reaching the Maritimes for five months before moving on to Sherbrooke to finish the year. A new partnership that saw CSA models, information cards and artefacts loaned to a museum attracted 11,665 visitors, among them 1,110 school groups over a 7-month period. However, no new traveling exhibit was produced as planned.
- Preparations began for NASA's scout mission to Mars, Phoenix that will include a sophisticated instrumentation package developed by Canadian scientists, industry and engineers. Launch scheduled for August 2007.
- Preparations began for the launch of Canada's Special Dexterous Manipulator, a sophisticated dual armed robot, which is part of Canada's contribution to the International Space Station.
- Despite the delay, preparations continued for the launch of RADARSAT-2, Canada's next-generation Earth Observation satellite.

## **LEARNING**

Three Learning Programs with a combination of accomplishments demonstrate how the following expected results were measured and attained.

**1- Space Learning Program – Objective:** Provide Canadian educators and students with targeted educational resources and space learning opportunities to build knowledge and enhance interest in space science and technology.

### **EXPECTED RESULT 1:**

Canadian educators and students further their learning related to science and technology through space themes.

<b>Indicators</b>	<b>Performance</b>
1. Number of educators reached through professional development initiatives (Target: Maintain or increase the number);	<b>Target Met:</b> 614 educators. <b>Precisions:</b> The number increased by 275%, from 164 to 614.
2. Number of students reached through learning activities (Target: Maintain or increase the number);	<b>Target Met:</b> 470,000 students. <b>Precisions:</b> The number increased by 13%, from 414,000 to 470,000.

<p>3. Number of participating educators incorporating space into their learning environment (Target: Establish a benchmark); and,</p>	<p><b>Target Met:</b> Benchmark established.</p> <p><b>Precisions:</b> 8,900 educators based on tele- and distance learning on-site and off-site workshops targeted to classrooms, Tomatosphere classrooms and educators participating in Star Count project.</p>
<p>4. Number of resources accessed by educators (Target: Maintain or increase the number).</p>	<p><b>Target Met:</b> 450,000 requests.</p> <p><b>Precisions:</b> The number increased by 57%, due to heightened interest in resources supporting STS-115.</p>

**PERFORMANCE ANALYSIS:**

Indicators 1 and 3

The STS-115 mission offered the CSA an excellent opportunity to build interest in learning related to science and technology among educators and students. The combination of educators reached through professional development initiatives, and those incorporating space into their learning environment revealed that CSA Space Learning resources reached approximately 20,000 Canadian classrooms in 2006-2007. Members of First Nations and Francophones living in minority official language communities were among those reached.

Indicator 2

The ratio of students reached (470,000) to the number of educators (614) involved in professional development and those participating in the incorporation of space into their learning environment (8,900) demonstrates on average that 50 students per educator involved are reached.

Indicator 4

There was a 36% increase in the number of resources developed in 2006-2007 for a total of 11 versus 7, which may have contributed to the 57% increase in the number of resources accessed by educators.

Number of participating educators incorporating space into their learning environments: 8,900 based on tele-and-distance learning on-site and off-site workshops targeted to classrooms, Tomatosphere classrooms and educators participating in Star Count project.

Source: Internal document.

**EXPECTED RESULT 2:**

Enhance expertise of Canadian scientists, engineers and physicians in space science, space technology and space medicine through the learning components of the CSA Grants and Contributions Program.

Indicators	Performance
1. Number of students, fellows and medical residents supported through the Program:  (Canadian Astronauts Office: Target: 4);  (Space Technology: Target: 10); and,  (Space Science: Target: 8).	          <b>Target Met: 4</b>  <b>Target not Met: 9</b>  <b>Target Met: 16</b>

**PERFORMANCE ANALYSIS:**Canadian Astronaut Office

Two students at the Kennedy Space Centre (KSC) in Florida and 2 students at the Johnson Space Centre (JSC) in Texas. The *percentage of grant recipients who participate in additional aerospace medicine training* is targeted at 10%. A survey is conducted with grant recipients every 2 years. The last survey, conducted in February 2005, revealed the following result: 17% or 1 out of 6 grant recipients participates in additional aerospace medicine training.

Space Technology

Thirteen new Post-Graduate Supplements and 6 new Post-Doctoral Fellowships were awarded. According to a survey performed to analyse the program's performance, more than 80% of the award recipients have completed their studies. Approximately 30% of students supported in previous years have completed their studies. This program was terminated in 2005-2006. The sunset targets for 2006-2007 and 2007-2008 have been modified accordingly.

Space Science

Space Science achievements exceed the target planned, with 12 Post-Graduate scholarships and 4 Post-Doctoral Fellowships awarded. Six scholarships and 2 fellowships are ongoing; 6 new scholarships and 2 new fellowships were awarded.

Source: Internal document.



<b>2006-2007 - Financial Resources (\$ in millions)</b>	
<b>Planned</b>	<b>Actual Spending</b>
1.9	1.5
<b>2006-2007 – Human Resources (FTEs)</b>	
<b>Planned</b>	<b>Actual</b>
5.8	3.1

### **Highlights of Main Accomplishments – Learning**

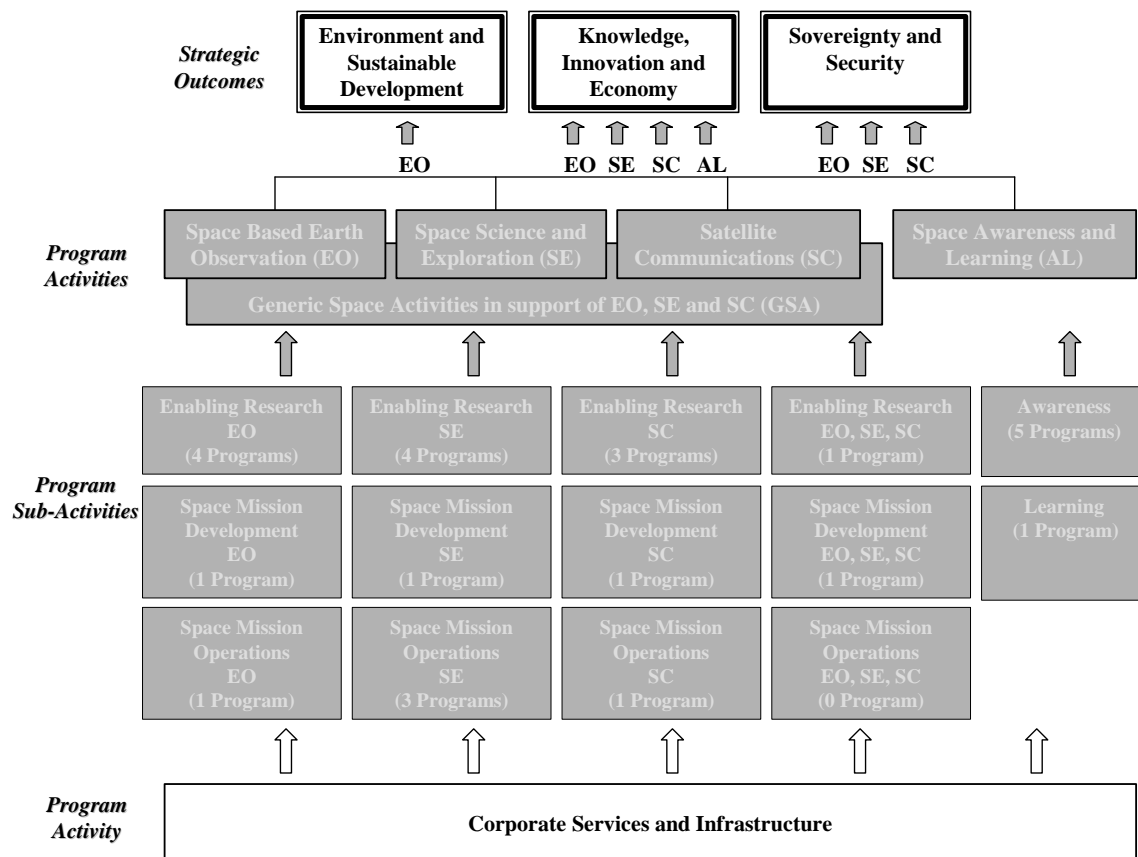
- A significant participation increase of 275% for educators and 13% for students was attained in space-centred learning initiatives, which encourage youth to pursue studies and careers in the field of science and engineering.
- STS-115 offered CSA Space Learning resources the opportunity to access 20,000 Canadian classrooms, reaching 470,000 primary and secondary students in 10 provinces and 2 territories.
- An increase of 57% was achieved in requests for educational space-based materials by not-for-profit and educational institutions, as well as increased requests for youth-oriented information across Canada.
- Professional development workshops were promoted and teaching materials, such as Web-based assisted learning opportunities, were developed to respond to the needs of educators; the number of resources developed increased by 36% this year.
- Four Canadians medical students/residents attended a four week Aerospace Medicine Elective through an agreement with the NASA-JSC Aerospace Medicine Clerkship Program, the NASA-KSC Biomedical Office and the Canadian Space Agency's (CSA) Operational Space Medicine (OSM) Group.
- The CSA Space Science Fellowship Program has been successful in keeping promising young Canadian researchers from leaving the country to pursue their careers in the space sciences and repatriating Canadians who have pursued higher education studies offshore. One fellowship winner in 2006 received an offer from a prominent Canadian university for a full-time faculty position.

To learn more about Space Awareness and Learning, go to:

<http://www.space.gc.ca/asc/eng/media/default.asp>; and,  
<http://www.space.gc.ca/asc/eng/educators/default.asp>

## 2.7 CORPORATE SERVICES AND INFRASTRUCTURE

### Program Activity: CORPORATE SERVICES AND INFRASTRUCTURE



**Priority:** To implement the government's commitment to modern public service management in accordance with the Management Accountability Framework's (MAF) expectations.

**Performance Status:** 67% (8/12) of the targets met in 2006-2007.

This performance report provides either baseline information or a progress report made since the year 2005-2006.

**CORPORATE SERVICES AND INFRASTRUCTURE**

**PROGRAM ACTIVITY PERFORMANCE MEASUREMENT**

**Expected Result**

Corporate Services provide added value for CSA managers in the performance of their duties.

<b>Indicators</b>	<b>Performance</b>
Services provided meet standards set under Government-wide and CSA policies as well as the expectations of the Management Accountability Framework.	<p>Ratings from the 2006 MAF assessments against the 18 indicators were:</p> <p>Strong = 1                      Acceptable = 10                      Opportunity for improvement = 6                      Attention required = 1</p> <p>Compared to 2005, 7 indicator ratings (39%) have improved and 3 (17%) have declined.</p>

**Performance Analysis**

Among the 18 criteria used in the assessment, the CSA showed a strong performance in *Project Management* and steady progress in *Corporate Risk Management*, with a rating rising from "opportunity for improvement" last year to "acceptable" in 2006. The CSA had varied results in the 3 areas identified as management priorities in the 2005:

*Integration of human resources and business planning:* A Draft Integrated Corporate HR Plan 2007-2010 was developed and will be approved in June 2007.

*Development of a long-term investment plan:* A Draft Integrated Long-term Investment Plan was developed and will be submitted for approval in 2007-2008.

*Project management:* The CSA demonstrated that it has implemented a sound project management capacity compliant with the Treasury Board project approval policy suite, which includes a project management governance structure and a risk management framework.

The Treasury Board has identified 3 management priorities for 2007:

*Asset Management:* The CSA must complete the Long Term Capital Plan.

*Internal Audit Function:* Although some key elements are in place, the CSA must develop and put in place an implementation plan for the new Policy on Internal Audit. The indicator rating is "Attention required".

*Financial Management and Control:* Although the CSA usually exhibits good performance, compliance with government policies should be monitored, specifically in the overall quality and timeliness of its external financial reporting information.

The Treasury Board assessment does not indicate management quality beyond MAF indicators.

## Expected Result 2

Key corporate risks are addressed and mitigated.

Indicators	Performance
Management and mitigation actions are implemented against the four highest priority risks identified in the CSA corporate risk profile.	Planned management and mitigations actions were completed in response to 3 out of the 4 highest priority corporate risks.

## Performance Analysis

1. All actions planned in the RPP 2006-2007 were completed in response to 2 of the 4 highest corporate priority risks, namely:

Workforce Competencies: Increase the capacity of CSA to maintain a qualified workforce of public servants to deliver CSA's mandate within the government's legislative frameworks, policies and rules.

As a result, 97% of managers had successfully completed the mandatory on-line assessment related to financial and human resources delegated authorities by December 31, 2006.

Function/Process Integration: Increase the capacity of CSA to align its strategies, planning priorities, funding levels, operations and capacity to deliver and obtain clear understanding and buy-in from managers and staff at all levels.

As a result, the new strategic outcome with a set of performance indicators will first appear in the 2008-2009 Report on Plans and Priorities; the CSA put in place a corporate information management system in response to Management of Resources and Results Structure policy requirements effective since April 1<sup>st</sup>, 2007; and drafted a Human Resources Strategic Plan to be submitted for approval by June 2007.

2. Some of the actions planned in the RPP 2006-2007 were completed in response to a third one, namely:

**Values and Ethics:** Increase the capacity of the CSA to instil public service values, to develop a working environment free of harassment and promote respect for individuals, integrity and honesty.

Since a new President had not been appointed, the CSA was not able to finalise and approve the governance structure and delegation of authority in order to improve its compliance with the Public Service values of respect, integrity, honesty and transparency. The revised governance structure will address the way other government departments and universities are to be approached. In the meantime, the current structure was in force.

3. No action planned in the RPP 2006-2007 was completed in response to the last corporate priority risk, namely:

**Stakeholder Support:** Increase the capacity of CSA to involve other government departments and universities in teaming up and creating a synergy in developing and implementing space activities for the benefit of Canadians.

The CSA was not able to put the engagement strategy with stakeholders in place as planned, or increase the frequency of advisory committee meetings.

Source: CSA's Corporate Risk Profile, internal document only in English.

<b>2006-2007 - Financial Resources (\$ in millions)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual Spending</b>
34.5	38.9	37.5
<b>2006-2007 - Human Resources (FTEs)</b>		
<b>Planned</b>	<b>Total Authorities</b>	<b>Actual</b>
239.0	Not applicable	215.6

## **CORPORATE SERVICES AND INFRASTRUCTURE – RISK MANAGEMENT**

**1- Corporate Risk Management – Objective:** Increase the CSA's capacity to mitigate the four highest priority risks: Stakeholder Support, Values and Ethics, Workforce Competencies, and Function/Process Integration.

**EXPECTED RESULT 1:**

Stakeholder Support: Increase the capacity of CSA to involve other government departments and universities in teaming up and creating synergy in developing and implementing space activities for the benefit of Canadians.

Indicators	Performance
1. An engagement strategy with stakeholders has been put in place. (Target: Measure initial state of consultations with national stakeholders in terms of quality and effectiveness.)	<b>Target not Met:</b> Engagement Strategy postponed.
2. Frequency of advisory committee meetings has increased (no target).	<b>Target not Met:</b> Number of advisory committee meetings reduced.

**PERFORMANCE ANALYSIS:**Indicators 1 and 2

Due to lack of human resources, the CSA was not able to establish the engagement strategy with stakeholders as planned and increase the frequency of advisory committee meetings. Without a newly appointed President, the CSA was not able to finalise and approve the governance structure, including a review of current advisory channels with stakeholders.

Source: Internal document.

**EXPECTED RESULT 2:**

Values and Ethics: Increase the capacity of the CSA to instil public service values, develop a working environment free of harassment, and promote respect for individuals, integrity and honesty.

Source: Internal document.

Indicators	Performance
1. Implement a Public Service Values and Ethics program (Target: Values and Ethics are addressed by management committees).	<b>Target Met:</b> Management Committees of CSA directorates have addressed Values and Ethics issues at 27 meetings.
2. A CSA governance and delegation of authority structure is established and implemented in compliance with the public service values of respect, integrity, honesty and transparency (Target: New governance structure approved).	<b>Target not Met:</b> Approval postponed.

**PERFORMANCE ANALYSIS:**Indicator 2

Without a newly-appointed President, the CSA was not able to finalise and approve the governance and delegation of authority structure in order to improve its compliance with the public service values of respect, integrity, honesty and transparency.

Source: Internal document.

**EXPECTED RESULT 3:**

Workforce Competencies: Increase the capacity of CSA to maintain a qualified workforce of public servants to deliver its mandate within the government legislative frameworks, policies and rules.

Indicators	Performance
1. The profile of essential qualifications for managers to receive delegation of authority has been established (Target: 50 % of managers received training on identified essential qualifications).	<b>Target Met:</b> 76% of managers received training on identified essential qualifications.
2. The majority of CSA managers are recognized as being qualified for increased delegation of authority. (Target 100% of managers.)	<b>Target not Met:</b> 97% of managers are recognized as being qualified for increased delegation of authority.

## **PERFORMANCE ANALYSIS:**

### Indicator 1

The first of three phases of the Continuous Learning Program for managers was implemented in 2006-2007. The mandatory training sessions obtained an average participation rate of 76% with the following breakdowns:

Ethics and Values: 80%

Staffing for managers with sub-delegated authorities: 81%

Management Communications: 66%

### Indicator 2

By December 31, 2006, 97% of managers had successfully completed the mandatory on-line assessment related to financial and human resources delegated authorities. The few managers on long-term absence could not complete the assessment (3%).

Following the tabling of the report from the Public Service Commission (PSC) in May 2006, the delegation of authority was set at the Director General level, even though, 81% of managers have acquired the necessary training to obtain sub-delegation.

Further more, the CSA has undertaken the following actions in response to the recommendations presented in the PSC report:

- Develop and implement a staffing framework and process monitoring system;
- Increase the number of human resources experts and provide continuous learning opportunities;
- Submit the selection criteria and assessment tools to the PSC for approval; and,
- Create a working group to identify the roles and responsibilities of the managers and human resources advisors.

Also, senior managers have created human resources management overview and steering committees, and were assigned as champions in values and ethics, official languages, equity, as well as for the development of staffing roles and responsibilities.

To learn more about the Public Service Commission Audit Report, go to:

[http://www.psc-cfp.gc.ca/audit-verif/reports/2006/csa/highlights\\_e.htm](http://www.psc-cfp.gc.ca/audit-verif/reports/2006/csa/highlights_e.htm)



**EXPECTED RESULT 4:**

Function/Process Integration: Increase the capacity of CSA to align its strategies, planning priorities, funding levels, operations and capacity to deliver and to obtain clear understanding and buy-in from managers and staff at all levels.

Indicators	Performance
1. Completed development of socio-economic performance indicators for each of the CSA's strategic outcomes and program activities expected results in accordance with the Canadian Space Strategy (Target: Socio-economic indicators in place for 2008-2009 Fiscal Year.).	<b>Target Met:</b> New strategic outcome approved in Program Activity Architecture submission to Treasury Board. Draft socio-economic indicators will be submitted for TBS approval in the fall 2007.
2. Financial and non-financial information is integrated into the CSA's work plans and supported by information management systems made available to managers (Target: Pilot information management system validated and ready for implementation).	<b>Target Met:</b> New information management system was validated and used by 9 of 13 CSA sectors for the planning of fiscal year 2007-2008.
3. Completed development of an Integrated Long-term Investment Plan. (Target: Draft Investment Plan is developed.)	<b>Target Met:</b> Draft Integrated Long-term Investment Plan was developed and will receive approval in 2007-2008.

**PERFORMANCE ANALYSIS:**Indicator 1

The CSA's three strategic outcomes were reviewed and streamlined into a single statement, along with draft socio-economic performance indicators, in the context of the full implementation of TBS Management, Resources and Results Structure (MRRS). The new strategic outcome and performance indicators will first appear in the 2008-2009 Report on Plans and Priorities.

Indicator 2

The CSA developed and put in place a custom-made information management system automatically linking results, responsibilities, and resources in response to current and future MRRS requirements. It was used for the preparation of 2007-2008 Work Plans, on a voluntarily basis, by 9 of the CSA's 13 sectors and it will become a corporate application for 2007-2008 performance monitoring and 2008-2009 planning.

Source: Internal document.

**EXPECTED RESULT 5:**

Function/Process Integration: Initiatives under the Public Service Management Act are being implemented.

Indicators	Performance
1. All managers are knowledgeable about the Staffing Management Accountability Framework (SMAF) (Target 100% of managers).	<b>Target Met:</b> 100% copies received.
2. Human resources management policies, procedures and practices are considered in accordance with the SMAF. (Target: Conformity control mechanisms are put in place.)	<b>Target Met:</b> Several control mechanisms were put in place to ensure a standardized staffing process. A monitoring framework is under development.
3. The development of a Strategic Human Resources Plan is initiated (Target: Draft Strategic Plan ready for June 2007).	<b>Target Met:</b> Draft Integrated Corporate Human Resources Plan 2007-2010 will be submitted for approval in June 2007.

**PERFORMANCE ANALYSIS:**Indicator 1

The Staffing Management Accountability Framework (SMAF) was approved by the CSA Executive Committee in January 2007 and circulated to managers in March 2007.

Indicator 2

Several control mechanisms supported the implementation of the SMAF:

- Mandatory Departmental guidelines and policies are in place and additional ones could be developed based on staffing-related risks;
- A monitoring committee is in place to monitor unannounced processes and long-term acting appointments;
- The Student Program strategy was approved by the PSC; and,
- A SMAF monitoring framework is under development.

Indicator 3

In order to finalize the CSA's Human Resources Strategic Plan by June 2007, the following actions were completed by March 31, 2007:

- A Planning Human Resources Guide for Managers was completed. The information provided by the sectors will be used to complete the CSA staffing plan;
- The demographic profile for 2005-2006 was completed and each sector was provided with data to be used in CSA managers' planning exercise; and,
- A meeting took place with close to 80% of the sector management committee.

## **Highlights of Main Accomplishments – Modern Management – Corporate Services and Infrastructure**

- From the 18 indicators outlined in the 2006-Round IV MAF assessment produced by Secretariat Treasury Board (SCT), 39% have improved, 44% have stayed the same and 17% have declined.
- CSA's three strategic outcomes were merged into a single outcome that will first appear in the 2008-2009 Report on Plans and Priorities.
- The Staffing Management Accountability Framework (SMAF) was approved by CSA's Executive Committee and circulated among managers.

To learn more about Corporate Services and Infrastructure, go to:  
[http://www.espace.gc.ca/asc/doc/maf\\_f.doc](http://www.espace.gc.ca/asc/doc/maf_f.doc), internal document only in French.