



# **THE CANADIAN SPACE AGENCY**

**2008-2009 Estimates**

**Report on Plans and Priorities**

## **SECTION 2:**

**Analysis of Program Activities by Strategic Outcome**

***- Detailed Information -***

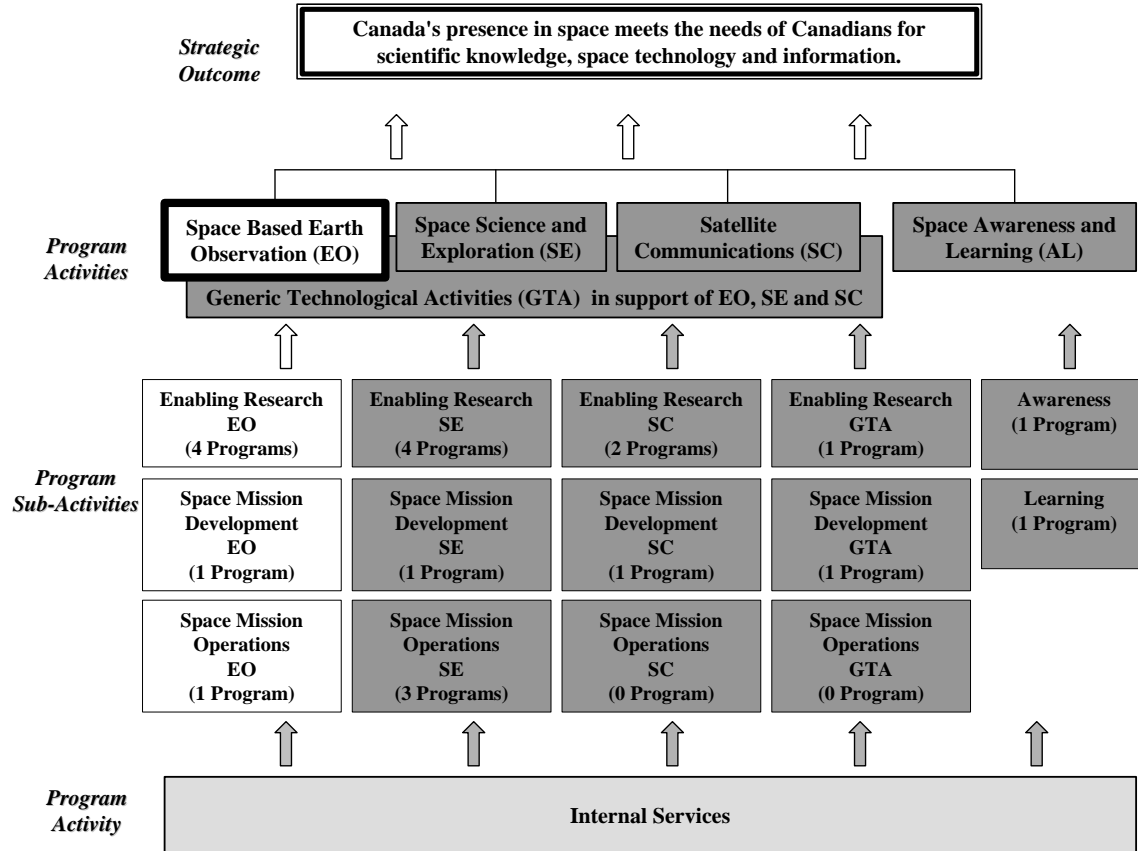


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## SECTION 2: ANALYSIS OF PROGRAM ACTIVITIES BY STRATEGIC OUTCOME

### Space Based Earth Observation



**Program Activity Priority:** Develop and operationalize the use of Space Based Earth Observation (EO) for the benefit of Canadians.

<b>SPACE BASED EARTH OBSERVATION (EO)</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicators</b>
<p>The benefits of activities of Earth Observation from space serve Canadians users in the areas of the environment, resource and land use management, and, security and sovereignty.</p>	<ol style="list-style-type: none"> <li>1. Proportion of active or successful missions relative to the total number of missions supported by Canada in the three priority EO areas;</li> <li>2. Number of applications and users per EO mission; and,</li> <li>3. Number of citations and peer-reviewed papers produced in academia and the R&amp;D community in Canada as a result of the CSA's participation in Canadian and international EO missions.</li> </ol>
<p><b>Planning and Reporting Continuity:</b></p> <p>RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp</a> - 2.1</p> <p>DPR 2006-2007: <a href="http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp</a> - 2.2</p>	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	129.2	126.1	128.4
<b>HUMAN</b> (FTEs)	82.2	81.6	67.1

**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**

**Objective:** Provide leadership, coordination or support to Earth Observation (EO) applied research and experimental development in line with the CSA priorities and stakeholders expectations in order to increase the knowledge base and devise new applications through space missions, and to allow the transfer of intellectual property and proven technologies to Canadian industry, academia, and government organizations.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
New project/mission concepts that progress to subsequent development phases related to Agency priorities.	1. Ratio of the number of new concepts presented to the number of new concepts retained for subsequent phases; and,  2. Quality of the concepts retained based on the average evaluation rating obtained according to the Priority Ranking Framework.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all enabling research projects/missions.	1. Number of consulting requests received by CSA personnel from internal sources (matrix support), as well as from the private sector, academia and other space agencies; and,  2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	26.8	28.0	24.1
<b>HUMAN</b> (FTEs)	16.6	13.0	12.8

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

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Industry, government and/or academia conduct mission and payload concept and feasibility studies to establish the technical and/or scientific feasibility and relevance of missions or payloads in order to enable CSA decisions on future EO space missions.	1. Number of concept (mission and payload) and phase 0/A studies initiated, pursued or completed (Target: 5).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	1.2	0.5	0.4
<b>HUMAN</b> (FTEs)	5.1	1.6	1.3

**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 #1	Performance Indicator
Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under EO optional programs.	1. Canadian industrial return in ESA optional programs in EO (Target: 84% or higher).

RESOURCES	2008-2009	2009-2010	2010-2011
FINANCIAL (\$ in millions)	9.9	9.5	5.6
HUMAN (FTEs)	0.0	0.0	0.0

**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 in the fields of atmospheric environment and climate change phenomena studies.

Expected Result #1	Performance Indicators
Identified opportunities for Canadian scientists to advance understanding and scientific knowledge of atmospheric environment through the use of space-based observations.	1. Number of Highly Qualified Personnel (HQP) involved in the program (Target: 150); 2. Number of awards granted in the year under the CSA Grants and Contributions Program (Target: 4); 3. Number of research partnerships (nationally and internationally) (Target: 20); 4. Number of scientific publications, reports and conference proceedings acknowledging CSA funding (Target: 60); and, 5. Number of scientific presentations (Target: 100).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	1.2	2.1	1.9
<b>HUMAN</b> (FTEs)	2.5	2.5	2.5

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

<b>Expected Result #1</b>	<b>Performance Indicators</b>
1. Development of EO applications responding to user needs in government, industry, academia and not-for-profit organizations in the fields of environment, resource and land use management, and, security and foreign policy.	1. Number of new applications using EO data (Target: 20); and, 2. Number of new users of EO applications (Target: 36).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	14.6	15.9	16.1
<b>HUMAN</b> (FTEs)	9.0	9.0	9.0

#### **Highlights of Expected Accomplishments – Enabling Research (EO)**

- Following the successful launch of RADARSAT-2 in December 2007, the Canadian government data allocation plan will be implemented to manage the \$445 million worth of prepaid data from the satellite. The objective of the program is to ensure that the allocation is effectively used by the Canadian Government. During the first year, CSA will negotiate agreements with Government departments to develop data acquisition plans. Results from the first Announcement of Opportunities (AO) will be presented at a workshop and more AO's targeting Canadian remote sensing community will be announced.
- Through the Earth Observation Application Development (EOADP) and the Government Related Initiatives (GRIP) Programs, CSA will continue satellite data application development and utilization, to support the growth of Earth Observation capabilities within Canadian Government Departments and Agencies and within value-added industry.



- Implement the Coordinated Earth Observation Marine Surveillance project (CEOMS) that will provide an exhaustive understanding of EO needs and requirements for operational users among the Canadian Government Marine Surveillance and Security Community.
- The Canadian Space Agency, in cooperation with the Center for South-eastern Tropical Advanced Remote Sensing (CSTARS), the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), has agreed to launch in early 2008 an International Announcement of Opportunity (AO) for researching new developments in applications of RADARSAT-1 data and innovative research and mapping applications related to ocean surface space borne SAR imagery of hurricanes. This new research will also help investigators become better prepared for using the more advanced data from missions like RADARSAT-2 and other international missions in the future.
- The Canadian Space Agency, in conjunction with the United States Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA), has initiated an international initiative to stimulate new research into the monitoring of subsidence processes in New Orleans using RADARSAT-1 SAR imagery as the primary data source. An Announcement of Opportunity was circulated to the global research community in October of 2006 and 24 proposals were submitted from Canada, and other countries. Final reports from the research groups will be presented by the researchers at a symposium during the spring of 2008.
- CSA will continue to support the TIGER initiative with the completion of phase 1 projects and preparation for phase 2. TIGER aims to demonstrate the usefulness of Space Based Earth Observation for water management applications in Africa.
- Develop advanced space-borne instruments and user-oriented applications by Canadian companies through the participation in ESA Programs. For example:
  - Canada will participate in the calibration and validation activities of the Earth Explorer Soil Moisture and Ocean Salinity (SMOS) and CryoSAT-2 missions.
  - Canadian companies will develop applications in the field of aquaculture, forestry and subsidence, global wetland and Polar monitoring.
  - An accurate high resolution mapping of Canadian Arctic coastline (COASTCHART-2 project) will be produced.
  - The development of the Electric Field Instrument, designed to monitor ionosphere for the SWARM mission will continue.
  - CSA plans to provide support to Canadian scientists participating in exploitation of ESA Earth Explorer mission data.

- Many scientific teams will continue with projects exploiting the data generated from the ENVISAT satellite. In particular, arrangement is in place to receive ENVISAT MERIS data directly over Canada, which will be used by other Canadian Government Departments such as DFO and NRCan for ocean colour and forestry applications.
- The CSA will complete the assessment of the requirements of the Canadian government users for a polar satellite system as part of a joint study with DND and Environment Canada. The Concept of the Polar Communications and Weather Mission is to put a constellation of satellites in highly elliptical orbit over the North Pole to provide communication services and monitor weather in the Arctic region.
- The CSA will propose an Earth Observation Core Program that will assess user requirements for future EO missions and ensure the technology readiness and timely preparation of future EO missions.

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

**Objective:** Provide coordination or support to the development of Earth Observation (EO) space missions in line with CSA priorities and stakeholders expectations through the definition, critical design, manufacturing, integration, testing and delivery phases leading to launch and early operations of space systems.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space mission proposals that efficiently, effectively and economically progress to subsequent operations phases in accordance with objectives, requirements, initial or revised specifications.	1. Percentage of projects requiring more than one EPA (Effective Project Approval) or an amendment to initial EPA over total number of projects (differentiating if modifications are attributable to factors outside or within CSA zone of control).
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all Space mission development projects.	1. Rate of expertise matrix support to all of CSA's program activities; and, 2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	86.7	89.0	94.7
<b>HUMAN</b> (FTEs)	34.0	40.7	20.8

**1- EO Projects – Objective:** Ensure the development, delivery and commission of space-qualified systems for EO missions in the fields of advanced imaging technologies, atmospheric environment and climate change phenomena studies through effective project, quality and engineering management.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
EO projects' deliverables are met.	1. Project milestones are met as defined in the detailed work plan (Target: 75%); 2. Project cost is maintained within authorized levels (Target: 100%); and, 3. Risks are identified and mitigation plans prepared for each project (Target: 100%).
<b>Expected Result #2</b>	<b>Performance Indicator</b>
EO projects' deliverables meet mission objectives at critical steps.	1. Number of missions associated with science support (Target: 2).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	86.0	88.4	94.4
<b>HUMAN</b> (FTEs)	29.5	36.2	16.3

**Highlights of Expected Accomplishments – Space Mission Development (EO)**

- With the successful launch of RADARSAT-2 on December 14, 2007, commissioning of satellite and transition to routine operations will be completed by April 2008. The CSA will close the RADARSAT-2 Major Crown Project by September 2008.
- The CSA will continue the planning of the first satellite for the RADARSAT-Constellation, the follow-on program to RADARSAT-2. It will further improve Canada's ability to manage its resources and environment and improve cosystem-monitoring, maritime surveillance, disaster management and Arctic sovereignty. The launch of the first satellite is planned for late 2013 followed by the other two satellites in 2014 and 2015 respectively.
- Many Canadian companies are expected to be supplying Space and Ground Segment subsystems for Sentinel missions –1, -2 and –3 of the ESA GMES Space component program. Sentinel missions are designed to provide necessary input data to be used by the GMES users, which is also expected to be very useful to Canadian Government users.

- Many Canadian companies are expected to participate in EarthCARE mission through ESA and JAXA. Canada is expected to provide RF Front-end of Cloud radar and microbolometer detector of Multi-Spectral Imager.
- The CSA will continue to develop the Chinook mission through validating key technology components and exploring partnership options. This mission is designed to study stratospheric winds and ozone flux so we can improve medium-range weather forecasts, better assess the ozone layer recovery and better predict climate change. The three-year mission is currently planned for 2011-2013.

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

**Objective:** Provide coordination or support to the operations of Earth Observation (EO) space missions in line with the CSA priorities and stakeholders' expectations through the development and conduct of on-orbit operations, system maintenance and logistic support, as well as data handling and delivery.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space mission operations are managed effectively and efficiently.	1. Percentage of projects that meet initial objectives in terms of data delivery to users.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all Space mission operations.	1. Level of internal proactivity in terms of innovation and production expertise for missions in operational phase; and,  2. Annual rate of investment in maintenance and improvement of the infrastructure required for mission operations.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	15.6	9.1	9.6
<b>HUMAN</b> (FTEs)	31.6	27.9	33.5

**1- EO Mission Operations – Objective:** Operate the space and ground segments for EO mission operations in the fields of advanced imaging technologies, atmospheric environment and climate change phenomena studies.

Expected Result #1	Performance Indicators
EO Space Mission Operations meet user/client needs as per mission requirements.	1. System performance, as per mission requirements and resources (Target: 80%); 2. Volume of data acquired or delivered as per mission requirements and resources (Targets: 8,000 SAR minutes of RADARSAT-1 data, 300 Gbyte of SCISAT-1 and establishment of data distribution service for RADARSAT-2); and, 3. Number of missions in operational phase associated with science support (Target: 4).

RESOURCES	2008-2009	2009-2010	2010-2011
<b>FINANCIAL</b> (\$ in millions)	15.0	8.6	9.0
<b>HUMAN</b> (FTEs)	27.6	23.9	29.5

**Highlights of Expected Accomplishments – Space Mission Operations (EO)**

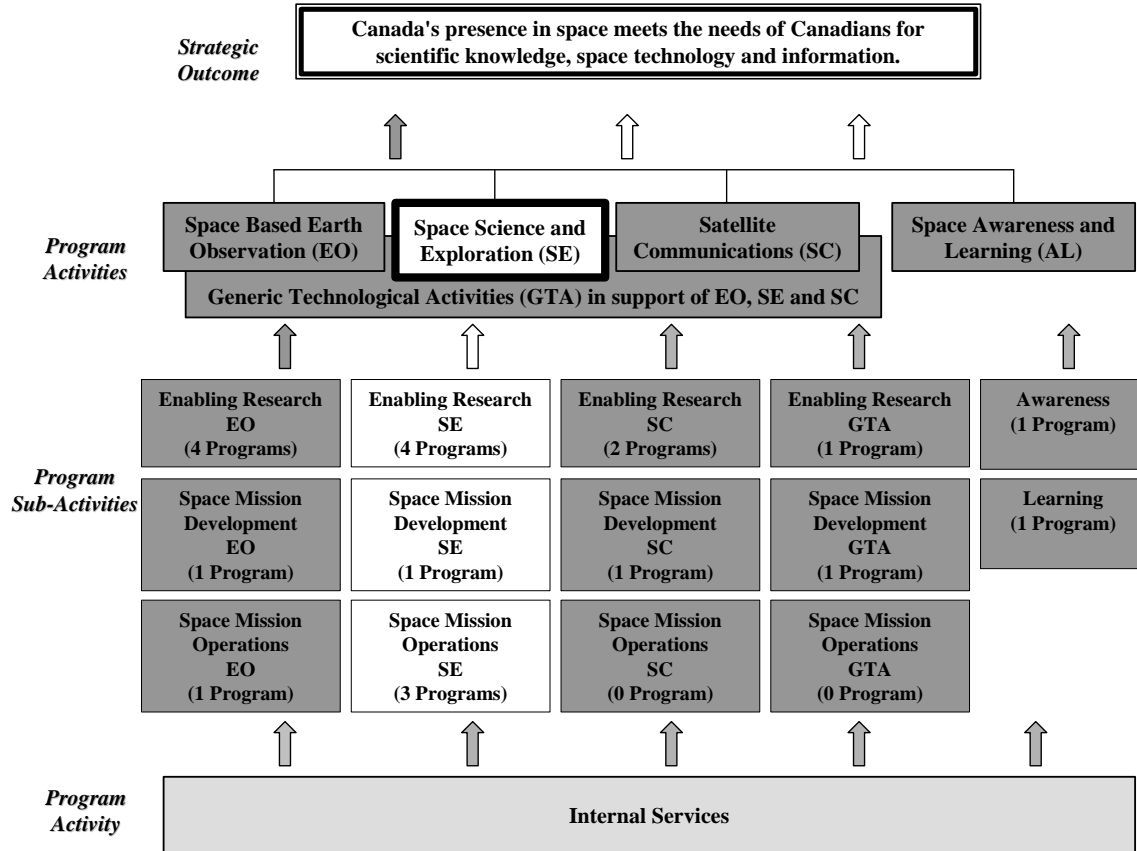
- RADARSAT-1 operations will continue with the usual level of high performance for satellite reliability and image production, and the supply of data to Canadian Government clients from RADARSAT-2 will begin in 2008 upon the commissioning of RADARSAT 2 as per client needs. With two satellites in operations data continuity to users is more assured. Moreover, a contingency plan is in place to secure the use of foreign sensors as backup in order to continue to meet the needs of operational users if Canadian satellites were unable to meet this requirement. This contingency plan provides an equivalent back-up capability using RADARSAT 1 and 2 data to ESA in case of national asset failures.
- CSA will ensure Canada's 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.
- The CSA will continue to support and operate SCISAT, a Canadian mission launched in August 2003. The mission is providing a large amount of very high quality data on more than 30 chemical species in the atmosphere for climate, weather and pollution studies. Through agreement with ESA, the data from those SCISAT-1 orbits not accessible from Canada are received by ESA receiving station and provided to Canadian scientists, which greatly expands the range of coverage.

- The CSA will continue to support MOPITT and OSIRIS, two major Canadian science instruments that are currently orbiting Earth and collecting new environmental data. MOPITT on the NASA Terra satellite measures pollutants in the troposphere, providing a wealth of data on global pollutant monitoring and transport. OSIRIS on the Swedish Odin satellite measures ozone in the stratosphere and mesosphere, providing important data to assess and predict the health of the ozone layer.
- The CSA will continue to support the validation of CloudSat data. CloudSat is a NASA satellite launched in 2006 to which Canada contributed important radar components. It is designed to study the water, snow and ice content of clouds, providing data to improve climate models and weather forecasting. As part of an agreement with NASA, the CSA will continue collaborating with the Meteorological Service of Canada (MSC) to run comprehensive validation campaigns.

To learn more about Earth Observation, go to:

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

# Space Science and Exploration



**Program Activity 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.

<b>SPACE SCIENCE AND EXPLORATION (SE)</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicators</b>
Participation in Canadian and international missions expands the scientific knowledge base made available to Canadian academia and R&D communities in the areas of astronomy, space exploration and solar-terrestrial relations, as well as in the physical and life sciences.	<ol style="list-style-type: none"> <li>1. Proportion of active or successful missions relative to the total number of missions supported by Canada in the priority science and space exploration areas;</li> <li>2. Proportion of applications/technologies developed per space exploration and science mission that are in line with the CSA's priority technology niche areas; and,</li> <li>3. Number of citations and peer-reviewed papers produced in academia and the R&amp;D community in Canada as a result of the CSA's participation in Canadian and international space exploration and science missions.</li> </ol>
<b>Planning and Reporting Continuity:</b>	
RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp</a> - 2.2	
DPR 2006-2007: <a href="http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp</a> - 2.3	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	115.4	93.3	79.6
<b>HUMAN</b> (FTEs)	188.4	181.5	179.8

**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**

**Objective:** Provide leadership, coordination or support to Space Science and Exploration (SE) applied research and experimental development in line with the CSA priorities and stakeholders expectations in order to increase the knowledge base and devise new applications through space missions, and to allow the transfer of intellectual property and proven technologies to Canadian industry, academia, and government organizations.



<b>Expected Result #1</b>	<b>Performance Indicators</b>
New project/mission concepts that progress to subsequent development phases related to Agency priorities.	1. Ratio of the number of new concepts presented to the number of new concepts retained for subsequent phases; and,  2. Quality of the concepts retained based on the average evaluation rating obtained according to the Priority Ranking Framework.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all enabling research projects/missions.	1. Number of consulting requests received by CSA personnel from internal sources (matrix support), as well as from the private sector, academia and other space agencies; and,  2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	25.7	23.3	18.5
<b>HUMAN</b> (FTEs)	39.5	38.9	37.7

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

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Industry, government and/or academia conduct mission and payload concept and feasibility studies to establish the technical and/or scientific feasibility and relevance of missions or payloads in order to enable CSA decisions on future SE space missions.	1. Number of concept/feasibility (mission and payload) and phase 0/A studies initiated, pursued or completed (Target: 15).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	2.3	2.2	0.9
<b>HUMAN</b> (FTEs)	5.0	3.1	3.1

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

Expected Result #1	Performance Indicator
Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under European Physical and Life programs.	1. Canadian industrial return in ESA optional programs in SE (Target: 84% or higher).

RESOURCES	2008-2009	2009-2010	2010-2011
FINANCIAL (\$ in millions)	5.8	5.5	3.3
HUMAN (FTEs)	0.0	0.0	0.0

**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 #1	Performance Indicators
Identified opportunities for Canadian scientists to advance exploration readiness and scientific knowledge through CSA, national and international research missions.	1. Number of Highly Qualified Personnel (HQP) involved in the program (Target: 450); 2. Number of research partnerships (nationally and internationally) (Target: 90); 3. Number of scientific publications, reports and conference proceedings acknowledging CSA funding (Target: 650); 4. Number of scientific presentations (Target: 450); and, 5. Number of awards granted under the CSA Grants and Contributions Program (Target: 25).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	9.2	7.8	7.0
<b>HUMAN</b> (FTEs)	20.4	21.3	20.1

**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 the opportunities of access to space for Canadian scientists.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
Continue to develop and maintain human space flight expertise to meet the requirements of the CSA's space science and human exploration programs.	<ol style="list-style-type: none"> <li>1. Canadian Astronauts are recruited according to recruitment plan (Target: Basic training plan under development);</li> <li>2. Canadian astronauts are qualified to be selected for missions on all flight vehicles such as Shuttle, Soyuz and ISS (Targets: 4 on Shuttle, 2 on Soyuz and 3 for ISS); and,</li> <li>3. Number of space flights and missions to which Canadian Astronauts participate (Target: shuttle flights to be negotiated).</li> </ol>

<b>RESOURCES</b>	<b>2007-2008</b>	<b>2008-2009</b>	<b>2009-2010</b>
<b>FINANCIAL</b> (\$ in millions)	4.2	4.4	4.5
<b>HUMAN</b> (FTEs)	7.0	7.0	7.0

#### **Highlights of Expected Accomplishments – Enabling Research (SE)**

- Through partnership with the European Space Agency (ESA), the CSA will position Canadian industry and scientists in future scientific and technological developments relating to the European planetary exploration program called Aurora and the physical and life sciences program called ELIPS-2.
- The CSA will continue to participate actively to the International Space Exploration Coordination Group that was created in 2007 to promote coordination for Moon and Mars exploration between various space agencies around the world.

- The CSA will establish an Exploration Core Program. This program will support the development of ground prototypes of systems that could become potential contributions to future Moon or Mars missions. This Program ensures the readiness of the space exploration community in Canada. The Core Exploration Program will also develop the user requirements for missions of potential interest for Canada. It will be implemented with industry, university and research institutions.
- The CSA will maintain a trained and versatile Astronaut Corps to develop and maintain human space flight expertise to meet the requirements of the CSA's space sciences and human exploration programs. Two Canadian astronauts have started training in preparation for an assignment to a long-duration space flight on the ISS in the 2009 timeframe. Two other Canadian astronauts are expected to be assigned; one to a Space Shuttle flight before 2010 and one to a second long-duration expedition on ISS in the 2012 timeframe. Canadian Astronauts perform additional duties for NASA and with the International Space Station Program.
- The CSA will maintain a robust parabolic flight program in collaboration with the National Research Council that offers science opportunities for up to 20 seconds of freefall.
- The CSA will assess the opportunity for a new Astronaut Recruitment Campaign to ensure that Canada can take full advantage of the flight opportunities available through its investment in the International Space Station Program and, possibly, to prepare for new missions with International partners.
- The CSA will consult on a regular basis with the Canadian science community on program development and work with other government departments to maximize synergy with the government of Canada.

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

**Objective:** Provide coordination or support to the development of Space Science and Exploration (SE) space missions in line with CSA priorities and stakeholders expectations through the definition, critical design, manufacturing, integration, testing and delivery phases leading to launch and early operations of space systems.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space mission proposals that efficiently, effectively and economically progress to subsequent operations phases in accordance with objectives, requirements, initial or revised specifications.	1. Percentage of projects that require more than one EPA (Effective Project Approval) or an amendment to initial EPA over total number of projects (differentiating if modifications are attributable to factors outside or within CSA zone of control).
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all mission Space development projects.	1. Rate of expertise matrix support to all of CSA's program activities; and, 2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	36.0	15.6	6.5
<b>HUMAN</b> (FTEs)	22.1	18.1	17.1

**1- SE Projects – Objective:** Ensure the development, delivery and commission of space-qualified systems for SE missions within the following scientific fields: astronomy, life sciences, physical sciences, space exploration and solar-terrestrial relations through effective project, quality and engineering management.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
SE projects' deliverables are met.	1. Project milestones are met as defined in the detailed work plan. (Target: 75%); 2. Project cost is maintained within authorized levels. (Target: 100%); and, 3. Risks are identified and mitigation plans prepared for each project. (Target: 100%).
<b>Expected Result #2</b>	<b>Performance Indicator</b>
SE projects' deliverables meet mission objectives at critical steps.	1. Number of approved projects associated with science support (Target: 15).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	36.0	15.6	6.5
<b>HUMAN</b> (FTEs)	22.1	18.1	17.1

### **Highlights of Expected Accomplishments – Space Mission Development (SE)**

- The Enhanced Polar Outflow Probe (e-POP) mission, integrated with the CASSIOPE Mission, is scheduled for launch in 2009. 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 e-POP will help scientists understand particle exchange and energy coupling processes between the Earth's atmosphere and space environment. The suite of e-POP instruments integrated in the CASSIOPE satellite will undergo environmental testing in CSA's David Florida Labs.
- The CSA will continue the detailed design and manufacturing of the Flight Detector Subsystem for the UltraViolet Imaging Telescope (UVIT) on-board the ASTROSAT satellite of the Indian Space Research Organization (ISRO). It is scheduled for launch no earlier than 2009. The CSA participation will guarantee 5% of the observing time for Canadian scientists and obtain ASTROSAT astronomic data.
- The CSA will complete the manufacturing and will deliver to NASA the Alpha Particle X-ray Spectrometer (APXS) for the Mars Science Laboratory to be launched by NASA in 2009. The Canadian contribution will help scientists to determine the chemical composition of various soil, dust and rock samples on the planet.
- Canada is participating in the James Webb Space Telescope (JWST), a major facility-class space observatory that will 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 to the international astronomical community of simultaneous images. The design of the FGS will be completed and the manufacturing will continue in 2008. By virtue of the CSA's contribution, Canadian astronomers will have guaranteed access to 5% of the observing time of the James Webb Space telescope.

- The Local Oscillator Source Unit (LSU) that was successfully integrated in the Heterodyne Instrument for the Far Infrared (HIFI) of the European Space Agency's Herschel satellite will be launched in 2008. It will carry an infrared telescope and three scientific instruments that 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 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 the Canadian territory. NEOSSat is scheduled to launch in 2009. A prime contractor has been selected and detailed design will continue during 2008.

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

**Objective:** Provide coordination or support to the operations of Space Science and Exploration (SE) space missions in line with the CSA priorities and stakeholders' expectations through the development and conduct of on-orbit operations, system maintenance and logistic support, as well as data handling and delivery.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space mission operations are managed effectively and efficiently.	1. Percentage of projects that meet initial objectives in terms of data delivery to users.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all Space mission operations.	1. Level of internal proactivity in terms of innovation and production expertise for missions in operational phase; and,  2. Annual rate of investment in maintenance and improvement of the infrastructure required for mission operations.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	53.8	54.4	54.6
<b>HUMAN</b> (FTEs)	126.8	124.5	124.9

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

Expected Result #1	Performance Indicators
<p>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.</p>	<ol style="list-style-type: none"> <li>1. Availability of Operations Centre (Target: at least 99%);</li> <li>2. Percentage of software and flight products delivered as required/scheduled (Target: more than 95%);</li> <li>3. Rate of training delivered vs. training requested (Target: more than 95%);</li> <li>4. Rate of payload operational support availability for planned and unplanned events (Target: 100%);</li> <li>5. Percentage of MSS system(s) and operational support availability for planned and unplanned events (Target: more than 95%); and,</li> <li>6. Percentage of active participation of the CSSP team in the various ISS multi-lateral boards and panels managing the ISSP (Target: more than 95%).</li> </ol>

RESOURCES	2008-2009	2009-2010	2010-2011
<b>FINANCIAL</b> (\$ in millions)	46.4	47.0	47.0
<b>HUMAN</b> (FTEs)	113.5	111.4	111.8

**2- SE Mission Operations – Objective:** Operate the space and ground segment for SE mission operations within the following scientific fields: astronomy, life sciences, physical sciences, space exploration and solar-terrestrial relations.

Expected Result #1	Performance Indicators
<p>SE Space Mission Operations meet mission objectives and user/client expectations.</p>	<ol style="list-style-type: none"> <li>1. Sponsoring organization's requirements for payload projects are met at critical steps of the operations (Target: 95%); and,</li> <li>2. Number of missions in operational phase associated with science support (Target: 3).</li> </ol>



<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	5.1	5.0	5.3
<b>HUMAN</b> (FTEs)	2.1	1.7	1.7

**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.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
Ensure and maintain Canadian Astronauts' health and safety for space flight missions.	<ol style="list-style-type: none"> <li>1. Maintaining Astronauts' Health and Safety by satisfaction level from client (Chief Canadian Astronaut) (Target: 100%); and,</li> <li>2. Percentage of participation in ISS Medical Boards, Panels and Working Groups (Target: 100%).</li> </ol>

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	2.3	2.5	2.2
<b>HUMAN</b> (FTEs)	11.2	11.3	11.4

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

- The Phoenix mission, successfully launched in August 2007, is targeted to land on the northern polar region of Mars on May 25<sup>th</sup>, 2008. After exposing the upper few feet of surface with a robotic arm, the Phoenix Lander will analyze weather conditions of the region. Canada's contribution, an onboard Meteorological Station (MET), will record the daily weather of the Martian northern plains using temperature and pressure sensors, as well as a light detection and ranging (LIDAR) instrument. This instrument will position Canada as a respected and reliable provider of planetary science instrumentation, will provide basic scientific knowledge of the Martian atmosphere, and will permit Canadian scientists to have access to all data from the mission.

- The CSA continue the analysis of the e-OSTEO space mission scientific experiment that was successfully completed in September. These experiments focus on bone loss in space that is one of the major obstacles to long duration space flight. The knowledge acquired will also enhance our understanding of bone loss in general and will have potential applications to osteoporosis. The CSA was given this flight opportunity by ESA in return for CSA lending ESA some e-OSTEO hardware for ESA scientists to repeat the bone experiments that were lost in the tragic loss of Columbia in 2003.
- On the International Space Station, CSA will upgrade its ground control operations of Canadarm2 now using the new ground control capability enabling the handling of heavy payloads from the ground and will initiate limited ground control operations of Dextre (Special Purpose Dexterous Manipulator). The development of expanded ground control capabilities for future Dextre operations will continue to enable a more efficient on-orbit commissioning of this new element reducing significantly astronaut time requirement for this task. Dextre's launch is now planned for March 2008 on Shuttle mission STS-123/1J/A. The CSA is also responsible for the training and qualification of all astronauts, cosmonauts and ground support personnel involved in the operations of the MSS including Dextre. Canada is the first country to implement and use this type of technology in space operations.
- CSA will continue to maintain operational preparedness for the MSS to support ISS maintenance operations. This will entail the preparation and certification of flight products and procedures to support operations that are not yet fully defined. The operation of Dextre (the third element of the Mobile Servicing System) will evolve MSS operations from highly planned and concisely tested assembly operations to more generic and holistic maintenance concepts. This will represent a major philosophical shift to Space Mission Design standards and better position Canada to support future exploration program endeavours.
- CSA will deliver the MSS-6 software release, which will provide a major enhancement to the capability of the Canadarm2 to better facilitate the capture of free flying vehicles. Canadarm2 will be required to capture the first such vehicle, the Japanese free flying H-II Transfer Vehicle, in July 2009. As such, the software is required earlier for astronaut training, simulation and mission development.
- The CSA responsibilities for MSS operations will be fulfilled. This involves maintaining and providing technical support for MSS hardware and software, launching one spare Canadarm2 joint to orbit in early 2008 for pre-positioning in case of on orbit failure of the arm during its life, performing repair and overhaul work on the 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 in St-Hubert, Quebec.

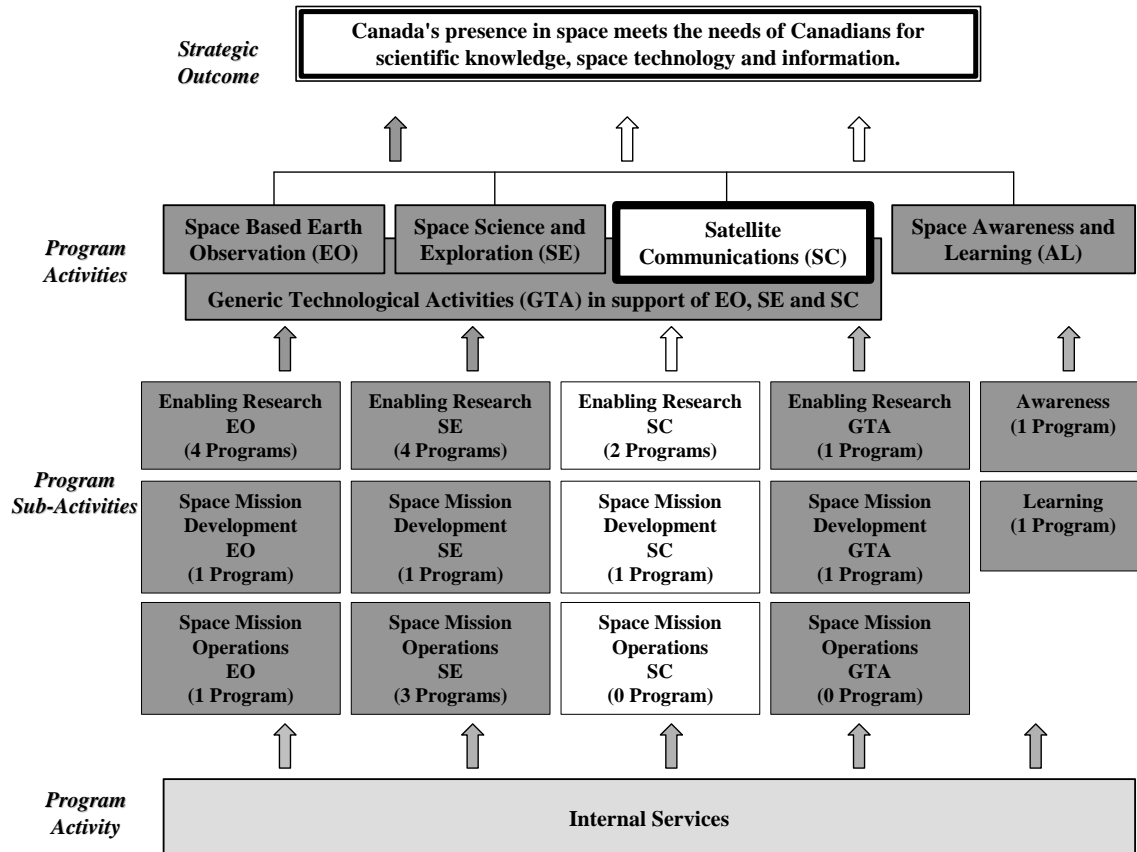
- The CSA will continue to support on-orbit commissioning of the Microgravity Vibration Isolation System (MVIS), launched in early 2008. All activities in support of the MVIS sub-system will also be supported in 2008. By providing this important component to ESA, Canadian scientists will gain access to this unique European ISS laboratory in space.
- The CSA will continue to explore how the Advanced Astronaut Medical Support (ADAMS) project can contribute to human exploration. Specifically, CSA will continue to explore solutions to the delivery of health care on future long duration exploration-class missions and how these solutions can help improve healthcare delivery on Earth through the transfer of space technology. CSA will develop collaborative projects with Academia and Industry and will continue to use analog environments for requirements definition and proof of concept.
- In collaboration with Agri-Food Canada, the CSA will continue work on a one-day bonus menu for the ISS thus providing a greater variety of nutrition food to astronauts on long-duration missions.
- The CSA will continue to collect radiation exposure data through a collaborative project with Russia on the ISS to which CSA provided two types of radiation dosimeters.

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>

# Satellite Communications



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

<b>SATELLITE COMMUNICATIONS (SC)</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicators</b>
The systems and applications developed satisfy the needs of Canadians and of the Canadian government that are not being met by existing commercial systems and applications.	1. Studies that clearly identify needs that are not being met by technological systems and applications;  2. List of capability enhancements developed in response to the unmet needs of commercial and government services; and,  3. Number of applications and users per SC mission.
<b>Planning and Reporting Continuity:</b>	
RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp</a> - 2.3	
DPR 2006-2007: <a href="http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/pr-2007.asp</a> - 2.4	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	26.7	18.7	14.5
<b>HUMAN</b> (FTEs)	12.9	14.0	14.2

**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.**

### **ENABLING RESEARCH – SATELLITE COMMUNICATIONS**

**Objective:** Provide leadership, coordination or support to Satellite Communications (SC) applied research and experimental development in line with the CSA priorities and stakeholders expectations in order to increase the knowledge base and devise new applications through space missions, and to allow the transfer of intellectual property and proven technologies to Canadian industry, academia, and government organizations.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
New project/mission concepts that progress to subsequent development phases related to Agency priorities.	1. Ratio of the number of new concepts presented to the number of new concepts retained for subsequent phases; and,  2. Quality of the concepts retained based on the average evaluation rating obtained according to the Priority Ranking Framework.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all enabling research projects/missions.	1. Number of consulting requests received by CSA personnel from internal sources (matrix support), as well as from the private sector, academia and other space agencies; and,  2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	16.6	15.3	13.5
<b>HUMAN</b> (FTEs)	6.0	6.0	6.0

**1- ESA Programs in SC – 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 SC.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
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.	1. Canadian industrial return in ESA optional programs in SC (Target: 84% or higher).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	12.5	12.2	10.4
<b>HUMAN</b> (FTEs)	0.0	0.0	0.0

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

Expected Result #1	Performance Indicator
Northern Communities access and utilize the Anik F2 Government of Canada Capacity Credit.	1. Use of the Government of Canada Capacity Credit for Government Applications and Services (Target: to be determined).

RESOURCES	2008-2009	2009-2010	2010-2011
FINANCIAL (\$ in millions)	2.0	1.0	1.0
HUMAN (FTEs)	0.0	0.0	0.0

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

- The CSA will continue to work towards the utilization of the Government of Canada capacity credit for broadband telecommunications services in the North. Additional demonstration of Ka-band technology will improve the use of the AnikF2 by northern communities for trials of innovative government services and in specific areas of interest to other government departments. This will be done by maintaining processor hubs and developing ground terminals, to provide expanded access to Ka-band user and government services in the North.
- Canada’s participation in the European Space Agency (ESA) programs allows our industry to access forward-looking studies on new telecommunications services; to develop new technologies, equipment and applications in multi-media, inter-satellite and mobile communications; and to demonstrate satellite-based communications services such as interactive communications services for remote communities and for disaster management. For example, In satellite navigation, CSA will continue collaboration with ESA the development of the Galileo ground infrastructure to support the monitoring of the quality of the localisation signal generated by the four experimental IOV (In-Orbit-Validation) satellites that will be put in orbit in 2010 as a precursor to the Galileo constellation.
- CSA will establish an Advanced Satellite Communications Program aimed at developing technologies to maintain leadership in satellite based communications, navigation and search and rescue systems.
- The CSA will complete the assessment of the telecommunications requirements of federal government users in order to support the definition of two mission concepts that could move into Phase A later in 2008-2009. They are:

- The next Generation Satcom Payload Mission, consisting of an advanced V-Band transporter on board one of Telesat's future Anik satellites; and,
- The Polar Communications and Weather Satellite, consisting of a high data rate communications providing coverage of the polar cap in the high Arctic.

**SPACE MISSION DEVELOPMENT – SATELLITE COMMUNICATIONS**

**Objective:** Provide coordination or support to the development of Satellite Communications (SC) space missions in line with CSA priorities and stakeholders expectations through the definition, critical design, manufacturing, integration, testing and delivery phases leading to launch and early operations of space systems.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space mission proposals that efficiently, effectively and economically progress to subsequent operations phases in accordance with objectives, requirements, initial or revised specifications.	1. Percentage of projects that require more than one EPA (Effective Project Approval) or an amendment to initial EPA over total number of projects (differentiating if modifications are attributable to factors outside or within CSA zone of control).
<b>Expected Result #2</b>	<b>Performance Indicators</b>
The CSA’s in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all Space mission development projects/missions.	1. Rate of expertise matrix support to all of CSA's program activities; and,  2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	10.1	3.4	1.0
<b>HUMAN</b> (FTEs)	6.9	8.0	8.2

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



Expected Result #1	Performance Indicators
SC projects' deliverables are met.	1. Project milestones are met as defined in the detailed work plan (Target: 75%); 2. Project cost is maintained within authorized levels (Target: 100%); and, 3. Risks are identified and mitigation plans prepared for each project (Target: 100%).

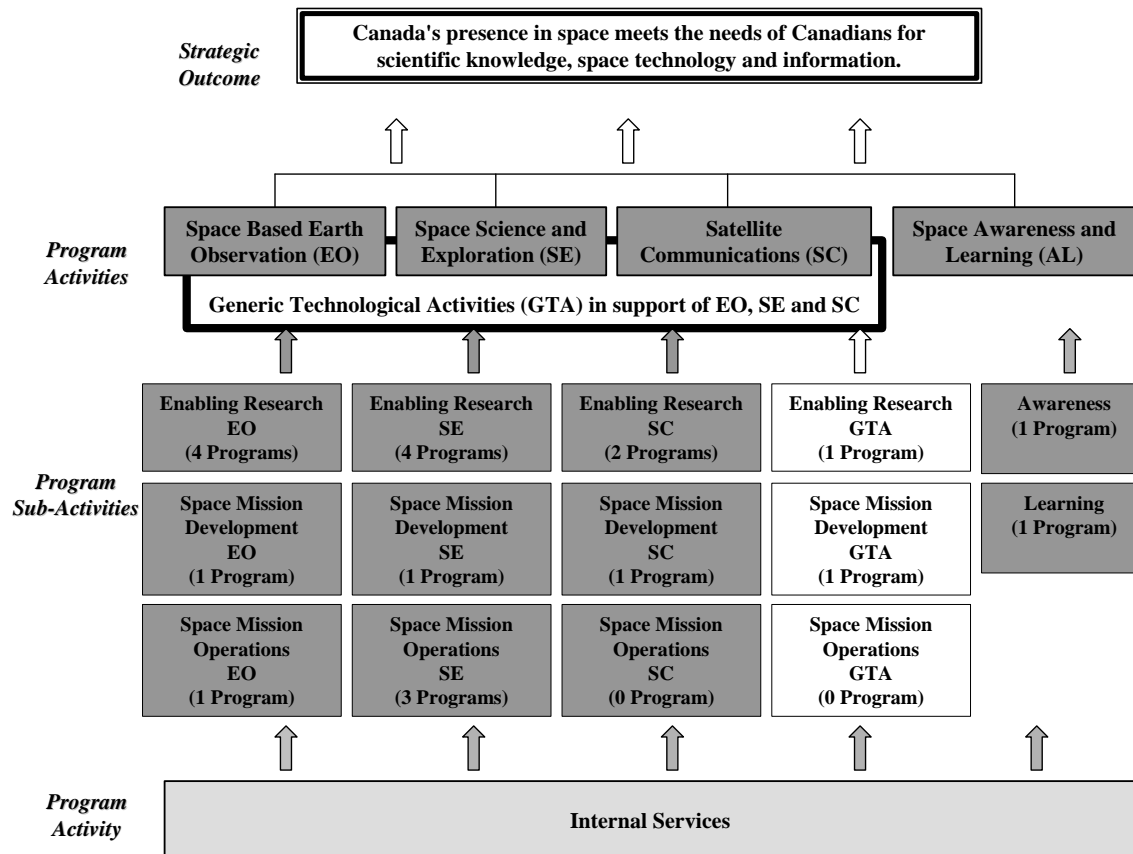
RESOURCES	2008-2009	2009-2010	2010-2011
FINANCIAL (\$ in millions)	10.1	3.4	1.0
HUMAN (FTEs)	6.9	8.0	8.2

### Highlights of Expected 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. This small satellite spacecraft will be fully designed and constructed by Canadian companies. During 2008, integration and environmental testing of the spacecraft will be completed and the launch is planned in 2009. Cascade is the precursor of a communication 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 anywhere in the world.
- CSA and DND are partnering to initiate and manage a second micro-satellite project (the first one being NEOSSat) which payloads will be an Automatic Identification System (AIS) supported on a micro-satellite bus. This project will demonstrate and further develop a multi-mission micro-satellite bus capability; will establish micro-satellites as operationally cost effective; will allow optimization of the AIS payload in maritime traffic identification; will significantly support Canadian industry business development strategies in a global market context; and will be a complement with CSA's RADARSAT-Constellation program and with DND's Polar Epsilon program. Preliminary design will be initiated in 2008. The launch is planned for mid 2010 and end of mission demonstration in 2012.

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

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



**Program Activity Priority:** Provide leadership, co-ordination or support to Earth Observation (EO), Space Science and Exploration (SE), and Satellite Communications (SC) Program Activities through activities that are generic.

<b>GENERIC TECHNOLOGICAL ACTIVITIES (GTA) IN SUPPORT OF EO, SE, AND SC</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicators</b>
Canada's industrial technological capabilities can meet the needs of future space missions and activities.	1. Ratio of the number of priority technologies identified for future EO, SE and SC missions to the number of priority technologies developed in GTA; and,  2. Number of priority technologies that are ready to be used.
<b>Planning and Reporting Continuity:</b>	
RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp</a> - 2.4	
DPR 2006-2007: <a href="http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.5">http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.5</a>	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	48.3	61.4	60.9
<b>HUMAN</b> (FTEs)	141.4	146.6	161.6

**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.**

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

**Objective:** Provide leadership, coordination or support to EO, SE and SC applied research and experimental development in line with the CSA priorities and stakeholders expectations.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Space technology concepts that support projects/missions related to Agency priorities.	1. Rate of adherence to the technology development plan/track records.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
Canadian industries and research organizations that are actively involved in space research and development.	1. Number of requests received vs. number of requests accepted (annual request for proposals [RFP] process); and,  2. Number of requests received vs. number of requests funded (annual request for proposals [RFP] process).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	40.5	52.5	52.6
<b>HUMAN</b> (FTEs)	96.9	102.1	116.6

**1- Generic Space Technologies in support of EO, SE, and SC – Objective:** Assume the leadership and support in the enabling research and development (R-D) of high-risk technologies leading to the realization of CSA or international EO, SE and SC missions.

<b>Expected Result #1</b>	<b>Performance Indicators</b>
Development and transfer of advanced space technologies by industry, government, academia and not-for-profit organisations in support of EO, SE, and SC activities.	<ol style="list-style-type: none"> <li>1. Number of technologies brought to higher readiness levels (Target: 23); and,</li> <li>2. Number of technologies chosen to enable future space missions of interest to Canada (Target: 6).</li> </ol>
<b>Expected Result #2</b>	<b>Performance Indicators</b>
Maintenance of in-house scientific and technical expertise, within the CSA and for the benefit of government, industry and universities, in support of EO, SE, SC activities of interest to Canada.	<ol style="list-style-type: none"> <li>1. Number of Highly Qualified Personnel (HQP) supporting CSA projects and/or programs (Target: 80); and,</li> <li>2. Number of scientific and technical publications by CSA personnel and visiting researchers (Target: 50).</li> </ol>
<b>Expected Result #3</b>	<b>Performance Indicator</b>
Successful development and demonstration of advanced technologies, systems, components or studies provided for in the contracts awarded to Canadian firms under mainly two ESA Programs.	<ol style="list-style-type: none"> <li>1. Canadian industrial return in ESA optional programs, and at the overall level (Target: 94% or higher).</li> </ol>
<b>Expected Result #4</b>	<b>Performance Indicator</b>
Transfer of space technologies generated by the CSA to industry, government, academia and not-for-profit organisations in support of EO, SE and SC activities.	<ol style="list-style-type: none"> <li>1. Number of licences granted for space technologies generated by the CSA (Target: 5).</li> </ol>

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	40.5	52.5	52.6
<b>HUMAN</b> (FTEs)	96.9	102.1	116.6

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

- The structure of CSA Technology Plan has been developed and dedicated resources are allocated to the development of technology roadmaps to guide and prioritize technology R&D at CSA. Priority technologies are defined in consultation with the technology manufacturers, the users and the experts. A mission database was developed and will be populated with potential missions. The database will be a tool to identify technology requirements.
- The Space Technology Development Program (STDP) addresses priority technologies required for national and international space missions and activities of interest to the Canadian Space Program. Through periodic RFP's, STDP awards R&D contracts to industry and research organizations to create mission concepts, propose innovative technologies, retire risk on the critical technologies required for future missions, and contribute to the enhancement of Canadian capabilities through the demonstration of new products and services. Examples of STDP activities in 2008-2009 includes:
  - The development of an infrared microbolometer detector to enhance thermal resolution and significantly reduces cost, weight and power consumption.
  - The development of a complete concept for a small, compact, yet-efficient space based solar-occultation spectrometer that could fit on a small platform, ultimately on a micro-satellite to measure vertical profile and column concentrations of atmospheric pollutants.
  - Develop a unique 3-D vision system that could be propose to NASA to equip their future Robotic Vehicles.
  - The development of a prototype communication ground terminal unit that is specifically designed to operate in harsh cold environments.

- The CSA will develop technologies that will serve to demonstrate the concept feasibility of Middle Earth Orbit Search-and-Rescue (MEOSAR). The objective is to use navigation satellites such as GPS and Galileo to relay in near real-time signals from activated distress beacons located in ships, plane or on a single individual needing help. This development effort represents a significant leap forward in new satellite-aided Search-and-Rescue capabilities that will increase the number of lives saved around the world.
- Through the Space Technology Research Program develop long-term high-risk space technologies and maintain in-house technical capabilities by conducting advanced R&D projects that meet the criteria of excellence and relevance in support of the implementation of the Canadian Space Program. For example, the program includes the development of:
  - Autonomous navigation technique based on vision and artificial intelligence for future planetary exploration rovers.
  - A laboratory demonstration of laser induced breakdown spectroscopy which can provide precise in-situ analysis of rocks and minerals in planetary exploration.
  - Next generation high performance radar electronics for future synthetic aperture radar missions.
  - A novel shape memory alloy based actuator that could be applied to switches or deployment mechanism on satellites.
- The CSA will manage its portfolio of patents and intellectual property licenses and conduct commercialization assessments in order to support the transfer of space technologies and their applications to other sectors of the economy and enhances Canada's industrial competitiveness.
- By using the Partnership Support Program and NSERC's Collaboration R&D Program, the CSA and NSERC will continue to foster closer collaboration between industry, universities and government in space research and technology development. Four projects will be supported in 2008-2009.

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

**Objective:** Provide coordination or support to the development of EO, SE and SC space missions in line with CSA priorities and stakeholders expectations through the definition, critical design, manufacturing, integration, testing and delivery phases leading to launch and early operations of space systems.

Expected Result #1	Performance Indicators
The CSA's in-house personnel are highly qualified, with recognized expertise, and are supported by a high-technology infrastructure that is suited to all Space mission development projects.	<p>1. Number of space missions supported by DFL facilities (or rate of use of the facilities); and,</p> <p>2. Median number of years of experience of specialized personnel across the Agency and the corresponding median classification.</p>

RESOURCES	2008-2009	2009-2010	2010-2011
<b>FINANCIAL</b> (\$ in millions)	7.8	8.9	8.3
<b>HUMAN</b> (FTEs)	44.5	44.5	45.0

**1- David Florida Laboratory (DFL) supports the Canadian Space Program – Objective:** Provide world-class space qualification services on a national scale, including facilities and expertise in support of the CSA programs and international EO, SE and SC missions.

Expected Result #1	Performance Indicator
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.	1. Percentage of satisfied clients (Target: 95% or more).

RESOURCES	2008-2009	2009-2010	2010-2011
<b>FINANCIAL</b> (\$ in millions)	6.5	6.4	6.5
<b>HUMAN</b> (FTEs)	44.5	44.5	45.0

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

- David Florida Laboratory provides world-class and cost-effective environmental space qualification services for the assembly, integration and testing of spacecraft systems and sub-systems to all of the CSA's programs. Many priority projects will benefit from DFL support, such as for:

- Science and Exploration: CASSIOPE e-POP mission; NEOSat; James Webb Space Telescope Space Telescope (JWST); and the UltraViolet Imaging Telescope (UVIT);
- Satellite Communications: CASSIOPE Cascade mission;
- Commercial Programs: Various spacecraft from Space Systems Loral, MDA (SSRMS & SRMS), TenXc Wireless (PCS Antennas), Inmarsat Aeronautical Antennas, Harris Corporation (MUOS); and,
- OGD: DND & L3 Communications (CF-18 Radome Characterization Project).

To learn more about Generic Technological Activities in support of Earth Observation, Space Science and Exploration, and Satellite Communications, go to:

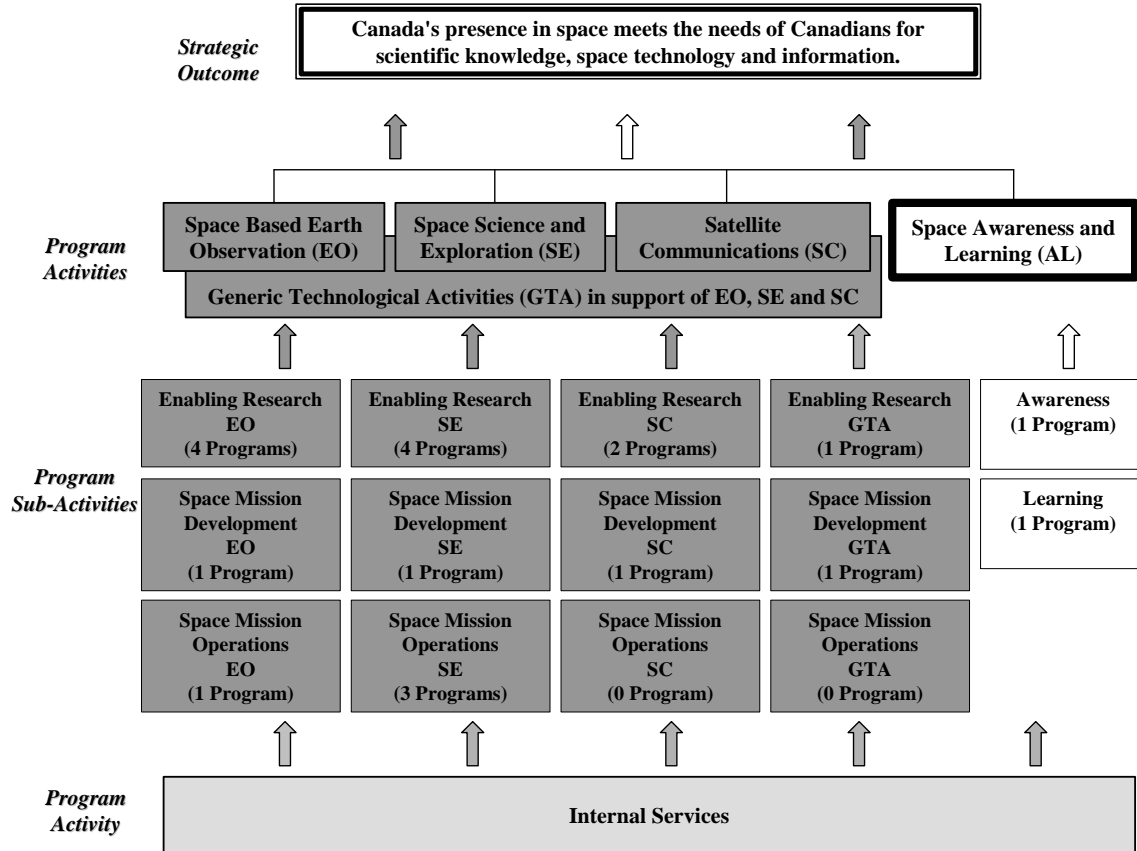
<http://www.space.gc.ca/asc/eng/industry/technology.asp>

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

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



# Space Awareness and Learning



**Program Activity Priority:** Further public understanding and engagement with regards to space related issues, ultimately leading to improving the scientific literacy of Canadians.

<b>SPACE AWARENESS AND LEARNING</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicator</b>
Targeted level of awareness of Canadians towards space is reached.	1. Survey results obtained every 3 years.
<b>Planning and Reporting Continuity:</b>	
RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp#2.5">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp#2.5</a> DPR 2006-2007: <a href="http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.6">http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.6</a>	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	7.9	8.9	8.8
<b>HUMAN</b> (FTEs)	29.0	29.0	29.0

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

### **AWARENESS**

**Objective:** Increase public awareness and understanding of how space affects and improves the quality of life.

<b>Expected Result #1</b>	<b>Performance Indicator</b>
Target audience is reached through outreach activities.	1. Number of initiatives according to targeted audiences (Target: benchmark to be determined).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	5.1	5.9	5.9
<b>HUMAN</b> (FTEs)	24.0	24.0	24.0

### **Highlights of Expected Accomplishments – Awareness**

The major communications activities will focus on the following:

- Awareness campaign related to Mars landing of NASA's Phoenix Mars Rover with a Canadian science instrument and weather station aboard.

- Awareness campaign related to the launch of Dextre, the final component and contribution of Canada's advanced space robotics suite to the ISS, a two-armed dexterous manipulator that will enhance construction and maintenance of the International Space Station.
- Promotion of the successful commissioning of Canada's most advanced Earth Observation imaging satellite, RADARSAT-2. As RADARSAT-2 is fully tested and declared operational, it will begin production of precise imaging for Government and commercial clients, support surveillance and Arctic sovereignty and begin validation of an experimental tracking module for National Defence, called Polar Epsilon.
- Awareness campaign related to the launch of Canada's hybrid small satellite mission CASSIOPE, which contains a high-speed large-capacity data communications module (Cascade), and an atmospheric science instrument (e-POP).
- Celebration of the 10<sup>th</sup> anniversary of the International Space Station; continuing promotion of Canada's key role as a member and contribution of critical scientific and technological expertise, and suite of space robotics that is building and maintaining the Space Station. Promotion of preparations by Canada and its international partners to send a full international crew to live and work onboard the Station in 2009, once construction has been declared complete.
- Awareness and public outreach campaign supporting the CSA's hosting of the world's largest gathering of the space science community and the 50<sup>th</sup> anniversary of its most venerable and renowned institution, COSPAR that will take place in July 2008 in Montreal.

## **LEARNING**

**Objective:** Direct a sustained multi-dimensional and inter-active learning program to build knowledge and enhance interest in space science and technology.

Expected Result #1	Performance Indicators
Canadian educators and students further their learning related to science and technology through space theme.	1. Number of educators reached through professional development initiatives (Target: Maintain or increase); and,  2. Number of students reached through learning activities (Target: Maintain or increase).

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	2.8	3.0	3.0
<b>HUMAN</b> (FTEs)	5.0	5.0	5.0

### **Highlights of Expected Accomplishments – Learning**

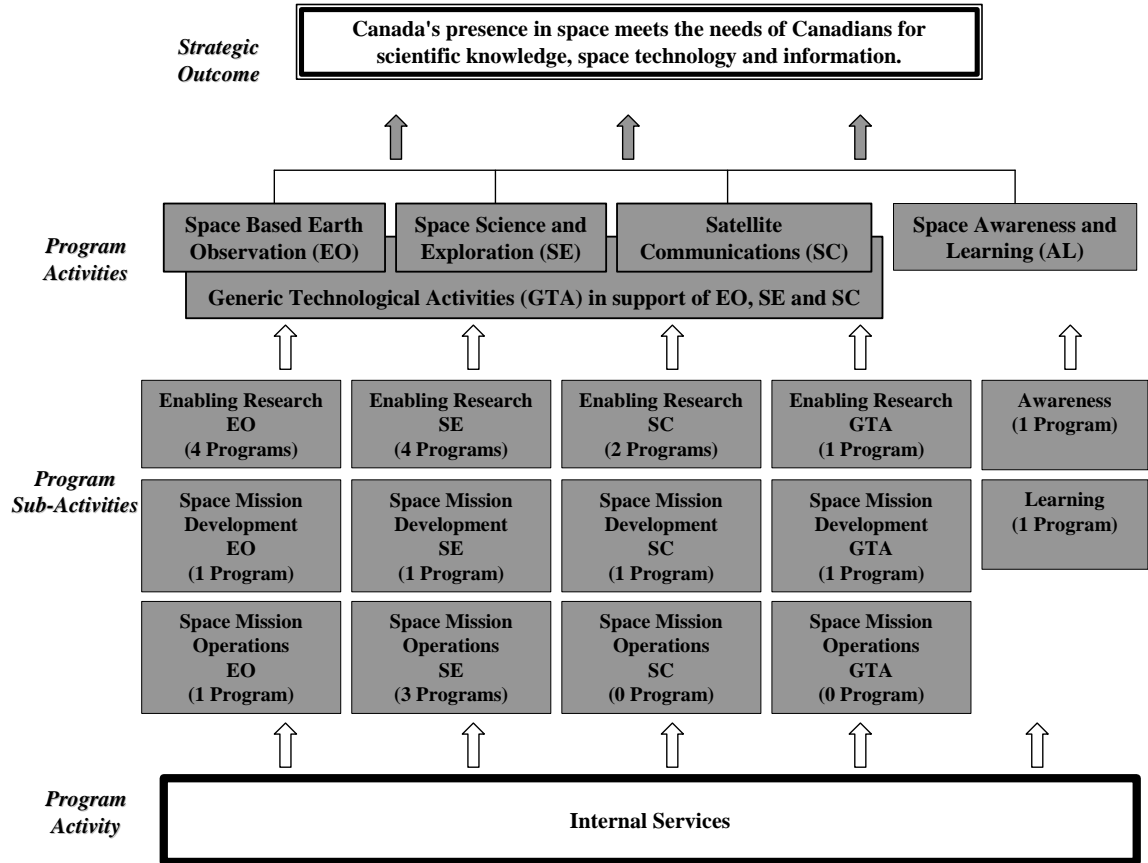
- Professional development workshops and teaching initiatives such as satellite enabled or web-based assisted tele-learning opportunities for educators.
- Partnered initiatives with schools, youth organisations and other institutions to expand student and educator access to the space science and technology community and space-learning materials.
- Targeted space-focused learning materials and teaching modules for educators and students at the primary and secondary level.
- Targeted grants, contribution and sponsorship programs in partnership with other federal departments and agencies to support awareness, research, development and training in space science and technology.

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>

## Internal Services



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

<b>INTERNAL SERVICES</b>	
<b>PROGRAM ACTIVITY PERFORMANCE MEASUREMENT</b>	
<b>Expected Result #1</b>	<b>Performance Indicator</b>
Internal Services provide an added value to CSA managers in the performance of their duties.	Services provided meet standards set under Government-wide and CSA policies as well as MAF expectations.
<b>Expected Result #2</b>	<b>Performance Indicators</b>
<p>The four highest priority risks identified in the CSA corporate risk profile are addressed and mitigated:</p> <p><b>1. Values and Ethics:</b> Increase the capacity of the CSA to instil public service values, to develop a working environment free of harassment, and promoting respect for individuals, integrity and honesty.</p> <p><b>2. Workforce Competencies:</b> Increase the capacity of CSA to maintain a qualified workforce of public servants to deliver CSA's mandate within the government legislative frameworks, policies and rules.</p> <p><b>3. Function/Process Integration:</b> 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.</p> <p><b>4. Trust in CSA Governance:</b> Increase the capacity of CSA in gaining and maintaining the confidence of stakeholders to effectively govern and manage its affairs.</p>	<p>Management and mitigation actions are implemented:</p> <p><b>1.</b> Phase 2 of the CSA Public Service Values and Ethics program is implemented.</p> <p><b>2.1.</b> The key to leadership competency profile is integrated in human resources management strategies and activities (Target: Competency profile is used for the hiring, evaluation and development of CSA managers);</p> <p><b>2.2.</b> The majority of CSA managers are recognized as being qualified for increased delegation of authority (Target: Full hiring delegated authority is granted by the Public Service Commission by September 2008);</p> <p><b>3.1.</b> The corporate Work Planning information system (eWP) is fully implemented and functional for all sectors for the planning of 2008-2009 and monitoring of 2007-2008;</p> <p><b>3.2.</b> Completed development of a Long-term Investment Plan (Target: The Plan is approved by CSA Executive Committee); and,</p> <p><b>4.</b> Management actions plans are implemented further to audit findings and recommendations regarding CSA management frameworks.</p>
<b>Planning and Reporting Continuity:</b>	
RPP 2007-2008: <a href="http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp">http://www.space.gc.ca/asc/eng/resources/publications/rpp-2007.asp</a> - 2.6 DPR 2006-2007: <a href="http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.7">http://www.espace.gc.ca/asc/eng/resources/publications/pr-2007.asp#2.7</a>	

<b>RESOURCES</b>	<b>2008-2009</b>	<b>2009-2010</b>	<b>2010-2011</b>
<b>FINANCIAL</b> (\$ in millions)	40.6	39.9	39.9
<b>HUMAN</b> (FTEs)	270.1	269.3	270.1

**Main Expected Accomplishments:**

The Internal Services Program Activity covers the following sub-activities: Management and Oversight, Human Resources Management, Financial Management, Supply Chain Management, Facilities and Asset Management, Information Management, Information Technology, Public Affairs and Communications, Program Evaluation, Internal Audit, and Legal Services. As part of their current activities, Internal Services will carry out key activities and service provision improvements such as:

**Management and Oversight**

Finalize the measurement strategy for the full deployment of the Performance Management Framework (PMF).

Ensure that corporate priority review exercise is completed in time for the 2009-2010 ARLU exercise.

**Evaluation and Internal Audit Services**

The following evaluations will be completed in 2008-2009:

- RADARSAT-1 and RADARSAT-2 Major Crown Projects;
- CASSIOPE Mission Grants & Contributions Program; and,
- Canada/ESA Cooperation Agreement.

Create an independent Departmental Audit Committee made of a majority of members from outside the federal public service.

Develop of a risk-based multi-year internal audit plan.

**Finance Services**

Implement internal control procedures in order to assure managers that all payments are compliant with current financial policies.

Develop a forecast module in the expenditure management system in order to optimize the spending of allocated funds.

## **Human Resources**

The Integrated Corporate Human Resources Plan developed in 2007-2008 will be implemented by all CSA sectors.

Establish the profile of essential competencies by which full delegation authority will be granted to managers and make sure that a majority of managers are qualified.