Canadian Space Agency
2005-2006 Departmental Performance Report

4. 2. 14 Details on Project Spending

($ in millions)	Current Estimated Total Cost	Actual 2003-2004	Actual 2004-2005	2005-2006			
				Main Estimates	Planned Spending	Total Authorities	Actual
Space Based Earth Observation							
(Q) RADARSAT-1 (MCP)	712.2	11.3	10.4	8.4	12.5	8.1	8.1
(CB-Q) RADARSAT-2 (MCP)	421.6	7.4	10.9	46.1	46.1	44.8	17.0
(O-Q) SWIFT-CHINOOK (PPA)	105.5	0.4	2.6	12.4	12.8	12.5	1.5
(Q-O) HYDROS (PPA)	11.5	0.4	0.3	0.4	0.4	0.3	0.3
(BC-M-O-Q) SAR CONSTELLATION (PPA)	200.0	-	-	-	-	5.1	4.7
Space Science and Exploration							
(O) Herschel HIFI (EPA)	11.0	2.0	3.5	2.5	2.6	4.0	3.9
(O) JWST (PPA)	65.9	-	3.4	11.9	12.1	10.7	8.3
(O) MARS PHOENIX (EPA)	29.8	-	8.4	10.3	10.3	13.4	11.9
(Q-M) MIM Base Unit (MIMBU) (EPA)	3.6	-	-	0.8	1.4	-	-
(O) UVIT (EPA)	6.3	-	-	-	-	1.7	1.3
TOTAL	1,567.3	21.6	39.6	92.8	98.1	100.6	56.9

Note:

- Due to rounding, figures may not add to totals shown.
- For the 2005-2006 reporting cycle, the total authorities column refers to total spending authorities received during the fiscal year, as well as funding received from 2005-2006 Governor General Special Warrants and TB Vote 5.

Province where the capital project will be carried out:
O = Ontario
Q = Québec
BC = British Columbia
M = Manitoba

Class of Project:
MCP = Major Crown Project
EPA = Effective Project Approval
PPA = Preliminary Project Approval
S = Substantive Estimate

Table 4.2.15 Status Report on Major Crown Projects

RADARSAT-1

Description

RADARSAT-1, Canada's first Earth Observation satellite is the only fully operational civilian remote sensing satellite that carries Synthetic Aperture Radar (SAR). This technology, contrary to optical sensor satellites, has the capacity to image day and night, in all weather conditions, regardless of cloud cover, smoke, haze and darkness. Launched in November 1995, RADARSAT-1 was meant to operate for five years with an impressive 96% operational reliability, to consistently supply timely, high-quality data to RADARSAT International (RSI), a wholly owned subsidiary of MacDonald, Dettwiler and Associates (MDA) and other partners (federal and provincial government departments, NASA and the U.S. National Oceanic and Atmospheric Administration). RADARSAT-1 is now in its tenth year of operation.

RADARSAT-1 operations will continue 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 mid 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 becomes available.

RADARSAT-1 acquires high quality images of the Earth, covering most of Canada every 72 hours and the Arctic every 24 hours. It has proven itself in gathering the data needed for more efficient resource management (e.g. support to fishing, shipping, oil and gas exploration, offshore drilling, mapping) as well as ice, ocean and environmental monitoring, disaster management, and Arctic and offshore surveillance.

Leading and Participating Departments and Agencies

Sponsoring Agency:	Canadian Space Agency
Contracting Authority:	Public Works and Government Services Canada
Participating Departments:	Environment Canada
	Natural Resources Canada (Canada Centre for Remote Sensing)

Prime and Major Sub-Contractors

Prime Contractor: - EMS Technologies (Now MacDonald, Dettwiler & Associates)	 - Ste.-Anne-de-Bellevue, Quebec
Major Sub-Contractors: - MacDonald, Dettwiler & Associates - SED Systems - EMS Technologies - COM DEV - Lockheed Martin	 - Richmond, British Columbia - Saskatoon, Saskatchewan - Ottawa, Ontario - Cambridge, Ontario - Longueuil, Quebec
Other Contractors: - Ball Aerospace - RADARSAT International (RSI)	 - Boulder, Colorado - Richmond, British Columbia

Major Milestones

Major milestones of the RADARSAT-1 Major Crown Project are now complete.

Major Milestones	**Date**
- Preliminary studies	Complete
- Feasibility and concept definition	Complete
- Systems requirement and preliminary design	Complete
- Development and testing up to qualification test review	Complete
- Manufacture of the prototype flight sub-systems up to acceptance testing of the sub-systems	Complete
- Assembly and integration of the sub-systems up to flight readiness review, plus post-launch and commissioning activities up to system acceptance	Complete
- First Antarctica mission - Second Antarctica mission - Original Mission Life of five years	Complete Complete Complete
- Satellite operations	April 1996 to June 2007

Progress Report and Explanation of Variances

Effective Program Approval was obtained for RADARSAT-1 in March 1991, with launch in November 1995 and beginning of operations in April 1996. The initial system included receiving stations for Synthetic Aperture Radar (SAR) data in Prince Albert (Saskatchewan), Gatineau (Quebec), Fairbanks (Alaska) and McMurdo (Antarctica). CSA and RADARSAT International (RSI) have since signed agreements with another 25 network stations distributed around the world: Argentina, Australia, Brazil, China, Japan, Korea, Malaysia, Norway, Puerto-Rico, Russia, Saudi Arabia, Singapore, Thailand, Turkey, the United Kingdom and the United-States. In addition to this list, agreements have been also signed with mobile stations for the direct reception of RADARSAT-1 data: four in the U.S., one in Taiwan and one in France. Presently, a fifth U.S. and an Italian mobile station are undergoing the certification process. Even more stations have joined the RADARSAT-1 network in 2005-2006.

Following a commissioning period, routine operations of RADARSAT-1 commenced in April 1996. The average system performance is being maintained at 95.8%. The worldwide client base includes more than 600 commercial and government users from over 60 countries.

Several system improvements were made to the RADARSAT-1 operations planning system. First, the new Data Loss Information System (DLIS) database was integrated in the Mission Management Office database, providing visibility of data losses to Order Desk clients for the first time in the mission. The DLIS front-end interface was also improved to facilitate data entry and tracking of data losses. Second, the new OBR planning strategy was tested extensively with the Order Desk and made operational, thus optimising OBR usage by storing only user requested data on tape. Third, new functionality was added in the mission planning software and associated planning tools for allowing new network stations to the RADARSAT-1 network, well beyond the previous limit of 26 stations. In addition, the RSI Order Desk server was upgraded and successfully moved to CSA from RSI (Richmond, British Columbia) for improved performance, security, and maintainability. All four Order Desk servers are now located at CSA.

Moreover, in October 2000, the CSA became a signatory, along with ESA and the Centre National d'Études Spatiales (CNES) in France, to the International Charter on Space and Major Disasters. The emphasis of the Charter is on multi-satellite support for disaster response and mitigation efforts around the world utilising RADARSAT-1 and satellites of other Charter member agencies. Since its official launch, the Indian Space Research Organisation (ISRO) and the National Oceanic and Atmospheric Administration (NOAA) have also joined the Charter (September 2001) and participate fully in Charter operations. CONAE, or Argentina's Comisión Nacional de Actividades Espaciales, became the latest member when the Argentinean Foreign Minister signed the Charter on July 16, 2003, during a state visit of the President of Argentina to France. The operational integration of CONAE in the Charter has now been completed and CONAE has assumed its full responsibility under the Charter.

Japan's membership application has been accepted and Japan is expected to sign the Charter soon with operational integration to follow. So far, there have been 63 activations of the Charter on events such as: floods in France, Canada, Russia, Austria, Germany, Indonesia, Morocco, Argentina, Nepal, the Dominican Republic, the Philippines, Sudan, Haïti, Namibia, the Czech Republic, and Colombia; landslides in Slovenia, Italy, Nepal, Russia and the Philippines; earthquakes in El Salvador, India, Afghanistan, Turkey, Algeria and Iran; volcanic eruptions in Italy, Congo, Montserrat, Colombia and Spain; oil spills off the coasts of Ecuador, Lebanon, Denmark, Yemen and Spain; forest fires in France, Portugal, Canada and Bolivia; and, wind storms in India and Mexico. One of the recent Charter activations took place following devastating forest fires in British Columbia. RADARSAT-1 images and the CSA satellite operations team played a lead role, thus providing a great deal of international visibility for the Canadian Space Program.

The RADARSAT-1 system has been improved to provide a less than 2.5-hour turnaround (on average) in the electronic delivery of images to the Canadian Ice Service (CIS) for the production of ice charts and bulletins for the Canadian Coast Guard and other marine clients. The CIS continues to be one of the leading users of RADARSAT-1 data since the first operational data began to flow in February 1996. Recently, the CIS has been collaborating with Noetix Research, CSA, and RSI on an ESA-sponsored Global Monitoring for Environment and Security (GMES) Project - The Northern View - to provide regular RADARSAT-1 images in support of a Floe Edge Service for two communities in the Canadian Arctic.

The RADARSAT-1 Background Mission has archived one of the largest microwave remote sensing data collections in the world. In fact, it is the first multi-mode uniformly collected database of its kind ever created. The data archive is the result of several Background Mission global coverage campaigns undertaken in the past seven years. These include a complete coverage of the world’s continents, continental shelves and polar ice caps, as well as complete coverage of a large majority of Earth's entire landmass with two RADARSAT-1 imaging beams for the first ever beam-pair stereo data collection. This is the world's largest radargrammetric dataset currently available. Some of the continents, including North America, were covered more than once to generate seasonal snapshots. Several time- and site-specific coverage types have also been done, such as remote oceanic island localities and major cities and capitals. A seasonal coverage of the tropical deltas is also underway. High-resolution RADARSAT-1 image mosaics of Canada, the U.S., Australia and Africa were produced with Background Mission data. The four-season continuous coverage of the Arctic basin is underway, to continue until the end of satellite operations. This coverage supports growing interest in the Arctic and climate change.

RSI continues to provide Earth-Observation data, derived information products, and leading-edge services to global clients. The broad range of RSI products includes geo-corrected imagery, digital elevation models, and application-specific products such as flood and ocean oil-seep vectors to meet the demands for new markets. Products are delivered to clients via Internet in near-real time for time-critical operations such as disaster management and ship navigation. Other services include training, monitoring and emergency response services, and custom product generation, as well as Geographic Information Systems (GIS) project implementation.

Industrial Benefits

The Canadian Space Agency undertook a study to determine the achievements of RADARSAT data in support of ice mapping and related activities in Canada. To date, the Canadian Ice Services is the only Canadian Government operational user of RADARSAT-1 data. RADARSAT-1 provides observations over a wider geographical area, at much lower cost and risk, and in much less time than with an aircraft. As a result, CIS has been able to improve its operational efficiency. Over five years (1995 to 2000), the net average annual savings to CIS operations have been about $7.7 million per year ($38.5 million over 5 years), with the same per year benefits continuing up to and including the eighth year of operations for RADARSAT-1.

The Canadian Coast Guard (CCG), the largest direct customer of CIS products, has felt these benefits most significantly. The CCG Ice Operation Centres can provide improved routing information to commercial shipping, which allows for faster transit times. The shipping industry has benefited from the accuracy of RADARSAT information to produce ice charts. The shipping companies believe that as a result of RADARSAT-based ice charts, there have been savings in transit time through ice-infested waters. These commercial shipping savings are estimated to be $18 million a year. Other benefits included less damage to ships and a reduction in the need for CCG escorts. The CCG has estimated dollar savings in both operating costs and transit time to be between $3.6 million and $7 million a year, depending on the severity of ice conditions.

In the past, the prime contractor SPAR and its Canadian sub-contractors created over 2,000 person-years of high technology employment during the construction phase of RADARSAT-1. Ongoing mission operations employ 75 people at CSA headquarters in Longueuil (Quebec), 7 in Saskatoon (Saskatchewan), 15 at ground stations in Prince Albert (Saskatchewan) and Gatineau (Quebec), as well as more than 80 at RSI in Richmond (British Columbia). In the highly competitive marketplace for space-based information, RSI continues to capture roughly 15% of the world’s space borne remote sensing market. RSI has continued to process scenes and integrate RADARSAT data into information products for delivery to nearly 600 clients in 60 countries, and furthermore, RSI has signed up 80 international distributions, 18 RADARSAT-1 Network Stations and 11 Resources Centres. The market development for data archives is likely to be significant and an area in which new benefits may develop.

RADARSAT-2

Description

The next generation of Canadian SAR-based satellite, RADARSAT-2, will be the most advanced satellite of its kind in the world. RADARSAT-2 will continue to provide all-weather, day-and-night coverage of the entire globe to support fishing, shipping, oil and gas exploration, offshore drilling, mapping and ocean research. Equipped with a C-band radar system, it will be the first fully commercial SAR satellite to offer multi-polarization, an important aid in identifying a wide variety of surface features and targets. It will also have the capability to image both the right and left with a resolution down to three metres and to access an area of 800 kilometres on either side. This translates into a new range of products and services, which will contribute valuable new information on natural resources and the global environment.

The RADARSAT-2 Major Crown Project, in partnership with MacDonald, Dettwiler and Associates (MDA), is elaborating the design, development, testing, deployment and operations of a space-borne SAR satellite to provide global coverage of terrestrial phenomena as a follow-up to RADARSAT-1. Total project cost, including the launch, is estimated at $521 million, with the government contributing $430 million, and the balance of $91 million provided by MDA.

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

Leading and Participating Departments and Agencies

Sponsoring Agency:	Canadian Space Agency
Contracting Authority for the CSA/MDA Master Agreement:	Canadian Space Agency
Participating Departments:	Natural Resources Canada (Canada Centre for Remote Sensing) Environment Canada Industry Canada Fisheries and Oceans National Defence Foreign Affairs International Trade Agriculture Canada

Prime and Major Sub-Contractors

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

Major Milestones

The major milestones on Major Crown Projects, by phase, are the following:

Phase	Major Milestones	Date
A and B	Requirement Definition	June 1999
C	System Design	May 2002
D1	Sub-system Construction	September 2005
D2	Integration and Testing	January 2007
E1	Pre-launch Preparations	March 2007
E2	Launch System Commissioning	March 2007 June 2007
E3	Operations	2007 to 2014

Progress Report and Explanation of Variances

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

The CSA and MDA signed a Master Agreement in December 1998 for the RADARSAT-2 mission, under a firm price agreement in which the government contribution was $225 million, in exchange for data. MDA was to invest $80 million. The Master Agreement between the CSA and MDA was updated in January 2000 to reflect changes in the schedule and the latest cost estimates. The company (MDA) is responsible for spacecraft operations and business development, while the CSA is responsible for arranging the launch and maintaining the long-term national archive of RADARSAT-2 data. The CSA

will also provide an additional "in-kind" contribution of certain assets, plus the services of its David Florida Laboratory and the NRC Institute of Aerospace Research Laboratory for spacecraft integration and testing.

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

The development of the RADARSAT-2 satellite has progressed, though at a slower pace than planned. Delays encountered by the main contractor and sub-contractors in the production of some of the satellite components have resulted in a significant delay in the assembly, integration and testing of the spacecraft. The Extendible Support Structure (ESS), one of the primary spacecraft sub-systems, was delivered to the Assembly, Integration and Test (AI&T) site at the David Florida Laboratory (DFL) in October 2003. The Solar Arrays and the Bus were delivered to DFL in April and May 2004, respectively. The SAR antenna was delivered in September 2005. The assembly, integration and test of the RADARSAT-2 spacecraft at the David Florida Laboratory, along with the operations-preparations activities at CSA St-Hubert and launch campaign in Baikonur, Kazakhstan, will be completed in time for a launch on a Soyuz rocket in March 2007. The initial phase of the commissioning of RADARSAT-2 is expected to be completed by June 2007.

Any additional costs to complete the construction and launch of RADARSAT-2 will be at the main contractor's expense. However, these additional delays will require that the CSA RADARSAT-2 project office remain operational beyond the time for which funding is available for this purpose, at an additional cost of $1.8 million. This will increase the current estimated total expenditure from $414.6 million to $416.4 million. This risk has been previously indentified and the necessary funding to cover the additional cost has been set aside in the CSA Five Year Risk Assessment and Source of Funds Plan.

Industrial Benefits

Significant industrial benefits in the space and earth observation sector are expected from this next-generation satellite system. The RADARSAT-2 program will generate employment growth in the Canadian knowledge-based economy, mostly from export sales, and spur the growth of small- and medium-sized businesses as the Canadian infrastructure and services industry continues to grow.

A major objective of this project is the transition of the Earth Observation industry from the public sector to the private sector. The intention is to build on the SAR data and value-added markets established with RADARSAT-1 to strengthen the Canadian industry's position as a supplier of SAR-related technology, systems and value-added products and services. Specifically, manufacturing potential and competitiveness will be encouraged in Canadian industry in the areas of phased array antenna design/manufacture, high performance receiver/transmitter design and manufacture, and enhanced structure design. Moreover, opportunities will be created for the export of ground station systems. The new capabilities also make new applications possible, creating new and expanded markets for data sales and value-added products.

As of March 31, 2006, the Canadian Space Program has funded $377.8 million worth of work to Canadian industry directly attributable to the RADARSAT-2 Major Crown Project (MCP). Direct industrial benefits from the construction of the RADARSAT-2 system will benefit all regions of Canada. The regional distribution of direct industrial benefits is shown in the following table.

Regional Distribution of RADARSAT-2 Contracts
(as of 31 March 2006)

PROGRAM	British Columbia	Prairie Provinces	Ontario	Quebec	Atlantic	Total Canada
RADARSAT-2	52.1%	0.2%	5.2%	41.9%	0.6%	100%

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

Summary of Non-Recurring Expenditures ($ in millions)
(as of 31 March 2006)

RADARSAT-2	Current Estimated Total Expenditure	Forecast to March 31, 2006	Planned Spending 2006-2007	Future Years
	421.6	393.5	**16.8**	11.3

Table 4.2.16 Details on Transfer Payment Programs

Contribution to European Space Agency (ESA)	
Start date: January 1st, 2000	**End Date:** December 31, 2009
Description: Enhance Canadian industry's technological base and provide access to European markets for value added products and services principally in the field of Earth Observation (EO) and Satellite Communications; allow the participation of Canadian academia; and, make possible the demonstration of Canadian space technologies in European science and exploration missions.	
Strategic Outcomes: **Environment and Sustainable Development:** A Space Program that helps Canada understand and protect the environment, and develop its resources in a sustainable manner. **Knowledge, Innovation and Economy:** A Space Program that generates knowledge and pushes innovation, while leading (where appropriate) to increased productivity and economic growth through commercialisation. **Sovereignty and Security:** A Space Program that supports recognition of Canada's sovereignty and the security of its communities.	
Expected Results (Program Activity Level) Space Based Earth Observation: 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 and Security and Foreign Policy, supported by access capacity development. Satellite Communications: Increased access for Canadians to state-of-the-art space communications systems and services to meet their social and economic needs. Space Science and Exploration: Increased Canadian participation in international astronomy and space exploration opportunities in order to expand the scientific knowledge base made available to Canadian academia and R&D communities. **Expected Accomplishments:** Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under the following ESA EO programs: ENVISAT, EOEP/ EOPP, Earth Watch GMES, TerraSar, and Aurora.	

Successful development and demonstration of advanced technologies, systems, components, or studies provided for in the contracts awarded by ESA to Canadian firms under the following ESA Telecommunications programs: ARTES 1,3,5,9, Artemis and GalileoSat.

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

Demonstration of space-qualified technologies and products developed by Canadian firms for the space exploration markets.

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

Results Achieved:

Several technologies and skills have been developed and improved through the participation of Canadian companies in ESA programs. Some businesses have integrated these technologies into products, allowing them to sell these products in markets other than European ones. The economic spin-offs totalled $128.3 million, a return of 1.27 times the amount invested throughout the terms of the direct contracts for a period of 6 years. In addition to generating revenues, the development and improvement of space technologies also created or maintained specialized jobs; an average of 100 person-years throughout the terms of the direct contracts were generated. In addition, specialized skills were created in the areas of space Hardware, ground segment, and space technology applications.

Also the program served to boost the visibility of Canada in European markets. Canadian contractors see the ESA Contribution program as a means of cultivating business relationships.

The program also fosters regional development and access to other markets by virtue of the successes of companies in Europe. Furthermore, Canada expanded its knowledge and technology in fields such as weather and ice movement forecasting, Earth Observation data, satellite communications technologies, environmental monitoring and security.

($ millions)	Actual Spending 2003-2004	Actual Spending 2004-2005	Planned Spending 2005-2006	Total Authorities 2005-2006	Actual Spending 2005-2006	Variance between Planned vs. Actual
Space Based Earth Observation	12.3	15.4	11.2	17.1	17.1	(5.9)
Space Science and Exploration	3.7	3.9	3.1	3.7	3.7	(0.6)
Satellite Communications	13.3	10.7	9.2	9.1	9.1	0.1
Total Contributions	29.3	30.0	23.5	29.9	29.9	(6.4)
Total PA	**29.3**	**30.0**	**23.5**	**29.9**	**29.9**	**(6.4)**

Comment on Variances:

The additional contributions to ESA served to increase Canada's participation in the following programs: the ESA Earth Observation Envelope Program (EOEP) ($1.6 million) for the development of a Canadian instrument (the Electric Field Instrument) in support of ESA EOEP-funded mission – SWARM, the Global Monitoring for Environment and Security Program (GMES) ($4.4 million) for the scaling-up of Polar Environment Services, and the Preparatory Phase of the European Space Exploration Program, Aurora ($0.6 million).

These increases in existing optional programs are made in conformity with the objectives and terms & conditions of the 2000-2009 Canada/ESA Cooperation Agreement. Canadian industry (similarly for other Member States) is awarded contracts for the implementation of ESA optional programs in direct proportion to Canada's financial contributions to ESA.

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

Canada has a good reputation with the Europeans, as the 25 years of cooperation between ESA and Canada clearly demonstrate. Canadian companies have made a significant contribution to the many technologies developed in the areas of Earth Observation and Satellite Communications.

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

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

The economic spin-offs totalled $128.3 million and created an average of 100 person-years throughout the terms of the direct contracts for a period of 6 years. Small and medium-sized companies have difficulty taking part in ESA programs and require greater support, not only to access these markets, but also to develop expertise so that they can continue doing business in these markets after their initial participation in ESA programs.

To learn more about the Evaluation of the Canada/ESA Cooperation Agreement, go to:
http://www.space.gc.ca/asc/pdf/er-0405-0202.pdf

To learn more about the Audit of the Management Framework of the Canada/ESA Cooperation Agreement, go to:
http://www.space.gc.ca/asc/eng/resources/publications/ar-0405-0101.asp

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

CASSIOPE Mission	
Start date: November 1, 2003	**End Date**: October 31, 2008

Description:

Support the integration of two payloads, the CASCADE telecommunications Ka-band component and the enhanced Polar Outflow Probe (e-POP) scientific instrument, on a single generic Canadian small satellite bus.

Strategic Outcomes:

Knowledge, Innovation and Economy: A Space Program that generates knowledge and pushes innovation, while leading (where appropriate) to increased productivity and economic growth through commercialisation.

Sovereignty and Security: A Space Program that supports recognition of Canada's sovereignty and the security of its communities.

Expected Results (Program Activity Level):

1. Satellite Communications: Increased access for Canadians to state-of-the-art space communications systems and services to meet their social and economic needs.

2. Space Science and Explorations: Increased Canadian participation in international astronomy and space exploration opportunities in order to expand the scientific knowledge base made available to Canadian academia and R&D communities.

Expected Accomplishments:

Development and demonstration of the CASCADE Ka-band telecommunications payload designed and built by Canadian companies. CASCADE is the precursor of communication satellite constellations that will help position Canadian industry on the international market as a supplier of advanced components and as a service provider.

Development of a small Canadian scientific satellite, the enhanced Polar Outflow Probe (e-POP), which will probe the upper atmosphere and ionosphere region where solar variability influences global change in various time scales.

Development of a generic Canadian small satellite bus that could also be used for future Canadian missions.

Accomplishments Achieved:

Completed the detailed design of all the payload components, excluding the software.

Commenced manufacture and initiated planning and preparation for payload assembly, integration and test. Continued manufacture of instruments, data handling units and booms. Planned payload assembly and test and integration onto the spacecraft. Completed detailed design of the bus. Commenced manufacture and testing of major components.

($ millions)	**Actual Spending 2003-2004**	**Actual Spending 2004-2005**	**Planned Spending 2005-2006**	**Total Authorities 2005-2006**	**Actual Spending 2005-2006**	**Variance between Planned vs. Actual**
Space Science and Exploration	0.4	3.2	13.0	3.9	3.2	9.7
Satellite Communications	5.7	14.3	15.0	25.0	14.5	0.5
Total Contributions	6.1	17.5	28.0	28.9	17.7	10.2
Total PA	**6.1**	**17.5**	**28.0**	**28.9**	**17.7**	**10.2**

Comment on Variances:

CASSIOPE

The December 10, 2004 CSA / MDA Senior Management meeting, which immediately followed the Mission Preliminary Design Review concluded that due to slippages in completing phase B and unavoidable delays in negotiating contracts for Phase C additional time would be needed for Bristol to develop the first generic Canadian SmallSat Bus and for MDA and its subcontractors to deliver a space-quality Cascade telecommunications payload. The meeting directed that the program should be extended by 11 months, which effectively moved the launch date from January 2007 to December 2007. After detailed reviews of all the mission components, the schedule and milestones were modified to fit the new program baseline, and the cash flow projections were adjusted to accommodate the resources available and the re-synchronized timelines.

ePOP

The reprofiling for ePOP is necessitated by the delay of the CASSIOPE launch schedule, which is beyond the control of University of Calgary. The schedule extension will require University of Calgary to stretch out the instruments development, assembly and test to fit the revised CASSIOPE schedule and maintain the project development teams at the Universities and in industry for a longer period. The integration of ePOP with the Cassiope spacecraft is MDA's responsibility, and will be performed at the David Florida Lab in Ottawa. Synchronization of all program elements and activities, including the ePOP payload development, integration and test is critical for success.

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

NIL

Notes:

Due to rounding, figures may not add to totals shown.
This table details contribution programs with funding in excess of $5 million per annum.
Planned expenditures for the main component of Cassiope should have been attributed to Satellite Communications.