



CANADIAN SPACE AGENCY

**Performance Report
For the period ending
March 31, 2003**

**Allan Rock
Minister of Industry**

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SECTION: 1 Message

1.1 Minister's Portfolio Message

Continued investment in research and development, the ingenuity of Canadian researchers, academics and business people and a growing awareness of the importance of innovation in a successful economy have greatly contributed to Canada's increased recognition worldwide as a significant partner in the knowledge-based economy.

By eliminating the deficit, cutting personal and business taxes, making strategic investments and examining its regulatory processes, the Government of Canada has encouraged investment and innovation in Canadian business and has laid the groundwork for success in this competitive world economy.

Since the introduction of *Canada's Innovation Strategy* in February 2002, we have worked with businesses, institutions, associations and governments at all levels to develop a consensus about what must be accomplished if the Canadian economy is to continue to excel. A number of priorities were identified during the November 2002 National Summit on Innovation and Learning, including improving the regulatory environment for businesses in Canada, encouraging the creation and commercialization of knowledge through strategic partnerships and investments, and continuing the growth of our highly skilled work force.

Canadians, wherever we may live, have an opportunity to take part in a dynamic and exciting economy. Some of us are developing expertise in highly skilled specialties like genomics, biotechnology and fuel cell technology. Others are benefiting from expanded access to broadband Internet services and, by extension, the resources of universities, research institutes and virtual networks around the world.

Industry Portfolio:

- Atlantic Canada Opportunities Agency
- Business Development Bank of Canada*
- Canada Economic Development for Quebec Regions
- Canadian Space Agency
- Canadian Tourism Commission*
- Competition Tribunal
- Copyright Board Canada
- Enterprise Cape Breton Corporation*
- Industry Canada
- Infrastructure Canada
- National Research Council Canada
- Natural Sciences and Engineering Research Council of Canada
- Social Sciences and Humanities Research Council of Canada
- Standards Council of Canada*
- Statistics Canada
- Western Economic Diversification Canada

*Not required to submit a Performance Report.

The Industry Portfolio, consisting of 16 departments and agencies, plays an integral role in encouraging innovation. Its many programs at the community, regional and national levels push Canadians to explore opportunities, identify new products, start new businesses and develop successful markets here and abroad.

The Canadian Space Agency can proudly state that the overriding priorities outlined in its 2002-2003 Report on Plans and Priorities progressed significantly and that the Agency continued to play a strategic role for the Canadian space sector.

These and other initiatives championed by the Canadian Space Agency and our partners in the Industry Portfolio will help us create conditions favourable for innovation by Canadian individuals, firms and institutions. This will help secure Canada's strong economic position and attract investments that will provide wide-ranging economic and social benefits for Canadians.

I invite you to review the Canadian Space Agency *Performance Report* for more details on how the Agency encourages innovation and economic growth in Canada.

Allan Rock
Minister of Industry

SECTION: 2 Raison d'être

2.1 Vision and Mandate

Canada is a vast country bordered by three oceans. The unique vantage point of space allows us to monitor our expansive landmass territories and waters. Canada is endowed with rich natural resources. Space-based technologies and applications help us to manage them properly. Canada is sparsely populated with many remote communities. Satellite communications efficiently link citizens wherever they work and live. Canada has an educated population. The space sector offers opportunities and high-quality jobs contributing to a strong knowledge-based economy.

The vision of the CSA is to *expand and apply our knowledge of Space for the benefit of Canadians and all humanity, and in doing so, inspire through excellence*. It provides the framework for the mandate to promote the peaceful use and development of space to meet Canada's social and economic needs and to develop an internationally recognized and technically capable space industry. The CSA is achieving this mandate by implementing the Canadian Space Program (CSP) in co-operation with other government departments and agencies, industries, and universities, as well as international partners. In addition to delivering its own programs, the CSA is responsible for coordinating all federal and civil, space-related policies and programs pertaining to science and technology research, industrial development, and international co-operation. *To learn more about the mission and activities of the Canadian Space Agency, go to: <http://www.space.gc.ca/asc/eng/about.asp> and for more about the Canadian Space Program, go to: http://www.space.gc.ca/asc/pdf/national_paper.PDF*

2.2 Partners

International co-operation is critical to the implementation of the Canadian Space Program. Canada co-operates with a number of international partners and has ties to various space agencies. Although the United States (U.S.) National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) remain Canada's principal international partners, we are increasingly developing relationships with other foreign space organizations. *To learn more about Canada's international partners, go to: http://www.space.gc.ca/asc/eng/resources/links_other.asp*

The CSA works closely with several government departments and agencies, notably with the Canada Centre for Remote Sensing (CCRS) of Natural Resources Canada, and the Communications Research Centre (CRC) of Industry Canada, the National Research Council and the Department of National Defence. The CSA has close co-operation links with the Department of Foreign Affairs and International Trade, Industry Canada, Environment Canada, Fisheries and Oceans and others. The CSA also works very closely with the Canadian Space Industry and the academic sector in the planning and implementation of the Canadian Space Program. *To learn more about Canadian space-related organizations, go to: <http://www.space.gc.ca/asc/app/csd/search.asp?Item=Resultat>*

SECTION: 3 Strategic Context

3.1 International Space Sector Perspectives

Space is now recognised by most industrialised nations as an essential and strategic tool to meet their social, economic and political objectives. Accordingly, many governments throughout the world are now looking for increased consolidation, nurturing and protection of their space capabilities. Space activities are global in scope and this characteristic favours co-operation between nations seeking common goals. Canada must therefore possess a Space infrastructure not only to meet its specific national needs, but also to play a tangible and visible role in responding to the issues that interest the international community. Canada strives to maintain strong international partnerships even though the world-wide thrust towards increased integration in the space industry as well as the preservation of national autonomy, often supported by domestic procurement policies and restrictive export regulatory regimes, make it increasingly challenging.

This situation, along with the severe global downturn in the telecommunications sector, has already had a significant negative impact on the Canadian space industry, which has historically generated almost half of its revenues on foreign markets. Moreover, recent events such as the Space Shuttle Columbia and Ariane-5 incidents have generated uncertainties world-wide, resulting in delayed major ventures and added budget pressures on space agencies. The CSA has limited means to act upon the situation during this difficult period and analysis suggests decreased revenues and continued layoffs at least through 2003.

Nevertheless, several international opportunities remain and Canada is still regarded as a non-threatening and reliable partner possessing unique technical and scientific capabilities that can meaningfully contribute to the initiatives of foreign space agencies. In particular, emerging space faring countries in Asia and South America seem to offer high potential for future co-operation. These markets are foreseen to remain limited in the short-term, however, as they could be the subject of intense competition in the long-term, Canada should seek to establish a foothold in these emerging markets. It is therefore of paramount importance for the CSA to continue to work with its stakeholders to ensure that both our research community and industry remain active and competitive vis-à-vis world standards and markets.

3.2 National Space Sector Perspectives

Space is particularly well suited to support short and long-term Canadian objectives, including priorities outlined in the Speeches from the Throne on January 30, 2001 and September 30, 2002. From economically monitoring the status and evolution of the environment to providing advanced communication services in remote areas, or advancing knowledge in health research, CSA programs past and present play an ever-increasing role in the day-to-day lives of Canadians.

In order to deliver its mandate the CSA relies extensively on industry, which is seen as the most appropriate vehicle for developing, using and commercializing technologies required to meet Canadian needs, whether it be for the purposes of the research community or those of government departments and agencies. The state and viability of our indigenous space industry is a concern for the CSA. It is essential for Canada to have a space industry that can design, develop, produce and operate space hardware, as well as provide related products and services. In addition to being able to respond directly to the needs of Canadians and without constraint, this industrial capability should be of sufficient size and quality to make Canada an attractive partner for nations with which it wishes to co-operate in order to meet common objectives.

While trying to minimise the potential negative effects of the international environment briefly described in the previous section, the CSA nurtures the conditions required to grow the domestic market and expand the utilisation of space products and services in Canada. The CSA approach is centred on the advancement of knowledge through leading-edge science; the development of next generation technologies driven by Canadian needs; the early introduction and use of advanced technologies to provide Canadians with new or more effective products and services at an affordable cost, and the commercialization of these products and services by Canadian industry, particularly in foreign markets. *To learn more about the state of the Canadian Space Sector, go to: http://www.space.gc.ca/asc/eng/resources/publications/state_css.asp*

3.3 Government's Priorities

The Speeches from the Throne on January 30, 2001 and September 30, 2002 outlining the government's priorities provided important guidance to the CSA in undertaking its strategic planning. First and foremost, in pursuit of the goal to be recognised as one of the most innovative countries in the world, the Canadian government expressed intentions to strengthen the research capacity of universities and government institutions and increase Canada's ability to commercialise research discoveries.

The CSA carried out consultations with Government of Canada organizations to identify where and how space technologies could be used to enhance the delivery of their mandates and provide new or more efficient services to Canadians. The 19 departments and agencies that participated in this first ever-comprehensive investigation to define the potential of space technology identified 46 specific space capability requirements¹. Collectively these requirements represent a substantial opportunity for space technology to contribute significantly to the effective and efficient delivery of government programs and services in the fields of communications, environment and sustainable development, security, intelligence and emergency preparedness, industry development and space science. However, most of the proposals are at the concept stage and require further technical and programmatic development. Nevertheless, the consultation sparked the interest of departments for space and has evolved into a continuing process.

¹ CANADIAN SPACE AGENCY; *A Study of the Canadian Space Agency's Support to Canadian Government Departments and Agencies* Final Report October 2002

3.4 Business Management

In September 2001, the CSA confirmed its participation in the government-wide initiative of Modern Comptrollership, through which it has committed to modernise its management practices. As part of the implementation of this initiative, the CSA conducted an agency-wide evaluation to assess its current management practices against the Modern Comptrollership model. The CSA Management Modernization Action Plan (MMAP) was approved by the President in September 2002.

Over the course of Spring and Summer 2002, the Office of the Auditor General conducted its first audit of the CSA. The objectives of the audit were to assess the CSA's capacity to deliver the Canadian Space Program with due regard to economy, efficiency, and effectiveness; to provide the government and Parliament with an assessment of the Agency's response to its new funding environment; and, to identify opportunities for improvement in the early stages of designing and implementing policies and procedures.

The Auditor General's final report, tabled in December 2002, concluded that the CSA needs to develop a new strategic plan that can help it align CSP activities with its annual funding level. Furthermore, the report noted that the CSA needed to inform the government of gaps in its ability to fully meet the Program's objectives. Early in 2003, the CSA started the process of developing a Strategy for the Canadian Space Agency with targeted results to be implemented in 2004-2005.

The Auditor General's report made other recommendations aimed at improving the management of the CSA over a range of issues:

- Implementation of the remaining components of the Canadian Space Program Management Framework;
- Consultation with stakeholders in its formulation of long-term strategies;
- Balance between capacity and financial obligation;
- Refinement of its Project Approval and Management Framework;
- Improvement of its performance measurement process and reporting; and,
- Development of a strategic human resources plan.

In response to the recommendations and concurrent with a series of actions undertaken as part of the Agency's Management Modernization Action Plan (MMAP), the CSA has gradually introduced improved management practices with full implementation expected by April 2004. The CSA Audit, Evaluation and Review Directorate produced the first progress report against the MMAP in December 2002. A second report is expected in December 2003.

To learn more about the CSA Management Modernization Action Plan, go to: <http://www.space.gc.ca/asc/eng/about/comptrollership.asp> and for more about the CSA's progress report, go to: <http://www.space.gc.ca/asc/eng/resources/publications/comptrollership.asp>
To learn more about the Office of the Auditor General Audit Report, go to: <http://www.oag-bvg.gc.ca/domino/reports.nsf/html/20021207ce.html>

SECTION: 4 Performance

4.1 Overview of Main Accomplishments by Strategic Outcome

Investments by the Government of Canada in space, provided Canadians with significant economic social and environmental benefits, through the following major accomplishments in 2002-2003:

Strategic Outcomes	Main Accomplishments
Economic Benefits	Integration of a Ka-Band payload on Anik-F2 satellite. Operation of RADARSAT-1 beyond its design lifetime. Canada's final contribution to the assembly of the International Space Station (ISS).
Technological Development and Diffusion	Successful flight demonstration of Canadian space technologies.
Understanding of the Environment and Contribution to Sustainable Development	Successful testing of SCISAT-1, the first Canadian-built scientific satellite since 1962.
World-Class Space Research	The micro-satellite MOST, Canada's first space telescope ready to be launched.
Contribution to the Quality of Life	Canadian scientific experiments carried out aboard the Space Shuttle and the ISS.
Social and Educational Benefits	Development and diffusion of youth oriented information and teaching material.
Promotion and Awareness of the Canadian Space Program	Increased profile of Canadian space activities.

The following section presents the CSA's performance for each of the Strategic Outcomes. The CSA is currently in the process of developing a Strategy for the Canadian Space Agency with targeted results to be implemented in 2004-2005, along with a possible revision to its Planning, Reporting and Accountability Structure (PRAS). At the same time, the CSA will develop and refine its results-based performance measurement regime in order to improve its capability to report on Strategic Outcomes.

4.2 The CSA's Strategic Outcomes

Strategic Outcome

✧ Economic Benefits

The CSA's Strategic Outcome *Economic Benefits* has the following three objectives:

- Develop space technologies and terrestrial applications to maintain Canada's world leadership in its traditional sectors (e.g., satellite communications, radar technology for Earth observation, and space robotics);
- Leverage federal funding and transfer expertise to the private sector through partnerships with industry to facilitate the development of commercial applications of space technologies; and,
- Encourage the participation of a growing number of firms in space-related activities, particularly small-and-medium-sized enterprises (SMEs), thereby, pursuing sustainable industrial regional development.

In pursuing these objectives, the CSA attempts to achieve enduring benefits to Canadians in the field of Economic Opportunities and Innovation. In 2002-2003, \$201.8 million (61% Total Actual Spending) was invested in the sectors of **Satellite Communications, Earth Observation, and the Canadian Space Station Program** to contribute to the generation of *Economic Benefits*.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time.

The CSA is working with a growing number of firms, especially SMEs, in space-related activities. By leveraging resources from international partnerships, the CSA and Canadian industry have expanded opportunities to develop or maintain expertise in core areas, to access new markets and to position themselves for follow on activities, leading to economic returns.

Overall Planned Results**★ Satellite Communications**

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for Satellite Communications were:

- 1) Position Canadian industry as a credible supplier of advanced components for the next generation of satellite communications systems on the international market, and as a service provider to all parts of Canada.
- 2) By participating in European Space Agency (ESA) programs, allow Canadian industry to access forward-looking studies on new telecommunications services; develop new technologies, equipment and applications in multi-media, optical inter-satellite and mobile communications, and demonstrate satellite-based communications services.
- 3) Select new programs for 2004-2005 in priority areas such as small, single-purpose communications satellites, ground segment technologies and user applications, and strategic sub-systems required by European satellite builders and international operators.

Program, Resources and Accomplishments**★ Satellite Communications**

The following programs, with expenditures of \$35.1 million in 2002-2003, supported the implementation of Planned Results in Satellite Communications:

The **Payload Flight Demonstration Program**, a private/public sector partnership will develop a Ka-Band payload demonstrating the capability of a broadband multi-media service throughout North America on Anik-F2 satellite. (Spending: \$22.5 million)

The **Canada/ESA Satellite Communications** programs will enhance the industry's technological base and provide access to European markets in advanced telecommunication areas. (Spending: \$12.6 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP is explained in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for Satellite Communications programs in 2002-2003 were the following:

- **As a contribution to Planned Result # 1:** All payload components for the Payload Flight Demonstration Program were successfully built by Canadian suppliers and are being integrated into the Anik-F2 satellite bus. The new launch date is scheduled for June 2004. *To learn more about the use of Ka-Band services on Anik-F2, go to: http://www.space.gc.ca/asc/eng/csa_sectors/satellite/future.asp*

- **As a contribution to Planned Result # 2:** Leading Canadian companies received ESA contracts for: the development of a return link satellite system and a low cost broadband terminal (EMS Technologies), filters and demultiplexers (COMDEV), satellite navigation receivers (NOVATEL), and for the development of a real-time emergency management satellite system for disaster recovery (REMSAT, a consortium of companies lead by TELESAT). Also Canada confirmed its participation in new phases of the ESA Advanced Research in Telecommunications Systems. (ARTES) program. *To learn more about Canada's participation in ESA telecommunications programs, go to:*
http://www.space.gc.ca/asc/eng/csa_sectors/technology/development/industry/programs/esa/description.asp
- **As a contribution to Planned Result # 3:** In early 2003, Canadian industry made proposals to the CSA to implement a series of initiatives aimed at maintaining industry core capabilities. The CSA recognised the need to support such initiatives and indicated that the selection of programs would be done through a priority review in early in 2003-2004.

To learn more about Satellite Communications, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/satellite/satellite.asp

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for Earth Observation were:

- 1) The continuation of RADARSAT-1 operations with the same level of high performance beyond its original design lifetime until RADARSAT-2 is launched and commissioned.
- 2) The completion of RADARSAT-2 development within budget and on schedule to ensure continuity of radar data supply in the worldwide remote sensing market.
- 3) The upgrade of Canada's ground systems to receive and process data from ENVISAT, RADARSAT-2 and other new sensors of strategic interest to Canada.
- 4) The continuation of satellite data application development and technology transfer programs to support the growth of Canada's value-added industry and the use of data, produced by RADARSAT and other satellites.
- 5) The development of advanced remote sensing technologies and applications by Canadian companies participating in ESA programs.

The following programs, with expenditures of \$87.3 million in 2002-2003, supported the implementation of Planned Results in Earth Observation:

RADARSAT-1 is an advanced Earth Observation satellite system developed by Canada to monitor environmental change and to support resource sustainability. Operations are due to continue until the full commissioning of its successor. (Spending: \$12.8 million)

RADARSAT-2 Development incorporates advanced technologies such as higher resolution and polar metric modes, to ensure continuity in radar data supply, maintain Canadian leadership in this technology, and open up new international remote sensing markets for the value-added industry. (Spending: \$51.1 million)

Earth Observation Support programs aim to enhance Canada's ground receiving and data processing systems, to develop value-added commercial applications based on data from RADARSAT and other satellites through contracts to industry, and to develop advanced imager technologies for the next generation of EO missions. (Spending: \$9.3 million)

Canada/ESA Earth Observation programs enhance the industry's technological base and provide access to European markets for value-added products and services derived from satellite-based EO data in areas such as radar technologies, hyper and multispectral application development, sensor instrument calibration facility, and sensor data algorithm development. (Spending: \$14.1 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP is explained in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for Earth Observation programs in 2002-2003 were the following:

As a contribution to Planned Result # 1: Due to delays in the construction and the launch of its successor RADARSAT-2, the satellite RADARSAT-1 was in its eighth year of operation and three years beyond its design lifetime. RADARSAT-1 continued to operate with the same level of high performance for reliability and image production to ensure data supply to clients. RADARSAT-1 remained operational within current available funding. The additional costs associated with extending the operations of RADARSAT-1 in 2004-2005 will be determined in Fall of 2003. *To learn more about RADARSAT-1, go to:* http://www.space.gc.ca/asc/eng/csa_sectors/earth/radarsat1/radarsat1.asp

As a contribution to Planned Result # 2: The development of the RADARSAT-2 satellite has progressed, albeit at a slower pace than planned. Delays encountered by the main contractor and subcontractors in the production of some of the satellite components have resulted in a significant delay in the assembly, integration and testing of the spacecraft. Launch is rescheduled for 2005. 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. These additional costs will be at the CSA's expense and will be precisely determined in Fall 2003. *To learn more about RADARSAT-2, go to:* http://www.space.gc.ca/asc/eng/csa_sectors/earth/radarsat2/radarsat2.asp

To learn more about RADARSAT-1 and RADARSAT-2 Major Crown Projects, go to: http://www.space.gc.ca/asc/eng/resources/publications/report_mcp.asp

As a contribution to Planned Result # 3: The upgrades to Canada's ground systems to receive and process ESA ENVISAT data have been completed. ENVISAT data are now received and processed on a regular basis and may be used as a complement to or contingency for RADARSAT-1 data. The upgrades to receive RADARSAT-2 data have progressed and will be completed by the end of 2003-2004.

As a contribution to Planned Result # 4: Twelve contracts valued at \$3.0 million were awarded to industry for the development of innovative applications for EO data. One of the recipient companies was invited to make a presentation to the UN's Food Aid Organization on the use of remote sensing for food sustainability. *To learn more about contracts awarded for innovative applications of EO data, go to:*
http://www.space.gc.ca/asc/eng/media/press_room/news_releases/2003/030612.asp

As a contribution to Planned Result # 5: Leading Canadian companies received ESA contracts for the development of L-band Synthetic Aperture Radar (SAR) phased array antennas as part of the Earth Watch TerraSar program, as well as for the development of user-oriented applications for the exploitation of satellite imagery by many Canadian companies through participation in the Global Monitoring for Environment and Security (GMES) and Market Development programs. Feasibility studies were also completed to determine Canada's potential participation in two new international imager technology missions (e.g. HYDROS and Hyperspectral).

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for the Canadian Space Station Program (CSSP) were:

- 1) The completion of the development and successful on-orbit commissioning of one more component of the Mobile Servicing System (MSS).
- 2) Ongoing fulfilment of responsibilities for MSS Operations.
- 3) The implementation of scientific programs and space technologies to utilise Canada's share of ISS facilities.

The following programs, with expenditures of \$79.2 million in 2002-2003, supported the implementation of Planned Results related to the Canadian Space Station Program:

The **Development of the Mobile Servicing System (MSS)** is Canada's contribution to the International Space Station (ISS). The MSS includes three components: Canadarm2, or the Space Station Remote Manipulator System (SSRMS), which is mounted on a Mobile Base System (MBS) designed to handle large loads onboard the Station, and Dextre, the Special Purpose Dexterous Manipulator, a second specialised robot designed to perform more delicate tasks. (Spending: \$15.5 million)

The **MSS Operations Program** allows Canada to maintain operational capabilities, as well as provide MSS training and real-time support to robotics operations for the flight and stage portion of every mission to the ISS over the next 15 years. (Spending: \$62.7 million)

The **ISS Utilization and Commercialization Program** markets use of Canada's allocation of 2.3% of the non-Russian ISS research facilities. (Spending: \$0.9 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP is explained in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for the Canadian Space Station Program in 2002-2003 were the following:

As a contribution to Planned Result # 1: The Mobile Base System was launched on June 5, 2002, and on-orbit checkout was successfully completed in July 2002. The development of Dextre, the Special Purpose Dexterous Manipulator, was completed in November 2002. The launch date is under review due to the interruption of shuttle flights.

As a contribution to Planned Result # 2: Effective teams of sustaining engineers and private contractors, together with specialised engineering facilities, have been put in place to support on-orbit operations of Canadarm2 and the Mobile Base System. Training was also provided at CSA headquarters for 49 cosmonauts/astronauts, mission controllers and other ground support personnel from Russia, the USA and Canada to enable them to meet all MSS operations mission requirements and simulations. The CSA's Mobile Servicing System Operations Complex provided real-time support to five Space Station assembly missions to NASA's full satisfaction.

As a contribution to Planned Result # 3: Canadian scientific experiments conducted aboard the ISS include the successful operation of the H-Reflex human physiology experiment and the EVARM radiation monitoring experiment. Canadian scientists have played a leadership role in 10% of the scientific research conducted on the ISS to date which is far more than Canada's long-term allocation of 2.3% of the non-Russian ISS research facilities. The challenge will be to ensure that Canadian-lead scientific experiments are ready for consideration once opportunities become available when Shuttle flights resume.

A comprehensive strategy was developed to promote the commercial use of Canada's share of ISS facilities and resources, and has led to the drafting of several Memoranda of Understanding (MOU) for ISS utilization on a cost recovery basis.

Impact of the Space Shuttle Columbia Incident

On February 1, 2003, the Space Shuttle Columbia broke apart during re-entry into the Earth's atmosphere with the loss of its seven crewmembers. The U.S. is conducting an on-going detailed investigation of the incident. The Canadian Space Agency (CSA) and the other international partners (Russia, ESA and Japan) of the International Space Station (ISS) are working with NASA to develop alternate plans for impacted activities. The Shuttle's return to flight date is uncertain but will occur no earlier than March 2004. While the Shuttle fleet is grounded, continued access to the ISS will be available through Russian Soyuz and Progress spacecraft.

The CSA and the Canadian scientific community lost two scientific payloads in the Columbia incident: a life science experiment on osteoporosis and a protein crystallization experiment. These research projects are valued at \$4.5 million. It is not decided yet whether they will be repeated in the future.

Several areas of the Canadian Space Program are affected by the interruption of shuttle flights: the Canadian Astronaut Program, the Life and Microgravity Sciences Programs and Canada's participation in the ISS. Together they represent about 20% of the budget of the Canadian Space Program. It is too early to assess the full impact and the future cost implications of the Shuttle tragedy. The CSA and other international partners must consider different scenarios based on the fact that shuttle flights are interrupted until at least March 2004.

To learn more about the Canadian Space Station Program, go to: http://www.space.gc.ca/asc/eng/csa_sectors/human_pre/iss/canada.asp

Closure of the Canadian Space Station Program Major Crown Project

As a result of the completion of Dextre, the Special Purpose Dexterous Manipulator, the closure activities of the Canadian Space Station Program Major Crown Project have started and will be completed during Summer 2003. The report on the evaluation of the Major Crown Project was recently issued with the following conclusions:

- The CSA has earned recognition for its technology capabilities and immense credibility from its partners in the ISS Program. Compared with other partners, it has accomplished a great deal with a substantially smaller budget.
- The Agency has maintained its leadership in space robotics and helped Canadian companies involved in the Major Crown Project to develop and adapt technologies to other markets.
- The Major Crown Project generated an estimated \$2.7 billion in economic benefits and created 45,282 person-years of employment from 1991 to 2000. This far exceeded initial estimates, which forecast the generation of \$1.9 billion in economic benefits and the creation of 35,200 person-years of employment for the 14-year period between 1986 and 2000.
- The Agency embarked on this Program with the principal aim of being able to use the International Space Station for scientific research in a microgravity environment. The User Development Program and its successor, the Microgravity Sciences Program, have supported the establishment of a scientific community to use the ISS. Regardless of delays, the CSA still expects that Canadian science experiments will be conducted, which could lead to long-term benefits for the health of Canadians. In addition, 50% of the CSA ISS non-Russian facilities and resources are available to industry. The Agency is taking part in the collective efforts of partners to commercialise the use of the ISS. So far, Canadian companies have been unable to conduct scientific experiments on the ISS because of the cost of preparing and launching useful payloads.

To learn more about the Canadian Space Station Program Major Crown Project (MCP), go to: http://www.space.gc.ca/asc/eng/resources/publications/report_mcp.asp, and about the MCP evaluation report, go to: http://www.space.gc.ca/asc/eng/resources/publications/report_mcp-2003.asp

Strategic Outcome

✧ Technological Development and Diffusion

The CSA's Strategic Outcome *Technological Development and Diffusion* has the following three objectives:

- Strengthen the technological base of Canadian space firms;
- Position Canadian space firms to seize international space mission opportunities; and,
- Maintain a focus on the technologies needed to deliver existing and future Canadian space projects.

The CSA attempts to achieve enduring benefits for Canadians in the field of Economic Opportunities and Innovation. In 2002-2003, \$26.5 million (8% Total Actual Spending) was invested in *Technological Development and Diffusion*.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular, the CSA is working with:

- Firms in space-related activities, particularly small-and medium-sized enterprises;
- Universities and specialised research institutes; and,
- Government of Canada departments and agencies.

In addition, the CSA has prioritised partnerships with foreign space agencies and firms to acquire expertise, to demonstrate Canadian technologies as space-qualified products and services, and to improve access to international markets.

Overall Planned Results

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for *Technological Development and Diffusion* were:

- 1) The enhancement of the Canadian space industry's competitiveness through the awarding of Research and Development (R&D) projects to companies following an annual Request for Proposal process.
- 2) The development of advanced concepts for future space missions, innovative applications from space technologies, as well as involvement in large space infrastructure projects by Canadian companies.

3) The maintenance of in-house technical capabilities by conducting internal R&D projects in support of the implementation of the Canadian Space Program.

4) The transfer and commercialisation of space technologies and their applications to other industrial sectors, primarily with Canadian companies.

Program, Resources and Accomplishments

The following programs, with expenditures of \$26.5 million in 2002-2003, supported the implementation of Planned Results in *Technological Development and Diffusion*:

Through a competitive contracting-out process, the **Space Technology Development Program**, co-funds with industry, the development of high-risk technologies required for future space missions and offering a high international market potential. (Spending: \$12.2 million)

The **Technology Demonstration Program** is designed to provide flight opportunities to space qualify technologies developed by industry. (Spending: \$0.7 million)

The **Commercialization Office** supports the transfer of proven space technologies to the market place and their application in non-space products and services. (Spending: \$0.3 million)

In-house Research and Development programs maintain a base of expertise within the Agency focussing on high-risk and innovative technology development activities to support the implementation of the Canadian Space Program, the acquisition of knowledge of worldwide technology trends, and the exploration, along with industry, of potential emerging technologies. (Spending: \$13.3 million)

There is no significant variance reported against Planned Spending set in the 2002-2003 RPP, as indicated in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *Technological Development and Diffusion* in 2002-2003 were the following:

As a contribution to Planned Result # 1: A total of 36 contracts were awarded to develop innovative technologies in areas of priority to the CSA and industry for a total sum of \$11 million. Some of these contracts represent up to 35% of total project costs based on the level of maturity of technologies.

As a contribution to Planned Result # 2: The Operational Space Medicine's research prototype for a System to Maintain and Monitor Performance (SMP) of MSS Robotics Operators was successfully launched on February 2 2003 on a Russian Progress vehicle and is currently being tested by ISS crewmembers. The system's success was due in large part to a CSA-developed software called SYMOFROS and an innovative smart electronic card developed by Xiphos with funding from the Space Technology Development Program.

Flight opportunities were provided for Caltrac systems, which are used aboard satellites to maintain positioning and pointing accuracy. These Caltrac systems have now been in continuous operation for over a year without failure (two on JPL/CNES Jason and two on the JPL Genesis spacecraft).

As a contribution to Planned Result # 3: Scientific and engineering expertise was acquired in order to maintain in-house technical capabilities in the fields of: advanced robotics and automation, space optics, ground systems and software development, radar and hyperspectral sensors, advanced materials, and thermal propagation.

The Virtual Spacecraft Integrated Operations Network (VISION) successfully demonstrated an advanced modular end-to-end simulation environment supporting the development of innovative satellite technologies, the design of space mission software and hardware, and operations during launch and operations phase. Developed in-house, this tool has already supported a number of space technologies projects.

Over 100 papers and formal presentations were published at various conferences around the world, and one patent application was submitted. The *Inventor and Innovator Awards Program* was inaugurated to officially recognise and reward CSA researchers.

As a contribution to Planned Result # 4: Completion of the Harsh Environments Initiative, a three-phase program, which aims to increase the use of space technologies for operations in hostile marine, mining and industrial environments.

The management of more than 100 active patents and licensing files, resulting from government R&D investments and several business opportunity/benefit studies, has supported the promotion and transfer of space technology. The CSA approved a new Intellectual Property Management policy and provided related information and training to its employees.

To learn more about Technology Development and Diffusion, go to:

http://www.space.gc.ca/asc/eng/csa_sectors/technology/technology.asp

Strategic Outcome

✧ Understanding of the Environment and Contribution to Sustainable Development

The CSA's Strategic Outcome *Understanding of the Environment and Contribution to Sustainable Development* has the following three objectives:

- Better understand the dynamics of the atmosphere;
- Monitor atmospheric pollution; and,
- Enhance the prediction capabilities of global climate change.

In pursuing these objectives, the CSA attempts to achieve enduring benefits to Canadians in the field of Environment. In 2002-2003, \$30.9 million (10% Total Actual Spending) was invested to contribute to the generation of environmental benefits nationally and internationally.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular, the CSA is working with:

- Government of Canada departments and agencies;
- Universities and specialised research institutes; and,
- Firms in space-related activities, particularly small- and medium-sized enterprises.

In addition, the CSA has collaborated with foreign space agencies on projects addressing global atmospheric pollution and climate change issues.

Overall Planned Results

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for *Understanding of the Environment and Contribution to Sustainable Development* were:

- 1) The enhancement of Canada's leadership in studies on stratospheric ozone with the construction and operation of SCISAT-1, an all-Canadian scientific satellite.
- 2) The participation of Canadian scientists in the study on global climate processes with the delivery of key radar components for NASA's CLOUDSAT mission.

- 3) A better understanding of global atmospheric circulation with the development, in collaboration with ESA, of an instrument called SWIFT (Stratospheric Wind Interferometer for Transport).
- 4) The study of stratospheric composition and ozone depletion processes at mid-latitudes, with the launch of Middle Atmosphere Nitrogen Trend Assessment (MANTRA) high-altitude balloon experiments, with the implementation of OSIRIS (Optical Spectrograph and Infra Red Imager System) onboard Sweden's Odin satellite, and with the launch and operation of SCISAT-1.
- 5) The advancement of knowledge on upper atmosphere and ionosphere phenomena with the development of a small scientific satellite.
- 6) An improved ability to forecast space weather with enhanced models of the near-Earth environment.
- 7) The fulfilment of Government of Canada department/agency mandates, with respect to natural resource and disaster management, by using space-borne imagery from RADARSAT and other Canadian Earth Observation sensors in their routine operations.

Program, Resources and Accomplishments

The following programs, with investments of \$30.9 million in 2002-2003, supported the implementation of Planned Results for *Understanding of the Environment and Contribution to Sustainable Development*:

The **Atmospheric Environment** programs study the dynamics of the atmosphere, the ozone layer, greenhouse gases, and other global climate change phenomena. (Spending: \$23.2 million)

The **Space Environment** programs develop small payload missions for in-studies of space plasma and Earth's electromagnetic field. (Spending: \$3.6 million)

The **Government Department-Related Initiatives Program** aims to develop and demonstrate the application of space-borne technologies in ongoing activities related to natural resources, disaster management, and environmental protection. (Spending: \$4.2 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP is explained in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *Understanding of the Environment and Contribution to Sustainable Development* in 2002-2003 were the following:

As a contribution to Planned Result # 1: SCISAT's payload and spacecraft integration and testing was completed for launch in Summer 2003. The scientific data will help researchers better monitor and understand the decline of stratospheric ozone at northern mid-latitudes and in the Arctic. *To learn more about SCISAT, go to:*

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/atmospheric/scisat/scisat.asp

As a contribution to Planned Result # 2: Canadian companies successfully developed components for the Cloud Profiling Radar. NASA's CLOUDSAT mission will provide the breakthrough information needed to improve climate and numerical weather prediction models.

As a contribution to Planned Result # 3 and 4: The feasibility study on the Canadian contribution to SWIFT was completed. This mission will measure wind velocities and ozone concentrations in the stratosphere.

As a contribution to Planned Result # 5: A feasibility study on the development of six instruments for the Canadian-led micro-satellite E-POP (Enhanced Polar Outflow Probe) was completed by the University of Calgary. This mission will study polar ion outflow and plasma instability over the Earth's polar cap.

As a contribution to Planned Result # 6: The development of the space weather forecast facility, in collaboration with Natural Resources Canada and the University of Alberta, is progressing as planned. This will improve our understanding of auroras, magnetosphere, and particle processes driving space weather.

As a contribution to Planned Result # 7: Major ongoing Earth Observation application projects continued with the participation of the Canadian Forest Service (national forest cover mapping), the Meteorological Service of Canada (cryosphere and its response to climate change), the Canada Centre for Remote Sensing (climate change and ecosystem impact) and Fisheries and Oceans Canada (offshore, inshore and coastal marine environments). RADARSAT International (RSI) concluded an agreement with the Yukon, Nunavut, and the Northwest Territories to provide RADARSAT-1 data for Canada North Mapping projects.

In addition, broad consultations were conducted with other Government of Canada departments with the view of defining specific projects for the use of spaceborne imagery within their priority areas. As a result, new developments covering a broad range of application domains (e.g., imaging of environmental changes in western arctic coastal communities and inland waters; Landsat and RADARSAT synergy for mapping northern boreal/sub-arctic wetlands and forest biomass) were initiated with several government departments that had had no previous participation in the Canadian Space Program.

To learn more about Understanding of the Environment and Contribution to Sustainable Development, go to:

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/atmospheric/atmospheric.asp

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/space_environment/space_environment.asp

Strategic Outcome

✧ World-Class Space Research

The CSA's Strategic Outcome *World-Class Space Research* has the following objective:

- Enhance Canada's tradition of excellence and our capacity and capability to co-operate with international partners in the worldwide exploration of space.

In pursuing this objective, the CSA attempts to achieve enduring benefits to Canadians in the field of Economic Opportunities and Innovation. In 2002-2003, investments of \$20.6 million (6% Total Actual Spending) contributed to building *World-Class Space Research*.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular the CSA is working with:

- Universities and specialised research institutes;
- Government of Canada departments and agencies; and,
- Firms in space-related activities, particularly small-and medium-sized enterprises.

Since the very beginning of the Canadian Space Program, Canada's space science programs have been founded on international co-operation. This has provided the scientific community and industry with exciting opportunities to contribute to the global knowledge base and enhance Canada's technological base with the development of unique scientific instruments.

Overall Planned Results

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for *World-Class Space Research* were:

- 1) A better understanding of the universe and the basic physical and chemical make-up of our solar system through the participation of our scientific community in astronomy and space exploration.
- 2) The provision of world-class environmental space qualification services for the assembly, integration and testing of spacecraft systems and sub-systems supporting both the Canadian space industry and the objectives of the Canadian Space Program.

Program, Resources and Accomplishments

The following programs, with investments of \$20.6 million in 2002-2003, supported the implementation of Planned Results for *World-Class Space Research*:

The **Astronomy and Space Exploration** programs enable our scientific community to contribute to international efforts aimed at understanding the universe and predicting its evolution. (Spending: \$13.5 million)

The **David Florida Laboratory** (DFL), is a world-class facility providing environmental testing and assembly facilities for space hardware, and contributes to the recognition of Canada's leadership in space research. The CSA operates DFL facilities for domestic and foreign clients on a fee-for-service basis. (Spending: \$7.1 million)

There is no significant variance reported against Planned Spending set in the 2002-2003 RPP, as indicated in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *World-Class Space Research* in 2002-2003 were the following :

As a contribution to Planned Result # 1: Elements of BLAST (Balloon-borne Large Aperture Sub-millimetre Telescope) were ready for launch as planned. However, launch was delayed due to external factors. BLAST is a multi-national research collaboration, which provides the opportunity to conduct unique galactic and extra-galactic surveys.

The micro-satellite MOST (Microvariability and Oscillations of Stars) was ready for launch as planned. After experiencing delays due to external factors, MOST, Canada's first space telescope and first science satellite since 1971, was ready to be launched in June 2003. MOST is designed to probe the interior of stars, set a limit on the age of the Universe, and for the first time, detect light reflected by little known planets beyond our Solar System.

Canada's participation to the Herschel/Planck mission to be launched in 2007 by ESA, progressed with the implementation of initial contracts for the development of essential components of two of the scientific instruments: SPIRE (Spectral and Photometric Imaging Receiver) and HIFI (Heterodyne Instrument for the Far-Infrared) will both contribute to enhancing our understanding of galaxy and star formation.

The CSA provided mission operations support to its first interplanetary mission with Japan's satellite Nozomi. The Thermal Plasma Analyser, designed to measure the lowest energy particles and gases in the Martian atmosphere, is expected to reach Mars in January 2004.

Science teams led and funded by the CSA are participating with international science teams in a NASA competition for low-cost missions to Mars (Scout Missions). Canada is favourably placed in terms of innovative technologies to win an opportunity to participate.

To learn more about Astronomy and Space Exploration go to:

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/astronomy/astronomy.asp

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/space_exploration/space_exploration.asp

As a contribution to Planned Result # 2: The David Florida Laboratory achieved a 55% loading rate in 2002-2003 (excluding maintenance and test set-up time) in support of 37 different clients and 58 separate programs. A total of 90 test reports were generated. Client satisfaction surveys indicated a 99% approval rating with DFL services. During the course of the fiscal year, major programs supported included SCISAT-1, MOST, CLOUDSAT, Anik-F2, INMARSAT VI, Space Vision System, and OPTUS C-1. Total revenues amounted to \$1,248,464 with \$940,000 being returned to the Consolidated Revenue Fund. Positive steps were made on the transition to the new ISO 9001:2000 standard from ISO 9002.

To learn more about the David Florida Laboratory, Canada's premier space qualification facility, go to: http://www.space.gc.ca/asc/eng/csa_sectors/dfl/dfl.asp

Strategic Outcome

✧ Contribution to the Quality of Life

The CSA's Strategic Outcome *Contribution to the Quality of life* has the following objective:

- Improve public health by advancing life sciences and biotechnologies through experiments using the effects of microgravity, and by advancing the understanding of basic physical and chemical processes in the weightless environment.

In pursuing these objectives, the CSA attempts to achieve enduring benefits in the field of Health of Canadians. In 2002-2003, \$17.7 million (5% Total Actual Spending) was invested in *Contribution to the Quality of Life* of Canadians.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular, the CSA is working with:

- Universities and specialised research institutes; and,
- Firms in space-related activities, particularly small-and medium-sized enterprises.

An essential contribution to this strategic outcome is the sustaining of an experienced Canadian Astronaut corps and Operational Space Medicine group. This Canadian contribution to the international effort in human space flight programs and studies in health technologies facilitates the testing of Canadian space material and life science experiments on board ISS and the development of medical applications for the Canadians. *To learn more about the role of Canadian Astronauts, go to:*

http://www.space.gc.ca/asc/eng/csa_sectors/human_pre/cao/cao.asp

Overall Planned Results

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for *Contribution to the Quality of Life* were:

- 1) An understanding of how human and other life forms adapt to a weightless environment and the improvement of medical knowledge, treatments and drugs through experiments using the effects of microgravity.

2) Advancement in the understanding of basic physical, chemical and biotechnology processes in the weightless environment and the improvement of material processing techniques.

Program, Resources and Accomplishments

Long-term improvement in the quality of life of Canadians can be attributable to several space programs. The two following programs, with expenditures of \$12.2 million in 2002-2003, directly supported the implementation of Planned Results for *Contribution to the Quality of Life of Canadians*:

The **Space Life Sciences Program** enables the Canadian scientific community and industry to advance our knowledge of changes to the cardiovascular, bone and nervous systems, as well as the adaptation of humans and other life forms in a weightless environment through Space Shuttle flights and use of the ISS. (Spending: \$5.6 million)

The **Microgravity Sciences Program** enables the Canadian scientific community and industry to advance our knowledge of basic physical and chemical processes in the weightless environment by developing instruments and facilities for carrying out experiments on Space Shuttle flights and, eventually, the ISS. (Spending: \$6.6 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP is explained in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *Contribution to the Quality of Life in 2002-2003* were the following:

As a contribution to Planned Result # 1: The Extra-Vehicular Activity Radiation Monitor experiment, launched on the ISS in August 2002, continues to provide information concerning radiation exposure of astronauts during space walks, and while inside the ISS. The technology and measurement techniques developed will be useful to measuring radiation doses in patients and medical staff during cancer treatment therapy.

CSA and NASA are jointly developing the Insect Habitat facility for the ISS. This facility will provide a controlled environment for insects (commonly used in genetic research) on the ISS. The Experiment Planning Model was completed this year. It will be used by science teams to evaluate the performance of the system before final manufacturing begins.

In the Space Shuttle Columbia accident the CSA and the Canadian scientific community lost two scientific payloads: a life science experiment on osteoporosis and a protein crystallization experiment. These research projects are valued at \$4.5 million. It is not decided yet whether they will be repeated in the future. The Perceptual-Motor Deficits in Space (PMDIS) experiment involving astronauts was delayed until shuttle flights resume.

To learn more about Space Life Sciences, go to:

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/life_sciences/life_sciences.asp

As a contribution to planned Result # 2: Work continued on development of the Microgravity Vibration Isolation System (MVIS), with a flight model to be delivered in 2004, for integration in ESA's Fluid Science Laboratory (FSL). The MVIS will enhance the quality of materials and fluids experiments conducted on the ISS. In return for this contribution, ESA will provide flight opportunities to Canadian scientists. MVIS encountered significant difficulties that led to delays and cost increases. After an extensive review of the project, the CSA decided to pursue MVIS development with a revised budget in order to preserve Canada's leaderships in microgravity isolation systems and its privileged access to ESA's Fluid Science Laboratory.

Work continued in industry on the development of the high-temperature furnace ATEN for use on the ISS. Using this furnace, scientists will be able to recrystallize metals and other substances in zero gravity, allowing pure crystal growth and development of advanced materials and pharmaceuticals.

To learn more about Microgravity Sciences Program, go to:

http://www.space.gc.ca/asc/eng/csa_sectors/space_science/microgravity/microgravity.asp

Strategic Outcome

✧ Social and Educational Benefits

The CSA's Strategic Outcome *Social and Educational Benefits* takes advantage of the unique appeal of space to fulfil the following three objectives:

- Improve scientific literacy among students and educators;
- Encourage youth to pursue careers in science and engineering; and,
- Promote awareness of the importance of science and technology to Canada's future.

In pursuing these objectives, the CSA attempts to achieve enduring benefits to Canadians in the field of Strength and Safety of Canadian Communities. In 2002-2003, \$1.5 million (1% Total Actual Spending) was invested in *Social and Educational Benefits*.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular, the CSA is working with:

- Provincial and territorial Ministries of Education;
- Science museums, schools and youth organisations;
- Universities and specialised research institutes; and,
- Government of Canada departments and agencies.

Canadian astronauts, space scientists, engineers and researchers are excellent role models that significantly contribute to the creation of space awareness.

Overall Planned Results

The Planned Results stated in 2002-2003 Report on Plans and Priorities for *Social and Educational Benefits* were:

- 1) Broaden awareness of Canada's leading role in space and encourage youth in all regions of the country to pursue careers in science and engineering.
- 2) Develop validated teaching materials, web-based materials and national web-casts to inspire youth and support outreach initiatives focused on meeting the needs of Canadian educators and youth.
- 3) Increase the number of qualified Canadian scientists, engineers and technicians for high technology and space-related industries.

Program, Resources and Accomplishments

The following programs, with investments of \$1.5 million in 2002-2003, supported the implementation of Planned Results for *Social and Educational Benefits*:

The **Youth Awareness and Outreach Program** encourages youth to undertake careers in Science and Technology (S&T) through reward and recognition activities, the distribution of space-related information and teaching materials, conduct of interactive distance learning classrooms and proactive public information campaigns across Canada. (Spending: \$1.4 million)

The **Training of Qualified Canadian Scientists, Engineers and Technicians** for high technology and space-related industries was conducted through a series of programs jointly delivered with the Natural Sciences and Engineering Research Council of Canada (NSERC) and/or the Public Service Commission, as well as through new training initiatives with industry and universities. (Spending: \$0.2 million)

The significant variance reported against Planned Spending set in the 2002-2003 RPP, as indicated in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *Social and Educational Benefits* in 2002-2003 were the following:

As a contribution to Planned Result # 1: The visibility of the Youth Awareness Outreach Program was increased due to expanded collaboration of the provincial Ministries of Education and Ministries of Industry and Economic Development in the Yukon, British-Columbia, Alberta, Manitoba, Ontario, Newfoundland and Prince Edward Island as well as the Ministry of Community, Aboriginal and Women's Services in British Columbia. The network was also expanded with first-line contact with six Canadian universities.

Three distance learning initiatives reaching 1000 students in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Northern Quebec and Newfoundland also received a high level of satisfaction rating according to a survey conducted with educators by the Communication Research Centre of Industry Canada.

During its first 10 months of operation, the CSA/ National Film Board space mission Internet website was visited by 25, 401 youth with an average of 600 visits per month.

Ten pro-active astronaut tours were co-ordinated throughout the country, reaching stakeholders at the primary, secondary and university level.

The use of focused regional tours and partnered initiatives with Canadian Space and Science Museums, schools and youth organisations were complemented with awards of the Youth Outreach Contributions Program.

As a contribution to Planned Result # 2: A national survey of educators conducted through the Canadian Space Learning Network Consultation revealed that teachers consider the quality and relevance of the resources provided to be the strongest element of the Space Awareness and Education program.

The Train-the-trainer Workshop attracted 85 educators from 7 provinces and received a very high level of satisfaction rating from the participants.

A 100% increase was recorded in the number of educators registering in the CSA database to receive regular information on space learning materials and activities; 1,010 in 2002-2003 compared to 500 in 2001-2002.

To learn more about Youth and Educators Outreach Activities, go to:

http://www.space.gc.ca/asc/eng/youth_educators/educators/educators.asp

As a contribution to Planned Result # 3: Programs were jointly delivered with the Natural Sciences and Engineering Research Council of Canada (NSERC) and/or the Public Service Commission, as well as new training initiatives with industry and universities, to help train Canadian scientists, engineers and technicians for high technology and space-related industries.

To learn more about Career Development initiatives, go to:

http://www.space.gc.ca/asc/eng/youth_educators/educators/careers.asp - Working

Strategic Outcome

✧ Promotion and Awareness of the CSP

The CSA's Strategic Outcome *Promotion and Awareness of the Canadian Space Program* has the following objectives:

- Build national pride through public awareness of Canadian achievements in space;
- Help Canadians to better understand the importance of space programs in Canada's future; and,
- Promote partnership with international and domestic stakeholders in the successful delivery of the Canadian Space Program.

In 2002-2003, \$5.4 million (2% Total Actual Spending) was invested in the *Promotion and Awareness of the Canadian Space Program*.

Key Partners

The CSA recognises that the attainment of this Strategic Outcome requires the combined resources and sustained effort of several partners over a long period of time. In particular, the CSA is working with:

- Government of Canada departments and agencies;
- Universities and specialised research institutes; and,
- Firms in space-related activities, particularly small-and medium-sized enterprises.

Overall Planned Results

The Planned Results stated in the 2002-2003 Report on Plans and Priorities for *Promotion and Awareness of the Canadian Space Program* were:

- 1) Increased awareness of the Canadian Space Program with Parliamentarians, stakeholders and the general public through a proactive communication strategy focusing on key space achievements.
- 2) Further co-operation with traditional international partners and the maintenance of effective relations with domestic stakeholders and help the positioning of Canadian space companies to seize global market opportunities.

Program, Resources and Accomplishments

The CSA invested \$5.4 million in communications and external relations initiatives for the *Promotion and Awareness of the Canadian Space Program*.

There is no significant variance reported against Planned Spending set in the 2002-2003 RPP, as indicated in [Section 5 - Spending by Strategic Outcome](#). The main accomplishments for *Promotion and Awareness of the Canadian Space Program* in 2002-2003 were the following:

As a contribution to Planned Result #1: Number of media requests increased by 58%. This number excludes the 300 media requests received concerning the Space Shuttle Columbia tragedy in February 2003.

Granted interviews increased by 140% (361 compared to 150 in 2001-2002) and presentations increased by 300% (92 were organized as compared to 30 last period). A wider reach of Canadians was also reached, with 8 provinces visited as compared to only 4 visited last year.

The CSA coordinated 10 Astronaut tours and increased participation in events, conferences and exhibitions by 24%.

A redesigned website was launched and increases were noted in the number of visits (37.8%), the number of visitors (40.5%) and total pages viewed (76%).

Major events covered were the installation of the Mobile Base System on the International Space Station and the launches of the ENVISAT, MOST and SCISAT satellites. Special events had been organized for the return of the two Canadian scientific community experiments, OSTEO-2 and Protein Crystal Growth, which were unfortunately lost in the Space Shuttle Columbia incident.

To learn more about CSA Awareness initiatives, go to:
http://www.space.gc.ca/asc/eng/media/press_room/press_room.asp

As a contribution to Planned Result # 2: On-going negotiations lead the CSA to the signing of several international agreements such as:

- With ESA, covering Canada's participation in the Global Monitoring for Environment and Security (GMES) program, and the Aurora program which will define the European strategy for the exploration of the solar system over the next 30 years.

- A Memorandum of Understanding (MOU) with the Canada Centre for Remote Sensing of Natural Resources Canada (NRCan-CCRS) and the Mekong River Commission (MRC), which plans to use satellite data to monitor a variety of areas, including: irrigation for agriculture, fisheries, the management of drainage basins, maritime transportation, hydroelectricity, the management of domestic and industrial sewage and disaster management.
- A long-term agreement with NRCan-CCRS and the Norwegian Space Centre (NSC) to continue their collaboration on radar-based Earth observation and assure seamless transition between RADARSAT-1 and RADARSAT-2 for Norway.
- A Memorandum of Understanding with the Indian Space Research Organization to foster the study of co-operative programs with India in satellite communications and satellite remote sensing, as well as encouraging co-operation in the field of exploration and use of space by the private sector and academia.
- A joint statement at the meeting of ISS Heads of Agency to unanimously endorse an option path that enables maximized ISS utilization in the 2006-2007 timeframe through greater use of ISS research elements.

In June 2002, the CSA hosted the first ESA Council meeting ever held outside Europe. Participating ESA member state representatives rated the event as exemplary.

To help position Canadian stakeholders to seize market opportunities, the CSA carries out key on-going intelligence projects such as:

- Production of " The Annual Global Space Sector Market Trends";
- Daily space news briefs;
- Production of a review: "The Annual State of the Canadian Space Sector";
- Updating "The Directory of the Canadian Space Sector";
- Monitoring the regional distribution of CSA contracts; and,
- Strategies and plans for international and domestic partnerships.

Showing a clear commitment to an open decision-making process, the CSA held preliminary consultations on the overall direction for the coming Strategy for the Canadian Space Agency with the Interdepartmental Committee on Space, the CSA Advisory Council, and CSA Service Line Advisory Groups, all of which draw their membership from Government, space industry, scientific research and academia stakeholders.

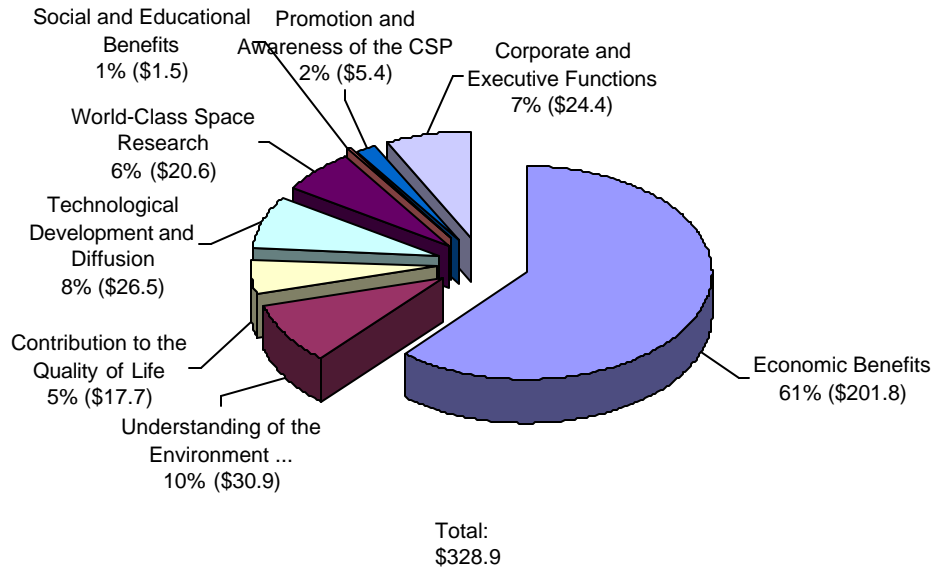
To learn more about CSA promotion initiatives, go to CSA Science and Industry:

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

SECTION: 5 Spending by Strategic Outcome

Description	Planned Spending (\$ in millions)	Actual (\$ in millions)	Variance (\$ in millions)	Comments
Economic Benefits – Satellite Communications	31.9	35.1	(3.1)	1) Increase in the Euro-Canadian dollar exchange rate. 2) Review by ESA of ARTES -3 and 5 programs resulted in an increased contribution from Canada to ESA.
Economic Benefits – Earth Observation	95.2	87.3	7.9	Delays in the construction of the RADARSAT-2 spacecraft.
Economic Benefits – Canadian Space Station Program	74.1	79.2	(5.1)	Additional expenditures for Logistic and Sustaining Engineering and Ground Infrastructure to the Mobile Servicing System.
Technological Development and Diffusion	25.5	26.5	(1.0)	Increased number of internal research projects.
Understanding of the Environment and Contribution to Sustainable Development	25.2	30.9	(5.8)	Delays in the launch of SCISAT and Cloudsat as requested by NASA.
World-Class Space Research	21.8	20.6	1.2	Replacement of equipment at DFL postponed.
Contribution to the Quality of Life	27.9	17.7	10.3	1) Microgravity project postponed to cover additional expenditures for CSSP 2) Funds kept in reserve to cover potential risks in different projects. Unspent funds in 2002-2003 were reprofiled to 2003-2004.
Social and Educational Benefits	2.8	1.5	1.3	Funds for Partnership Program reallocated after CSA Priority Review.
Promotion and Awareness of the Canadian Space Program	5.1	5.4	(0.3)	None
Corporate and Executive Functions	26.3	24.4	1.9	Funds kept in reserve to cover unforeseen expenditures. Unspent funds were carried forward to 2003-04.
Total	335.8	328.9	6.9	

**Strategic Outcomes and Business Line for 2002-03
Actual Spending
(Percentage and Millions)**



SECTION: 6 Annexes

6.1 Financial Tables

6.1.1 Summary of Voted Appropriations

Financial Requirements by Authority (\$ in millions)				
Vote		2002-2003		
		Planned Spending	Total Authorities	Actual
	Canadian Space Agency			
30	Operating expenditures	111.8	116.5	114.1
35	Capital expenditures	164.3	165.7	155.7
40	Grants and contributions	52.1	52.1	52.0
(S)	Contributions to Employee Benefit Plans	7.7	7.1	7.1
	TOTAL	335.8	341.3	328.9
Notes:				
<ul style="list-style-type: none"> ✧ Due to rounding, figures may not add up to totals shown. ✧ Planned Spending corresponds to Main Estimates Budget. ✧ Total Authorities are Main Estimates plus Supplementary Estimates and other Authorities. ✧ Difference between Total Authorities and Actual Spending is mostly due to the re-profiling of funds in the Canadian Space Station Program and RADARSAT-2 from 2002-2003 to 2003-2004. 				

6.1.2 Comparison of Total Planned Spending to Actual Spending

Departmental Planned versus Actual Spending (\$ in millions)			
Space Knowledge, Applications and Industrial Development	2002-2003		
	Planned Spending	Total Authorities	Actual
FTEs	514	514	524
Operating	118.7	122.8	120.5
Capital	165.0	166.4	156.4
Grants and Contributions	52.1	52.1	52.0
Total Gross Expenditures	335.8	341.3	328.9
Less:			
Respendable Revenues	0.0	0.0	0.0
Total Net Expenditures	335.8	341.3	328.9
Other Revenues and Expenditures			
Non-respendable Revenues	(1.7)	(3.7)	(3.7)
Cost of services provided by other departments	3.1	3.6	3.6
Net Cost of the Program	337.2	341.2	328.8
Notes:			
<ul style="list-style-type: none"> ✧ Due to rounding, figures may not add to totals shown. ✧ Total Authorities are Main Estimates plus Supplementary Estimates and other Authorities. ✧ Operating and Capital Expenditures include Employee Benefit Plans. ✧ Difference between Total Authorities and Actual Spending is mostly due to the re-profiling of funds in the Canadian Space Station Program and RADARSAT-2 from 2002-2003 to 2003-2004. 			

6.1.3 Historical Comparison of Total Planned Spending to Actual Spending

Historical Comparison of Departmental Planned versus Actual Spending (\$ in millions)					
Space Knowledge, Applications and Industrial Development	Actual 2000-2001	Actual 2001-2002	2002-2003		
			Planned Spending	Total Authorities	Actual
Canadian Space Agency	318.8	336.1	335.8	341.3	328.9
TOTAL	318.8	336.1	335.8	341.3	328.9
Notes:					
<ul style="list-style-type: none"> ✧ Planned Spending corresponds to Main Estimates Budget. ✧ Total Authorities are Main Estimates plus Supplementary Estimates and other Authorities. ✧ Difference between Total Authorities and Actual Spending is mostly due to the re-profiling of funds in the Canadian Space Station Program and RADARSAT-2 from 2002-2003 to 2003-2004. 					

6.1.4 Crosswalk between Strategic Outcomes and Business Lines

Business Line: Space Knowledge, Applications and Industry Development (\$ in millions)		
Strategic Outcomes	2002-2003	
	Planned Spending	Actual Spending
Economic Benefits	201.2	201.8
Understanding of the Environment and Contribution to Sustainable Development	25.2	30.9
Contribution to the Quality of Life	27.9	17.7
Technological Development and Diffusion	25.5	26.5
World-Class Space Research	21.8	20.6
Social and Educational Benefits	2.8	1.5
Promotion and Awareness of the CSP	5.1	5.4
Strategic Outcomes – Sub Total	309.5	304.5
Corporate and Executive Functions	26.3	24.4
Total	335.8	328.9
Notes:		
1) Due to rounding, figures may not add to totals shown.		

6.1.5 Revenues: Respendable and Non-respendable

Revenues (\$ in millions)					
Respendable Revenues					
	Actual 2000-2001	Actual 2001-2002	2002-2003		
			Planned Revenues	Total Authorities	Actual
Canadian Space Agency	0.0	0.0	0.0	0.0	0.0
Unplanned	0.0	0.0	0.0	0.0	0.0
Total Respendable Revenues	0.0	0.0	0.0	0.0	0.0
Non-Respendable Revenues					
Canadian Space Agency	3.1	3.9	1.7	3.7	3.7
Unplanned	0.0	0.0	0.0	0.0	0.0
Total Non- Respendable Revenues	3.1	3.9	1.7	3.7	3.7
Total Revenues	3.1	3.9	1.7	3.7	3.7
Notes:					

6.1.6 Transfer Payments (Grants and Contributions)

Transfer Payments (\$ in millions)					
Space Knowledge, Applications and Industrial Development			2002-2003		
Canadian Space Agency	Actual 2000-2001	Actual 2001-2002	Planned Spending	Total Authorities	Actual
GRANTS					
Joint CSA / NSERC Programs	0.4	0.2	0.9	0.1	0.1
International Space University	0.2	0.3	0.2	0.2	0.2
Youth Awareness Program	0.0	0.0	0.1	0.0	0.0
CSA / Networks of Centers of Excellence Research Program	0.4	0.5	0.5	0.1	0.1
Total Grants	1.0	1.0	1.6	0.4	0.4
CONTRIBUTIONS					
Canada / ESA Programs					
<i>General Budget</i>	5.0	5.3	6.8	8.2	8.2
<i>Satellite Communications Programs</i>	6.2	8.1	8.2	10.0	10.0
<i>Earth Observation Programs</i>	7.6	6.1	13.8	11.4	11.4
Payload Flight Demonstration Program	12.0	26.0	21.0	21.7	21.7
Space Science Enhancement Program	0.4	0.3	0.5	0.2	0.2
Youth Awareness Program	0.5	0.2	0.1	0.2	0.2
Total Contributions	31.6	46.1	50.5	51.7	51.6
Total Transfer Payments	32.6	47.0	52.1	52.1	52.0
Notes:					
◇ Due to rounding, figures may not add to totals shown.					

6.1.7 Resource Requirements by Organization and Business Line

Comparison of 2002-2003(RPP) Planned Spending and Total Authorities to Actual Expenditures by Organization and Business Line (\$ in millions)			
Space Knowledge, Applications and Industrial Development			
Organization	2002-2003		
	Planned Spending	Total Authorities	Actual
Space Systems	136.2	143.4	133.9
Space Technologies	87.0	89.1	88.8
Space Sciences	48.7	48.0	48.0
Canadian Astronauts Office	10.9	5.8	5.5
Space Operations	20.5	22.8	22.3
Corporate Functions	14.8	14.9	14.9
Executive Functions (Including President's Office)	17.8	17.4	15.4
TOTAL	335.8	341.3	328.9
% of Total			100 %
Notes:			
<ul style="list-style-type: none"> ✧ Due to rounding, figures may not add to totals shown. ✧ Planned Spending corresponds to Main Estimates Budget. ✧ Total Authorities are Main Estimates plus Supplementary Estimates and other Authorities. ✧ Difference between Total Authorities and Actual Spending is mostly due to the re-profiling of funds in the Canadian Space Station Program and RADARSAT-2 from 2002-2003 to 2003-2004. 			

6.1.8 Capital Projects

Projects (\$ in millions)						
Space Knowledge, Applications and Industrial Development	Current Estimated Total Cost	Actual 2000-2001	Actual 2001-2002	2002-2003		
				Planned Spending	Total Authorities	Actual
Canadian Space Agency						
Canadian Space Station Program (MCP)	1396.5	33.1	15.2	18.6	18.6	15.5
RADARSAT-1	666.4	12.0	12.4	12.9	12.9	12.8
RADARSAT-2	414.8	74.2	66.8	56.5	57.9	51.1
MOST	9.9	1.9	2.5	2.0	2.1	2.1
Insect Habitat	10.4	2.5	2.7	3.8	2.4	2.4
Cloudsat	14.7	1.9	6.0	3.5	5.3	5.3
SciSat-1	62.1	15.4	19.4	9.3	14.1	14.1
MIM Base Unit (MIMBU)	6.3	0.2	0.7	3.1	2.7	2.7
MVIS	10.0	0.4	2.5	1.0	2.7	2.0
HYDROS	10.8	0.0	0.0	0.0	0.4	0.3
Notes:						
<ul style="list-style-type: none"> ✧ The sums include contributions to Employee Benefit Plans. ✧ Due to rounding, figures may not add to totals shown. ✧ Difference between Total Authorities and Actual Spending is mostly due to the re-profiling of funds in the Canadian Space Station Program and RADARSAT-2 from 2002-2003 to 2003-2004. 						

6.1.9 Contingent Liabilities

Contingent Liabilities (\$ in millions)			
List of Contingent Liabilities	Amount of Contingent Liability		
	March 31, 2001	March 31, 2002	Current as of March 31, 2003
Claims, Pending and Threatened Litigation:			
Litigation:			
CS500-05-042325-98	14.4	14.4	14.4
CSA7140-3-1	-	-	0.2
Total	14.4	14.4	14.6
Notes:			
✧ A lawsuit for damages in the amount of \$5 millions was instituted in June of 1998 pertaining to some questions related to intellectual property. The claimant has its intention to raise his claim to \$14.4 millions. Issue unlikely			

6.1.10 Status Summary of Major Crown Projects

Information on the Canadian Space Station Program, and RADARSAT-1 and RADARSAT-2 Major Crown Projects is reported on the CSA Web site at the following address: http://www.space.gc.ca/asc/eng/resources/publications/report_mcp.asp

6.2 Procurement and Contracting

Procurement and contracting is at the core of CSA program delivery. Most program objectives are achieved through the procurement of space hardware and services from Canadian industry, often implemented under international arrangements. In 2002-2003, CSA awarded all of its contracts in accordance with *Government Contracts Regulations*.