
THE CANADIAN SPACE AGENCY

2003-2004 Estimates

REPORT ON PLANS AND PRIORITIES

Allan Rock
Minister of Industry

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SECTION 1: MESSAGES

1.1 MINISTER'S PORTFOLIO MESSAGE

I am proud to report on the measures being taken by the Industry Portfolio to help realize the government's goal of moving Canada into the ranks of the most innovative countries in the world by the year 2010. In today's global economy, innovation is the key to success. Thanks to innovation, we are finding new ways of thinking and better ways of working.

As the Minister responsible for the Industry Portfolio, I was pleased to be part of creating *Canada's Innovation Strategy*, which was launched in February 2002. Throughout the year, Industry Canada and its partners held 34 regional innovation summits and took part in many expert round tables and sectoral meetings. In all, the views of more than 10,000 Canadians were heard. That exciting and productive process culminated at the National Summit on Innovation and Learning, which brought together more than 500 business, government and academic leaders, as well as representatives from non-governmental organizations.

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 Report on Plans and Priorities.

The Government of Canada is listening to Canadians. During the engagement process many excellent ideas were brought forward and, at the National Summit, were ranked in order of priority. Eighteen items were identified for action over the short term. I want to emphasize, however, that the process being discussed will be fully implemented over a 10-year period and must involve not only the Government of Canada, but all of its partners. Still, we have forged a very good beginning, and I am very encouraged by the positive response of the business and academic communities to the measures taken to date.

The Industry Portfolio's 16 member organizations work in partnership to ensure that Canadians have the support they need to meet the challenges of a rapidly evolving world economy. The cornerstone of all our future activities will be innovation.

It is my great pleasure to present the *Report on Plans and Priorities* for the Canadian Space Agency, which describes their expected achievements and results over the next three years.

We have made great strides forward in working with Canadians through the engagement process for *Canada's Innovation Strategy*. We connected with businesspeople, academics and private citizens in every region of the country. I am confident that this renewed partnership will flourish over the coming year and that the results of our efforts will mean more and better jobs, a stronger and more dynamic economy, and a better quality of life for all Canadians.

The Honourable Allan Rock

1.2 PRESIDENT'S VISION FOR SPACE

Very few countries are as well suited as Canada to take advantage of space for the benefit of its people. From monitoring our territory and waters to inspiring Canadians to reach for their highest aspirations, the programs of the Canadian Space Agency (CSA) continue to play an increasingly important role in the day-to-day lives of our citizens. Our vision for the future is one where ***Canada will expand and apply knowledge of space for the benefit of its citizens, and in doing so, will inspire through excellence.***

This vision speaks to a greater engagement of Canadians in CSA activities - an opening and extension of dialogue and consultation on programs and priorities with an increasing number of stakeholders in industry and academia, as well as federal, provincial and territorial governments. Created in 2002, the CSA Advisory Council, alongside the five Service Line Advisory Groups, will be instrumental in further extending the reach to secure the input of key stakeholders. Canadians will be better informed about the benefits they receive from their investment in the Canadian Space Program. Communications activities will inspire Canadians, thereby strengthening the pride they feel for Canada's achievements in space and improving science literacy among youth and their understanding of the world.

Increased emphasis will be focused on strengthening synergies between federal government departments and agencies, enhancing the capacity for policy development and support for operational programs through the transfer of core space technologies developed under CSA programs. The ultimate outcome will be more effective and more efficient programs and services delivered to Canadian citizens.

Meeting the evolving needs of Canadians means extending the vision to ensure Canada continues to lead in the development of next-generation technologies. Investing in high-risk technology development will continue to build on a long-standing successful model linking government, industry and the university research community, leveraged through international partnerships. This model has proven itself to be the most efficient means of attaining our national objectives to build innovation, expertise and excellence within the constraints of a defined and limited budget.

The measure of this vision's success will be a direct reflection of Canadians' perception of the CSA and its recognition as one of the most outstanding organisations in the country, both in terms of the quality of its people and the programs and services it delivers. Personal excellence will continue to be nurtured, and teamwork will be fostered as a key value within all levels of the CSA. Through the introduction of innovative and modern government-wide management practices, the CSA has set its sights on becoming a leader amongst smaller sized organisations.

There is absolutely no question that the global use of space will grow in the coming decades and Canada intends to be at the forefront of nations using Space for peaceful purposes. Having said that, it must also be pointed out that the Canadian Space Agency has a challenge in balancing the requirements expressed by our stakeholders from Government, from the Research community and from Industry with the agency's current budget allocation. This fact was also noted by the Auditor General of Canada during her recent audit of the Agency. Greater attention will therefore be paid to managing stakeholder expectations in certain areas and to prioritizing the agency's activities while continuing to inspire Canadians.

The CSAs commitment to this vision supports a dynamic Canadian Space Program and will be instrumental in helping Canada become one of the most advanced, connected and innovative nations in the world.

Marc Garneau, President

1.3 MANAGEMENT REPRESENTATION

I submit, for tabling in Parliament, the 2003-2004 *Report on Plans and Priorities* (RPP) for the Canadian Space Agency. To the best of my knowledge the information in this document:

- Accurately portrays the organization's plans and priorities;
- Is consistent with the reporting principles contained in the *Guide to the Preparation of the 2003-2004 Report on Plans and Priorities*;
- Is comprehensive and accurate;
- Is based on sound underlying departmental information and management systems.

I am satisfied as to the quality assurance processes and procedures used for the RPP production.

The Planning, Reporting and Accountability Structure (PRAS) on which this document is based has been approved by Treasury Board Ministers and is the basis for accountability for the results achieved with the resources and authorities provided.

Name:

Marc Garneau, President

Date:

SECTION 2: RAISON D'ÊTRE

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 CSA vision, "To serve and to inspire Canadians through excellence," 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 competitive space industry. The CSA is achieving this mandate by implementing the Canadian Space Program (CSP) in cooperation with other government departments and agencies, industries, and universities, as well as international partners. The CSA is helping to develop a competitive domestic industry, mainly by contracting the development of spacecraft, space systems, and instruments to Canadian firms.

In addition to delivering its own programs, the CSA is responsible for coordinating all federal, civil, space-related policies and programs pertaining to science and technology research, industrial development, and international cooperation.

To learn more about the vision, mission and activities of the Canadian Space Agency, you may refer to the website:

<http://www.space.gc.ca/>

To learn more about the Canadian Space Program, you may refer to the following documents:

http://www.space.gc.ca/asc/pdf/national_paper.PDF

http://www.space.gc.ca/asc/pdf/ASC_Br_Corpo.pdf

SECTION 3: PLANNING OVERVIEW

Over the planning horizon of this RPP, three key objectives of the CSA will be to (a) define a new CSA strategy; (b) develop a Space Plan for the Government of Canada; and (c) implement the CSA Management Modernization Action Plan while maintaining efficient management of initiatives already approved under the Canadian Space Program.

The new CSA strategy, to be completed in June 2003, will establish strategic objectives and define how the CSA will manage itself and the Canadian Space Program. The development of a Space Plan for the Government of Canada will build on work initiated in 2002 to define a Space Strategy for the Government of Canada. The plan, to be completed before the end of 2004, will define how space products and services can be introduced to enable Federal Government departments and agencies to meet their policy and operational mandates more efficiently.

By bringing back science and advanced Research and Development (R&D) to the forefront of the Canadian Space Program, these strategies and plans will aim to facilitate the generation of new ideas and accelerate their transition to innovative solutions that respond to the needs of Canadians.

The CSA will deliver the above in the context of a very challenging international and national environment.

International environment

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 across the world are looking for increased consolidation, nurturing and protection of their space capabilities. Our most important space partners, the United States of America (U.S.) and Europe, have both taken strong steps in that direction, including efforts for much closer domestic cooperation and synergies between civilian and defence space programs.

The thrust towards increased integration and autonomy, often supported by domestic procurement policies and restrictive export regulatory regimes, will make it increasingly challenging for Canada to maintain the strong international partnerships it has enjoyed in the past. 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. The CSA has limited means to support the industry during this difficult period and its analysis suggests decreased revenues and continued layoffs at least through 2003.

There nevertheless remain several international opportunities, and Canada is still regarded as a non-threatening and reliable partner that possesses unique technical and

scientific capabilities to contribute meaningfully to the initiatives of foreign space agencies. In particular, emerging space faring countries in Asia and South America seem to have high potential for future cooperation, although these markets are foreseen to remain limited in the short-term and could be the subject of intense competition in the long-term. It will therefore be 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.

National environment

Space is particularly well suited to support short and long-term Canadian objectives, including priorities outlined in the recent Speech from the Throne. 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 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 industry will therefore remain a source of great concern for the CSA, at least through 2003.

While trying to minimize the potential negative effects of the international environment briefly described in the previous section, the CSA will nurture conditions to grow the domestic market and expand the utilisation of space products and services in Canada. Through a broad consultation initiated in 2002, particularly amongst federal government departments and agencies, the CSA has identified many promising ideas that could use space to enhance Canada's innovation capacity. Many of these ideas will be further articulated in a Space Plan for the Government of Canada, to be presented for consideration by the government before the end of 2004.

The new CSA strategy will be 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. Broad policy issues may have to be addressed in developing the CSA Strategy, such as how the Government will organize itself to deliver cross-departmental programs and services.

CSA Business Planning and Management

Contracts for projects involving industry, universities, and specialized research institutes represent a major proportion of the CSAs budget; program management, internal research and development, executive and corporate functions account for the rest. The challenges

set by the development of leading-edge space science and technology, the design of unique space hardware and its on-orbit operation require stringent quality control as well as effective planning and risk management processes.

In the 1990s, before the CSA had stable ongoing funding, the discipline imposed by government requirements for major capital projects made the setting and balancing of priorities relatively simple. However, the Agency's environment has changed, with a trend towards smaller but more numerous projects. In that context, the CSA has two management challenges: to determine relative priorities among competing project proposals, and to monitor and control the costs of several simultaneous projects in order to maximize results.

These challenges call for a review of the CSA Planning, Reporting and Accountability Structure (PRAS), which may itself dictate a redefinition of the current CSA service lines structure and adjustments to existing programs. It will also require a closer coordination with the current five-year Risk Assessment and Commitment Control Plan and the key corporate and project planning processes. This renewal, mostly defined in the CSA Management Modernization Action Plan, will be instrumental in developing the new CSA strategy and the many plans that will further articulate it.

Keeping with its objective of being an open and transparent organisation, the CSA will achieve the above in full consultation with its Canadian stakeholders, particularly through the use of the CSA Advisory Council and the five Service Line Advisory Groups. The CSA will also continue to leverage international partnerships to extend the reach and efficiency of its programs.

SECTION 4: PLANS AND PRIORITIES BY STRATEGIC OUTCOME

The CSAs plans and priorities for the next three Fiscal Years will advance space knowledge and will develop new processes, technologies and terrestrial applications. These activities have been planned with the objective of meeting Canadian needs and will be carried out in support of the development of an internationally competitive Canadian space hardware and service industry. In collaboration with other public organisations, the CSA will contribute to Canada's sustainable socio-economic development by linking Canadians from coast to coast, enhancing the management of our environment and natural resources, and learning how space phenomena affects life on Earth.

The CSA has established seven (7) Strategic Outcomes, which are not mutually exclusive. Hence, a single program, project or activity may be contributing to more than one strategic outcome. The main priorities for each Strategic Outcome are the following:

Strategic Outcome	Main Priorities for 2003-2004
Economic Benefits	Complete RADARSAT-2 development
Understanding of the Environment	Launch and operate SCISAT-1
Technological Development and Diffusion	Award new technology development contracts to enhance the Canadian space industry's competitiveness
Contributions to the Quality of Life	Carry out Canadian experiments in Space Life Sciences
World-Class Space Research	Determine Canada's contribution to international exploration of Mars
Social and Educational Benefits	Improve scientific literacy among Canadian students and educators
Promotion and Awareness of the CSP	Broaden public awareness of the Canadian Space Program Modernize the management of the CSA

The plans and priorities for each strategic outcome are described in detail in the following sections.

4.1 ECONOMIC BENEFITS

In order to meet domestic needs with space-based technologies and to develop an internationally competitive industry, the CSA, in cooperation with its partners, has established the following long-term strategy:

- To develop world-class missions, space technologies, and terrestrial applications to maintain Canada's world leadership in its traditional niches (e.g., civilian radar technology for Earth observation, advanced satellite communications services, and space robotics);
- To facilitate the development of commercial applications of space technologies by leveraging federal funding and transferring expertise to the private sector through partnerships with industry; and,
- To encourage the participation of a growing number of firms, particularly small and medium sized enterprises (SMEs), in space-related activities, and thereby, pursuing sustainable industrial regional development.

In 2003-2004, the CSA will spend \$172.7 million, or 56% of its total planned budget, to contribute directly to the generation of economic benefits. This strategic outcome covers three main areas: Satellite Communications, Earth and Environment, and the Canadian Space Station Program.

4.1.1 Satellite Communications

Emerging space technologies and broadband applications hold the promise of connecting urban, rural and remote communities, so that every citizen will have access to the information highway. For example the telecommunications satellite, ANIK F2, will be launched in 2003 with an onboard Ka-band multi-media payload, which will demonstrate new capabilities of providing two-way, high-speed satellite services for cheaper and faster delivery of Internet and broadcasting to all parts of Canada.

Satellite Communications is the largest space-sector activity in Canada with sales of more than \$920 million, representing 63% of the total space industry revenues¹. The Canadian industry aims at responding to globalization challenges by re-deploying itself as a supplier of sub-systems and components for the growing international space-based multi-media and mobile personal communications market. This strategy demands important investment in research and development (R&D) and the CSA supports industry with programs to develop advanced components and sub-systems to join international consortia as suppliers and maintain its competitiveness in its traditional market niches.

¹ Characteristics of the Canadian Space Sector, Canadian Space Agency Survey 2000.

State of the Canadian Space Sector:

[http://www.space.gc.ca/asc/pdf/state of the canadian space sector 2000.pdf](http://www.space.gc.ca/asc/pdf/state%20of%20the%20canadian%20space%20sector%202000.pdf)

The 2003-2004 Plans, with budgeted expenditures of \$33 million, will contribute to achieving the following results:

- The development and space-qualification of an advanced Ka-band multi-media payload scheduled for launch on Anik F2 in October 2003. This program will position Canadian industry on the international market both as a supplier of advanced components and as a service provider for the next generation of satellite communications systems.
- Canada's participation in European Space Agency (ESA) programs allows our industry to access forward-looking studies on new telecommunications services; to develop new technologies, equipment and applications in multi-media, optical inter-satellite and mobile communications; and to demonstrate satellite-based communications services such as interactive communications services for remote communities (e.g., tele-medicine/education networks) and disaster management (e.g., forest fires).

Through the renewal process and development of the new CSA strategy, a set of new programs will be established for 2004-05, when significant funds become available due to the normal change over of projects. The priorities being considered are cost-shared programs with industry for the development of advanced technologies and user applications in satellite communications, and increased participation in future ESA programs to position Canadian companies as suppliers of strategic sub-systems to European satellite builders and international operators.

To learn more about *Satellite Communications* go to:

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

4.1.2 Earth & Environment

Earth Observation (EO) is the second largest Canadian space-sector activity with annual revenues of \$254 million, representing 18% of the total space industry revenues². It is an innovative, technologically advanced industry capable of developing products and services in demand on world markets. Building on these industrial strengths, the CSA, in collaboration with other government and industry partners, has established a strategy to maintain Canada's world dominance in commercial space-borne radar technologies and promote the use of EO data and applications by governments. These programs will contribute to natural resources management, environmental monitoring, and surveillance and security activities (e.g. natural disasters). The strategy aims at developing an internationally competitive, value-added industry for satellite-based applications.

² Characteristics of the Canadian Space Sector, Canadian Space Agency Survey 2000.

State of the Canadian Space Sector:

[http://www.space.gc.ca/asc/pdf/state of the canadian space sector 2000.pdf](http://www.space.gc.ca/asc/pdf/state%20of%20the%20canadian%20space%20sector%202000.pdf)

The 2003-2004 Plans, with budgeted expenditures of \$87.9 million, will contribute to achieving the following results:

- The continuation of RADARSAT-1 operations with the same level of high performance for satellite reliability and image production, so as to ensure the supply of data until RADARSAT-2 is launched and commissioned. Contingency plans are being considered to use foreign sensors as backup to RADARSAT-1, in order to continue to meet operational uses until RADARSAT-2 data is available. Ongoing operation of RADARSAT-1 will include using data to monitor changes in ice fields, brought on by global warming and to observe wetlands in selected areas of environmental concern.
- The completion of RADARSAT-2 development will, ensure continuous all-weather, day and night radar coverage of the entire globe for the worldwide remote sensing data market. Equipped with advanced technologies, RADARSAT-2 will be the first commercial radar satellite to offer multi-polarization (an important aid in identifying a wide variety of surface features and targets), to produce images with a resolution of down to three meters, and to access an area of 800 kilometres wide on either side of the sub-satellite track. The original spacecraft design has been modified to include data encryption capabilities in response to security requirements. Key milestones are the completion of spacecraft integration and testing in January 2004, with the launch presently scheduled for March 2004 and the start of operations planned for July 2004. The current RADARSAT-2 launch date is under pressure due to technical and manufacturing problems being encountered by the spacecraft payload and bus subcontractors in their respective Assembly, Integration and Test (AI&T) campaign. Every attempt is being made to maintain the present launch. However, as the situation progresses, the prime contractor continuously updates their spacecraft level AI&T plan, including workaround solutions, to obtain the earliest feasible launch date. Any likely additional costs to the CSA, due to a change in launch date, are being covered by its risk management framework.
- The upgrade of Canada's ground systems to receive and process data from RADARSAT-2 and other new sensors of strategic interest to Canada will be available by the end of 2003-2004.
- The continuation of satellite data application development, technology transfer and demonstration programs (e.g., the Earth Observation and Applications Development, and the pre-competitive R&D programs) to support the growth of Canada's value-added industry.
- The implementation of a Preparatory Program for using and promoting RADARSAT-2 data, including the Canadian Government data allocation valued at \$445 million; this program will generate several Requests for Proposals from industry, pilot and demonstration projects within the government, research opportunities within the university community, and international partnerships opportunities.

- The development of advanced space-borne instruments and user-oriented applications by Canadian companies through the participation of Canada in ESA Programs. As part of the SWIFT mission, Canadian industry will develop a Michelson Doppler Imaging interferometer to measure winds in the stratosphere. ESA is taking the lead in pursuing LIDAR based EO missions: ADM to measure vertical wind profile using UV Doppler LIDAR, WALES for water vapour observation in upper troposphere and lower stratosphere, and a future mission to measure CO₂. Optech, Passat and MPB Technologies are playing a critical role in the design of new laser instruments. As part of the Earth Watch TerraSar program, EMS Technologies is exploiting the expertise acquired on the RADARSAT program to develop L-band SAR phased array antennas. In the areas of user-oriented application, many Canadian value-added companies and scientific investigators are participating (GMES and Market Development program) in the exploitation of satellite imagery.

To learn more about *Earth and Environment* go to:

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

4.1.3 Canadian Space Station Program (CSSP)

Canada has established itself as a vital partner in international efforts to establish a human presence in space with the development of the Mobile Servicing System³ (MSS), designed to assemble, service and maintain the International Space Station (ISS). Under the CSSP, the CSA is also responsible for the training and qualification of all astronauts and cosmonauts operating the MSS, for the mission controllers mandated to support robotics operations on orbit and for the provision of an operational support capacity at the John H. Chapman Space Centre in Saint-Hubert, Quebec. In exchange for this contribution, Canada has gained the rights to use up to 2.3% of non-Russian laboratories and crew onboard the ISS. The CSSP has generated a robotics industry with revenues of \$125 million⁴ per year.

NASA has made significant progress in the resolution of its budget problems. Funding has been secured to reach the important United States (U.S.) milestone called “U.S. Core Complete,” consisting of the full assembly of the truss segment and the four solar arrays of the ISS, as well as the installation of Node 2 (the connecting element to allow the follow-on installation of the European and Japanese modules in the 2004-2006 timeframe). The heads of the space agencies participating in the ISS Program have agreed on a path to significantly grow the crew complement of the ISS from the current three astronauts, beginning in 2006. The CSA sees this development as a very positive

³ The MSS includes Canadarm2 - the Space Station Remote Manipulator System (SSRMS), mounted on a Mobile Base System (MBS) and designed to handle large loads onboard the Station, and the Special Purpose Dexterous Manipulator (SPDM), a second robot designed to perform more delicate tasks.

⁴ Characteristics of the Canadian Space Sector, Canadian Space Agency Survey 2000.

State of the Canadian Space Sector:

http://www.space.gc.ca/asc/pdf/state_of_the_canadian_space_sector_2000.pdf

outcome since it will restore the desired frequency of flight opportunities for Canadian Astronauts and will provide the crew time availability for Canadian scientific experiments and the possible commercial utilization of the ISS.

The CSAs long-term strategy is to maintain Canada's position as a world leader in space robotics by exercising a greater level of responsibilities for MSS Operations and by developing advanced technologies in related areas (e.g., high reliability software, object oriented software, ground control of space robots, artificial vision, advanced real-time simulation, dexterous tools, robotic systems for planetary exploration, on-orbit assembly and servicing). This strategy will ensure the continuation of economic benefits for Canada in the foreseeable future.

The 2003-2004 Plans, with budgeted expenditures of \$51.7 million, will contribute to achieving the following results. However, it should be noted that the CSA will have to deal with the consequences following the tragic loss, on February 1, 2003, of Space Shuttle Columbia and its crew. The CSA is presently evaluating the event's impact for the planned activities.

- The completion of the ground test equipment and beginning testing of the SPDM in preparation for its launch in April 2005 (the 3rd element of the MSS).
- The fulfillment of responsibilities for MSS Operations: maintaining MSS hardware and software, performing repair and overhaul work on the MSS, operating MSS training facilities in Canada, planning and operating MSS missions, and commissioning initial operations of the Remote-Multi-Purpose Support Room, directly supporting robotics operations from Saint-Hubert, Quebec.
- The launch of the first experiment to use the Canadian ISS allocation rights during Mission STS 115/12A scheduled for May 2003.
- The promotion of the commercial use of the ISS research laboratory and the proper brand management of the ISS, its logo and its name with the intent of generating revenues.

To learn more about *Canadian Space Station Program* go to:

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

4.2 UNDERSTANDING OF THE ENVIRONMENT

The unique scientific data provided by space-based instruments and EO satellites contributes to the understanding, monitoring and prediction of the Earth's environment and climate change, the formulation of policies for emission control of atmospheric pollutants with respect to Canada's international commitments, natural resources enhancement and natural disasters management.

Building on the Canadian scientists' international reputation of excellence, the CSA is pursuing a two-pronged strategy focused on: (i) participation in international missions dedicated to understanding better the dynamics of the atmosphere, monitoring atmospheric pollution and enhancing the prediction capabilities of global climate change, and (ii) Canadian-led small satellite missions addressing specific domestic needs. The scientific instruments are usually conceived by Canadian universities and are built by Canadian industry.

Two major Canadian science instruments are currently orbiting the Earth and collecting new environmental data: MOPITT (Measurements of Pollution in the Troposphere), aboard the NASA Terra satellite is Canada's first major instrument to measure pollution of the Earth's atmosphere from space; and OSIRIS (Optical Spectrograph and Infrared Imaging System) onboard the Sweden Odin satellite, measures the concentration of various gases in the stratosphere, thereby allowing our scientists to make a significant contribution to the understanding of stratospheric ozone depletion processes.

In 2003-2004, \$30.5 million, or 10% of the total planned spending, will contribute to achieving the following results:

- The late Spring 2003 launch and operation of SCISAT-1, the first Canadian-led mission since the early 1970s, to enhance Canada's leadership in stratospheric ozone studies. The satellite will measure numerous trace gases, thin clouds and aerosols in the stratosphere, thereby enabling a more comprehensive understanding of the several chemical processes that play a role in stratospheric ozone depletion.
- The execution of preparatory activities for the launch of NASA's CloudSat mission in Fall 2004 and final delivery of key radar components for the Cloud Profiling Radar; this mission allows Canadian scientists to participate in the study of global climate processes.
- The continued development, in collaboration with ESA, of an instrument called SWIFT (Stratospheric Wind Interferometer for Transport studies) to understand better the global atmospheric circulation; this instrument is scheduled to fly onboard the Japanese Space Agency's Global Change Observation Mission in 2007.
- The study of stratospheric composition and ozone depletion processes at mid-latitudes, through the launch of high-altitude balloon experiments in August 2003, as part of validation campaigns for Canada's OSIRIS instrument onboard Sweden's Odin satellite and SCISAT-1.
- The continued development of a small Canadian scientific satellite, the Enhanced Polar Outflow Probe (e-POP), and six Canadian scientific payloads. The e-POP mission, scheduled for launch in 2005-2006, will probe the upper atmosphere and ionosphere region where solar variability exerts influence on global change in various time scales. The scientific data collected by e-POP will help understand the particle

exchange and energy coupling processes between the Earth's atmosphere and space environment.

- The continuation of satellite data application development and technology transfer through the Government-Related Initiatives program.
- The modernization and upgrade, completed by 2004-2005, of a Canada-wide array of ground-based instruments (known as Geospace Monitoring) to complement and validate a large fleet of international space missions (including e-POP), which will be launched between 2005 and 2015 under the coordinated International Living With a Star (ILWS) Program. The ILWS fleet will simultaneously collect data in the entire Sun-Earth system, from the surface of the Sun to that of the Earth, and in so doing, allow scientists to identify critical links connecting solar variability to global change.
- The development and delivery of new and improved forecasts of space weather conditions affecting power-grids, telecommunications, and low-Earth orbiting satellite (including ISS); this work is performed in collaboration with Natural Resources Canada, the National Research Council of Canada and the University of Alberta.

To learn more about *Understanding of the environment* go to:

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

4.3 TECHNOLOGICAL DEVELOPMENT AND DIFFUSION

In response to the challenges raised by globalization, the CSA has strategically focused its programs on strengthening the technological base of space firms and positioning them to seize international space mission opportunities, while maintaining a focus on the technologies needed to deliver existing and future Canadian space projects. Considering the modest level of internal resources dedicated to technology development, the CSA has prioritized partnerships with foreign space agencies and firms to acquire expertise, demonstrate Canadian technologies as space-qualified products and services, and improve access to international markets. The CSA will develop a comprehensive Space Technology Plan to define technology thrusts and build roadmaps to help define research priorities.

The 2003-2004 Plans, with budgeted expenditures of \$27.1 million or 8% of the total planned spending, will contribute to achieving the following results:

- The enhancement of the Canadian space industry's competitiveness by awarding new technology development projects to companies following an annual Request for Proposal process. Priority technologies are defined in consultation with industry, and between 25-30 new technology development contracts are awarded annually with industry contribution representing up to 35% of total project costs (based on the level of maturity of technologies). Thus, industry has the opportunity, with government, to co-fund the development of high-risk technologies, critical to penetrating emerging

international markets and meeting the requirements of future space missions. It also supports the early adoption and use by government departments of space technologies in the day-to-day delivery of their mandated operations.

- The development of advanced concepts for future space missions, innovative space technologies, and involvement in international projects by Canadian companies through participation in ESAs General Support and Technology Program. For example, the Harsh Environments Initiative Project develops and demonstrates the use of space technologies for operations in hostile marine, mining and industrial environments.
- The maintenance of in-house technical capabilities by conducting advanced R&D projects that meet the criteria of excellence and relevance in support of the implementation of the CSP.
- The transfer and commercialization of space technologies and their applications to other sectors of the economy to enhance Canadian industrial competitiveness. This is being achieved by managing the CSAs portfolio of patents and intellectual property licenses, by conducting commercialization assessments and marketing plans for technologies developed in-house and through contracts to industry (e.g., namely with the Technology Diffusion Program, which supports potential licensees in assessing business opportunities associated with their space technologies).

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

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

4.4 CONTRIBUTIONS TO THE QUALITY OF LIFE

Space-based sciences and technologies are increasingly contributing to making our lives better on Earth. Here are a few examples:

High-speed satellite telecommunications and the Internet are helping doctors diagnose diabetes in patients living in remote communities hundreds of kilometers away from proper medical care. Doctors screen their patients by examining the retinal patterns of a patient's eye through a small high-resolution imaging device. The early diagnosis of diabetes enables community-based preventative medicine and improves the quality of healthcare for Canadians living in remote communities.

The use of space-borne imagery from RADARSAT and other Canadian Earth Observation sensors contributes to the fulfilling of federal department and agency mandates, such as weather forecasting, ice monitoring for marine navigation, and natural resources and disaster management.

The space environment data collected by Canadian instruments is being used by scores of Canadian companies to predict the hazardous effects of space weather. The ability to predict accurately and in a timely manner the eruptions of energy and particles from the

Sun, which can pose threats to power grids, pipelines, communications, and satellite orbits, will reduce the risks posed to these systems and the socio-economic activities they serve.

The Meteorological Service of Canada (MSC/EC) and scientists in Canadian universities are currently developing procedures for the assimilation of data collected by the MOPITT and OSIRIS instruments into atmospheric models to deliver improved air quality forecasts to all Canadians, and to test and enhance the complex Canadian climate model used to predict climate change in response to future greenhouse gas and aerosol emissions scenarios.

In the near future, Canadians will reap benefits arising from its investments in maintaining a human presence in space, in the training of Canadian Astronauts for participation in the construction and operation of the ISS and in the exploitation of the microgravity environment.

In 2003-2004, a budget of \$26.9 million, or 8% of the total planned spending allocated to Space Life Sciences, Microgravity Sciences and to the Astronaut Program, will contribute to achieving the following results. However, it should be noted that the CSA will have to deal with the consequences following the tragic loss, on February 1, 2003, of Space Shuttle Columbia and its crew. The CSA is presently evaluating the event's impact for the planned activities.

- An understanding of how human and other life forms adapt to a weightless environment. Experiments focusing on changes in bone and the nervous systems will be conducted onboard the Space Shuttle and the ISS. Four separate experiments looking at bone loss occurring in microgravity flew on the Columbia Space Shuttle in January 2003 but were unfortunately lost. Not only will such experiments provide key information about why astronauts lose as much bone during one month in microgravity as a postmenopausal woman loses in one year, but they will also provide insights into osteoporosis, a disease affecting millions of Canadians. The Extra-Vehicular Activity Radiation Monitor experiment, launched on the ISS in August 2002, continues to provide information about determining radiation exposure of astronauts during space walks. Originally scheduled in May 2003, the Perceptual-Motor Deficits in Space (PMDIS) experiment during the STS-115/12A mission with Canadian Astronaut Steve MacLean, will look at why astronauts often experience potentially dangerous decreased hand-eye coordination when they first enter the space environment. The Insect Habitat facility will undergo rigorous testing here on Earth in preparation for its launch to the ISS in mid 2005.
- The improvement of medical knowledge, treatments and drugs through experiments using the effects of microgravity, like the Protein Crystal Growth experiment on the Columbia flight that was unfortunately lost. A precise knowledge of protein structures helps design more efficient medication, with fewer side effects. Protein crystal growth has applications in the fight against cancer and diabetes, as well as in research to control antibiotic-resistant bacteria. The development of the Canadian

Biotechnology Facility to enable protein crystals to be grown on ISS is expected to begin in 2004.

- The advancement in the understanding of basic physical, chemical and biotechnology processes in the weightless environment and the improvement of material processing techniques (including proteins, fluid and combustion processes) through the use of the Space Shuttle and eventually, the ISS. The main Microgravity Sciences projects include the development of: the Microgravity Vibration Isolation System, with a flight model to be delivered in 2003 for integration in ESAs Fluid Science Laboratory, and the Microgravity Isolation Mount Base Unit and ISS Furnace, with acceptance reviews scheduled in October 2004.
- With the recent announcement that Canadian Astronaut Dave Williams will take part in the STS-118/13A mission to the ISS scheduled for November 2003, efforts are underway to include a study of cardiovascular adaptation to the space environment.

To learn more about *Contributions to the Quality of Life* go to:

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

4.5 WORLD-CLASS SPACE RESEARCH

Over the years, Canada's space science programs have been founded on international cooperation. This strategy has offered exciting opportunities to the scientific community for participating in international space missions, as well as to Canadian industry for enhancing its technological base. The development of unique scientific instruments has contributed to the formation of Canada's tradition of excellence and to the human quest for knowledge about space and the growing interest in planetary exploration.

In addition, the ISO-9002 certified David Florida Laboratory (DFL), a world-class facility providing environmental testing for the qualification of space hardware, actively contributes to the recognition of Canada's leadership in space research and the development of a competitive domestic space industry. The CSAs strategy is also to market DFL services internationally.

In 2003-2004, a budget of \$26.8 million, or 8% of the total planned spending, will contribute to achieving the following results:

- 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 Space Astronomy and Exploration programs. Upcoming key projects include: the development of scientific instruments for participation in NASAs Next Generation Space Telescope (Hubble Telescope replacement recently renamed the James Webb Space Telescope) and the Herschel/Planck missions led by ESA; the development and launch of the Microvariability and Oscillations of Stars (MOST) micro-satellite in the

second quarter of 2003. As well, discussions will continue with potential international partners to collaborate on upcoming robotic missions as part of a Canadian strategy for exploring Mars, which will include benefits for Canada in science and industrial competitiveness

- The operation of the CSAs Thermal Plasma Analyzer on its way to Mars to study the Martian atmosphere in an effort to understand our environment better. This project represents Canada's first interplanetary mission, and participation in this mission anticipates Canadian involvement in future initiatives.
- 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, which include RADARSAT-2, MOST, and CLOUDSAT, over the next two fiscal years.
- Increased efforts to market DFL services internationally, which involves the negotiation of a generic "Facilities Use Agreement" to satisfy U.S. technology transfer concerns regarding commercial satellite programs, and hence, facilitate the conclusion of arrangements with U.S. prime contractors for conducting environmental tests at the DFL.
- To undertake facility preparations and test technology development to respond to the qualification requirements of future missions and maintain the DFL's ISO-9002 certification. Much of the DFL's equipment has already exceeded its designed lifetime and should be replaced before damage to flight hardware occurs and to ensure that upcoming space programs can be properly supported by the DFL.

To learn more about *World-Class Space Research* 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/dfl/dfl.asp

4.6 SOCIAL AND EDUCATIONAL BENEFITS FOR CANADIANS

In support of its vision "*To serve and to inspire Canadians through excellence,*" the CSA is taking advantage of the unique appeal of space to improve scientific literacy among students and educators. Through an integrated and proactive public appearance and outreach strategy, Canadian astronauts, CSA scientists, engineers and program specialists are all contributing to enhancing the awareness of Canada's contribution to leading-edge space science and technology while encouraging youth to pursue careers in science and engineering.

The training of qualified Canadian scientists, engineers and technicians for high technology and space-related industries is also supported through a series of programs jointly delivered with the Natural Sciences and Engineering Research Council of Canada

and/or the Public Service Commission, as well as new training initiatives (e.g., CSA Fellowship) with industry and academia.

In 2003-2004, a budget of \$2.4 million, or 1% of the total planned spending, will contribute to achieving the following results:

- An increase in educator and student participation in the space-centered learning initiatives of the Youth Awareness and Education Program, which contributes to encouraging youth to pursue careers in the field of science and engineering.
- The enhanced use of targeted and educational space-based materials by not-for-profit and educational institutions, and increased requests for youth-oriented public information campaigns across Canada.
- The promotion of Teach the Teacher training workshop and the development of validated teaching materials, web-based materials and national web casts responding to the needs of educators while expanding interest and inspiring Canadian youth.
- An expanded network of leveraged expertise and partnered initiatives in response to an increasing demand for educational materials and support.
- Regional tours and partnered initiatives with Canadian Space and Science Museums, schools and youth organizations, as supported by awards of the Youth Awareness and Education Grants & Contributions Program.
- The implementation of the new Grant and Contribution programs, in partnership with other federal departments and agencies, to support awareness, research and training in space science and technology.

To learn more about *Social and Educational benefits for Canadians* go to:
http://www.space.gc.ca/asc/eng/youth_educators/educators/educators.asp

4.7 PROMOTION AND AWARENESS OF THE CANADIAN SPACE PROGRAM

4.7.1 Public Awareness of the Canadian Space Program

The CSA places great emphasis on building national pride through public awareness initiatives focused on Canadian achievements in space science and technology. Eight in ten Canadians are proud of Canada's achievements in space and believe it is important for Canada to have an active space program and to be involved in the development of

advanced technologies and science related to space⁵. Furthermore, three in four believe Canada should take an active role in future international missions to Mars⁶.

Communications and outreach activities targeting Parliament, key stakeholders and the public will continue to heighten understanding of the benefits of the CSP and of the leveraged partnerships driving collaboration between government, industry, the research community and other space agencies which contribute to the international recognition of Canada as an innovative space science and technology leader.

The 2003-2004 Plans with a budget of \$5.8 million or 2% of the total planned spending, will contribute to increase awareness of the Canadian Space Program by implementing a proactive and balanced communications strategy focusing on important space achievements. The major communications activities are the following. However, it should be noted that the CSA will have to deal with the consequences following the tragic loss, on February 1, 2003, of Space Shuttle Columbia and its crew. The CSA is presently evaluating the event's impact for the planned activities.

- The Canadian scientific experiments OSTEO-2 and Perceptual-Motor Deficits in Space.
- Astronaut launches with Steve MacLean scheduled for May 2003 and Dave Williams scheduled for November 2003, supporting construction of the International Space Station.
- The launch of SCISAT-1, Canada's first science satellite in thirty years.
- The launch of MOST, Canada's micro-satellite space telescope.
- The launch of Anik F-2, containing a specialised Ka-Band transponder.
- The launch of Radarsat-2 in 2004.

4.7.2 Modernizing the Management of the Canadian Space Agency

The Canadian Space Agency is fully committed to the objectives of the government-wide Modernization of Comptrollership to ensure efficient and effective delivery of programs and services. The CSA's commitment reflects our leadership and engagement to organisational and professional excellence.

Based on the Capacity Assessment completed in April 2002, the CSA has developed a Management Modernization Action Plan that was approved by the Executive Committee in September 2002. The Treasury Board Secretariat identified the CSA's Action Plan as a

⁵ Compas National Survey, May 2001

⁶ Compas National Survey, January-March 2002

good management tool to support the implementation of Modern Comptrollership and invited the CSA to share its methodology with other departments and agencies.

The CSA is aiming to achieve an overall “*Good Management Practice Level*” against the Capacity Assessment Criteria by early 2004. The main priorities are:

- The development of a new CSA Strategic Plan by June 2003, along with the review of the CSA Planning, Reporting and Accountability Structure (PRAS);
- The development of a performance measurement framework by April 2003 and its full implementation by April 2004;
- The streamlining of the Project Approval and Management Framework by the end of 2003; and,
- The development and initiation of a modular orientation program for new CSA staff in 2003.

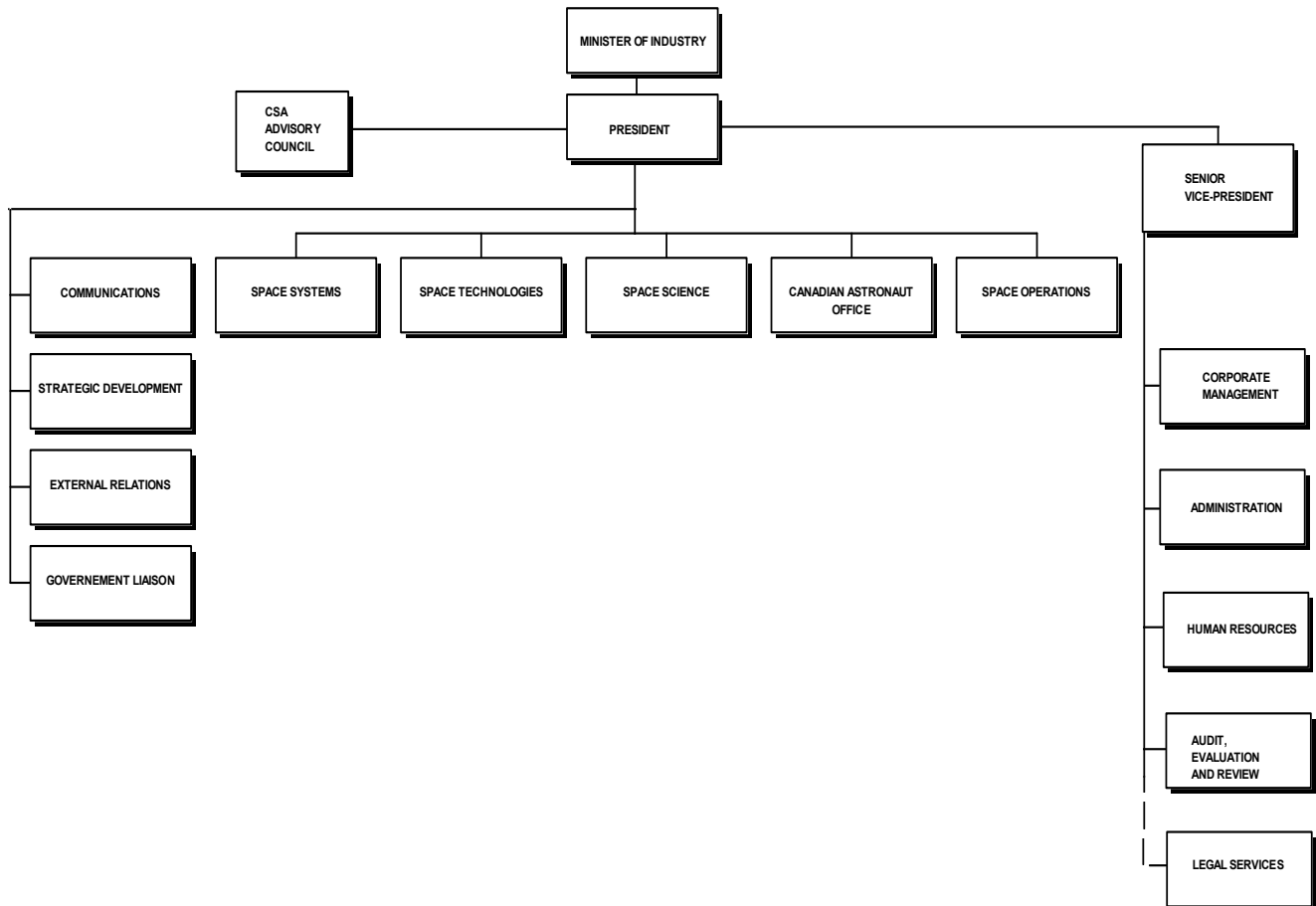
A first internal review of the progress made for the calendar year 2002 indicated measurable improvements. A second review will be conducted in December 2003.

SECTION 5: ORGANISATION

Reporting to the Minister of Industry, the Chief Executive Officer of the CSA is the President, assisted by the Senior Vice-President. The five core functions and the Executive functions report directly to the President. The five corporate functions report directly to the Senior Vice-President. Legal Services are offered by the Department of Justice to provide counsel to the President, the Senior Vice-President and to members of the Executive Committee.

The CSA works closely with several government departments and agencies, most notably with the Canada Centre for Remote Sensing (CCRS) of Natural Resources Canada, which operates satellite data ground receiving stations in Quebec and Saskatchewan, and the Communications Research Centre (CRC) of Industry Canada, which manages satellite communications programs on behalf of the Agency. The CSA also has close cooperation links with the Department of Foreign Affairs and International Trade, Industry Canada, Environment Canada, Fisheries and Oceans and others.

CANADIAN SPACE AGENCY - JOHN H. CHAPMAN SPACE CENTER / CSA ORGANISATION



SECTION 6: FINANCIAL INFORMATION

6.1 CSA PLANNED SPENDING

Planned Spending for the Canadian Space Agency

Business Line: Space Knowledge, Applications and Industry Development				
	Forecast Spending 2002-2003	Planned Spending 2003-2004	Planned Spending 2004-2005	Planned Spending 2005-2006
(\$ millions)				
Budgetary Main Estimates (gross)	335.8	318.7	305.3	305.3
Non-Budgetary Main Estimates (gross)	0.0	0.0	0.0	0.0
Less: Respendable Revenue	0.0	0.0	0.0	0.0
Total Main Estimates	335.8	318.7	305.3	305.3
Adjustments **	(1.4)	4.1	4.1	0.0
Net Planned Spending	334.5 *	322.8	309.4	305.3
Less: Non-Respendable Revenue	0.9	1.7	1.6	1.6
Plus: Cost of Services Received without Charges	3.6	4.1	4.1	4.1
Net Cost of Program	337.2	325.2	311.9	307.8
Full Time Equivalent	528	630	630	630

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

* Reflects the best forecast of Total Net Planned Spending to the end of the fiscal year.

**Adjustments are to accommodate approvals obtained since the Main Estimates and are to include Federal Budget initiatives, Supplementary Estimates etc.

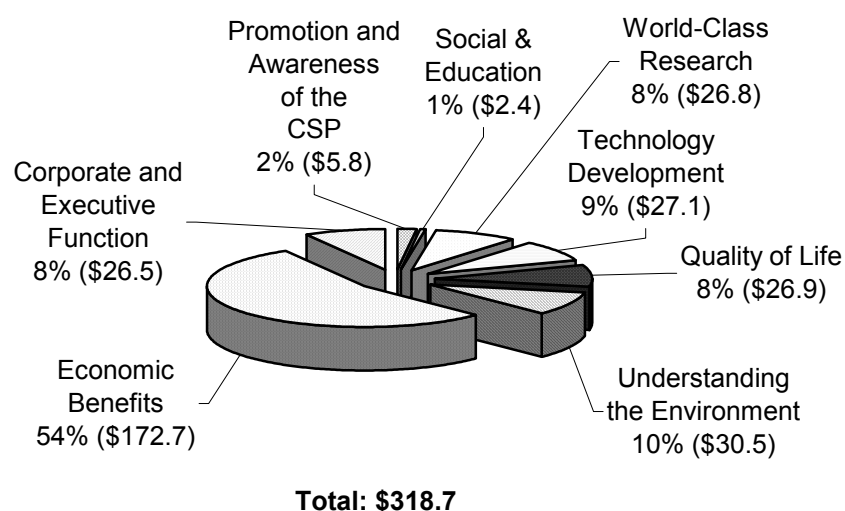
6.2 CSA PLANNED SPENDING BY STRATEGIC OUTCOME

The following table presents planned spending by strategic outcome for the CSAs Business Lines over the next three Fiscal Years.

Business Line: Space Knowledge, Applications and Industry Development			
Strategic Outcomes (\$ millions)	2003-2004	2004-2005	2005-2006
Economic Benefits	172.7	141.7	141.6
Understanding the Environment	30.5	33.1	30.8
Technology Development	27.1	34.0	37.3
Quality of Life	26.9	27.0	27.3
World-Class Space Research	26.8	35.3	34.2
Social & Education	2.4	3.1	3.1
Promotion and Awareness of the Canadian Space Program	5.8	5.8	5.8
Strategic Outcomes – Sub Total	292.2	280.0	280.1
Corporate and Executive Functions	26.5	25.4	25.2
Total	318.7	305.4	305.3

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

Strategic Outcomes and Business Line for 2003-2004 (\$ millions)



SECTION 7: ANNEXES ON FINANCIAL INFORMATION

- 7.1 Summary of Capital Spending by Program and Business Line
- 7.2 Details on Major Capital Project Spending
- 7.3 Status Report on Major Crown Projects
- 7.4 Summary of Transfer Payments
- 7.5 Details on Transfer Payments Programs
- 7.6 Source of Respendable and Non-Respendable Revenue
- 7.7 Net Cost of Program for the Estimates Year

The annexes are linked to the Canadian Space Agency's web site:

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