ESTIMATES

Canadian Space Agency

2002-2003
Estimates

Part III – Report on Plans and Priorities

Canada

The Estimates Documents

Each year, the government prepares Estimates in support of its request to Parliament for authority to spend public monies. This request is formalized through the tabling of appropriation bills in Parliament. The Estimates, which are tabled in the House of Commons by the President of the Treasury Board, consist of three parts:

Part I – The Government Expenditure Plan provides an overview of federal spending and summarizes both the relationship of the key elements of the Main Estimates to the Expenditure Plan (as set out in the Budget).

Part II – The Main Estimates directly support the *Appropriation Act*. The Main Estimates identify the spending authorities (votes) and amounts to be included in subsequent appropriation bills. Parliament will be asked to approve these votes to enable the government to proceed with its spending plans. Parts I and II of the Estimates are tabled concurrently on or before 1 March.

Part III – Departmental Expenditure Plans which is divided into two components:

(1) **Reports on Plans and Priorities (RPPs)** are individual expenditure plans for each department and agency (excluding Crown corporations). These reports provide increased levels of detail on a business line basis and contain information on objectives, initiatives and planned results, including links to related resource requirements over a three-year period. The RPPs also provide details on human resource requirements, major capital projects, grants and contributions, and net program costs. They are tabled in Parliament by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*. These documents are tabled in the spring and referred to committees, which then report back to the House of Commons pursuant to Standing Order 81(4).

(2) **Departmental Performance Reports (DPRs)** are individual department and agency accounts of accomplishments achieved against planned performance expectations as set out in respective RPPs. These Performance Reports, which cover the most recently completed fiscal year, are tabled in Parliament in the fall by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*.

The Estimates, along with the Minister of Finance's Budget, reflect the government's annual budget planning and resource allocation priorities. In combination with the subsequent reporting of financial results in the Public Accounts and of accomplishments achieved in Departmental Performance Reports, this material helps Parliament hold the government to account for the allocation and management of public funds.

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THE CANADIAN SPACE AGENCY

2002-2003 Estimates

REPORT ON PLANS AND PRIORITIES

Allan Rock
Minister of Industry

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SECTION 1: MESSAGES

1.1 MINISTER'S PORTFOLIO MESSAGE

Today, our people, our universities and our industries are successfully competing around the globe. At the same time, we have a democratic society and way of life that continues to be judged one of the best in the world. To continue our economic growth and social development, indeed, to continue our success as a nation, we must strive to be among the best in creating and commercializing new knowledge. We are committed to building a world-leading, knowledge-based economy and we need to be more innovative to stay competitive.

To support a nation of innovators, we are investing in the skills and abilities of all Canadians so that they can actively contribute to and participate in today's knowledge-based economy. By harnessing our human potential and talent, we can continue our economic success.

The Government of Canada is investing in research and development to improve the capability of our universities and private sector firms to compete internationally. To foster a culture of innovation, we are creating an environment that is favourable to innovation, an environment of trust and confidence, where the public and private interests are protected and there are marketplace incentives for innovation.

The Industry Portfolio organizations are:

- 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
- 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 Reports on Plans and Priorities.

Whether stimulating the creation and use of knowledge, supporting the creation and development of businesses and industries, promoting inclusive economic growth, or ensuring a fair and equitable marketplace, each of the fifteen member organizations of the Industry Portfolio is contributing to Canada's innovation strategy. Their work with public and private sector partners across the country is key to Canada's success.

I am pleased 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.

To secure Canada's continued success in the 21st century, we are committed to nurturing and developing the potential of all our citizens in every community across our nation. By investing in organizations like the Canadian Space Agency, we will continue building an innovative economy and society for the benefit of all Canadians.

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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, 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, academia, provincial and territorial governments. The newly created CSA Advisory Council and 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 concrete benefits they personally receive from their investment in the Canadian Space Program. Communications activities will inspire Canadians; strengthening the pride they feel about 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 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 better, more effective and 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 the success of this vision 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 fostered as key values promoted within all levels of the Agency. 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.

The CSA's 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 2002-2003 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 2002-2003 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 properly manage them. Canada is sparsely populated with many remote communities. Satellite communications efficiently links citizens wherever they work and live. Canada has a large, well-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, which is 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 these objectives by working closely with other government departments and agencies, industries, and universities, as well as international partners. The CSA is helping to develop a competitive domestic industry by contracting out the development of spacecraft, space systems, and instruments to Canadian firms.

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

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/_publications/pdf/csa_pub/national_paper.PDF

http://www.space.gc.ca/_publications/pdf/csa_pub/ASC_Br_Corpo.pdf

SECTION 3: PLANS AND PRIORITIES BY STRATEGIC OUTCOME

The CSA's 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, export-oriented Canadian space hardware and service industry. In collaboration with other public organizations, 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 phenomena in space affects life on Earth.

The CSA has established seven (7) strategic outcomes to be derived from its programs.

1. Economic Benefits
2. Understanding of the Environment and Contribution to Sustainable Development
3. Technological Development and Diffusion
4. Contributions to the Quality of Life
5. World-Class Space Research
6. Social and Educational Benefits for Canadians
7. Promotion and Awareness of the Canadian Space Program

These strategic outcomes are not mutually exclusive and therefore a single program, project or activity may be contributing to more than one strategic outcome. The plans and priorities for each strategic outcome are described in detail in the following sections.

3.1 ECONOMIC BENEFITS

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

- To develop 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, pursue sustainable industrial regional development.

In 2002-2003, $ 201.2 million, or 61% of the total planned spending, will contribute directly to the generation of economic benefits. This strategic outcome is suported by three main priorities; Satellite Communications, Earth and Environment, and Canadian Space Station Program.

3.1.1 Satellite Communications

Globalisation has driven a restructuring of the world's space industry around a few giant firms capable of producing complete satellite systems and associated services, from design through to launch and operations. Most of those systems are designed to provide worldwide coverage. This situation has generated significant challenges for Canada's satellite communications industry, which traditionally built satellites for the domestic market. (Satellite Communications is the largest space-sector activity in Canada with sales of more than $1 billion, representing 60% of the total space revenues and 2,800 jobs)[1]. Canadian industry responded to globalisation 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) to penetrate and maintain international markets successfully. The role of the CSA is to support industry with programs that allow Canada to develop advanced components and sub-systems to join international consortia as suppliers and maintain its competitiveness in our traditional market niches.

The 2002-03 Plans, with budgeted expenditures of $31.9 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 June 2003 to position Canadian industry as a credible supplier of advanced components (e.g., on-board processing, multi-beam antennas, and dynamic allocation of capacity) for the next generation of satellite communications systems on the international market, and as a service provider (e.g., multi-media and Internet by satellite) by providing two-way, high-speed satellite services to all parts of Canada.

- The development of technological capabilities in advanced multi-media broadband /mobile communications sub-systems and services by participating in European Space Agency (ESA) programs that 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 such as the development of new interactive communications services for remote communities (e.g., tele-medicine /education networks) and disaster management (e.g., forest fires).

[1] Survey conducted by the CSA in 1999

- The selection of new programs for 2004-05 will be made, as significant uncommitted funds become available. The priorities being considered are the development of small single purpose communications satellites to protect Canada's orbital slots, cost-shared programs with industry for the development of ground segment technologies and user applications, and participation in future ESA programs to position Canadian companies as suppliers of strategic sub-systems to European satellite builders (e.g., Alcatel, Astrium), and international operators (e.g., Intelsat, Inmarsat and Astra).

3.1.2 Earth & Environment

In addition to the worldwide concern for the environment, the international scene is dominated by intensified competition from the U.S. and Europe to commercialise Earth Observation (EO) satellite data, the need to control access to satellite data for reasons of national security, and the growing interest in the use of hyper-spectral technologies in remote sensing from space. Canada is particularly well positioned to take advantage of the international thrust towards commercialisation. Indeed, Canada's EO sector (the second largest Canadian space industry with annual revenues of $265 million and 1,600 employees)[2] is an innovative, technologically advanced industry capable of developing products and services in demand on world markets. The marketing of RADARSAT-1 data has been privatised for several years through Radarsat International Inc. (RSI), a division of MacDonald Dettwiler & Associates (MDA). RADARSAT-2 has been industry-owned by MDA from its early development. Canada's ground infrastructure is state-of-the-art and continues to be upgraded to receive and process the most recent satellite data. The legislation and associated regulations addressing national security concerns are being developed in time to ensure secure access and distribution of RADARSAT-2 data.

Building on these strengths, the CSA, in collaboration with other government and industry partners, has established a strategy aimed at maintaining Canada's world dominance in commercial space-borne radar technologies while continuing to develop an internationally competitive value-added industry for satellite-based applications. In this context, a key priority is to prepare the Canadian user community to access RADARSAT-2, ENVISAT (the largest satellite ever built in Europe for the study of Earth and its environment), hyper-spectral and other satellite data sources, and to develop high-potential applications.

The 2002-03 Plans, with budgeted expenditures of $95.2 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 while ensuring continuity in data supply at least until RADARSAT-2 is launched and commissioned while recognizing that the requirement to operate RADARSAT-1 until 2004, more than three years beyond its original design lifetime, significantly raises the risks of failure.

[2] Survey conducted by the CSA in 1999

- The completion of RADARSAT-2 development within budget and on schedule to ensure continuity in radar data supply in the worldwide remote sensing market. Equipped with advanced technologies, RARDARSAT-2 will continue to provide all-weather, day and night coverage of the entire globe; but, it 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 the capability to access an area of 800 km width on either side of the sub-satellite track. The original spacecraft design has been modified to include data encryption capabilities and to accommodate a potential tandem mission with RADARSAT-3. The RADARSAT-2 launch is scheduled for November 2003. Other key milestones are: mission critical design review in March 2002, completion of spacecraft integration and testing in July 2003, and operations beginning in 2004.

- 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. These new capabilities will be available by the end of 2002-03.

- The continuation of satellite data application development and technology transfer programs (e.g., the Earth Observation and Applications Development Program) will support the growth of Canada's value added industry and the use of data, produced by RADARSAT and other satellites in which Canada has participated, for the management of natural resources, monitoring of the environment and surveillance activities.

- The development of advanced remote sensing technologies and applications by Canadian companies participating in ESA programs that allow Canadian industry to obtain contracts related to: the design and, where feasible, the development of advanced EO instruments such as LIDAR, radars, spectrometers and hyper-spectral instruments; the operations of ENVISAT, whose mission is complementary to that of RADARSAT; and the development of user-oriented applications for the "Global Monitoring for Environment and Security," an initiative of the European Union to study phenomena such as global warming processes for ocean monitoring and resource management.

- The participation with ESA, CNES (Centre national d'études spatiales de France) and others in the International Charter on Space and Major Disasters.

3.1.3 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 System[3] (MSS), designed to assemble, service and maintain the International Space Station (ISS). Under the CSSP, the CSA is also responsible for the training of all astronauts and cosmonauts manoeuvring the MSS and for the provision of an operational support capacity at the John H. Chapman Space Center in Saint-Hubert, Québec. In exchange for this contribution, Canada has gained the rights to use up to 2.3 % of non-Russian laboratories and crew on-board the ISS. The CSSP has generated a robotics industry with revenues of $224 million and a workforce of more than 1,100 employees.[4]

The delivery of the Canadian Space Station Program continues to be quite challenging. The long-term scope and international dimension of the ISS limit the ability of any one country to control fully the changes in design, schedule and cost. For example, the constraints imposed by the U.S. Administration on the NASA budget will delay the launch date of the Special Purpose Dextrous Manipulator (SPDM), the last Canadian element of the MSS, and possibly reduce the frequency of Canadian Astronaut flights to and stays on the ISS, as well as the scientific and commercial utilization of the Station.

The uniqueness of the space hardware being designed for the ISS requires very stringent quality control. For example, there has been a one-year delay in the delivery of the SPDM to the CSA, due to technical problems encountered by the contractor (MD Robotics). The delay has no impact on the CSA in terms of costs, as the manufacture of the SPDM is covered by a fixed price contract, and its launch has been delayed by NASA.

Finally, another recurring challenge has been the management of significant risks associated with both the manufacture and operation of the MSS. With the completion of the SPDM, the risks will be limited from now on to MSS Operations, and the on-orbit integration of the Mobile Base System (MBS) and SPDM elements.

The CSA's long-term strategy is to maintain Canada's position as a world leader in space robotics by exercising full 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 to Canada for the foreseeable future.

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[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 on-board the Station, and the Special Purpose Dextrous Manipulator (SPDM), a second robot designed to perform more delicate tasks.

[4] Survey conducted by the CSA in 1999

The 2002-03 Plans, with budgeted expenditures of $74.0 million, will contribute to achieving the following results:

- The completion of the development and successful on-orbit commissioning of the last two MSS elements: MBS scheduled for launch in May 2002 and SPDM to be launched no earlier than 2004 and possibly as late as 2006.

- The continuation of 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 (support of MSS real-time operations at Saint-Hubert, Québec will commence in August 2002).

- The implementation of the scientific programs (e.g., Material and Life Sciences) and space technologies to prepare Canada to take advantage of its share of ISS facilities; and, the selection of a Canadian company to champion commercialisation by the private sector.

3.2 UNDERSTANDING OF THE ENVIRONMENT AND CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

Protecting the Earth's environment and preserving natural resources have become increasingly important to government agendas. These world-wide concerns have led to a rising demand for systems enabling the monitoring of the Earth's environment from space. The unique scientific data provided by space-based instruments and EO satellites have contributed 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, as well as the enhancement of natural resource and disaster management.

Building on the Canadian scientists' international reputation of excellence, the CSA has pursued a strategy focused on participation in international missions dedicated to better understanding the dynamics of the atmosphere, monitoring atmospheric pollution, and enhancing the prediction capabilities of global climate change. This strategy has led to several invitations from international space agencies to develop scientific instruments for flight onboard their satellites. Those instruments are usually conceived in Canadian universities and built by industry.

For example, MOPITT (Measurements of Pollution in the Troposphere) is Canada's first major instrument to measure pollution of the Earth's atmosphere from space. It is also the Canadian Space Agency's biggest contribution to the NASA Earth Observation System, the most ambitious study of the planet's environmental processes to date. Also, through the ten-year extension of the Canada - European Space Agency agreement, Canadian companies compete for and obtain contracts in certain niche markets in which the Canadian Space Agency participates, such as the Earth Observation Envelope Program. Canadian Companies have received $ 39.5 million in contracts from the European Space

Agency for their contributions of innovative space technologies, sensors and expertise in the construction of ENVISAT. ENVISAT is the follow-up to the earlier Earth Observation satellites, ERS-1 and ERS-2 satellites, in which Canada also made a significant contribution. ENVISAT will ensure the continuity of radar images and will be used extensively by Canadian users, together with data provided by our own RADARSAT-1 and soon RADARSAT-2.

A few years ago, it was decided to complement international opportunities with a small, indigenous scientific satellite program to address questions more directly related to Canada's geography, such as the depletion of stratospheric ozone over the Arctic in the springtime and ionosphere phenomena associated with aurora borealis.

In 2002-2003, $ 25.2 million, or 7% of the total planned spending, will contribute to achieving the following results:

- The enhancement of Canada's leadership in studies on stratospheric ozone with the construction and operation of SCISAT-1, Canada's first scientific satellite since the early 1970's. This small satellite is scheduled for launch in December 2002.

- The participation of Canadian scientists in the study of global climate processes with the delivery of key radar components to NASA's CLOUDSAT mission by the end of 2002. This satellite is scheduled for launch in April 2004.

- A better understanding of the global atmospheric circulation with the development, in collaboration with ESA, of an instrument called SWIFT (Stratospheric Wind Interferometer for Transport studies), which is scheduled to fly onboard the Japanese Space Agency's (NASDA) 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 2002 and 2003, as part of the validation campaigns of Canada's Optical Spectrograph and Infra Red Imager System (OSIRIS) instrument onboard Sweden's Odin satellite and SCISAT-1.

- The advancement of knowledge on upper atmosphere and ionosphere phenomena with the development of a small scientific satellite, the Enhanced Polar Outflow Probe (e-POP), for launch in 2005; continuation of operations and modernization (to be completed by 2004) of a Canada-wide array of ground-based instruments for a real-time study of the polar space environment.

- An improved ability to forecast space weather with enhanced models of the near-Earth environment, in collaboration with Natural Resources Canada and the University of Alberta.

- The fulfilling of federal department/agency mandates, with respect to natural resource and disaster management by using space-borne imagery from RADARSAT and other Canadian EO sensors in their routine operations, as well as in studies related to the

cryosphere; the inventory, management and sustainable development of Canadian forests; climate change and its impact on the environment; and, the management of oceans, coastal and inland waters.

3.3 TECHNOLOGICAL DEVELOPMENT AND DIFFUSION

Globalisation and rapid technological evolution have resulted in greater challenges for Canada's space industry. The principal challenges in the near future are to maintain the international competitiveness of Canadian manufacturing capabilities, while developing innovative advanced systems required to sustain industry growth. In response to these challenges, 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 resources dedicated to technology development, the CSA has prioritised partnerships with foreign space agencies/firms to acquire expertise, demonstrate Canadian technologies as space-qualified products and services, and improve access to international markets.

In 2002-2003, $ 25.5 million, or 7% of the total planned spending, will contribute to achieving the following results:

- The enhancement of the Canadian space industry's competitiveness through the awarding of R&D projects to companies following an annual Request for Proposal process. 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. Priority technologies are defined with industry, and 15-25 new contracts are awarded on an annual basis with industry contribution representing up to 35% of total project costs (based on the level of maturity of technologies).

- The development of advanced concepts for future space missions, innovative applications from space technologies, and involvement in large infrastructure projects by Canadian companies through participation in the General Support and Technology Program. For example, the Harsh Environments Initiative, which aims to use space technologies for operations in hostile marine, mining and industrial environments, and the construction of a 35 meter antenna for the tracking, telemetry and command of planetary probes will both be completed by Canadian prime contractors in 2003.

- The maintenance of in-house technical capabilities by conducting internal R&D projects in support of the implementation of the Canadian Space Program, the acquisition of intelligence information on technology trends worldwide and, along with industry, on the potential of advanced emerging technologies.

- The transfer and commercialisation of space technologies and their applications to other industrial sectors, primarily with Canadian companies, by managing the CSA's portfolio of active patents and Intellectual Property licenses, and by conducting

commercialisation assessments and marketing plans on technologies developed in-house and with contracts to industry.

3.4 CONTRIBUTIONS TO THE QUALITY OF LIFE

Today more than ever, Canadians are reaping the benefits of Canada's long tradition as a space-faring nation. Connecting urban, rural and remote communities, Canadian telecommunications satellites are linking citizens from coast to coast, providing Canadians wherever they live, work and play with access to direct broadcasting television, high-speed Internet and mobile communications.

These beyond-state-of-the-art advancements in Canadian satellite technologies are currently benefiting people living in remote areas in the far north. The use of high-speed multimedia telecommunications satellites is providing hospitals, marine vessels and isolated regions with a direct link to best possible healthcare thousands of kilometers away.

As an example, high-speed satellite telecommunications and the Internet are helping doctors diagnose diabetes in patients living in remote communities hundreds of kilometers from a downtown health clinic. Doctors screen their patients, viewing the retinal patterns in the patient's eye through a small high-resolution imaging device. The early diagnosis of diabetes enables community-based preventative medicine and significantly improves the quality of healthcare for Canadians living in remote communities.

Emerging space technologies and broadband hold the promise of reaching out and linking that last kilometer, so that every citizen will have access to the information highway. Space-based telecommunications satellites such as ANIK F2 will soon be demonstrating the capability of the Ka-band to deliver cheaper, faster multi-media, Internet, broadcasting and mobile communications and helping the government provide on-line access to information on government programs and services, 24 hours a day - seven days a week**.**

The use of space enabled technologies enables us to instantly monitor events, activities and changes on Earth and its environment, however remote the location, or however dense the cloud cover or darkness. Remote sensing from space is a key element in the understanding and solution of some of the world's most pressing problems: drought, climate change, the greenhouse effect, ozone depletion and pollution.

Technologies developed to support space missions are increasingly contributing to making our lives better here on Earth. As an example, Canada's RADARSAT-1 Earth Observation satellite images are helping monitor and manage our natural and agricultural resources, track endangered species, map our coastlines, support search and rescue missions, direct mining and water exploration and keep our waters safer for vessels navigating through the Arctic. RADARSAT-2, currently in development, will do even more.

Space-based resources are now being marshaled to support firefighters battling forest fires in British Columbia. Using pocket sized portable or hand held personal terminals linked through telecommunications satellites, images provided by Earth Observation satellites and positioning provided by navigation satellites, firefighters in the field are directed where needed in near real-time from mobile command centers.

The depletion of the ozone layer in the stratosphere is one of the major environmental crises our Planet faces today. Polar regions are the most affected by ozone depletion, which may increase health hazards for Canadians exposed to excessive levels of radiation. Supporting leading-edge research, the Canadian Space Agency, in cooperation with NASA, designed a Light Detection And Ranging (LIDAR) instrument to measure chemical pollution and the ozone in our fragile atmosphere. The design of this instrument will eventually contribute to our knowledge of the environment, and provide the Meteorological Service of Canada with a powerful tool to help understand weather systems.

Culture preparation for microbiology is a labour intensive, tedious process, done, for the most part, manually. Specimen streaking lacks precision and repeatability and varies considerably between lab personnel. Moreover, lab personnel are exposed to biohazards and themselves represent potential sources of contamination for specimens. The terrestrial spin-off of space technology has produced a technology that simplifies the process and makes it both more reliable and more efficient. The automated workcell uses robotic control and vision system technology to perform the culture preparation in microbiology labs.

Here are some other examples:

Detecting Ozone Depletion: OSIRIS (Optical Spectrograph and InfraRed Imager System) a Canadian instrument, was launched on the Swedish Odin satellite in February 2001. It is the first instrument to measure the concentration of ozone-depleting pollutants allowing scientists to identify the human activities that result in depletion of atmospheric ozone and the serious consequences it creates.

SCISAT-1 A Partnered Approach to Space Science: SCISAT-1 will be the first all-Canadian science satellite in over thirty years. Its mission, to measure and understand the chemical processes that controls the distribution of ozone in the Earth's atmosphere, is a partnership between Canadian government, industry and universities.

Harsh Environments Initiative (HEI): Lead by a consortium of Memorial University researchers, and public and private sector entrepreneurs, the Harsh Environments Initiative is a leading example of the power of cooperation and innovation. This initiative has created a network of partnerships engaged in the transfer and adaptation of Canadian and European space technologies and applications for use in extreme environments found in mining, underwater and offshore exploration, the oil and gas industry, and forestry.

Space Vision System: Canadian Space vision technologies, developed within the Canadian Space Program, are helping mining experts extract the most from their geological explorations while immeasurably improving the safety of workers.

Education and Outreach Program: As Canada takes on the world in highly competitive niche space markets, a steady source of motivated, talented, highly skilled and resourceful workers will be required. An aggressive Space Awareness Program targeted at youth will sow the seeds of interest for science and engineering careers, and become a fundamental cornerstone in building the knowledge-based economy in the future. Canada's leading achievements in space are today providing youth with strong positive role models—motivating youth to embrace careers in the sciences, engineering and technology, and serving as a source of pride for all Canadians.

In 2002-2003, $ 27.9 million, or 8% of the total planned spending, allocated to Microgravity science and to the Astronaut Program will contribute to achieving the following results:

- An understanding of how human and other life forms adapt to a weightless environment, including changes in the cardiovascular, bone and nervous systems through experiments conducted on board the Space Shuttle and eventually the ISS. The main Space Life Science projects in development are: osteoporosis experiments on the Space Shuttle STS-107 flight in June 2002, Extra-Vehicular Activity Radiation Monitor and Perceptual-Motor Deficits experiments on the ISS in August 2002 and late 2003 (respectively), and Canada's Insect Habitat facility slated for launch in 2004 to the ISS.

- The improvement of medical knowledge, treatments and drugs through experiments using the effects of microgravity, like the Protein Crystal Growth experiment on STS-107 in June 2002 and the Canadian ISS Biotechnology Facility with concept selection planned for mid-2002.

- 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 Material Sciences projects include the development of: the Microgravity Vibration Isolation System with a flight model to be delivered in the fourth quarter of 2002 for integration in the ESA's Fluid Science Laboratory, the Microgravity Isolation Mount Base Unit and ISS Furnace with acceptance reviews scheduled in the third quarter of 2003.

- The maintenance of an experienced Canadian Astronaut corps to meet the needs of human space flights and studies in health technologies, as well as the testing of Canadian space material and life science experiments. The main activities focus on the training of Canadian Astronauts for participation in the construction and operation of the ISS and the development of a strong space medicine program.

3.5 WORLD-CLASS SPACE RESEARCH

Canada has achieved internationally recognized excellence in a number of areas, notably space robotics, through our contribution to: building and operating the International Space Station with the Mobile Servicing System; civilian space-borne radar technologies and applications with RADARSAT-1; satellite communications sub-systems specifically radio frequency multi-plexing and antennas; and certain space science disciplines such as solar-terrestrial relations sciences, space astronomy and space qualification services. Also, the CSA's Thermal Plasma Analyzer is on its way to Mars to study the Martian atmosphere in an effort to understand our own environment better. This project represents Canada's first interplanetary mission, and participation in this mission anticipates Canadian involvement in future initiatives. Considering that most of those areas have already been addressed, this section focuses on Space Science and the David Florida Laboratory.

Since the very beginning of the Canadian Space Program in 1962, Canada's space science programs have been founded on international co-operation. This co-operation has provided the scientific community with exciting opportunities to contribute to industry and the global knowledge base through challenges that enhance its technological base with the development of unique scientific instruments. The strategy developed over the years has enhanced Canada's tradition of excellence, as well as our capacity and capability to co-operate with international partners in the exploration of space. These ventures offer opportunities to our scientific community to participate in international space science missions, especially the new era set to unfold through expanded use of the ISS. These missions meet the human quest for knowledge about space and the very origins of the universe, and the growing interest in planetary exploration as witnessed by the numerous missions to Mars.

The ISO-9002 certified David Florida Laboratory (DFL), a world-class facility providing environmental tests 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 CSA's strategy is also to market DFL services internationally. Negotiations are continuing with U.S.-based companies for the assembly, integration and testing of a series of communications satellites at DFL. However, current International Trade in Arms Regulations (ITAR) restrictions are hindering negotiations between the DFL and U.S. prime contractors. This issue is being addressed by negotiating a generic "Facilities Use Agreement" to satisfy U.S. technology transfer concerns, especially regarding commercial satellite programs.

In 2002-2003, $ 21.8 million, or 6% 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 the Next Generation Space Telescope or NGST (Hubble Telescope replacement led by NASA) and the Herschel/Planck mission led by ESA; the development and launch of the Microvariability and Oscillations of Stars (MOST) micro-satellite in the fourth quarter of 2002; as well as the development of plans, possibly including robotic contributions, for the scientific exploration of Mars and other planetary bodies.

- 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. Over the next two fiscal years include: RADARSAT-2, SCISAT-1, MOST, and CLOUDSAT.

3.6 SOCIAL AND EDUCATIONAL BENEFITS FOR CANADIANS

The CSA takes advantage of the unique appeal of space to improve scientific literacy among students and educators, to encourage youth to pursue careers in science and engineering, and to promote awareness of the importance of science and technology to Canada's future. Canadian Astronauts are a very significant contributing factor in the creation of space appeal. A pro-active public appearance strategy for the Astronauts will more finely target prospective stakeholders and youth audiences. Moreover, the nature of space hardware development (which involves meeting exceptional technical requirements, very stringent quality controls and mastering advanced technologies) constitutes an excellent vehicle for training highly qualified scientists, engineers and technicians for Canada's high technology industries.

In 2002-2003, $ 2.8 million, or 1% of the total planned spending, will contribute to achieving the following results:

- The broadening of awareness of Canada's leading role in space and the encouragement of youth to pursue careers in science and engineering through the Youth Awareness and Education Program, which develops and distributes targeted educational space-based materials, supports not-for-profit and educational institutions in the preparation of space-related materials and activities, and conducts youth-oriented public information campaigns across Canada. Emphasis will be placed on leveraging expertise through partnering initiatives in order to respond to the increasing demand for educational materials and support.

- The use of regional tours and partnered initiatives with Canadian Space and Science Museums, schools and youth organisations, supported by awards of the Grants &

Contributions Program, to help expand awareness with youth in all regions of the country.

- The use of the teacher training workshop and the development of 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.

- The active promotion of CSA space activities and accomplishments to broaden stakeholder awareness of the full range of the Canadian Space Agency and industry expertise that is contributing to enhancing international recognition of the Canadian Space Program.

- The training of qualified Canadian scientists, engineers and technicians for high technology and space-related industries 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 new training initiatives (e.g., CSA Fellowship) with industry and universities.

3.7 PROMOTION AND AWARENESS OF THE CANADIAN SPACE PROGRAM

Eight in ten Canadians[5] 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 space. The CSA places great emphasis on building national pride through public awareness initiatives focused on Canadian achievements in space. The Canadian Space Program (CSP) is actively contributing to developing expertise and knowledge, and to providing opportunities for Canadians in the emerging knowledge-based global economy. Communications and outreach activities will heighten awareness and interest with Parliament and the public and broaden the development of partnerships with stakeholders to enhance understanding of the role and importance of the CSP.

In 2002-2003, $ 5.1 million, or 2% of the total planned spending, will contribute to achieving the following results:

- Increased awareness of the Canadian Space Program with Parliamentarians, stakeholders and the general public by implementing a balanced communications strategy focusing on key space achievements and benefits. The main upcoming communications activities are: the installation of the Mobile Base System on the ISS and the launches of ENVISAT, MOST and SCISAT-1 in 2002-03; the launches of Radarsat-2 and Anik F-2 satellites in 2003-04; the installation of the Special Purpose Dextrous Manipulator on the ISS and the launches of Insect Habitat, OSTEO-2 and Protein Crystal Growth Experiments on the ISS.

[5] CSA Survey Conducted May 2001

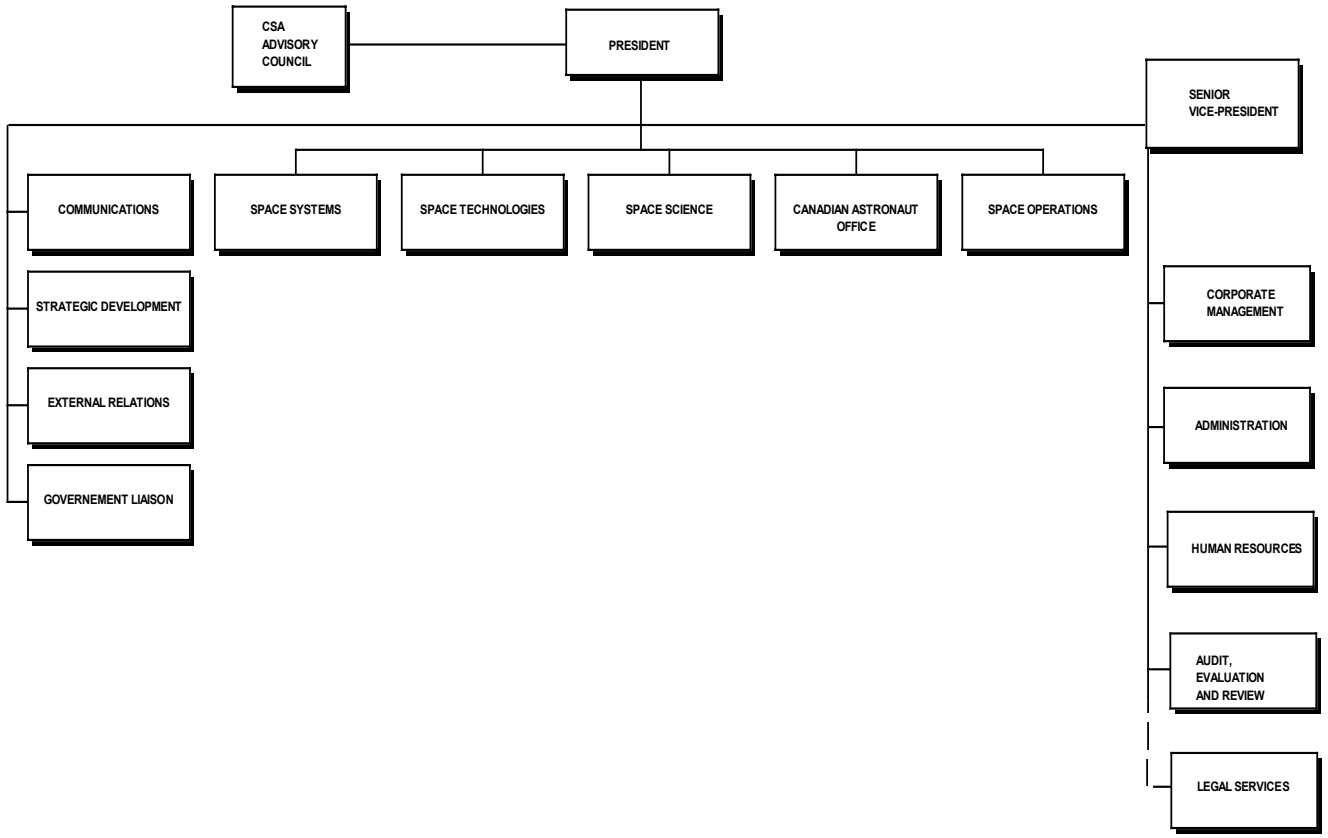
- Further development of international co-operation with our traditional partners (e.g., U.S., Europe, Russia and Japan), as well as the maintenance of effective relations with domestic stakeholders (e.g., industry, other government departments and agencies, the provinces and universities) to support the implementation of the CSP.

- The positioning of Canadian space companies to seize global market opportunities by actively supporting the industry's international marketing strategies.

SECTION 4: ORGANISATION

The CSA is a relatively small organization with a staff of 514 full-time employees, about 100 student interns (including post-doctoral fellows) and approximately 250 contractuals. The majority of the staff (90%) work at the John H. Chapman Space Center, the CSA headquarters located in Saint-Hubert, Québec. The remaining staff are assigned to offices located in Ottawa, Washington, the Johnson Space Center in Houston, the Kennedy Space Center in Florida, and Paris. 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, Space Systems, Space Technologies, Space Science, Canadian Astronaut Office, and Space Operations, report directly to the President as do the Executive core functions, Strategic Development, Communications, Government Liaison and External Relations. The five Corporate functions, Corporate Management, Administration, Human Resources, Audit, Evaluation and Review, and Legal Services report directly to the Senior Vice-President. Legal Services are offered by the Department of Justice to provide counsel to the President and members of the Executive Committee via the Senior Vice-President.

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



4.1 CSA'S PARTICIPATION IN GOVERNMENT WIDE INITIATIVES

The Canadian Space Agency is fully committed to the government objective of modernizing management culture to ensure the efficient and effective delivery of programs and services. Since 2000-01, the CSA has successfully initiated major changes in its business practices, such as: the development and approval of a risk management framework policy to ensure program delivery within approved financial envelopes; the development of a project approval management framework; the integration of project planning and performance reporting into the annual work planning process, and the implementation of the Financial Information Strategy (FIS).

The CSA's commitment to the government-wide Modernization of Comptrollership initiative reflects our leadership and engagement to organisational and professional excellence. The continuation of such practices ensures that the CSA remains focused on results, open communications, transparency, accountability, and recognition for its ability to manage risk effectively. Initiated in the last quarter of 2001-02, a Modern Comptrollership Project Office will lead the CSA to embrace the government-wide reform and the Modern Comptrollership model.

The CSA will develop and implement management frameworks to fulfil the requirements of the Treasury Board revised program evaluation and internal audit policies. This will be carried out simultaneously with the activities already scheduled in the three-year internal audit plan approved in 2000-2001.

4.2 CSA PLANNED SPENDING

Planned Spending for the Canadian Space Agency

Business Line: Space Knowledge, Applications and Industry Development				
	Forecast Spending 2001-2002 ($ millions)	**Planned Spending 2002-2003** ($ millions)	Planned Spending 2003-2004 ($ millions)	Planned Spending 2004-2005 ($ millions)
Budgetary Main Estimates (gross)	352.4	**335.8**	306.5	304.2
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	352.4	**335.8**	306.5	304.2
Adjustments **	(12.8)	**4.1**	4.1	4.1
Net Planned Spending	339.6 *	**339.9**	310.6	308.3
Less: Non-Respendable Revenue	1.6	**1.7**	1.7	1.6
Plus: Cost of Service Received without Charges	2.9	**3.1**	3.0	2.9
Net Cost of Program	340.9	**341.3**	311.9	309.6
Full Time Equivalent	483	**514**	489	482

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

* Reflects the best forecast of total net planned spending to the end of the fiscal year.

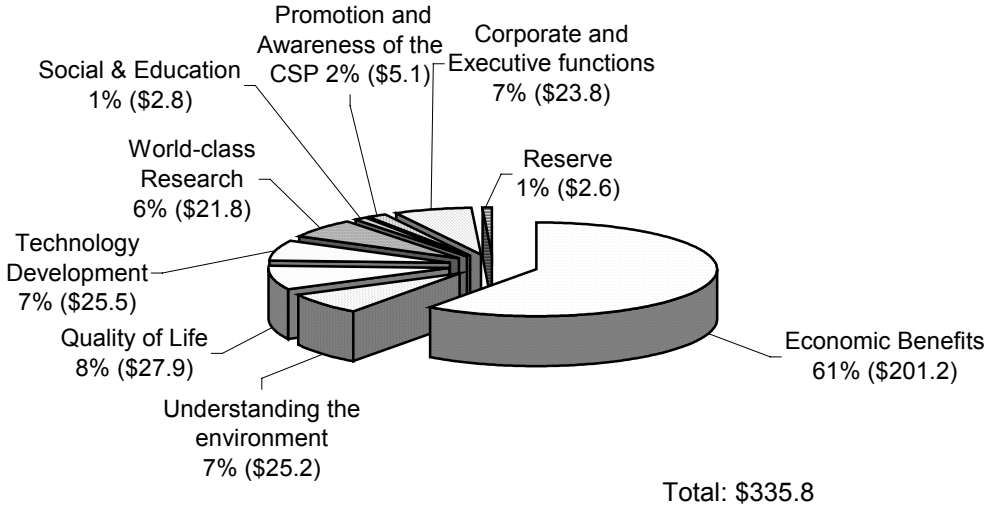
** Adjustments are to accommodate approvals obtained since the Main Estimates and are to include Budget initiatives, Supplementary Estimates etc.

4.3 CSA PLANNED SPENDING BY STRATEGIC OUTCOME

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

Business Line: Space Knowledge, Applications and Industry Development			
Strategic Outcomes	**2002-2003 ($ millions)**	2003-2004 ($ millions)	2004-2005 ($ millions)
Economic Benefits	**201.2**	165.7	116.8
Understanding the Environment	**25.2**	31.4	33.6
Technology Development	**25.5**	26.1	33.5
Quality of Life	**27.9**	25.1	26.9
World-Class Research	**21.8**	26.2	35.3
Social & Education	**2.8**	2.7	3.4
Promotion and Awareness of the Canadian Space Program	**5.1**	5.1	5.1
Strategic Outcomes – Sub Total	**309.4**	282.3	254.6
Corporate and Executive functions	**23.8**	23.7	23.7
Reserve	**2.6**	0.4	25.8
Total	**335.8**	306.5	304.2

Strategic Outcomes and Business Line for 2002-2003 (Percentage and Millions)



SECTION 5: LIST OF ANNEXES

1. Summary of Capital Spending by Business Lines
2. Details of Major Crown Projects Spending
3. Status Report on Major Crown Projects
4. Summary of Transfer Payments
5. Details of Transfer Payments Programs
6. Source of Respendable and Non-Respendable Revenue
7. Net Cost of Program for the 2001-02 Estimates Year

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

http://www.space.gc.ca/space/publications/default.asp - parliament