THE CANADIAN SPACE AGENCY

2004-2005 Estimates

REPORT ON PLANS AND PRIORITIES

David L. Emerson
Minister of Industry

Table of Contents

SECTION 1: Messages 2
1.1 Minister's Portfolio Message 2
1.2 President's Message 4
1.3 Management Representation 5
SECTION 2: Raison d'être 6
2.1 Mandate 6
2.2 Partnership 6
SECTION 3: Planning Overview 7
3.1 International Environment 7
3.2 National Environment 8
3.3 CSA Business Planning and Management 8
SECTION 4: Plans and Priorities by Strategic Outcome 11
4.1 Economic Benefits 12
4.1.1 Satellite Communications 12
4.1.2 Earth and Environment 14
4.1.3 Canadian Space Station Program (CSSP) 15
4.2 Technological Development and Diffusion 17
4.3 Understanding of the Environment 18
4.4 Contribution to the Quality of Life 20
4.5 World-Class Space Research 22
4.6 Social and Educational Benefits for Canadians 24
4.7 Promotion and Awareness of the Canadian Space Program 25
SECTION 5: Organisation 27
SECTION 6: Financial Information 28
6.1 CSA Planned Spending 28
6.2 CSA Planned Spending by Strategic Outcome 29
SECTION 7: Annexes – Financial Information 30

SECTION 1: MESSAGES

1.1 MINISTER'S PORTFOLIO MESSAGE

As Minister of Industry, I am proud to report on Industry Portfolio initiatives to foster the creation and growth of a thriving, innovative economy. Through the programs of the Canadian Space Agency and the other federal departments and agencies that make up the Industry Portfolio, we have encouraged progress on a number of priorities for Canadians, including improving Canada's business environment, continuing investment in the creation and commercialization of knowledge, building a skilled workforce, strengthening our communities, increasing health research and advancing sustainable development.

Canada is gaining recognition as a world leader in the knowledge economy. This is due in part to our significant investments in advanced research and ground breaking developments by Canadians in new technologies. By increasing our focus on research and development and working in partnership with Canadian firms, post-secondary institutions and not-for-profit organizations, we have stimulated innovation and have improved the productivity and competitiveness of Canadian businesses.

In the coming years we must make a concerted effort to improve Canada's performance even further by achieving greater successes in the industries that have brought Canada to where it is today. We must make it a priority for our businesses, large and small, to be leaders in developing the enabling, transformative technologies of tomorrow. As part of our commitment to building a thriving 21st century economy, we will foster the creation and growth of innovative Canadian companies by strengthening our focus on science and technology, increasing the commercialization of university research, and improving access to early-stage financing.

We are committed to supporting small business access to markets, promoting leading-edge technologies with emphasis on the health and environmental sectors, and information and communications technologies (ICTs) sectors, and promoting the development of value-added industries, particularly those related to the resource sectors. We will make our expertise available to the small businesses that drive the social economy, and we will collaborate with key stakeholders to widen the scope of programs currently available to small and medium-sized enterprises to include social enterprises.

These initiatives will build upon the excellent work that has been achieved to date by the Department and its Portfolio partners. Their work will continue to drive Canada's economic growth in the future and allow us to seize opportunities that present themselves, enabling us to leverage and showcase Canadian creativity and expertise in the global marketplace.

It is my pleasure to present the *Report on Plans and Priorities* for the Canadian Space Agency. This report describes the anticipated achievements and results over the next three years as we embark on building an economy for the 21st century.

We are on our way to ensuring that Canada remains a nation with unique strengths that supports a growing economy and values social enterprise, a country where we can continue to build a better standard of living with quality jobs and competitive wages. We must create opportunities and overcome the economic and social challenges that will arise. In short, we must commit ourselves to the pursuit of excellence, leveraging the ingenuity and creativity of our people.

David L. Emerson

1.2 PRESIDENT'S MESSAGE

Generating knowledge, designing advanced technologies and applying them in ways that improve the economic and social well being of Canadians and humanity has always been—and will remain—the central motivation of the exceptional women and men working at the Canadian Space Agency (CSA).

The CSA will continue to focus on strengthening synergies between Government departments and agencies. The ultimate outcome will be more effective and more efficient programs and services delivered to Canadian citizens in communities where they live and work.

Meeting the evolving needs of Canadians means extending our vision to ensure Canada continues to lead in the development of next-generation technologies and to pursue world-class scientific research. Investing in high-risk space technology development will build on a successful model linking government, industry and the university research community, leveraged through international partnerships. This model has proven the most efficient means of attaining our national objectives.

Maintaining Canada's long-term competitive edge in research, development, and space exploration calls for proactive measures to inspire the next generation of space scientists and engineers. Through the unique learning opportunities that only the Canadian Space Program can provide, and in collaboration with a national network of stakeholders, the CSA will continue to reach out to students and educators across the nation to increase scientific literacy and the pursuit of careers in science and technology.

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 remaining a recognised leader amongst smaller sized organisations.

Space embodies the very essence of innovation, and a dynamic Canadian Space Program will be instrumental in helping Canada become and be recognized as 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 2004-2005 *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 organisation's plans and priorities;
- is consistent with the reporting principles contained in the *Guide to the Preparation of the Report on Plans and Priorities*;
- is comprehensive and accurate; and,
- 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

2.1 MANDATE

Canada is a vast country bordered by three oceans. The unique vantage point from 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 career opportunities contributing to a strong knowledge-based economy.

The mandate of the Canadian Space Agency (CSA) is to promote the peaceful use and development of space to meet Canada's social and economic needs and to develop an internationally recognised and technically capable space industry. The CSA is achieving this mandate by implementing the Canadian Space Program (CSP) in co-operation with other government departments and agencies, industries, universities, as well as international partners. In addition to delivering its own programs, the CSA is responsible for co-ordinating all federal and civil, space-related policies and programs pertaining to science and technology research, industrial development, and international co-operation. *To learn more about the mandate of the CSA, go to:* http://www.space.gc.ca/asc/eng/about.asp

2.2 PARTNERSHIP

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

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, and the Communications Research Centre (CRC) of Industry Canada, which manages satellite communications programs on behalf of the Agency. The CSA has close co-operation links with the National Research Council, and the Departments of National Defence, Foreign Affairs, International Trade, Industry Canada, Environment Canada, Fisheries and Oceans and others. The CSA also works very closely with the Canadian Space Industry and the academic sector in the planning and implementation of the Canadian Space Program. *To learn more about Canadian space-related organisations, go to:*
http://www.space.gc.ca/asc/app/csd/search.asp?Item=Resultat

SECTION 3: PLANNING OVERVIEW

Over the planning horizon of this Report on Plans and Priorities (RPP), the CSA will deliver the Canadian Space Program in the context of a very challenging international and national environment.

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

This situation, along with the severe global downturn in the telecommunications sector, has already had a negative impact on the Canadian space industry, which, historically, has generated almost half its revenue in foreign markets. Moreover, recent events such as the Columbia Space Shuttle and Ariane-5 incidents have generated uncertainties worldwide, resulting in delayed major ventures and the review of priorities by major space agencies.

Still, several international opportunities remain and Canada is regarded as a non-threatening and reliable partner that possesses unique technical and scientific capabilities, and that can meaningfully contribute to the initiatives of foreign space agencies. In particular, emerging space-faring countries in Asia and South America offer high potential for future co-operation. These markets, while limited in the short-term, are likely to be subject to intense competition in the long-term. Consequently, Canada must maintain its efforts to establish a foothold in these emerging markets. Therefore it is 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.

To learn more about CSA international partners, go to:
http://www.space.gc.ca/asc/eng/resources/links_agencies.asp

3.2 NATIONAL ENVIRONMENT

The Canadian Space Agency recognizes that the best means of turning scientific and technological advancements into innovative products and services is through industry. Industry is also the best vehicle for providing a broad range of services to diverse groups of users – from individuals to public and private organisations. With its highly skilled workforce, the space industry in Canada not only generates wealth in our economy, but also provides Canadians with competitive products and services that would otherwise be obtained from foreign sources.

In addition to being able to respond directly to the needs of Canadians without constraint, this industrial capability should be of sufficient size and quality to make Canada an attractive partner for nations with whom it wishes to co-operate in order to meet common objectives. Given that the Canadian market is relatively small, it is critical that industry be able to leverage foreign investments and generate export sales. Capitalizing on export revenue depends on industry's ability to commercialize highly competitive products and services, as well as the Government of Canada's ability to establish open trade regulations with its closest international partners.

Canada's overall space revenues reflected the downturn in the global space sector, showing very marginal growth in 2002. Once again telecommunications activities generated over 63% of total revenues – remaining the core workhorse for the space sector.

While trying to minimise the potential negative effects of the international context briefly described in the previous section, the CSA also nurtures the conditions needed to expand the domestic market as well as the utilisation of space products and services in Canada. This is being done through the Canadian Space Program, which is centred on: the advancement of knowledge through leading-edge science; the development of next generation technologies driven by Canadian needs; the early introduction and use of advanced technologies to provide Canadians with new or more effective products and services at an affordable cost; and the commercialisation of these products and services by Canadian industry, particularly in foreign markets.

To learn more about the state of the Canadian space sector, go to:
http://www.space.gc.ca/asc/eng/science_industry/state.asp

3.3 CSA BUSINESS PLANNING AND MANAGEMENT

In the first year of the planning horizon of this RPP, the CSA will finalise the development of the Canadian Space Strategy and pursue the implementation of the CSA Management Modernization Action Plan, while still maintaining efficient management of initiatives already approved under the Canadian Space Program.

Recent Speeches from the Throne outlining the government's priorities provided important guidance to the CSA in undertaking its strategic planning. First and foremost, in pursuit of the goal of being recognised as one of the most innovative countries in the world, the Canadian government expressed intentions to strengthen the research capacity of universities and government institutions and increase Canada's ability to commercialize research discoveries.

The CSA carries out on-going consultations with Government of Canada organisations to identify where and how space technologies could be used to enhance the delivery of their mandates and provide new or more efficient services to Canadians. Collectively the identified space capability requirements represent a substantial opportunity for space technology to contribute significantly to the effective and efficient delivery of government programs and services in many fields: communications, environment and sustainable development, security, intelligence and emergency preparedness, industry development and space science. However, most of the proposals are at the concept stage and require further technical and programmatic development.

In keeping with its objective of being an open and transparent organisation, the CSA strategic planning is done in full consultation with its Canadian stakeholders, particularly through the use of the CSA Advisory Council and Service line Advisory Groups. This will result in the final development and implementation of the CSA Canadian Space Strategy, along with a revision of its targeted results and strategic outcomes in 2004-2005 that will define how the Canadian Space Program will be managed starting in 2005-2006.

Participating in the government-wide Modern Comptrollership initiative, the CSA conducted an agency-wide evaluation to assess its current management practices that led to the approval of the Management Modernization Action Plan (MMAP) in September 2002. Meanwhile, the Office of the Auditor General conducted its first audit of the CSA and tabled its report in December 2002. The objective of the audit was to assess CSA capacity to deliver the Canadian Space Program with due regard to economy, efficiency, and effectiveness. The CSA response to the Report of the Auditor General of Canada and the MMAP have dovetailed in a joint initiative to improve CSA management over the following issues:

- develop a strategy for the CSA;
- consult with stakeholders in the formulation of long-term strategies;
- implement the remaining components of the CSP Management Framework;
- balance financial capacities and obligations;
- refine the Project Approval and Management Framework;
- improve the performance measurement process and reporting; and,
- develop a strategic human resources plan.

In the last two fiscal years, the CSA has made significant progress in improving management practices. The CSA Audit, Evaluation and Review Directorate produced a first progress report relating to the MMAP in December 2002. A second report was tabled in February 2004 indicating that the CSA is well on its way to achieving the goals set by the MMAP. Through the transition from the Modern Comptrollership initiative to the implementation of the Management Accountability Framework put forward by Treasury Board, the CSA will pursue the improvement of its management practices by:

- fully integrating financial and non-financial performance information;
- developing an integrated corporate information management system;
- developing a training program leading to the acquisition of modern management competencies; and,
- promoting public service values and ethics throughout the CSA.

To learn more about the CSA Management Modernization Action Plan, go to: http://www.space.gc.ca/asc/eng/about/comptrollership.asp *and for more about the CSA progress report*, go to: http://www.space.gc.ca/asc/eng/resources/publications/comptrollership.asp

To learn more about the Office of the Auditor General Audit Report, go to: http://www.oag-bvg.gc.ca/domino/reports.nsf/html/20021207ce.html

SECTION 4: PLANS AND PRIORITIES BY STRATEGIC OUTCOME

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 2004-2005**
Economic Benefits	Complete the development of RADARSAT-2 Implement the new CASSIOPE Mission Contribution Program Completion of the testing of Dextre prior to launch
Technological Development and Diffusion	Enhance Canadian space industry competitiveness
Understanding of the Environment	Support the collection of data on the environment by developing and operating Canadian satellites
Contribution to the Quality of Life	Develop Canadian experiments in Space Life Sciences
World-Class Space Research	Contribute to the understanding of the universe by developing and operating space scientific instruments
Social and Educational Benefits for Canadians	Improve scientific literacy among Canadian students and educators
Promotion and Awareness of the CSP	Broaden public awareness of the Canadian Space Program

The following section presents CSA performance for each of the Strategic Outcomes. The CSA will continue the development of the Canadian Space Strategy in 2004-2005 along with a revision of its targeted results and strategic outcomes for 2005-2006. At the same time, the CSA will develop and refine its results-based performance measurement regime in order to improve its capability to report on Strategic Outcomes. 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 co-operation 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 2004-2005, the CSA will spend $156.2 million, or 49% 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 satellite communication technologies hold the promise of connecting urban, rural and remote communities, so that every citizen will have access to the information highway. Satellite Communications is the largest space-sector activity in Canada with sales of more than $1.261 billion, representing 67.4% of total space industry revenues[1]. 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). As such 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 2002.
State of the Canadian Space Sector: http://www.space.gc.ca/asc/eng/science_industry/state.asp

The 2004-2005 Plans, with planned spending of $28.5 million, will contribute to achieving the following results:

- The integration of an advanced Ka-band multi-media payload on the Anik F2 satellite. Previously scheduled for launch in October 2003, the launch of the satellite is now expected in June 2004. By demonstrating the capability of this multi-media service throughout North America, this private/public sector partnership 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 and disaster management.

Also, in response to difficulties in the space industry, highlighted in previous reports, the CSA has tried to redirect 2003-2004 budgets to implement special initiatives that maintain core Canadian space manufacturing capabilities, while developing the innovative advanced systems needed to sustain industry growth.

- In 2003-2004, as part of the CASSIOPE Mission Contribution Program, the CSA has initiated the development and demonstration of the Cascade telecommunications payload on a small satellite bus that will be fully designed and constructed by Canadian companies during the next three years (2004-2007). Cascade is the precursor of communication satellite constellations that will help position Canadian industry on the international market both as a supplier of advanced components and as a service provider.

- Through the special CSA Accelerated Satellite Telecommunications Research initiative (CASTOR), space manufacturing companies will continue a series of directed research and development projects initiated in 2003-2004 under awarded contracts valued at $ 8 million.

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

4.1.2 Earth and Environment

Earth Observation (EO) is the second largest Canadian space-sector activity with annual revenues of $219 million, representing 11.7% of total space industry revenues[2]. It is an innovative, technologically advanced industry capable of developing products and services in demand by 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, disaster response, and security activities. The strategy aims at developing an internationally competitive, value-added industry for satellite-based applications.

The 2004-2005 Plans, with planned spending of $70.8 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 full commissioning of RADARSAT-2 in early 2006. Until then, contingency plans are in place 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 provides useful information to both commercial and scientific users in such fields as disaster management, interferometry, agriculture, cartography, hydrology, forestry, oceanography, ice studies and coastal monitoring.

- Once completed, RADARSAT-2 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-polarisation (an important aid in identifying a wide variety of surface features and targets), to produce images with a resolution of down to three (3) meters, and to access an area of 800 kilometres to either side of the sub-satellite track. With the RADARSAT-2 development activities completed in 2003-2004 and the completion of hardware deliveries to the David Florida Laboratory (DFL) in early 2004-2005, the main activity will be the spacecraft Assembly Integration & Test to be completed in August 2005, with the launch presently scheduled for September 2005 and the full commissioning in early 2006. The original spacecraft design has been modified to include data encryption capabilities in response to security requirements.

- 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 early 2004-2005.

[2] "Characteristics of the Canadian Space Sector" Canadian Space Agency Survey 2002.
State of the Canadian Space Sector: http://www.space.gc.ca/asc/eng/science_industry/state.asp

- 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, as well as research opportunities within the university community, and international partnerships opportunities.

  To learn more about *RADARSAT,* go to:
  http://www.space.gc.ca/asc/eng/csa_sectors/earth/earth.asp

- The continuation of satellite data application development, technology transfer and demonstration programs (e.g., Earth Observation and Applications Development, and the pre-competitive R&D programs) to support the growth of Canada's value-added industry.

- The development of advanced space-borne instruments and user-oriented applications by Canadian companies through the participation of Canada in ESA Programs.

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 become a vital partner in international efforts to establish a permanent human presence in space on board the International Space Station (ISS). Through the Canadian Space Station Program (CSSP), the CSA undertook the task of developing the Mobile Servicing System[3] (MSS), which was designed to assemble, service and maintain the ISS. The CSA is also responsible for the training and qualification of all astronauts, cosmonauts and ground support personnel involved in the operations of the MSS, for the mission controllers and planners, and dynamic analysis groups mandated to support robotics operations on orbit, and for the provision of an engineering support capability at the John H. Chapman Space Centre in St. Hubert, Quebec.

In exchange for this contribution, Canada has gained the rights to use up to 2.3% of the non-Russian laboratory space, resources and related crew time onboard the ISS. The integration, as well as the operational support of the CSA experiments flying to and being conducted onboard the ISS, are also included in the scope of the CSSP. The CSSP has generated a robotics industry with revenues of $156 million[4] per year.

---

[3] The MSS includes Canadarm2, also called the Space Station Remote Manipulator System (SSRMS), which is mounted on a Mobile Base System (MBS). Together they support the assembly of large structures, support spacewalks and exterior inspections on the Station. The third major component of the MSS is the Special Purpose Dextrous Manipulator (SPDM), a second robot named Dextre designed to perform more precise tasks. Canada also contributed a Space Vision System to the MSS to support the early assembly missions.

[4] "Characteristics of the Canadian Space Sector" Canadian Space Agency Survey 2002.
State of the Canadian Space Sector: http://www.space.gc.ca/asc/eng/science_industry/state.asp

The Columbia shuttle accident on February 1, 2003 and the resulting halt of all space shuttles have temporarily stalled the assembly of the ISS. Fortunately, the Russian Space Agency was able to tailor its launch schedule of unmanned re-supply Progress vehicles and to reprioritize the use of the Soyuz capsules to allow the Partnership to maintain a continued but reduced human presence on ISS.

While the Space Shuttle Return to Flight work advances at NASA, the ISS partners continue to develop the new modules and structures to be launched to the ISS once shuttle flights resume. The assembly sequence leading to an International Core Complete configuration, including Dextre, is now expected for 2007-2008.

The ISS Partnership also continues to redefine how the ISS will grow from its reduced crew of astronauts to a crew of six to seven persons. This capability is now expected to be in place in 2008. The crew size increase is a priority for the CSA since it will provide the desired frequency of flight opportunities for Canadian Astronauts and will ensure the crew time availability for the conduct of Canadian scientific experiments and the possible commercial utilisation of the ISS.

The CSA 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 both photogrammetry and laser, 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 2004-2005 Plans, with planned spending of $57 million, will contribute to achieving the following results:

- The completion of the MSS-4 software load destined for the integration of the Dextre software into the MSS integrated flight load to support the planned testing of the element prior to launch.

- The completion of the end-to-end testing of Dextre (SPDM), the third element of the MSS, for its launch now expected in early 2007, and the continuation of the design and development of the training material for Dextre.

- The fulfilment 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 supporting operations of MSS missions, and commissioning initial operations of the Remote-Multi-Purpose Support Room, an operational facility directly supporting robotics operations from St. Hubert, Quebec starting early in the fiscal year.

- The launch of Perceptual-Motor Deficits in Space/Test of Reaction and Adaptation Capabilities (PMDIS/TRAC), the first experiment to use the Canadian ISS allocation rights during Mission STS-121/ULF1.1 and STS 115/12A now scheduled for late 2004 and early 2005.

- The continued support of the Microgravity Vibration Isolation System (MVIS) delivered to ESA for integration into its Fluid Science Laboratory, which will be flown on their Columbus module. Launch date will be scheduled after NASA's successful return to flight.

- The promotion and support of the use of the ISS Research Laboratory by the Canadian scientific community.

- The promotion of the commercial use of the ISS research laboratory and the proper brand management of the ISS logo and 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 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 prioritised 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.

In 2004, the CSA will develop a comprehensive space technology plan to define technology thrusts and build roadmaps, which will guide and prioritise technology research and development internally and the preparation of future missions and programs in Earth Observation, Satellite Communication, and Space Sciences and Exploration.

The 2004-2005 Plans, with budgeted expenditures of $43.2 million or 13% 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 through an annual Request for Proposal process. Priority technologies are defined in consultation with industry. Twenty-five to thirty new technology development contracts are awarded annually with industry contributions 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 CASSIOPE Mission Contribution Program will pioneer world-leading technologies, systems and associated ground segments using an innovative approach that will allow the Cascade Ka-Band telecommunications payload and the enhanced Polar Outflow Probe (e-POP) scientific research instruments to be integrated on a single Canadian small satellite bus that could also be used for future Canadian missions. By flying the spacecraft as a joint mission, the CSA will make the best use of public funds, while providing considerable future business opportunities for the Canadian space industry and for the advancement of Canadian expertise in space science and technologies.

- The development of advanced concepts for future space missions, innovative space technologies, and involvement in international projects by Canadian companies through participation in the ESA General Support and Technology Program.

- 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 commercialisation of space technologies and their applications to other sectors of the economy to enhance Canadian industrial competitiveness. This is being achieved by managing the CSA portfolio of patents and intellectual property licenses, by conducting commercialisation assessments and marketing plans for technologies developed in-house and through contracts to industry with the Technology Diffusion Program, which supports potential licensees in assessing business opportunities associated with their space technologies.

To learn more about *Technological Development and Diffusion*, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/technology/technology.asp

4.3 UNDERSTANDING OF THE ENVIRONMENT

The unique scientific data provided by space-based instruments and Earth Observation 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 excellent international reputation of Canadian scientists, the CSA has pursued a strategy focused on participation in international missions dedicated to a better understanding of atmospheric chemical and dynamical processes, to the monitoring of atmospheric pollution and to 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 but are built by industry.

In the mid-90's, 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 springtime depletion of stratospheric ozone over the Arctic and ionosphere phenomena associated with aurora borealis.

Two major Canadian science instruments are currently orbiting Earth and collecting new environmental data: MOPITT (Measurements of Pollution in the Troposphere) and OSIRIS (Optical Spectrograph and Infrared Imaging System). MOPITT, which is aboard the NASA Terra satellite, contributes to our understanding of the sources and pathways of atmospheric pollutants, and is a true pathfinder in this regard. OSIRIS, which is 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 2004-2005, $30 million, or 9% of the total planned spending, will contribute to achieving the following results:

- Science data acquisition by Canada's SCISAT-1 Atmospheric Chemistry Experiment. Launched in August 2003, this experiment will take place over the next two years and there are expectations of significant science results that will ultimately 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 study of stratospheric composition and ozone depletion processes at mid-latitudes, through the launch of high-altitude balloon experiments in August 2004, as part of validation campaigns for Canada's OSIRIS instrument onboard Sweden's Odin satellite and SCISAT-1.

- The execution of final preparatory activities for the launch of the NASA CLOUDSAT mission in Spring 2005 with key hardware components from Canada. This mission will allow 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 better understand the global atmospheric circulation and thereby provide means to validate complex climate and weather models. This instrument was to fly onboard Japan's GCOM-A1

mission scheduled for launch in 2008. However, the Japan Aerospace Exploration Agency (JAXA) has recently decided to re-scope and significantly simplify the mission that will now carry a single Japanese sensor. Various options will be studied in close co-operation with ESA for the flight of the SWIFT instrument, including a Canadian-led small satellite mission.

- 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, now integrated into the CASSIOPE Mission Contribution Program, is scheduled for launch in late 2006. It will probe the upper atmosphere and ionosphere region where solar variability exerts influence on global change in various time scales. The scientific data collected by e-POP will help 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 co-ordinated 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

4.4 CONTRIBUTION TO THE QUALITY OF LIFE

Space-based sciences and technologies are increasingly contributing to making our lives better on Earth while addressing issues of concern to Canadians. As a nation rich in natural resources, with the second largest landmass and the longest coastline in the world, space provides our country with an unparalleled vantage point to observe, monitor and manage the wealth of our natural heritage and biomass through the watchful eyes of Earth Observation satellites.

To solve the challenges of connecting our communities across our vast territory, we turn to advanced communications satellites to link our population from large urban centres to remote settlements.

A country that strives to promote the ideals of democracy, peace and international co-operation throughout the world, Canada is using space to make salient contributions to international initiatives in science, the environment, security and safety, and global communications.

In the near future, Canadians will reap scientific benefits arising from Canada's 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 2004-2005, a budget of $23.4 million, or 7% of the total planned spending allocated to Space Life and Physical Sciences and to the Astronaut Program, will contribute to achieving the following results. However, it should be noted that the CSA still has to deal with the consequences following the loss of Space Shuttle Columbia and it's crew.

- Space Shuttle Columbia carried three separate experiments designed to understand why astronauts lose as much bone mass during one month in microgravity as a postmenopausal woman loses in one year. Plans are underway to replace the hardware that was lost and continue research into mechanisms of bone loss onboard the Space Shuttle and the ISS. It is clear that bone research in microgravity will also provide insights into osteoporosis, a disease affecting millions of Canadians.

- Originally scheduled for May 2003, the Perceptual-Motor Deficits in Space (PMDIS) experiment is now slated for the STS-115/12A mission with Canadian Astronaut Steve MacLean. This experiment will study the potentially dangerous decrease in hand-eye co-ordination often experienced by astronauts during the first few days in space. Once the precise cause of the problem is determined, effective countermeasures can be designed.

- The Insect Habitat facility will undergo rigorous science testing in the final phase of development as an ISS facility. When operational, this facility will provide researchers with the opportunity to study insects as model organisms in space.

- Efforts are underway to include a study of cardiovascular adaptation to the space environment in the STS-118/13A mission with Canadian Astronaut Dave Williams.

To learn more about *Space Life Sciences*, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/space_science/life_sciences/life_sciences.asp

- The development of the Canadian Biotechnology Facility to enable protein crystals to be grown on the ISS is expected to begin in 2006. The Protein Crystal Growth experiment that was lost with Space Shuttle Columbia is an excellent example of the type of microgravity experiment that can deepen our medical knowledge. A precise knowledge of protein structure is important in the design of more efficient medication for better treatments with fewer side effects.

- 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 integrated in the ESA Fluid Science Laboratory, and the Microgravity Isolation Mount Base Unit and ISS Furnace, with acceptance reviews scheduled in October 2004.

To learn more about *Microgravity Science*, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/space_science/microgravity/microgravity.asp

4.5 WORLD-CLASS SPACE RESEARCH

Over the years, Canada has based its space science programs on international co-operation. 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 9001:2000 certified David Florida Laboratory (DFL) is Canada's world-class facility providing space qualification testing on a fee-for-service basis to Canadian and foreign aerospace and telecommunications organisations for qualifying their space-bound hardware. The DFL actively contributes to the recognition of Canada’s leadership in space research and the development of a competitive domestic space industry.

In 2004-2005, a budget of $36.2 million, or 11% 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 Planetary Exploration programs. Key activities include:

- The development of a Fine Guidance Sensor for NASA's Next Generation Space Telescope (replacement of the Hubble Telescope, recently renamed the James Webb Space Telescope) and participation in the design and manufacturing of a sub-system for the Heterodyne Instrument in the Far-Infrared (HIFI) for the Herschel/Planck missions led by ESA.

- Operations for the Microvariability and Oscillations of Stars (MOST) micro-satellite space telescope, launched in June 2003, will continue and there are expectations of significant science results from this innovative mission.

- The production of a meteorological station for the NASA PHOENIX Scout mission is a key project for potential international partners to collaborate on upcoming robotic missions as part of a Canadian strategy to explore the Moon and Mars. This program will also include benefits for Canada in science and industrial competitiveness.

To learn more about *Space Astronomy and Exploration*, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/space_science/astronomy/astronomy.asp
http://www.space.gc.ca/asc/eng/csa_sectors/space_science/space_exploration/space_exploration.asp

- The provision of world-class and cost effective environmental space qualification services for the assembly, integration and testing of spacecraft systems and sub-systems in support of CSA and Canadian space industry projects such as RADARSAT-2, CLOUDSAT, HERO, CASSIOPE Mission, and JWST (James Webb Space Telescope), as well as those of other government departments over the next two fiscal years.

- Increased efforts to market DFL services internationally, which involves the conclusive negotiation of a generic "Facilities Use Agreement" to satisfy U.S. technology transfer concerns regarding commercial satellite programs, and hence, facilitate arrangements with prime U.S. 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-9001:2000 certification. Most DFL equipment has already exceeded its designed lifetime and should be replaced to ensure that upcoming space programs can be properly supported.

To learn more about the *David Florida Laboratory*, go to:
http://www.space.gc.ca/asc/eng/csa_sectors/dfl/dfl.asp

4.6 SOCIAL AND EDUCATIONAL BENEFITS FOR CANADIANS

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 specialists contribute to enhancing the awareness of Canada's contribution to 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 delivered jointly with the Natural Sciences and Engineering Research Council of Canada and/or the Public Service Commission, as well as new training initiatives with industry and academia.

In 2004-2005 a budget of $2 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-centred 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 professional development workshops and the development of validated teaching materials such as web-based assisted learning opportunities, to respond 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 organisations, to expand student and educator access to the space science and technology community.

- The implementation of the 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

The CSA fosters 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 space[5]. For example, three in four believe Canada should take an active role in future international missions to Mars[6].

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 a leader in innovative space science and technology.

In addition, the promotion of the CSP actively contributes to developing expertise and knowledge, and to providing opportunities for Canadians in the emerging knowledge-based global economy.

The 2004-2005 Plans with a budget of $5.4 million or 2% of the total planned spending, will contribute to the promotion and awareness of the Canadian Space Program.

- The CSA is implementing a proactive and balanced communications strategy focusing on important space achievements. The major communications activities will focus on the following:

    - Space Shuttle launches with Steve MacLean and Dave Williams, supporting construction of the International Space Station and CSA collaborative efforts with NASA and other members of the ISS to restore a safe return to flight and the continued and expanded habitation and scientific use of the Station.
    - Scientific implementation of SCISAT-1, Canada's first science satellite in 30 years.
    - Scientific use of MOST, Canada's micro-satellite space telescope.
    - Public announcement of CASSIOPE Mission (Cascade communications/e-POP science small satellite).
    - Promotion of Canada's heightened role in Mars exploration missions.
    - Launch of the Anik F2 satellite, containing a specialized Ka-Band transponder.
    - Celebration of 20 years of Canadian human space flight.

[5] Compas National Survey, May 2001.
[6] Compas National Survey, January-March 2002.

- Recognition of 25 years of collaboration between Canada and the ESA.
- Staging of the Space Ops 2004 conference in Montréal and support for the IAC-2004 conference in Vancouver.
- Launch of RADARSAT-2 in 2005.

To learn more about *Communication Activities*, go to:
http://www.space.gc.ca/asc/eng/media/press_room/press_room.asp

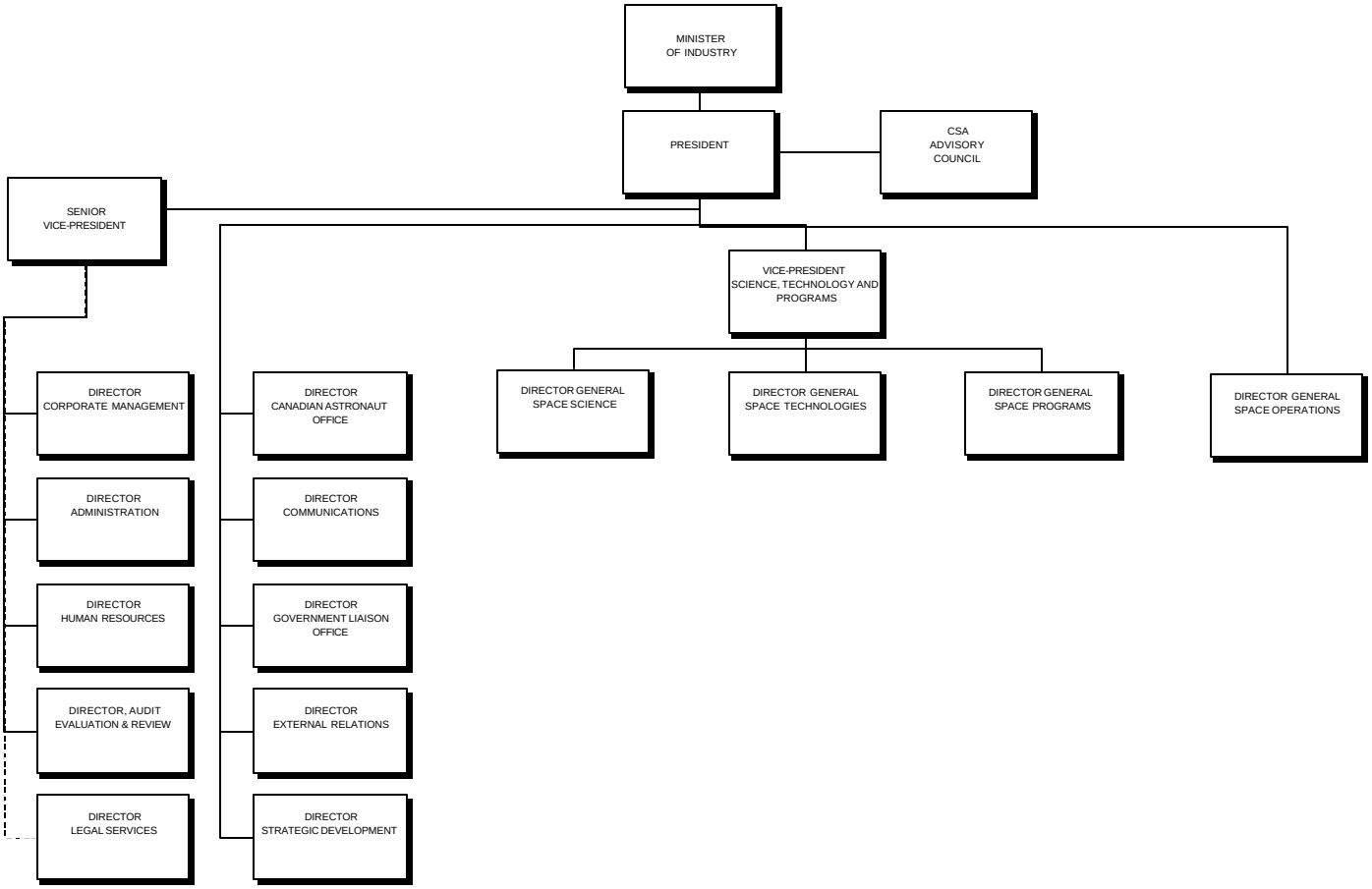
- Further co-operation with traditional international partners and maintenance of effective relations with domestic stakeholders in the successful delivery of the Canadian Space Program through on-going consultations and negotiations, as well as signing of international agreements.

- Help the positioning of Canadian space companies to seize global market opportunities by carrying out key on-going intelligence activities.

To learn more about *Promotion of the Canadian Space Program*, go to:
http://www.space.gc.ca/asc/eng/science_industry/policy.asp

SECTION 5: ORGANISATION

Reporting to the Minister of Industry, the CSA Chief Executive Officer is the President, assisted by the Senior Vice-President and the Vice-President of Science, Technology and Programs. The executive functions, the Space Operations function, and the Canadian Astronaut Office report directly to the President. The three core functions report to the Vice-President of Science, Technology and Programs. The five corporate functions report directly to the Senior Vice-President. Legal Services are provided by the Department of Justice.



SECTION 6: FINANCIAL INFORMATION

6.1 CSA PLANNED SPENDING

Planned Spending for the Canadian Space Agency

Business Line: Space Knowledge, Applications and Industry Development

($ millions)	Forecast Spending 2003-2004	**Planned Spending 2004-2005**	Planned Spending 2005-2006	Planned Spending 2006-2007
Budgetary Main Estimates (gross)	318.7	**322.9**	313.2	306.1
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	318.7	**322.9**	313.2	306.1
Adjustments **				
Additional Operating Costs	0.2	**0.0**	0.0	0.0
Collective Agreements Compensation	0.6	**0.0**	0.0	0.0
Royalties from Activities related to the RADARSAT Program	3.3	**4.1**	4.1	4.1
Reprofiling of Funds	(27.1)	**7.3**	0.0	0.0
Total Adjustments	(23.0)	**11.4**	4.1	4.1
Net Planned Spending	295.7*	**334.3**	317.3	310.2
Less: Non-respendable Revenue	1.0	**0.9**	0.7	0.7
Plus: Cost of Services Received without Charges	3.7	**4.1**	4.1	4.1
Net Cost of Program	298.4	**337.6**	320.7	313.6

Full Time Equivalent	571	614	614	614

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 include Supplementary Estimates and other in-year approved adjustments.

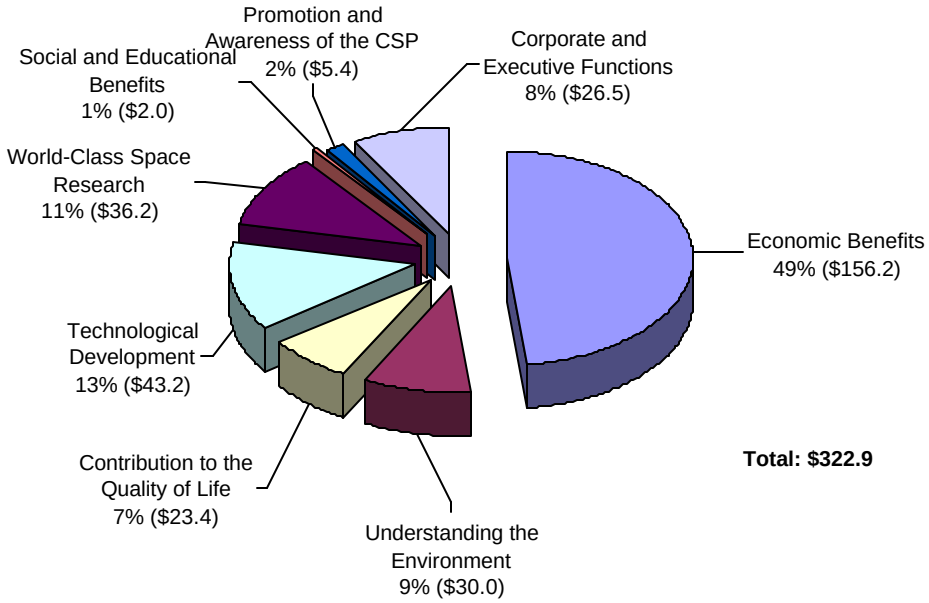
6.2 CSA PLANNED SPENDING BY STRATEGIC OUTCOME

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)	**2004-2005**	2005-2006	2006-2007
Economic Benefits	**156.2**	139.5	131.5
Technological Development	**43.2**	52.2	52.9
Understanding the Environment	**30.0**	29.1	27.2
Contribution to the Quality of Life	**23.4**	24.4	27.6
World-Class Space Research	**36.2**	34.3	33.4
Social and Educational Benefits	**2.0**	2.0	2.1
Promotion and Awareness of the Canadian Space Program	**5.4**	5.3	5.3
Strategic Outcomes – Sub Total	**296.4**	286.8	280.0
Corporate and Executive Functions	**26.5**	26.4	26.1
Total	**322.9**	313.2	306.1

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

Strategic Outcomes and Business Line for 2004-2005
(Percentage and Millions)



SECTION 7: ANNEXES – FINANCIAL INFORMATION

7.1 Summary of Capital Spending by Program and Business Line

7.2 Details on Project Spending

7.3 Status Report on Major Crown Projects
- 7.3.1 Canadian Space Station Program
- 7.3.2 RADARSAT-1
- 7.3.3 RADARSAT-2

7.4 Summary of Transfer Payments

7.5 Details on Transfer Payments Programs (Grants, Contributions and Other Transfer Payments)

7.6 Major Programs

7.7 Source of Respendable and Non-respendable Revenue

7.8 Net Cost of Program for the Estimates Year

The annexes are linked to the Report on Plans and Priorities 2004-2005 posted on the Canadian Space Agency Web site:
http://www.space.gc.ca/asc/eng/resources/publications/publications.asp - parliament