ESTIMATES

Canadian Space Agency

Performance Report

For the period ending
March 31, 1998

Canada

Improved Reporting to Parliament
Pilot Document

The Estimates of the Government of Canada are structured in several parts. Beginning with an overview of total government spending in Part I, the documents become increasingly more specific. Part II outlines spending according to departments, agencies and programs and contains the proposed wording of the conditions governing spending which Parliament will be asked to approve.

The *Report on Plans and Priorities* provides additional detail on each department and its programs primarily in terms of more strategically oriented planning and results information with a focus on outcomes.

The *Departmental Performance Report* provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the spring *Report on Plans and Priorities.*

Available in Canada through your local bookseller or by mail from

Canadian Government Publishing — PWGSC

Ottawa, Canada K1A 0S9

Catalogue No. BT31-4/30-1998
ISBN 0-660-60695-X

Foreword

On April 24, 1997, the House of Commons passed a motion dividing on a pilot basis what was known as the annual *Part III of the Estimates* document for each department or agency into two documents, a *Report on Plans and Priorities* and a *Departmental Performance Report.*

This initiative is intended to fulfil the government's commitments to improve the expenditure management information provided to Parliament. This involves sharpening the focus on results, increasing the transparency of information and modernizing its preparation.

This year, the Fall Performance Package is comprised of 80 Departmental Performance Reports and the government's "*Managing For Results*" report.

This ***Departmental Performance Report,*** covering the period ending March 31, 1998, provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the department's *Part III of the Main Estimates* or pilot *Report on Plans and Priorities* for 1997-98. The key result commitments for all departments and agencies are also included in *Managing for Results.*

Results-based management emphasizes specifying expected program results, developing meaningful indicators to demonstrate performance, perfecting the capacity to generate information and reporting on achievements in a balanced manner. Accounting and managing for results involve sustained work across government

The government continues to refine and develop both managing for and reporting of results. The refinement comes from acquired experience as users make their information needs more precisely known. The performance reports and their use will continue to be monitored to make sure that they respond to Parliament's ongoing and evolving needs.

This report is accessible electronically from the Treasury Board Secretariat Internet site: http://www.tbs-sct.gc.ca/tb/key.html

Comments or questions can be directed to the TBS Internet site or to:

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The Canadian Space Agency

Performance Report
for the period ending
March 31, 1998

John Manley
Minister of Industry

Canadian Space Agency | Agence spatiale canadienne

Canada

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EXECUTIVE SUMMARY

Although Canada is a relatively small nation by world population standards, it occupies a prominent position in the global space industry, ranking eighth among space-faring nations. As the Canadian economy moves from natural resources to information and high technology exports, the opportunities for growth in the Canadian space industry are unlimited.

Most of the Canadian Space Agency's 350 employees work at the John H. Chapman Space Centre – CSA's headquarters – in Saint-Hubert, Quebec.

The Canadian Space Agency (CSA) is the overall manager of Canada's investment in space. It endeavours to secure a role in space that suits our country's needs and aspirations. The Canadian Space Program (CSP), developed on the premise of international collaboration, strives to combine its efforts with those of other countries to share the costs and benefits of space research and development. Such cooperation enables Canada to achieve goals which might otherwise be unattainable, maximizing spinoffs for the Canadian space industry and the Canadian economy.

The CSA's activities fall under three business lines:

1) Space Sciences,

2) Space Applications and Industry Development,

3) Management.

The Space Sciences business line pursues several concerns that are vital to the quality of life on Earth. It applies research to problems such as atmospheric pollution and climate change. It furthers advances in health and medicine, and it enhances our understanding of the universe. Canada, the second largest country on Earth, is heavily affected by phenomena that can best be studied from space. Ozone depletion, for example, is most severe in the polar regions. Global warming is expected to have a much greater effect at high latitudes. Space Sciences helps to monitor and understand these and other phenomena.

Space Sciences also helps to create a large number of domestic space research companies with internationally renowned expertise. It provides opportunities for scientists and engineers to participate in advanced science and technology projects at the international level. These activities lead to technology transfer and progress, increasing our status and reputation as a space-faring nation and contributing to the diversity and expansion of Canada's economy.

Projects are based on world-class research by Canadian scientists. They are often carried out by Canadian Space Agency astronauts in space or by Canadian instruments aboard spacecraft of other countries. In 1997-1998, Bjarni Tryggvason flew on a Space Shuttle mission and conducted microgravity experiments. Later in 1998, Dave Williams conducted life sciences experiments aboard Neurolab. In October 1998, when mission STS-95 launches on space shuttle *Discovery*, three Canadian experiments will be aboard: one studying the underlying processes of osteoporosis and evaluating treatments for this condition; the second studying how microgravity can enhance biological separation techniques used for procedures such as bone marrow transplants, and the third to enhance our abilities in protein crystallization research.

*CANADA'S SPACE SECTOR (1996)

- **$1 billion annual sales of goods and services**
- **$300 million in exports**
- **255 companies, mostly innovation driven**
- **5,000 jobs across Canada**

The CSA pursues a policy of regional industrial development, to ensure that the benefits of space reach all parts of Canada. From the $2 billion in contracts awarded under the Canadian Space Program from January 1988 to December 1997: 4.2% were distributed in the Atlantic Provinces, 8.1% in the Prairies, 8.5% in British Columbia, 34.4% in Quebec, and 44.9% in Ontario.

* Statistics extracted from the CSA document "Characterization of the Canadian Space Sector for 1996". This document is produced on a yearly basis and 1997 statistics will be available in March 1999.

The Space Applications and Industry Development business line ensures that Canadians are able to pursue the growing opportunities presented by space, to utilize our space knowledge, and to contribute to the sustainable development of Canada and the world. Working with industry and other partners across Canada, the CSA facilitates the application of space science and technology which leads to an internationally competitive export-oriented space sector. More than 80% of its budget is contracted out to research organizations and businesses in a sector that employs over 5,000 people across the country. The Canadian space industry generates $1 billion in annual sales of which 30% are exports (1996 data).

Space applications include satellite observation of the Earth, whose benefits were evident during the January 1998 ice storm in Eastern Canada, the Red River and Saguenay flooding, and other natural disasters around the world. Data from Canada's RADARSAT Earth observation satellite was also used for other flood control efforts, damage assessment, and other emergency and disaster relief operations. RADARSAT data is used for crop monitoring, land management, weather and climate measurements, and fisheries monitoring. New uses for RADARSAT continue to develop. In 1997, RADARSAT provided the first high-resolution radar mapping of the entire Antarctic continent, an area which contains 70% of the world's water supply.

The data collected will also serve as a benchmark for testing the predicted effects of global warming in the South Pole and will provide greater insight into the effects of human activity on the Southern Continent. In the global market for environmental services, which is already as large as the global aerospace industry and growing rapidly, RADARSAT gives Canadians the means to create unique and valuable new environmental and disaster management services.

In 1997, the second year of commercial operation of RADARSAT, sales of images increased by 123%. While sales have yet to reach original projections, RADARSAT has succeeded in capturing 12% of the world market. Sales in the first quarter of 1998 continued to show a growth trend. This increasing commercial success of *RADARSAT-1* is giving the private sector confidence to make substantial investments in *RADARSAT-2*.

In February 1998, MacDonald Dettwiler & Associates was selected as the prime contractor to build and operate *RADARSAT-2*. This new satellite, with enhanced capabilities, is smaller, more powerful, and cheaper than *RADARSAT-1.* The objectives of the project are to develop Canadian Earth observation satellite business through a private sector-led arrangement with the federal government and to provide data continuity to *RADARSAT-1* users. *RADARSAT-2* will build on Canada's strong position in the Earth observation sector and open further commercial opportunities worldwide.

Canadian Space Agency astronauts to fly ISS missions in 1999 following official announcement by Minister John Manley. From L-R: W.M. (Mac) Evans, CSA President; John Manley, Minister of Industry; Canadian Space Agency astronauts Marc Garneau, Julie Payette, and Chris Hadfield; Dan Goldin, NASA Administrator.

Space Applications and Industry Development includes Canada's participation in the *International Space Station* (*ISS*), a vast cooperative international effort to extend human presence in space. Canada's contribution to the ISS involves our technology, our science and most importantly, our people. The CSA is providing the Mobile Servicing System (MSS) — which is comprised of a space arm for the ISS, also referred as the Space Station Remote Manipulator System (SSRMS) and the Special Purpose Dextrous Manipulator (SPDM) – a smaller two-armed robot designed to handle delicate assembly tasks on the ISS. In 1998, Canadian Space Agency astronauts Julie Payette and Marc Garneau were assigned to participate in ISS assembly flights scheduled for 1999. Astronauts Payette and Garneau will fly on missions STS-96 and STS-97 respectively to begin assembly of the ISS. Chris Hadfield will fly in 1999 for a critical mission (STS-100) to install the SSRMS on the Space Station.

The Advanced Satellite Communications Initiative promotes technologies for a new generation of satellite systems for advanced multimedia services.

Satellite communications is another critical space application. The CSA is helping Canadian industry to open new domestic and international markets. The Advanced Satellite Communications Initiative promotes technologies for a new generation of satellite systems for advanced multimedia services, a rapidly growing sector. During 1997-98, five contracts were negotiated for the development of space and ground technologies as well as for the demonstration and trial of satellite communication applications. Phase 1 began in 1997-1998, with the awarding of $50 million in industry contracts for R&D projects.

The CSA pursues a space technology development strategy through its contract award programs with industry. It develops and reinforces Canadian technological excellence in key areas of space technology, many of which have commercial spinoffs in other fields back on Earth. In 1997-1998, over 200 technology development contracts worth $65 million were awarded, more than 35% to small and medium-sized companies.

The CSA's space awareness program builds public knowledge of Canada's activities and accomplishments in space, and of the importance of science and technology in general. It uses the unique attractiveness of space to encourage young people to become interested in careers in science and technology, thereby securing Canada's place in the knowledge-based economy. In 1997-1998, students across Canada were given many opportunities to become involved in experiments taking place in space. A network of five Canadian Space Resource Centres (CSRCs) provided students and educators with space-related information and curriculum resource products. 1997 also witnessed Canada's first National Space Day, an event staged simultaneously in numerous locations across Canada which increased youth and public participation in space-related activities.

External Relations improves the competitiveness, coordination, and global relevance of the Canadian space industry, and maximizes the industrial benefits of space in all regions of Canada. It focuses on building, maintaining, and improving the CSA's relationships with government, academic, and private sector space organizations in Canada and throughout the world. Its 1997-1998 activities provided international marketing support for the Canadian space industry, and expanded the CSA's database of strategic industry related information. New relationships were built with key emerging space powers, while established relationships with US, Europe and Japan were maintained and expanded.

The Management business line ensures that the CSA provides leadership and overall management for the Canadian Space Program. Despite the risks of such an endeavour, together we are successfully implementing the activities and programs approved by the government in Canada's Long Term Space Plan II (LTSP II) for the period 1994 to 2004. Under the Management business line, the CSA began preparations for LTSP III during 1997-1998, to chart the future of the space program as current projects reach completion.

CHART OF KEY RESULTS COMMITMENTS

On the following chart, specific indicators demonstrate the benefits to Canadians of the Canadian Space Program. It includes the two business lines of the Agency which carry out program activities: **Space Sciences** and **Space Applications and Industry Development**.

This chart reflects Annex B of the 1998 Annual Report to Parliament: "Managing for Results," as well as the CSA's Performance Reporting and Accountability Structure (PRAS).

Space Sciences

TO PROVIDE CANADIANS WITH:	knowledge and core competencies in space sciences
TO BE DEMONSTRATED BY:	

Peer review of papers published or presented at conferences.
Number of Canadian research instruments and experiments aboard satellites launched by NASA or other space agencies as well as on NASA Space Shuttle missions and the Russian *MIR* station.
Number of instruments and spacecraft systems developed in industry and number of scientists and engineers involved in space science & technology.
Improvements in technology, materials, medical procedures.
Processes attributable to involvement with Space Sciences.
Participation of Canadian astronauts in international human space flights.

ACHIEVEMENT REPORTED IN:	Section 3.2.1

Space Applications and Industry Development

TO PROVIDE CANADIANS WITH:	economic and social benefits from the application of space technology and space based research
TO BE DEMONSTRATED BY:	

Numbers of new applications transferred to industrial or operational uses.
Numbers of new technologies brought to market and licences negotiated.
Economic growth of the Canadian space sector in terms of total revenues, exports and employment.
Periodic economic analyses showing increased employment and regional distribution of industrial activity as a result of Canada's investment in space.
Positive feedback from stakeholders on CSA relations.
Annual increases in royalty revenues generated by *RADARSAT-1*.
Increases in the number of firms in the Canadian remote sensing industry which are commercially exploiting Earth observation satellite data.
Distribution of the CSP contracts in accordance with regional distribution targets.
Case studies showing medical benefits from experiments in space.
Economic studies showing job attribution to spin-offs from space technologies.
Case studies demonstrating the diffusion of space-based technologies into resource management and disaster management.
Polls showing annual increases in the level of awareness of the Agency and its programs among the public, especially youth, the media,stakeholders, and industry.
Number of requests for information about space and the number of hits on the Agency web site (www.space.gc.ca).
Surveys reporting on the usefulness of education materials developed by the Agency and distributed to schools and resource centres.
Number of graduate students receiving scholarships in S&T in Canada.
Number of highly-trained Canadian graduate students hired by Canadian firms, government and academia for space-related work.

ACHIEVEMENT REPORTED IN:	Section 3.2.2

MINISTER'S MESSAGE

Canada is well positioned to be a leader in the new emerging global knowledge-based economy. Our government is working with the private sector to address the challenges in making the transition to this economy. By focussing on the challenges of a competitive 21st century economy, we can turn Canada's potential into reality and create jobs and wealth for our citizens. The Industry Portfolio, bringing together 13 departments and agencies with complementary goals and objectives, plays an important role in helping Canadians achieve this vision.

In 1997-98, the Industry Portfolio focussed on three areas of activity - each crucial for our economic success - now and into the next century:

- promoting innovation through science and technology;
- assisting businesses to grow by providing information, advice and financing support; and
- ensuring a fair, efficient and competitive market place.

The Portfolio members' Performance Reports collectively illustrate how the Portfolio is making a contribution toward the realization of these objectives.

The 13 Industry Portfolio members are ...

Atlantic Canada Opportunities Agency
Business Development Bank of Canada*
Canadian Space Agency
Competition Tribunal
Copyright Board
Canada Economic Development for Quebec Regions 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 Performance Reports

I am pleased to present the Performance Report for the Canadian Space Agency (CSA) for the fiscal year ending March 31, 1998. In the 1997-98 Estimates Part III, CSA articulated its strategic objectives and described how its plans for the fiscal year would contribute to their realization. This report sets out the Canadian Space Agency's accomplishments against those plans and shows the contribution the Agency is making to Portfolio and government-wide objectives.

The Honourable John Manley

SECRETARY OF STATE'S MESSAGE

Message from the Secretary of State
(Science, Research and Development)

Canada's future is being built on a resource that is virtually limitless: knowledge. In a competitive global economy, all Canadians must be able to use knowledge to their best advantage. Competence in science, technology and innovation is an essential ingredient for success in the knowledge-based society.

Almost half of Canada's GDP growth is in the knowledge-intensive sectors of the economy. The fastest growing sectors include information and communications technology, aerospace, and consulting engineering. Canada's science and technology challenges, then, are to ensure that our people have the skills to benefit from the knowledge-based economy, and are able to innovate through science and technology in all aspects of our industrial growth. The Canadian Space Agency plays an essential part in doing just that - helping Canadians and businesses meet the challenges.

As Secretary of State for Science, Research and Development, I have taken a personal interest in the government's promotion of a culture where we use innovation and turn it into a competitive advantage in the marketplace. We need to keep the best and brightest minds in Canada, and we need to attract others from around the world. We need to build support for international partnerships that help build on the foundation of Canada's knowledge-based economy. As we enter the next century, the challenge will be to build on our momentum and ensure that Canada has the science and technology necessary to secure our place in the world for the next generation.

The Honourable Ron J. Duhamel

SECTION 2: AGENCY OVERVIEW

2.1 MANDATE

The legislated mandate of the CSA, from the Canadian Space Agency Act, SC. 1990, c. 13, is:

"...to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians."

MISSION

The Canadian Space Agency is committed to leading the development and application of space knowledge for the benefit of Canadians and humanity.

To achieve this, the CSA:

- pursues excellence collectively,
- advocates a client-oriented attitude,
- supports employee-oriented practices and open communications,
- commits itself to both empowerment and accountability, and
- pledges to cooperate and work with partners to our mutual benefit.

OBJECTIVES

The principal objectives of the Canadian Space Program are: ***to develop and apply space science and technology to meet Canadian needs and aspirations; and to foster an internationally competitive space industry.***

2.2 OPERATING ENVIRONMENT

2.2.1 The Canadian Space Agency and Canada's Space Policy Framework

The Space Policy Framework, approved by the government in 1994 as part of Long Term Space Plan II, establishes the strategic importance of space in Canada's transition to a knowledge-based economy, by identifying its significance to the government's social, scientific, sovereignty, industrial, security and foreign policy objectives. Within this framework, the CSA coordinates all the federal government's policies and programs in civil space-related research, science and technology, industrial development and international cooperation.

The key elements of this Space Policy Framework are as follows:

- Earth Observation and Satellite Communications have priority in space technology development and application.
- Programs maximize the leverage of federal funding through partnership with industry and the provinces.
- Program implementation is open to more firms, particularly small and medium-sized enterprises.
- Industrial regional development is pursued through regional distribution targets.
- Synergy between civil and defence space activities is encouraged to optimize the effectiveness of federal space funding.
- A country-wide communications and space awareness campaign is to be implemented.

This policy framework allocates an important role to the private sector in managing the Earth Observation, Satellite Communications and International Space Station programs.

Significant changes have occurred in the international and Canadian space environment since 1994, giving rise to new opportunities and new considerations for the Canadian Space Program. To achieve the best results from Canada's investment in space, and the best mix of social and economic benefits from the Program, the following adjustments were approved:

- The Special Purpose Dextrous Manipulator (SPDM) – a smaller two-armed robot capable of delicate assembly tasks currently handled by astronauts during spacewalks – is being manufactured in Canada under a firm price contract with Spar Aerospace, at a total cost of $206.9 million. Producing the SPDM, a key component of the *International Space Station*, maintains Canada's leading position in space robotics;

- The Advanced SatCom Initiative is to be implemented in two phases: a technology development phase to be carried out with currently approved funds; and a service development phase to be considered later;

- The SAR (Synthetic Aperture Radar) Technology program is to be integrated into *RADARSAT-2*; and,

- The Contingency Reserve is to be maintained at a reduced level to ensure that programs will be implemented within the existing funding envelope.

This adjusted framework provides for the development of *RADARSAT-2*, and ensures that the Earth Observation, Space Science, Space Technology and Astronaut programs approved in 1994 can continue on course.

2.2.2 Main Partners and Stakeholders

Canada's space program involves many agencies, departments, companies, institutions and organizations across Canada. The following chart presents its main partners and stakeholders.

Chart THE CANADIAN SPACE AGENCY'S MAIN PARTNERS AND STAKEHOLDERS

CANADIAN PROVINCES

- Alberta Economic Development and Tourism
- British Columbia Ministry of Employment and Investment
- Manitoba Department of Industry, Trade and Tourism
- New Brunswick Department of Economic Development and Tourism
- Newfoundland & Labrador Department of Industry and Technology Development
- Nova Scotia Economic Development and Tourism
- Ontario Ministry of Economic Development and Trade
- PEI Department of Economic Development and Tourism
- Ministère de l'Industrie, du Commerce, de la Science et de la Technologie du Québec
- Saskatchewan Economic Development

INTERNATIONAL PARTNERS

- ESA (European Space Agency)
- CNES (France)
- NASDA (Japan)
- NASA (United States)
- Russia
- Sweden

CSA ASC

CANADIAN SPACE INDUSTRY

- Private companies
- Research centres
- Universities
- Industry associations

OTHER FEDERAL DEPARTMENTS AND AGENCIES

- Industry Canada
- Communication Research Centre (CRC)
- Canada Centre for Remote Sensing (CCRS)
- Environment Canada
- Department of National Defence (DND)
- Fisheries and Oceans Canada
- National Research Council of Canada
- Natural Sciences and Engineering Research Council of Canada
- Atlantic Canada Opportunities Agency
- Canada Economic Development for Quebec Regions
- Western Economic Diversification Canada

2.2.3 Challenges

Institutionally, the risks of the space program are implicit in the long-term scope of programs, the international dimension of most space programs (which limits the ability of any one country to control schedule, design and cost changes), the uniqueness of the space hardware to be developed, the very stringent quality control requirements and the use of advanced technologies. In the face of these risks and uncertainties, program cost control and budget flexibility are dominant concerns for all space faring nations.

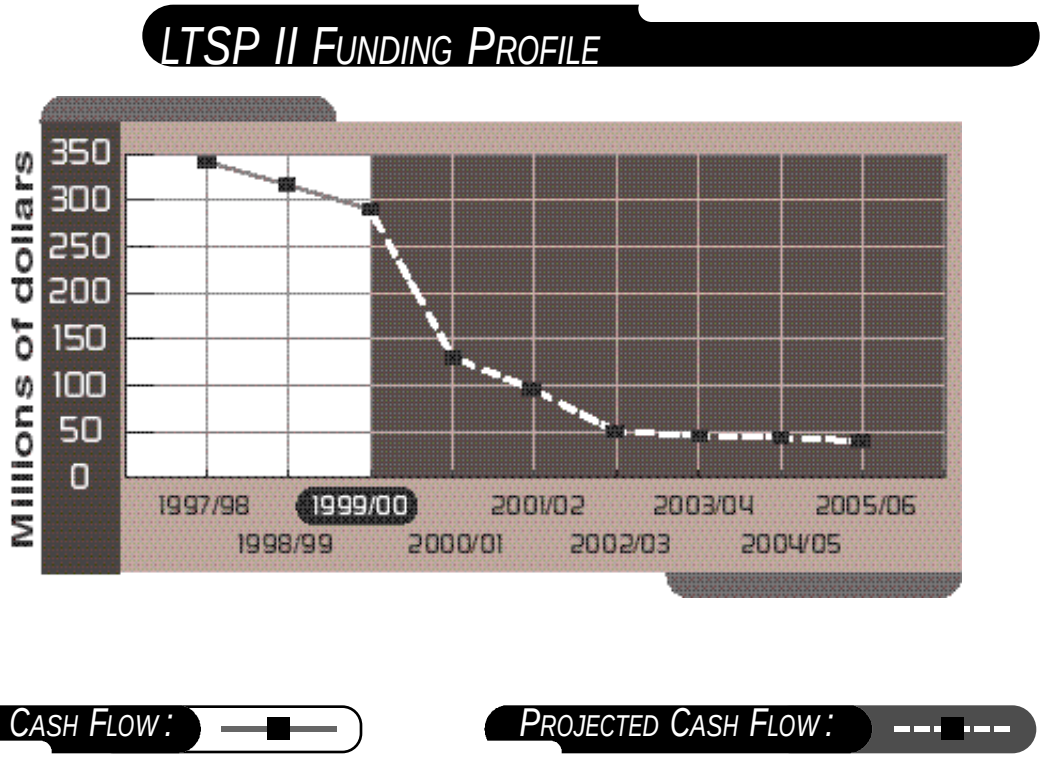
Under LTSP II, CSA contracts assign full responsibility for program risks and cost increases to the contractor. Most current major development projects such as the Special Purpose Dextrous Manipulator (SPDM) – a smaller two-armed robot capable of delicate assembly tasks on the *International Space Station* – are under a firm price contract. The government contribution to phase 1 of Advanced SatCom is limited to a maximum of $50 million. *RADARSAT-2* development and operation risks have been entirely assumed by the private sector. Nevertheless, to complete all CSA programs within approved funds represents more of a challenge than anticipated in March 1997, when the LTSP II Mid-Course Adjustments were approved. Cost increases continue to be a concern for programs still governed by "cost-plus" development contracts. The Space Station program has been encountering difficulties related to late tests failures of the MSS system and prime contractor cost overruns that are resulting in unforeseen cost increases. On the revenue side, royalties from the sales of RADARSAT data are not likely to reach the level projected when the program was approved several years ago.

Another challenge arises from the fact that, unlike most federal departments and agencies, the CSA has no significant base budget. Most of its programs and financial resources are approved by Cabinet for a few major crown projects such as the International Space Station program, and *RADARSAT-1*. As smaller and quicker space missions become more typical, the CSA needs greater budget flexibility to seize opportunities as they occur, and to effectively manage the risks and uncertainties of space programs.

CSA is now well on the way to developing the Long Term Space Plan III (LTSP III) to help deal with the challenges mentioned above and to seize opportunities as they occur. The LTSP III submission is also critical to the future of the CSA's activities.

The CSA's current funding base declines rapidly as current LTSP II activities move toward completion. By Year 2000, it declines to a level that cannot sustain a meaningful Canadian Space Program.

The following chart highlights the LTSP II funding profile.



2.2.4 Strategic Priorities

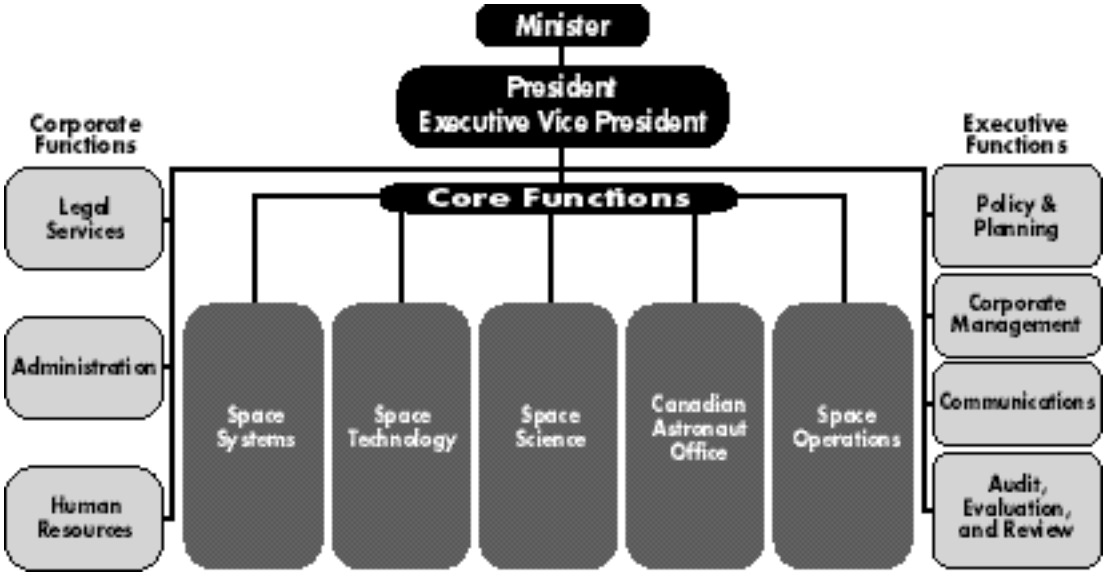
Considering global trends, market opportunities, and the particular challenges it faces, the CSA has set four strategic priorities:

- delivering Canada's contribution to the *International Space Station*, the MSS and SPDM;
- operating *RADARSAT-1* and building *RADARSAT-2*;
- delivering the Advanced Satellite Communications Initiative; and
- obtaining the approval of Long Term Space Plan III (LTSP III).

2.3 AGENCY ORGANIZATION AND BUSINESS LINE STRUCTURE

2.3.1 Organization Chart

CSA ORGANIZATION



2.3.2 Business Lines

The plans, priorities and strategies of the CSA are carried out through three business lines:

- **Space Sciences**
- **Space Applications and Industry Development**
- **Management**

2.3.2.1 Space Sciences

Objectives

To advance knowledge and develop core competencies in space sciences.

Description

Working with Canadian scientists, universities and graduate students, the Canadian Space Agency contributes to the advancement of space knowledge, and the development of scientific expertise, new processes and applications.

This is achieved through two service lines as follows:

- **Space Science** — sustaining Canadian excellence in the international scientific exploration of space, and procuring instruments from Canadian industry that are needed to obtain relevant scientific data.
- **Canadian Astronaut Program** — training Canadian astronauts to participate in international human space flights, contributing to Canadian science and technology experiments in space, and inspiring Canadian youth to pursue careers in science and technology.

2.3.2.2 Space Applications and Industry Development

Objectives

To ensure that Canadian companies benefit from space technology development. To contribute to the sustainable development of Canada and the world, and increase awareness of the importance of space technology in all regions of Canada.

Description

The CSA works with industry across Canada to foster the use and applications of space science and technology, and to stimulate an internationally-competitive, export-oriented Canadian space equipment and services sector. It works with other public sector organizations, or on its own to contribute to the sustainable development of Canada by linking Canadians from coast to coast, enhancing the management of our environment and natural resources, and advancing human understanding of how phenomena in space affect life on Earth. The CSA also undertakes various space awareness and external relations activities.

Space Applications and Industry Development includes the following seven service lines:

- **Earth Observation** — ensuring Canadian leadership in the international Earth observation market, by meeting Canadian environmental monitoring and resource management needs.

- **Space Technology** — ensuring that Canada remains at the forefront of space technology development, through technology development and diffusion. This maintains Canada's place in future space programs and enhances Canadian industry's international competitiveness.

- **Canadian Space Station Program** — meeting our commitments to the International Space Station Program, while enhancing Canada's ability to operate in space and to exploit the potential of space technologies, particularly automation and robotics.

- **Satellite Communications** — ensuring that Canadians have access to new multimedia, personal, and mobile communications services made possible by advanced satellite communications, and helping Canadian industry expand international market share.

- **Space Qualification Services** — providing an environmental test facility to meet the current and emerging needs of Canada's space community.

- **External Relations** — building and maintaining foreign partnerships, to help carry out Canada's Space Program and support the space industry's domestic and export development efforts. This service line supports and monitors industrial regional development, and manages the CSA's relations with Canadian and foreign agencies and partners.

- **Space Awareness** — helping to spread the dream of space, increasing awareness of Canada's accomplishments, and their benefits.

2.3.2.3 Management

Objectives

- To provide strategic direction, management and administrative support services to the CSA.
- To provide leadership for and ensure the cohesion of all Canadian Space Program activities.

Description

This business line ensures that the CSA performs its leadership role as the manager of the Canadian Space Program. It also includes Agency management activities related to Human Resources, Corporate Management, Administration, Communications, and Review. The Executive and Horizontal Coordination service line articulates strategic direction for the Agency, provides management and administrative support services, and ensures the necessary integration of all activities of the Long Term Space Plan II and future space plans.

2.3.2.4 Crosswalk from Old Structure

The CSA has moved from seven to three business lines as shown below. Each business line is focussed on specific outcomes for specific target clienteles.

The new structure reflects a changing environment for space programs. Many space activities are becoming more service-oriented, with their future often tied to end-uses on the ground, or to the integration of their technology in terrestrial applications. Future investment will ensure that the needs and aspirations of Canadians are met, that key manufacturing niches remain in Canada, and increasingly, will seek significant business opportunities back on Earth for Canadian industry.

Furthermore, the globalization of world space efforts means that today's needs — whether they are commercial, humanitarian or environmental — are met by international entities. Accordingly, Canadian space programs are predicated on playing an active role at the sub-systems level in global partnerships and consortiums.

Through its three new business lines, the Agency has moved away from program oriented business lines and positioned itself to know how well it is performing in meeting Canadian needs and expectations. The following table compares the old and new structures. The financial crosswalk is shown in Table 4 of Section 4.

PREVIOUS BUSINESS LINES	NEW BUSINESS LINES
Space Science Canadian Astronaut Program	Space Sciences
Earth Observation Space Technology Canadian Space Station Program Satellite Communications * Executive and Horizontal Coordination (External Relations) (Space Awareness)	Space Applications and Industry Development
* Executive and Horizontal Coordination	Management

* This previous business line was split in two new business lines.

SECTION 3: AGENCY PERFORMANCE

3.1 PERFORMANCE EXPECTATIONS AND HIGHLIGHTS OF ACCOMPLISHMENTS

The Canadian Space Agency is committed to leading the development and application of space knowledge for the benefit of Canadians and humanity.

In the Space Sciences business line, performance in this role is a matter of advancing knowledge of space, the universe, and basic physical, chemical, and biological processes. The CSA is responsible for finding opportunities for research in space for Canadian scientists in universities and industry, and building a core of Canadian scientists with skills and expertise in space R&D. Knowledge gained through research in space should also lead to new and improved processes and applications, and operational solutions to terrestrial problems. Medical improvements from space research are expected to lead to the health, well-being and productivity of humans in space, and also to have significant uses on Earth.

In 1997-1998 the CSA secured opportunities for Canadian life sciences and microgravity research aboard NASA's Space Shuttles and Russia's *MIR* space station. This resulted in better insight into the protein crystal structure. It will help in the development of more effective drugs, and in gaining a better understanding of a number of medical disorders. These experiments could not be conducted on earth because of earth's gravity. Canada was collaborating in international missions such as NASA's *EOS*, Sweden's *Odin*, Russia's *Interball*, and Japan's *Planet-B*. Development began on Microgravity and Life Sciences experimental facilities for the International Space Station. An agreement was made with NASA for launching *SciSat-1*, the first Canadian-led science satellite since *Alouette* in the early 1960s. Data from Canadian instruments continued to improve our understanding of Earth's climate, weather, and atmospheric conditions.

In the Space Applications and Industry Development business line, the CSA's performance is measured by the extent to which space is a technological springboard for Canada, generating further high-quality jobs in the knowledge economy, and economic growth and spinoffs in other areas from the use and application of space science and technology. CSA's performance measures include the extent to which Canadians are winning international recognition for leadership in space technology and research. They include the improved competitiveness, coordination and relevance of Canada's space industry, and the extent to which it participates in major space-related science and technology programs on an international scale. Performance should also be seen in terms of space applications delivering a growing range of solutions to Canadian and global problems, improved methods for tracking and predicting climate and pollution problems, and support for the sustainable development of Canada and the world.

The following table summarizes expected results and accomplishments of Canada's Space Program, under the CSA's three business lines: Space Sciences, Space Applications and Industry Development, and Management. The items listed under the Expected Result column are extracted from the PRAS and are linked to the Performance Reporting and Accountibility Structure (PRAS) indicators shown on page V of this report. All service line tables which follow refer to these PRAS results.

Performance Expectations

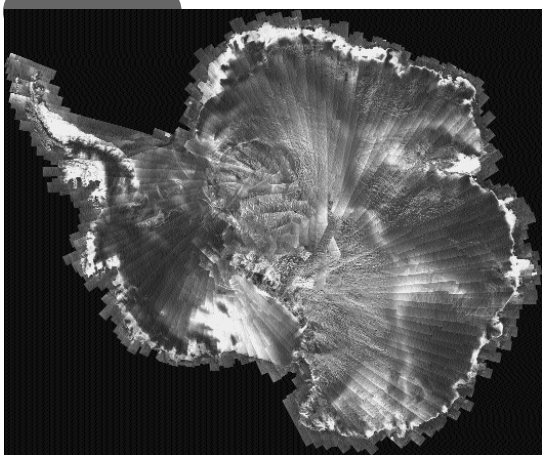
BUSINESS LINE	EXPECTED RESULT	KEY ACCOMPLISHMENTS
Space Sciences	A better understanding of space, the universe and basic physical and chemical processes.	Numerous scientific papers published.
	Opportunities for research in space for Canadian scientists and engineers in universities and industry.	Agreement with NASA re: *SciSat*. Life Sciences and Microgravity experiments aboard NASA Shuttles and *MIR* Russia station. TPA launch aboard Japan's *Planet-B*. Continued operation of instruments and delivery to science teams.
	Canadian scientists with skills and expertise in space R&D.	CSA astronauts participate in Space Shuttle Missions. Canadian collaborations in: *Odin* (Sweden), *Interball* (Russia), *Planet-B* (Japan), *EOS* (NASA). Instruments delivered to foreign space gencies for integration and launch in 98-99. Development work of microgravity and life sciences experimental facilities for *ISS*.
	Operational solutions to terrestrial problems developed from knowledge gained through research in space.	Continued use of data from space science instruments by space weather facilities.
	New and improved processes and applications, especially in space robotics technology.	Enhanced understanding of protein crystal structure for development of more effective drugs for medical disorders.
	Medical improvements from space research lead to the health,well-being and productivity of humans in space.	Canadian participation in Operational Space Medicine program and Human Space Flights program.
Space Applications and Industry Development	Improved technical capabilities and economic benefits to Canadian industry from the use and application of space science and technology.	AMM completed by *RADARSAT-1*. 200 development projects by SMEs. Assembly of SSRMS continued in 97. Acceptance review in October 97. Test & integration continue for delivery to NASA on schedule in late 98. MSS operations and training simulator complex completed in 1997. A firm price contract for the manufacture of the SPDM awarded to SPAR in 1997. ISS astronaut/cosmonaut training facilities established at CSA HQ.
	Participation of Canadian SMEs in all regions of Canada in space technology development programs and development by SMEs of technologies for space applications. Participation of Canadian industry in S&T programs on an international scale.	Canadian space industry expanded sales, generated employment,developed new skills and enhanced its commercial competitiveness, (estimated benefits (1996):5000 jobs & $1 billion in sales). Employment and revenues in the Earth observation business growing at a rate of 20% per year.
	International recognition of Canada's leadership in space technology and research.	All CSA activities contributed to build the international recognition *ISS*, RADARSAT, SPDM,S&T research and applications and astronaut's missions.
	Improved competitiveness, coordination and global relevance of the Canadian space industry.	Selected consortium led by industry to build and operate a more advanced *RADARSAT-2* satellite within the allocated federal budget envelope. Performed environment tests for RADARSAT, MSAT and MSS at DFL.

Performance Expectations

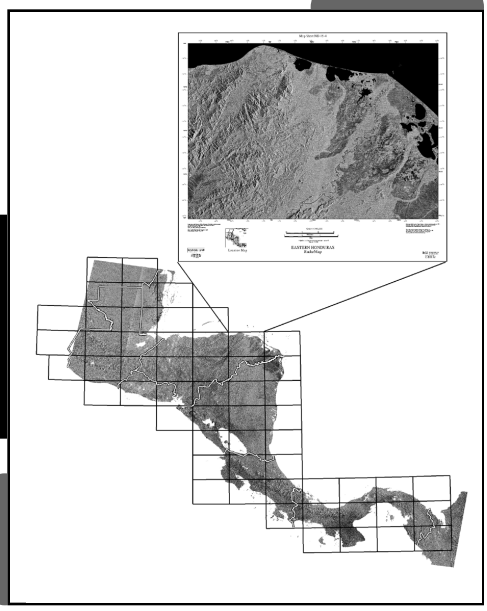
BUSINESS LINE	EXPECTED RESULT	KEY ACCOMPLISHMENT
Space Applications and Industry Development	Maximized industrial benefits of the CSP to all regions of Canada.	Royalty revenues from RADARSAT data sales were $2 million in 1997-98 compared to $566,000 in the previous year. Undertook and published a comprehensive study on the Canadian space sector.
	Improved relationships with governmental, academic and private sector space organizations throughout the world.	Built new relationships with key emerging space powers:China,Brazil,India. Maintained and expanded relationships with established markets:US, Europe, Japan.
	Economic development deriving from the application of space technology and space-based research. Enhancement of the health of Canadians from the application of space technology and space-based research. Benefits to the economy and society from the application of space technology and space-based research.	New technologies developed throughout Canada. $66 million in contracts awarded,supported by incremental industry contributions, in order to develop multi-media satellite communications technologies. Awarded 15 contracts, with average 50% industry contributions to position Canadian industry in the fast growing market for mobile/personal communications services.
	Improved resource management and disaster management,and techniques for the prediction of climate and pollution problems, which support the sustainable development of Canada,through the application of space technology and space-based research.	Mapping North America completed. 99% world landmass coverage.
	Public awareness of the role of space in Canada's future. Youth involvement in S&T through increased interest in space activities.	6% annual increase of information requests received by CSRCs. Space Day reached thousands across Canada. 20% increase foreseen re:CSA Web use.
	Highly qualified personnel are available to the public sector and the high-tech industry.	Several graduates and post doctoral fellows have been supported through CSA / NSERC university-industry partenership programs. The forecasted job creation (5000 in 1996)
Management	Cost-effective management of the Canadian Space Program and the Long Term Space Plans.	Government approval to manufacture SPDM and adjustments to CSSP. Development of a long-term space vision and plan for Canada.
	Canadian Space Agency employees have the appropriate knowledge, tools, processes, and systems to do their jobs.	CSA executives use performance framework to make decisions.
	Effective communications strategies, plans, and public awareness activities that satisfy the needs of the Agency, departments in the Industry Portfolio, and space stakeholders. Effective, results-based,open,and transparent relations between the Agency and stakeholders.	Positive feedback received from central agencies, partners and stakeholders
	A representative, motivated,capable, innovative and productive work force.	CSA reorganization completed and mission implemented. CSA internal survey has provided a baseline to ensure follow-up.

3.1 PERFORMANCE EXPECTATIONS AND HIGHLIGHTS OF ACCOMPLISHMENTS (continued)

Highlighting accomplishments in Space Applications and Industry Development, in 1997-1998 the space sector expanded sales, generated employment, developed new skills and enhanced its commercial competitiveness. It generated 5,000 jobs and approximately $1 billion in sales of goods and services (based on a 1996 study). Approximately 30% of its manufacturing sales were exported, the highest ratio in the world. Over 200 technology development and adaptation projects were under way. RADARSAT captured a 12% share of the world market for satellite data, accomplished the first full mapping of Antarctica and a 99% coverage of the world's land-mass. Employment and revenues in the Earth Observation business grew by 20%, and a consortium was selected to build and operate *RADARSAT-2*. Manufacture and assembly of Canada's contribution to the *International Space Station* continued, with the SSRMS going through acceptance review, an MSS operations and training simulator complex being completed, and a firm contract being signed for the construction of the "Canada Hand". There were 15 contracts awarded to help position Canadian industry in the fast-growing market for mobile and personal communications services, with an average 50% industry contribution.



This RADARSAT mosaic view of Antarctica provides a critical benchmark for measuring global climate change.



This RADARMap of Central America is a new RADARSAT product recently introduced by RADARSAT International Inc. and Resource GIS and Imaging (RGI).

3.2 PERFORMANCE BY BUSINESS LINE

3.2.1 Space Sciences

In 1997-1998, Space Sciences collaborated with Canadian scientists, universities, graduate students, and high-technology enterprises to provide them opportunities for research in space. It advanced knowledge and developed Canada's core competencies in space. It delivered a better understanding of space, the universe, and basic physical and chemical processes, and provided operational solutions to Canadian and global problems. The Space Sciences business line incorporates two service lines: Space Science, and the Canadian Astronaut Program.

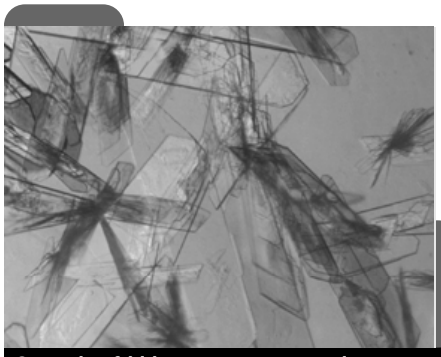
3.2.1.1 Space Sciences

FINANCIAL REQUIREMENTS FOR 97-98 ($)

Service Lines	1997-1998 Planned Spending	1997-1998 Total Authorities	1997-1998 Actual
Space Science	29,931,000	29,801,000	29,763,000
Canadian Astronaut Office	6,679,000	5,634,000	5,609,000
Total	36,610,000	35,435,000	35,372,000

Nota: 1) Planned Spending corresponds to Main Estimates Budget.
2) Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
3) Includes contributions to Employee Benefit Plans.

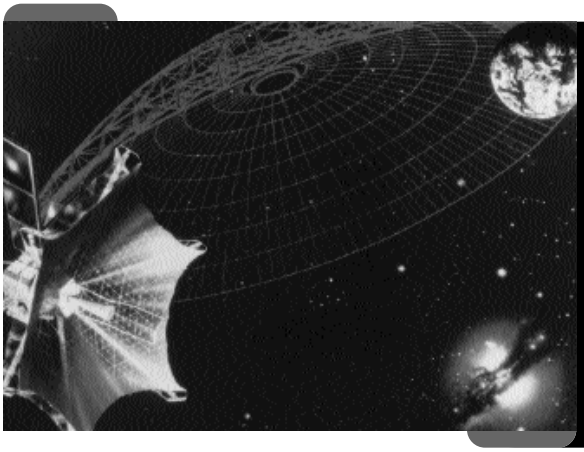
3.2.1.1 Space Science



Crystals of kidney stones grown in space as part of the CAPE experiments onboard *MIR* station. Protein crystals formed in micro-gravity may hold the key to medical break-throughs in diabetes, breast cancer, Alzheimer's disease, and hypertension.

The Canadian Space Agency's Space Science activities ensured the participation of hundreds of Canadian scientists in the best space science projects to meet Canada's needs. These activities were typically carried out in international partnerships, focussing Canadian resources in our areas of expertise and gaining access to a wider range of scientific missions and data.

Space Science investigations delivered new knowledge of space phenomena, as well as their terrestrial effects on climate, the atmosphere, and pollution. They addressed the effects of gravity on the human body, biological and physiological processes, and on materials.



The international VLBI Space Observatory Project (VSOP) is the first to link radio telescopes on Earth with one in space. Working together, they create a "virtual" mega-telescope dish that is over 25,000 km wide and by far the most powerful imaging device ever created for space astronomy.

Space Science anchored Canada's place in space by delivering world-class space science research opportunities for Canadian universities. It reinforced Canadian expertise in developing scientific instrumentation for space, and it helped many Canadian small and medium companies to gain technology, capabilities and competitiveness, and win international reputations for their work in this field.

In 1997-1998, Space Science activities included:

- Life Sciences experiments flown on the Space Shuttles and the *MIR* station. Later in 1998, two Canadian life sciences experiments selected through international competition (VCF and Visual Cues) were conducted aboard NASA's Neurolab mission by astronaut Dave Williams. These experiments, designed to help future astronauts to better live and work during prolonged missions on the *International Space Station*, could also lead to new treatments for medical disorders such as insomnia, motion sickness, blood pressure regulation and inner-ear ailments.

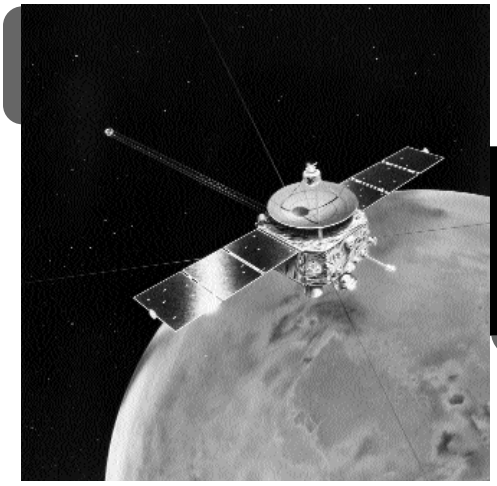
- Canada's MOPITT (Measurement of Pollution in the Troposphere) instrument, which measures carbon monoxide and methane, was prepared to fly on NASA's *EOS* satellite. Canada's OSIRIS instrument for the study of stratospheric ozone was prepared for launch on Sweden's *Odin* satellite. These are among the first instruments to monitor air pollution from space.

- Microgravity initiatives used the Microgravity Isolation Mount (MIM) and crystallization/liquid diffusion furnace, aboard Russia's *MIR* station. The Canadian Protein Crystallization Experiments (CAPE) project sent over 700 protein samples into orbit in *MIR* for nearly four months, as 15 Canadian universities and research centres investigated space-made protein crystals that could hold a key to the development of new drugs and medical breakthroughs in the treatment of many life-threatening diseases such as diabetes, breast cancer, Alzheimer's and hypertension. Other material processing and fluid experiments (Commercial Float Zone Furnace, FLEX) were conducted on NASA Space Shuttles and *DC-9* parabolic flights.

- The development of a small Canadian scientific satellite, *SciSat-1*, was undertaken. An agreement was reached with NASA in 1997-1998 to launch this first Canadian-led science satellite since the *Alouette/ISIS* series in the 1960s.

- Preparations for Canadians, especially scientists and engineers, to use Canada's allotted time on the *International Space Station*. Microgravity knowledge gained there may point the way to important future industries in ceramics, composite materials and biotechnology.

- Canada's participation in the Japanese space radio telescope, the Very Long Baseline Interferometry Space Observatory Project (VSOP), launched in 1997; a Thermal Plasma Analyser for Japan's *Planet-B* satellite mission to Mars, launched in 1998; a Fine Error Sensor to be provided to NASA for the Far Ultraviolet Spectroscopic Explorer, planned for launch in 1998-99; and the Small Payloads Program, which includes two balloon experiments to be flown in 1998-99 to investigate stratospheric ozone chemistry (*MANTRA*), and the formation of the universe through analysis of the cosmic background radiation (*BAM*).



The Thermal Plasma Analyser (TPA) will sample the Martian atmosphere in 1999, measuring energetic particles similar to those that cause the Northern Lights. Preparing for future voyages and possible colonization of Mars, it also provides insight into Earth's atmospheric systems.

Space Science programs have permitted companies across Canada to hone their competitive edges and gain international recognition. For example, CAL Corp. of Ottawa has developed a star tracker, CALTRAC, that is now a key component of attitude control systems in satellites from several nations. COM DEV of Cambridge, Ontario, developed high-precision mechanisms that have allowed it to join an international venture to provide inter-satellite link devices for communications. Bomem of Quebec City developed ground and flight IR calibration sources with the CSA, and went on to win contracts for similar sub-systems with NASA and ESA. Bristol Aerospace continues to provide its reliable sounding rockets to the world market.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

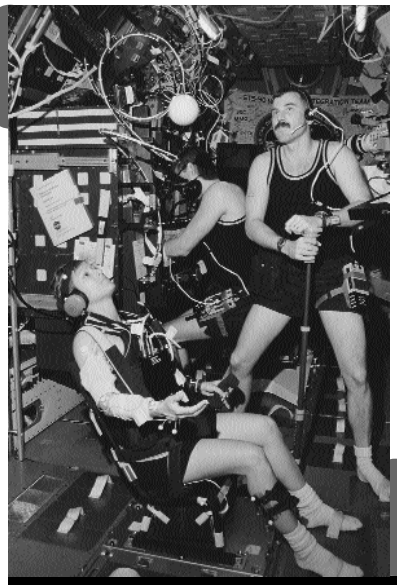
Space Science Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
A better understanding of space, the universe and basic physical, chemical and biological processes.	Hundreds of scientific papers published and presented.	Numerous scientific papers published.
Opportunities for research in space for Canadians scientists in universities and in industry.	15 large and dozens of small experiments launched by NASA or other space agencies as well as on Space Shuttles and *Mir* over the present decade.	Life Sciences and Microgravity experiments (e.g. VCF and Visual Cues on Neurolab, Fluid Physics Experiments and Canadian Protein Crystallization Experiment) were successfully conducted aboard Space Shuttles and *Mir*. Launch of a Thermal Plasma Analyser (TPA) in July 1998 aboard Japan's *Planet-B* mission to Mars. Continued operation of a number of instruments and delivery of the data collected to science investigation teams. Agreement with NASA for launching the first Canadian-led science satellite (*SciSat-1*) since the *Alouette/ISIS* series in the early 1960s.
Canadian scientists and industry with skills and expertise in space R&D.	Hundreds of Canadian scientists and engineers involved in the program. Canadian scientists seen as world-class researchers and advisors in high tech areas. Instruments and spacecraft systems developed in industry. Improvements in technology, skills and management in industry.	Extensive participation of Canadian scientists and engineers in international programs. Invitation for several Canadian collaborations in international missions such as NASA *EOS*, Sweden's *Odin*, Russia's *Interball* and Japan's *Planet-B*. Delivery of several new instruments to foreign space agencies for final integration and launch during 1998-99. Start of development work in industry of Microgravity and Life Sciences experimental facilities for the *International Space Station*.
Operational solutions to terrestrial problems developed from knowledge gained through research in space.	Attributions to the CSA of improvements in space weather, modelling of atmospheric processes.	Continued utilization of data from Space Science instruments by operational space weather facilities and atmospheric modelling research teams.
New and improved processes and applications.	Attributions to the CSA of processes, materials, medical procedures.	Enhanced understanding of protein crystal structure for the development of more effective drugs, and of a number of medical disorders through microgravity and life sciences experiments conducted in space.
Highly qualified personnel available to the public sector and the high-tech industry.	Dozens of graduate students involved in Space Science projects in universities.	Increased number of small projects undertaken in universities and in collaboration with industry to better match the duration of graduate studies and encourage even greater exposure of graduate students to the end-to-end development process of R&D projects.

3.2.1.2 Canadian Astronaut Program

Astronaut flights provide unique opportunities for research in space. LTSP II has secured annual flights for Canadian astronauts to perform such research. In 1997-1998, Bjarni Tryggvason flew on Shuttle Mission STS-85 to perform microgravity research, and Dave Williams flew on STS-90, which performed 26 life sciences experiments. Dr. Williams' experiments focussed on studying the effects of microgravity on the brain and other parts of the central nervous system. Researchers hope that these experiments will lead to treatments for neurological abnormalities such as sleep, motion sickness, balance, and blood pressure regulation disorders. In June 1997, it was announced that the Space Station Remote Manipulator System (SSRMS) will be installed on the *International Space Station* by Chris Hadfield during Mission STS-100. Later on in 1998, it was also announced that astronauts Garneau and Payette will fly on STS-96 and STS-97 Shuttle missions respectively, missions to begin assembly of the *International Space Station* in 1999.

Bjarni Tryggvason (upper left hand corner) and the STS-85 crew experiencing microgravity, a phenomenon with enormous potential for the future health and wealth of Canadians.



Dr. Dave Williams performs a neurological experiment with Kathryn P. Hire of NASA, to evaluate the ability of the central nervous system to accept and interpret new stimuli in space.

Canada's astronauts are internationally recognized for their skills. Canadian Space Agency astronaut Dr. Williams, Director of the Space and Life Sciences Directorate at NASA's Johnson Space Center in Houston, and a physician specialized in emergency medicine, heads a team of over 1,200 people devoted to understanding the opportunities and challenges of living and working in space. In April 1998, astronauts Julie Payette and Steve MacLean graduated from Mission Specialist training at the Johnson Space Centre in Houston, qualified to operate experiment apparatuses, as well as orbiter systems including the CANADARM.

Julie Payette prepares for her upcoming mission by training on the Space Vision System (SVS), a Canadian-made technology destined for use on the *International Space Station* by astronauts and cosmonauts.

As highly qualified, dedicated individuals, Canada's astronauts are standard bearers for the Canadian space program. In 1997-1998 they made frequent public appearances at media events, professional associations and educational institutions. They visited thousands of students across Canada, giving high visibility to the space program, and providing inspiration to young people to pursue careers and interests science and technology. Studies will be conducted to measure the increase in the interest of young people in careers in science and technology arising from astronaut visits. The Young Space Scientists Program, which allows students across Canada to get involved in the experiments being carried out by astronauts on space flights, had a particularly enthusiastic response to the STS-90 mission in 1998.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Canadian Astronaut Program Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Opportunities for research in space for Canadian scientists in universities and in industry.	Approximately 20 Canadian research projects on shuttle missions over the next 5 years.	Microgravity Vibration Isolation Mount (MIM) and associated physics experiments flew on STS-85 with astronaut Tryggvason. Astronaut Williams participated in the development of experiments for STS-90 Neurolab mission.
	The continued existence of an active highly qualified Canadian astronaut corps.	Astronaut Williams flew on STS-90 Neurolab in 1998. Astronauts Payette and MacLean graduated from Mission Specialist Training.
New and improved processes and applications, especially in space robotics technology.	The use of the Canadian built SSRMS in the construction of the ISS. Extensive positive media coverage.	Three CSA astronauts will participate in missions to assemble ISS in 1999.
	Visibility of Canadian space robotics technology and of Canada's role as an essential partner in the construction of the ISS.	This will be measured when the astronauts are assembling the ISS in 1999.
Medical improvements from space research lead to the health,well-being and productivity of humans in space.	The existence of a strong Canadian Operational Space Medicine (OSM) program.	Requirements analysis into OSM completed. New extravehicular activity (EVA) pre-breath protocol being tested at the Environmental Medicine Facility in Toronto. Participation in multicultural Space Medicine Panels and working groups to prepare for long duration space flights.

3.2.2 Space Applications and Industry Development

Working with industry, in 1997-1998 the CSA facilitated the use and application of space science and technology, and stimulated an internationally-competitive, export-oriented Canadian space equipment and services sector. Space applications link Canadians from coast to coast, enhance the management of our environment and natural resources, and advance human understanding of how phenomena in space affect life on Earth. The CSA also undertook various communications activities to contribute to better awareness of space in all regions of Canada, and encourage youth to pursue careers in science and technology. Performance in these areas is reported below under seven service lines.

Space Applications and Industry Development

FINANCIAL REQUIREMENTS FOR 97-98 ($)

Service Lines	1997-1998 Planned Spending	1997-1998 Total Authorities	1997-1998 Actual
Earth Observation	30,120,000	42,603,000	42,340,000
Space Technology	27,452,000	26,396,000	26,256,000
Canadian Space Station Program	51,121,000	70,548,000	70,532,000
Satellite Communications	18,574,000	25,357,000	25,357,000
Space Qualification Services	9,601,000	8,953,000	8,837,000
External Relations	1,075,000	1,075,000	1,004,000
Space Awareness	1,105,000	745,000	666,000
Total	139,048,000	175,677,000	174,992,000
Less: Revenue credited to the Vote	(7,403,000)	(7,403,000)	(6,508,000)
Total	**131,645,000**	**168,274,000**	**168,484,000**

Nota:
1) Planned Spending corresponds to Main Estimates Budget.
2) Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
3) Includes contributions to Employee Benefit Plans.
4) Difference between Planned Spending and Total Authorities is mostly due to supplementary budgets obtained during the fiscal year for the SPDM as a component of the Canadian Space Station Program, for the Major Crown *RADARSAT-1* Major Crown Project,for the program subsequent to RADARSAT and for the Advanced Satellite Communications Program (see page 50 for additional information).

3.2.2.1 Service Lines

- Earth Observation
- Space Technology
- Canadian Space Station Program
- Satellite Communications
- Space Qualification Services
- External Relations
- Space Awareness

3.2.2.2 Earth Observation

Earth Observation is emerging as a major Canadian knowledge industry, using data from *RADARSAT-1*. In 1997-1998 this sector included some 170 Canadian companies selling value-added services for an estimated $200 million annually. Employment and revenues in this business are growing at a sustained rate of 20% yearly. Forty percent of its revenues are produced from export sales of products and services.

***RADARSAT-1* can transmit and receive signals through clouds, fog, smoke, and darkness, making it one of the most reliable sources of high quality images of the Earth.**

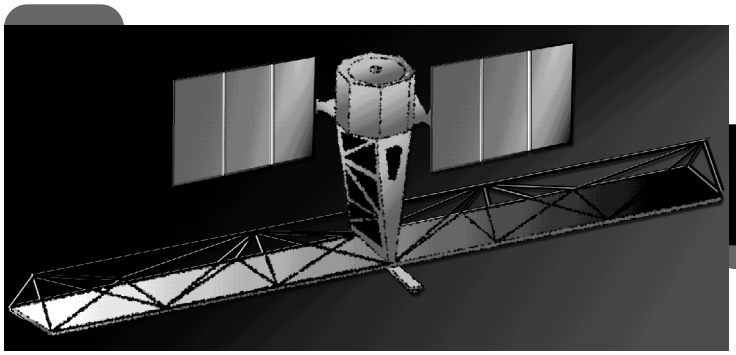
In 1997-1998, after two years of operation, *RADARSAT-1* was performing better than ever! It achieved full coverage of Earth's landmass, giving Canada an archive of images of any part of the Earth's landmass that can be obtained without reserving satellite time.

RADARSAT's Antarctic Mapping Mission, concluded for NASA in 1997-1998, provided the first high resolution snapshot radar coverage of the entire Antarctic continent. Governments and scientists worldwide will use this unique data set to study, manage, and protect Antarctica in accordance with the Antarctic Treaty System. The RADARSAT images of Antarctica allow scientists to make detailed estimates of the ice topography and ice motion in central parts of the ice sheet, where scarcely any other measurements have been made. It will bring a better understanding of why changes in the ice sheet occur, providing more insight into the effects of human activity and global warming on the rapid retreat of large portions of the ice shelves in the Antarctic Peninsula. According to NASA, RADARSAT far exceeded expectations for the coverage, quality and information content of its Antarctic images.

In 1997-1998, RADARSAT's role increased in environmental monitoring and the sustainable development of resources, as the Global Observation of Forest Cover Project was initiated with national and international partners.

When a disastrous ice storm struck Eastern Canada in January 1998, RADARSAT data helped to assess the storm's impact on forest and farm land. RADARSAT reception facilities remained in operation despite the storm, and no data was lost. Since it began operations, *RADARSAT-1* has shown its ability to respond rapidly and effectively to natural disasters in Canada and around the world, including flooding in the Saguenay region in 1996 and the record-breaking Red River Flood in 1997, where it was used to predict flood crests and other critical factors. *RADARSAT-1* supplies data to help the Canadian Ice Services (CIS) ensure safe routing of vessels in potentially hazardous conditions. The CIS, a major user, obtains superior data not possible under its previous methods, and saved an estimated $6-7 million in 1997-1998 by using RADARSAT.

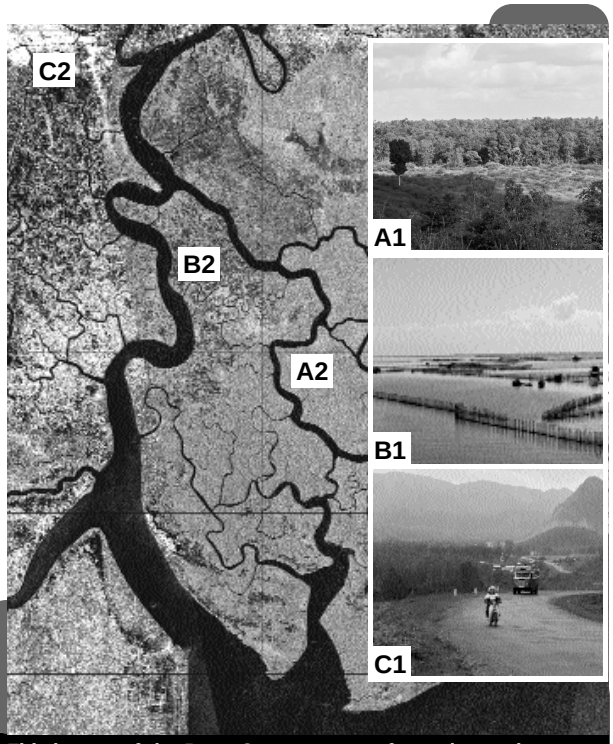
RADARSAT data is marketed by RADARSAT International (RSI), a BC company licensed by the CSA. RSI has 55 distributors in 41 countries, delivering data products to nearly 400 users. Approximately 9,500 scenes including 2,000 products in near real-time were processed in 1997-98. RADARSAT's network of eight ground stations is a competitive advantage, ensuring fast delivery of data. Two stations were brought on line in 1997-1998 in China and Singapore. Station agreements were also signed with Japan and Thailand.



To maintain RADARSAT's internationally competitive position the CSA is preparing an enhanced second satellite, *RADARSAT-2*.

RADARSAT sales increased by 123% in 1997, and continued this strong performance in the first quarter of 1998. RSI has now captured 12% of the world-wide remote sensing market, placing Canada at the vanguard of this emerging industry. To provide improved technical capabilities and economic benefits to Canadians, in 1997-1998 the CSA successfully transferred several EO applications to the private sector: in the fields of land cover mapping, large area digital elevation model generation, information products for agri-business and mineral exploration, environmental impact assessment, and mobile technical office. More data was available to the public, including some 99 geomatics databases. TV weather channels are also using the products derived from Earth Observation data.

LTSP II includes $240 million in funding for a second satellite, *RADARSAT-2*, to supply data for an additional seven years beyond *RADARSAT-1* service to the year 2001. In February 1998, MacDonald Dettwiler & Associates was selected as the prime contractor to build and operate *RADARSAT-2*. Improvements, including higher resolution and polarimetric data, will open new international markets and build on the strong market position established by *RADARSAT-1*.



This image of the Rung Sat mangrove forest in southern Vietnam shows the extent of herbicide damage as a result of the Vietnam war (1961-1975), and changes since the war, including rehabilitation of mangrove forests (A1/A2), expansion of wet rice cultivation (B1/B2) and urban growth of Ho Chi Minh City (C1/C2).

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Earth Observation Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved technical capabilities and economic benefits to Canadian industry from the use and application of space science and technology.	Positive feedback from NASA,NOAA and RADARSAT International at international steering meetings and bilateral communications.	The first mapping of Antarctica by RADARSAT is complete, and it has far exceeded NASA's expectations in completeness of coverage and in quality and information content of the images.
	Three new applications of RADARSAT data successfully transferred to industrial or operational users over a one-year period.	Applications successfully transferred include:land cover mapping, large area digital elevation model generation,information products for agribusiness and mineral exploration, environmental impact assessment, and mobile technical office.
Participation of Canadian SMEs in all regions of Canada in space technology development programs and development by SMEs of technologies for space application.	Addition of two RADARSAT foreign stations to the RADARSAT international network over a one-year period.	Stations in China and Singapore were brought operationally on line which increases the RADARSAT international network to eight stations. Network station agreements were signed with Japan and Thailand. Employment and revenues in the Earth observation business growing at a rate of 20% per year. 40% of revenues are produced from export sales of products and services.
Improved competitiveness, coordination and global relevance of the Canadian space industry.	Successful negotiation and signing of contract with industry for the *RADARSAT-2* mission.	Selection of MDA as a prime contractor in February 1998 and *RADARSAT-2* contract negotiations are in progress.
Maximized industrial benefits of the CSP to all regions of Canada.	Annual increase in royalty revenues generated by *RADARSAT-1.*	Royalty revenues from *RADARSAT-1* data sales were $2 million in 1997-98 compared to $566,000 in the previous year.
	A 10% annual increase in the number of firms in Canadian remote sensing industry exploiting commercially Earth observation satellite data.	The Canadian remote sensing industry has grown by 20% during the past year. New products and services were developed throughout Canada.
	On-line connection to two private sector Earth observation service providers over a one-year period.	SAT International (British Columbia) for RADARSAT products services and CORETEC (Newfoundland) for environmental and engineering services.

Earth Observation Service Line (continued)

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved relationships with governmental,academic and private sector space organizations throughout the world.	Positive feedback from NASA at International Steering Committee meetings and through bilateral communications.	NASA expressed considerable satisfaction over the Antarctica mapping mission. Also, the US National Image Mapping Agency, the government of Mexico and others provided very positive feedback on the Canadian expertise in radar.
Improved resource management and disaster management and improved techniques for the prediction of climate and pollution problems which support sustainable development of Canada,through the application of space technology and space-based research.	Meeting the image requirements of the Canadian Ice Service estimated at 2,000 images annually. Completion of North America mapping project. Acquisition of complete global landmass coverage for archives.	The requirements of the Canadian Ice Service were fully met with the delivery of over 3,300 RADARSAT images. The mapping of North America was completed,including significant progress towards stereo coverage. The global landmass coverage of the world is more than 99% complete. Significant progress has been achieved in a second ScanSAR coverage of the North American continent.
	Achieving an imaging performance index of equal or greater than 95%.	The average end-to-end system performance of the satellite system and satellite stations was 95%.
	Initiation of the Global Observation of Forest Cover Project with national and international partners.	The Global Observation of Forest Cover Project progressed from an expression of intent to an international initiative recognized by the Committee on Earth Observation Satellites as one of six projects to be promoted internationally.
	Number of geomatic databases available on-line will be increased by 50% over a one-year period.	There are 99 geomatic databases available on-line today compared to some 35 a year ago.
Highly qualified personnel are available to the public sector and the high-tech industry.	Grant of three scholarships for graduate studies in Earth observation over a one-year period.	One scholarship granted based on three applications received.

3.2.2.3 Space Technology

Space Technology pursues Canada's interests in advanced technologies for space. It helps Canadian high-technology industries enhance their R&D and manufacturing capability, so that they can benefit from the use and application of space science and technology. It encourages economic development through technology transfers and spinoffs, and provides opportunities for students in space science and technology, to encourage a continuing supply of talented and qualified new people into this field.

In 1997-1998 there was significant investment to develop new technologies for advanced satellite communications, atmospheric monitoring, land management and other purposes. Industrial infrastructure was enhanced throughout Canada. This helped the CSA's industrial partners to expand sales of space products and services, and to adapt space technologies for terrestrial commercial applications. There were positive impacts in employment, skills development and commercial competitiveness.

Approximately 87% of the 1997-1998 Space Technology budget of $76 million was invested in some 200 different technology development projects with industry, over 40% small or medium-size enterprises (SMEs). An additional $12 million was invested by the contractors and other partners. This work generated 35 new licences signed or under negotiation with industry to commercialize CSA-owned technology. Additionally, 14 patents were awarded or are pending for CSA-owned technology.

A total of $20.5 million in contracts was awarded this year in partnership with the European Space Agency (ESA) to 50 companies across Canada. For example, the BESTLAB project is a satellite communications simulation facility with nodes in Canada and eventually in Europe. It will help in the development of multimedia applications, a rapidly growing international market. Bomem recently completed a series of European Space Agency contracts on the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS), an instrument for studies of the upper atmosphere.

Canada's participation in European Space Agency (ESA) programs was assessed in 1997-1998. The industrial return coefficient is currently at 91% and the ratio of indirect benefits, estimated at 3.2 to 3.5, is the highest among ESA member states. Canada's participation in ESA has included some 40 alliances or partnerships with European companies, including Alcatel, Dornier, Aerospatiale, Matra-Marconi and Thomson. Some of these relationships have gone beyond ESA contracts and now involve commercial agreements.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Space Technology Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved technical capabilities and economic benefits to Canadian industry from the use and application of space science and technology.	Sustained trend in the number of licenses negotiated.	35 new licence files were opened,21 were issued and 14 were still under negotiation at the end of the year.
Participation of Canadian SMEs in all regions of Canada in space technology development programs and development by SMEs of technologies for space application.	Dozens of technologies enhanced or demonstrated and proven.	Over 200 development projects were carried out for technology adaptation and enhancement of six (6) new technologies were demonstrated.
	Over 30 scientific papers, text books and patents contributed yearly.	41 papers were published,over 150 communications were presented and 4 patents were filed.
Participation of Canadian industry in S&T programs on an international scale.	Number and profile of stakeholders reached and resulting growth.	35% of the funding and 81 contracts out of 200 (40%) went to SMEs distributed across Canada.
Improved competitiveness, coordination and global relevance of the Canadian space industry.		Canadian space industry has expanded sales, generated employment, developed new skills and enhanced its commercial competitiveness.
Economic development deriving from the application of space technology and space-based research.	$190 million worth of contracts given to Canadian industry (SMEs) and research institutes over 3 years.	Over $65 million worth of contracts were awarded, mainly to industry.
		Industry invested $12 million on technology development projects.
Benefits to the economy and society from the application of space technology and spaced-based research.		New technologies were developed throughout Canada.
Improved resource management and disaster management and improved techniques for the prediction of climate and pollution problems.	Preparation of new satellite missions on resource management and atmospheric environment for flight in the next ten years.	Initiated international collaboration projects on Ozone measurement with NASA,on land resource management with ARIES (Australia).
Highly qualified personnel are available to the public sector and the high-tech industry.	25 Ph. D. and Master level students benefiting from financial support or from projects awarded to universities.	23 graduate students and 7 Postdoctoral fellows supported directly and tens of them supported through CSA/NSERC University-Industry Partnership Program.

New technologies were developed by companies across Canada, such as the CALTRAC™ Star Tracker, an innovative spacecraft attitude sensing instrument with precise attitude determination capability and high speed response. Developed by CAL Corporation of Ottawa, this is a small, light, efficient and highly versatile instrument for future small satellites. Bomem Inc. of Quebec City has developed a space version of its Fourier Transform Interferometer product, which has already generated over $5 million of sales in meteorological satellites. Measurand Inc., a Fredericton company, developed SHAPE TAPE™, a fibre optic 3D shape measuring system.

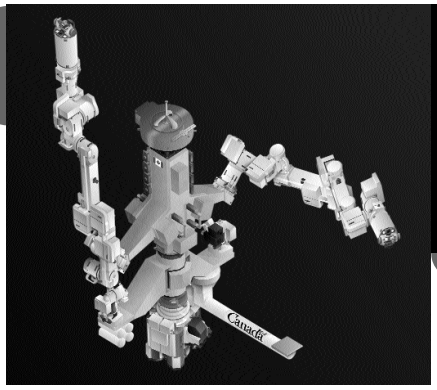
SHAPE TAPE™ is a flexible tape that generates a computer image. It is used to rapidly enter car body and seat shapes into computers, collect crash-test data and aid surgeons in the operating room. Narrowband Telecommunications Research Inc. of Burnaby, B.C., is developing a vehicular antenna and on-board data communications system for two-way exchanges between trucks and a central dispatch, which has already been sold to U.S. customers.

The CALTRAC™ Star Tracker is a sophisticated new star-tracking device to help satellites determine their position in orbit. This device will help to keep TV signals and long-distance phone calls working by pointing telecommunications satellites in the right direction.

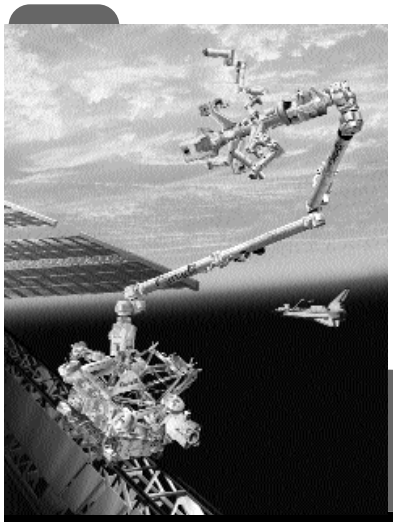
ISE, a B.C. company, used Canadian space robotics expertise to develop Shell's Smart Pump, the largest production consumer robot in the world. ISE is now working on other potential applications in forestry, mining and manufacturing.

3.2.2.4 Canadian Space Station Program

The Canadian Space Station Program is Canada's part of the *International Space Station* (ISS). This station is the next key step for the human presence in space. It will provide an efficient platform for space research and long term experimentation. The *International Space Station*, the largest international scientific project ever undertaken, is being jointly built by the United States, Canada, Russia, Japan and 11 European member states of ESA (European Space Agency). Canada is a full partner in the ISS, giving Canadian scientists use of station. Canadian astronauts Hadfield, Payette and Garneau will fly missions to assemble the station in 1999.



The Special Purpose Dextrous Manipulator (SPDM) is a smaller two-armed robot capable of delicate assembly tasks currently handled by astronauts during spacewalks, that works in conjunction with the SSRMS. Astronauts and cosmonauts aboard ISS will use it to remove or replace components of the International Space Station, and monitor cargos.



Canada's crucial contribution to the International Space Station (ISS) is the Mobile Servicing System (MSS). It will help build the station in orbit, and then remain in operation, reducing the time astronauts and cosmonauts need to spend outside ISS in the hostile space environment.

In 1997-1998, the CSA was focussed on ensuring delivery of Canada's contributions. Also, Canada's ISS utilization plan, including a commercialization strategy, was being developed. ISS development paves the way for a whole new generation of advanced robotic products with large global markets, creating jobs and opportunities for Canadians. An even larger impact on Canadian companies is expected as a result of the development, manufacturing and marketing of commercial spin-offs from these robotic technologies.

In all, some $5 billion of economic benefits are expected to result from Canada's ISS participation, and 63,000 person-years of employment. Contracts totalling $919 million have been awarded to industry to date, generating $2.8 billion in benefits and 32,000 person-years of employment. The *International Space Station* will also provide the most highly visible showcase possible for Canadian industry's ability to produce sophisticated robotic equipment for the most demanding operating environment known.

Canada's Role in the *International Space Station*

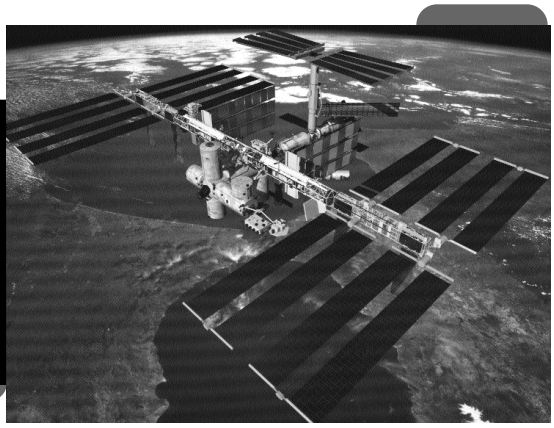
$919 million in contracts to date
$2.8 billion in economic benefits to date
32,000 person-years of employment to date

The Space Station Remote Manipulator System (SSRMS), the first of the components of the Mobile Servicing System, was on track for delivery to NASA in 1998. Acceptance Review took place in October 1997, followed by an extensive round of integration and testing. In early Spring 1998, the assembly and functional tests of major components were completed. The Mobile Base System (MBS) also reached this stage, with Acceptance Review scheduled for June 1999, and delivery to NASA immediately after. Acceptance Review of the Canadian Space Vision System was completed in December 1997.

Russian Cosmonaut Yuri Usachev uses the hand controllers of the Robotics Workstation, while NASA Astronauts Susan Helms and James Voss, along with CSA President Mac Evans, (right corner) look on.

The Mobile Servicing System Operations and Training Simulator (a component of the MSS Operations Complex at CSA HQ) overcame technical difficulties and was completed in 1998. The Multimedia Learning Centre, courseware development and the Virtual Operations Training Environment completed their first phase in mid-1997. In the second quarter of 1998, Canada reached a historical milestone when training was provided to two American astronauts and one Russian cosmonaut, in preparation for ISS Expedition 2 in 1999.

The *International Space Station* (ISS), the largest international scientific program, is being jointly built by Canada, the United States, Russia, Japan, and 11 European member states of ESA (European Space Agency). Its solar arrays will generate 110 kw. Its laboratory and habitation modules will support a permanent international crew of seven astronauts. It will be a platform for Earth and space observation, and for investigations leading to new materials and medicines possible only with microgravity.



The *International Space Station* is a complex program, with uncertainties in the assembly sequence. In May 1998, the ISS partners agreed to new launch dates for ISS assembly sequence. As a result, Canadian MSS element launch dates have slipped by 4-6 months.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Canadian Space Station Program Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved technical capabilities and economic benefits to Canadian industry from the use and application of space science and technology.	Successful in-orbit commissioning of SSRMS, MBS and SPDM with real-time support from the MSS Operations Complex.	SSRMS Acceptance Review was completed. AVU Acceptance Review was completed. SPDM Baseline Configuration Review was completed.
Participation of Canadian SMEs in all regions of Canada in space technology development programs and development by SMEs of technologies for space application.	Technologies brought to market	Over 70 technologies have been identified pertaining to high reliability software, life critical software, artificial vision,expert systems, robotics, force moment sensors, object oriented software, other software and simulations.
Participation of Canadian industry in S&T programs on an international scale.	$5 billion of economic benefits resulting from the CSSP over the life of the program.	$2.8 billion in benefits accrued since 1984.
International recognition of Canada's leadership in space technology and and research.	On time delivery of quality systems.	Signing of the International Treaty on ISS, Intergovernmental Agreement (IGA) and Memorandum of Understanding (MOU) between CSA and NASA.
Maximized industrial benefits of the CSP to all regions of Canada.	$230 million worth of contracts to industry.	$919 million worth of contracts given to industry since 1984.
Economic development deriving from the application of space technology and space-based research.	63,000 person-years of employment created from the CSSP over the life of the program.	32,000 jobs created since 1984.
Benefits to the economy and society from the application of space technology and spaced-based research.	Dozens of experimental/payloads and data generated.	Use of the space station is sheduled for 2001.
	Implementation of the SPDM Offset.	The implementation of the offset, which relates to ISS utilization, will occur when ISS is operational.
	Successful funding and/or bartering of Canadian allocation on the ISS.	Use of the space station is sheduled for 2001.
Highly qualified personnel available to the public sector and the high-tech industry.	Level of employment in S&T fields in Canada stimulated by ISS related work.	32,000 jobs created since 1984.
	Highly trained personnel migrating from industry, academia and government related ISS work to other high technology fields in Canada.	

3.2.2.5 Satellite Communications

The CSA satellite communications programs enable improved communications capabilities for Canadians and the world. They bring economic benefits to Canadians, as Canadian firms develop expertise and technology they need to win places in international satellite consortiums.

In 1997-1998, over $60 million worth of contracts were announced for the development of innovative satellite communications technologies to five Canadian high-tech companies. The contracts are being awarded through the CSA's Advanced Satellite Communications Program, in co-operation with the Communications Research Centre (CRC) of Industry Canada. In this public/private sector partnership, the participating companies are providing 25% (approximately $15 million) of the funding, while the federal government is providing 75% of the costs (approximately $47 million).

The new technologies being developed are specifically aimed at increasing the capability of satellites to handle the rapidly expanding market demands for high speed data comunications within financial reach of ordinary homeowners. They will make it possible to transmit and receive huge amounts of information for multi-media products such as high-speed Internet access, two-way video communications.

The CSA satellite communications programs enable improved communications capabilities for Canada and the world.

The contracts were awarded to CAL Corporation in Ottawa, Com Dev International in Cambridge, Ontario, Nortel in Ottawa, Ontario, Spar Aerospace in Ste-Anne de Bellevue, Quebec, and Telesat Canada in Gloucester, Ontario. These contracts will also include subcontractors in many other regions of the country.

Canada's participation in European Space Agency Satellite Communications Programs (e.g., DRTM, ARTES 2, 3, and 5) also supports Canada's industrial strategy for multimedia communications. For instance, COM DEV and EG&G have developed, with ESA contracts, SAW filter and optical inter-satellite link technologies that constitute an important segment of Com Dev's future business.

The International Mobile Satellite Initiative led by CRC positions Canadian industry in the fast-growing market for mobile and personal satellite communications services. Canadian firms are supplying subsystems to international consortia operating constellations of satellites, and are providing services to Canadians. Fifteen contracts totalling $9 million have been awarded.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Satellite Communications Service Line

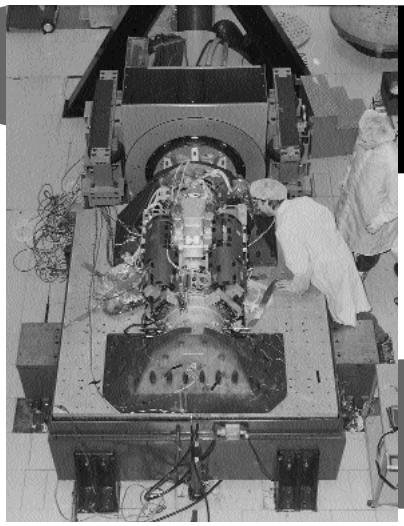
EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved technical capabilities and economic benefits to Canadian industry from the use and application of space science and technology.	Number of new applications transferred to industrial or operational uses.	Several technologies developed which will form the foundation of the next generation multimedia services.
Participation of Canadian SMEs in all regions of Canada in space technology development programs and development by SMEs of technologies for space applications.	New products / applications of space S&T for use by Canadian industry. New technologies brought to market. Increased employment and better regional distribution of economic activity.	System specification and design review for over ten new technologies were completed; they form the basis of number of new products and applications. 50% of funding for International Mobile Satellite Program comes from industry,
Improved competitiveness, coordination and global relevance of the Canadian space industry.	Participation by Canadian companies in international consortia.	SPAR and COM DEV formally participating in the SKYBRIDGE international consortium.
Economic development deriving from the application of space technology and space-based research. Benefits to the economy and society from the application of space technology and spaced-based research.	$50 million worth of technology development contracts over 3 years.	Contracted over $60 million worth of development work.Funded in FY 97/98, $15 million of SATCOM technology development activities, co-funded by industry. Funded via the European Space Agency, $8 million of technology development performed with international partners and for international markets.

3.2.2.6 Space Qualification Services

The David Florida Laboratory (DFL), located in the National Capital Region, is a key asset of the Canadian Space Agency. It was developed to meet Canada's needs to assemble, integrate and test spacecraft and space systems in the closest thing to space conditions achievable on Earth. Having earned a reputation among the finest such facilities in the world, its growing international business allowed it to return $890,393 to the government in 1997-1998.

The David Florida Laboratory (DFL), located west of Ottawa. The DFL was developed to allow the assembly, integration, and testing of spacecraft and systems in an environment that simulates space conditions.

In 1997-1998, the DFL played a vital role in Canada's contribution to the *International Space Station*. For the Space Station Remote Manipulator System (SSRMS), all system motor modules, joints, latching end effectors as well as the mobile base system (MBS) were subjected to an array of tests, ranging from thermal vacuum to thermal, vibration, modal, static load and electromagnetic compatibility (EMC) testing. Testing also began on the Special Purpose Dextrous Manipulator (SPDM), a smaller two-armed robot capable of delicate assembly tasks currently handled by astronauts during spacewalks. Other space station activities included environmental stress screening on the Canadian Space Vision System for Neptec Design Group and testing of the Ku-Band SGANT and ACRFG space station communications antennas for Spar Aerospace.



Vibration testing of the LEE joint of the SSRMS. DFL personnel prepare the joint for testing.

Environmental testing was also completed on Space Science flight experiments, as well as on the Head/Hand R&D project (sponsored by the Communications Research Centre of Industry Canada) to measure safe radiation levels between hand held cellular telephone sets and the human body. Also, a full environmental test campaign was performed on the Indonesian direct broadcast satellite, *INDOSTAR*, for Spar Aerospace / Orbital Sciences.

Overall, the David Florida Laboratory performed 147 tests in 1997-1998, with a total commercial value of $2.8 million. Some 32 different commercial companies working on 51 programs and projects used DFL services and facilities.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Space Qualification Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
International recognition of Canada's leadership in space technology and research.	Positive response to client satisfaction surveys and satisfactory disclosure of new test capabilities.	Very positive results received from formal client satisfaction survey conducted upon completion of *INDOSTAR* S/C level testing.
Improved competitiveness, coordination and global relevance of the Canadian space industry.	Number and commercial value of tests performed at the DFL.	Performed 147 tests with a total commercial value of $2,758,673.
	Number of client test requests meeting client specification and schedule.	DFL used by 32 different commercial companies working on 51 separate programs and projects.
	Continued provision of solutions to the demands of space clients.	Good progress achieved on midlife refit project including refit of thermal vacuum and vibration test areas and completion of swing space addition. Estimated increase in total value of capital assets is $3 million.
	Revenues to the Consolidated Revenue Fund. DFL support provided to CSP and LTSP II as requested.	Revenues to CRF amounted to $890,393.Significant progress on MSS testing achieved;testing of Space Science, Space technology and CAO experiments also completed.
Improved relationships with governmental,academic and private sector space organizations throughout the world.	DFL recognized as a world class facility, as demonstrated by client response.	Test technology development activities achieved in the areas of thermal/PIM testing, control systems and EHF testing.
	Development of strategic partnerships.	Entered into partnerships with CRC (Head/Hand cellular telephone study),Matra Marconi Space and Realix (ESD Characterization Study) and Telesat Canada (consulting contract with NSPO, Taiwan).
	Tours of the DFL as a Canadian high-tech show case.	DFL welcomed 485 «guests» to its facilities. Held a special combined event to celebrate Canada's 35 Years in Space and DFL's 25th Anniversary.

3.2.2.7 External Relations

External Relations include diverse and substantial cooperation projects between Canada and foreign space agencies. In this arena, the CSA pursues and manages strategic partnerships with other governmental organizations and foreign space agencies in support of the Canadian Space Program and assists Canadian space companies in their efforts to penetrate world markets.

In 1997-1998, relations were maintained and expanded in the US, Europe, and Japan, and new relationships were developed with key emerging space powers. An export development strategy was established. Working in close cooperation with other government departments concerned with space, it provided for better information sharing, coordination and synergy between them. A strategic framework for international cooperation was formulated for LTSP III planning, and a comprehensive study on the Canadian space sector was completed and published.

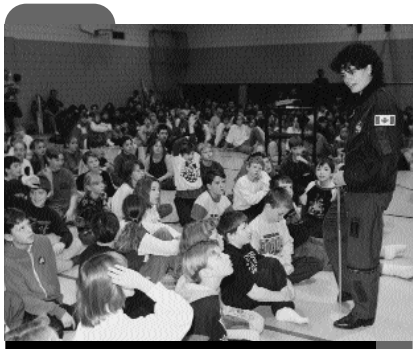
The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

External Relations Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Improved competitiveness, coordination and global relevance of the Canadian space industry.	Development and implementation of a marketing support strategy, structure and tools.	Developed market trends analyses for Telecommunications, Earth Observation and Robotics. Developed region-by-region International Marketing Plan (IMP). Developed a strategic framework for international cooperation in support of the next LTSP.
Maximized industrial benefits of the CSP to all regions of Canada.	Expanding the CSA database to accommodate the collection and dissemination of strategic industry-related information.	Undertook and published a comprehensive study on the Canadian space sector. Improved regional distribution of CSA contracts.
Improved relationships with governmental,academic and private sector space organizations throughout the world.	Positive feedback from stakeholders. Successful relationships with US, Europe, Japan and key emerging space markets.	Built new relationships with key emerging space powers. Maintained and expanded relationships with established markets:US, Europe, Japan. Increased membership in the National Sector Team for Space (NSTS) to 65 organizations.

3.2.2.8 Space Awareness

The Canadian Space Agency works to ensure Canadians know about their country's space-related achievements and the benefits they bring to Canada. The Space Awareness Program places great emphasis on the ability to increase the level of interest, participation and scientific literacy among Canadian youth. Throughout the year, Space Awareness initiatives are undertaken by Communications in conjunction with the service lines - Canadian Astronaut Program, Space Science, Space Technology, Canadian Space Station Program and Earth Observation. In 1997-98, various programs, activities and events stimulated learning among youth and provided support mechanisms for educators in the areas of science and technology as they pertain to space.



Astronaut Julie Payette speaks to elementary school students, encouraging young people to pursue careers in science, engineering, and mathematics.

In order to reach out to young people and educators across Canada, the Canadian Space Agency has established a network of five Canadian Space Resource Centres (CSRCs), located in Halifax, Montreal, Toronto, Saskatoon and Vancouver. The CRSCs provide students, teachers and the general public with easy access to print and multi-media based information and activities related to space. The CRSCs regularly include teacher training workshops, attendance at education conferences and participation in nationally launched programs such as Marsville. These and other outreach activities have increased the number of CRSC teacher-clients from 2,500 in 1995 to 10,000 in 1997.

Albena Davidova, the winner of 1998 Senior Student Challenge, enjoys a visit to the CSA with astronaut Marc Garneau.

Canadian Space Agency astronauts contribute consistently to the development of space awareness across the country. In 1997 alone, Canada's seven astronauts – Julie Payette, Bjarni Tryggvason, Steve MacLean, Chris Hadfield, Dave Williams, Bob Thirsk and Marc Garneau - participated in over 431 public appearances throughout Canada, reaching thousands of youth and other Canadian audiences. In addition, the Canadian post flight tour in Canada by the STS-85 crew, including Bjarni Tryggvason, also provided countless opportunities for the Canadian public to learn about the benefits of Canada's participation in the global space program.

During STS-90, university and high school students were linked to space and Canadian astronaut Dave Williams and the STS-90 crew through two educational downlinks and over the internet. Print-based educational materials and an interactive web site were also produced, reflecting the experiments conducted during Neurolab. As part of the revamping of the CSA's web site to allow for more targeted and updated information, the Canadian Space Agency also added two other new Internet sections targeting educators and youth — Educator's Corner and Kool Zone.

Other educational material developed included print and video kits as part of the Young Space Scientists Program, providing an overview of the science performed during Marc Garneau's STS-74 mission and Bob Thirsk's STS-78 mission.

The Senior Student Challenge provided an opportuntiy for 16-18 year old students to demonstrate in essay and poster format their knowledge and understanding of Canadian achievements in space. Marc Garneau, Canada's first astronaut, welcomed the winner of the Senior Student Challenge into his home in Houston for one week. Albena Davidova lived the dream of many Canadian youth, to live with and learn first-hand about our Canadian astronauts and Canada's role in space.

The Canolab project continued for a second successful year with the participation of more than 30,000 elementary and high school students across the country growing and comparing Canola seeds flown and unflown in space. The CAPE experiments provided a unique educational endeavor by allowing students to develop and conduct a science experiment involving protein crystallization in the microgravity environment onboard *MIR*, the Russian Space Station. Twelve Canadian universities and research institutions also participated in this experiment.

The first National Space Day on October 17, 1997 was an astounding success, including more than 120 students at CSA HQ in Saint-Hubert alone where they met with all seven Canadian astronauts, Minister Manley and Prime Minister Jean Chrétien. Canadian National Marsville, a program which encourages youth to develop strategic thinking, collaborative skills and hands-on math and science experience reached more than 2,000 students across Canada in 1997. Three oustanding educators as well as two students were chosen as Canadian representatives at International Space Camp and/or Boeing Educators for Space Camp. In 1997-98, the CSA's Grants and Contributions Program provided approximately $160,000 in support of the development of 15 space awareness projects by not-for-profit institutions.

Numerous articles were successfully published by both mainstream and specialized media throughout Canada, contributing to increasing the public awareness of the space sector in Canada. Articles included reports on the development of innovative satellite communications technologies, the Special Purpose Dextrous Manipulator (SPDM), provision of *RADARSAT-2*, space technology achievements such as Smart Pump – a unique Earth application from space robotics, MOPITT, the role of RADARSAT images in managing the Red River disaster, and the signing of the Intergovernmental Agreement on ISS. Products derived from Earth Observation data are also routinely used by the TV Weather Channel. 273 articles published on Canada's astronaut and space science involvement in STS-90 alone amount to the equivalent of $227,753 in advertising dollars. In addition, 117 media participated in an awareness campaign on the Canadian Space Program during STS-90. Very positive media feedback was received from a post-campaign survey. Internet applications were also used to distribute information to media, other target audiences and the general public. The complete revamping of the CSA web site scheduled for April 1, 1998, is expected to generate an overall increase of 20 % among users between April 1, 1998, and April 1999.

The following table compares this service line's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Space Awareness Service Line

EXPECTED RESULT	SERVICE LINE INDICATOR	ACCOMPLISHMENT IN 97-98
Public awareness of the role of S&T in Canada's future. **Youth involvement in S&T through increased interest in space activities.**	**6% annual increase in the level of awareness of the Agency and its programs among the public,especially youth, the media, stakeholders, and industry.** **Youth and educators have found the education material useful.** **20% increase in the number of hits on the web site.** **Awareness of the Canadian public of the Canadian technological contribution (MSS) and ongoing benefits of Canada's involvement in ISS. (Canadian Space Station Program)** **Increase in the accessibility of Earth observation products and services to the general public.(Earth Observation Program)**	***CSA awareness activities are a collaborative effort between Communications and the various services lines and have greatly contributed to meeting the expected results and indicators.*** CSA noted an overall 25 % increase in information requests received by the Canadian Space Resources Centres. Thousands of students and members of the public participated in events staged across Canada during the first National Space Day. Creation of a web site which will lead to an increase of 20% in 1998-1999 in the web site hits. The Young Space Scientists Program allowed students to take on the role of space scientists by providing them the opportunity to design experiments and compete for the chance to have them performed in orbit by a Canadian astronaut. Students of various levels conducted space science experiments in the microgravity environment onboard MIR as well as flew ozone research experiments onboard a rocket launched in Canada. 50,000 english and 10,000 french interactive Teacher Guides demonstrating the importance of the Canadian experiments performed during STS-90,an STS-90 educational web site and a multimedia Guide to Microgravity for Students of all Age were used by youth across Canada. Two educational downlink events and live internet coverage connected thousands of students and members of the media and general public with space and the STS-90 crew. The National Marsville Project reached hundreds of students across the country. The Canolab project continued for a second year with approximately 30,000 students participating. The Senior Student Challenge contest provided an opportunity for students across the country to show Canada's achievements in space on a poster and in an article. The winner visited Marc Garneau in Houston while the second and third prize recipients spent a week at International Space Camp. Three outstanding educators represented Canada at Boeing Educators Space Camp and/or International Space Camp. The development of 15 space awareness projects by not-for-profit institutions was supported. Numerous articles were published by various media throughout Canada highlighting Canadian space success stories involving astronaut flights, space technology, the Canadian space station program,Earth observation and space science, creating better awareness of Canada's role in space. Products derived form Earth Observation data are routinely used by the TV weather channel. 117 media participated in an awareness campaign in the Canadian Space Program during STS-90 distributing 428 Astropaks to youth and other quiz participants. Very positive media feedback was received from a post-campaign survey. 273 articles were published by media on the Canadian Space Program during STS-90,the equivalent to $227,753 advertising dollars.

3.2.3 Management

The CSA is managing its portfolio of projects and programs to meet the expectations of the Government of Canada and the Canadian space community, as specified in the Long Term Space Plan II (LTSP II). LTSP II was amended in mid-course to realign the funding related to the *International Space Station*, Satellite Communications and Earth Observation initiatives, and reflect the Program Review initiative.

In 1997-1998 a major reorganization was completed which gives managers greater flexibility in managing the CSA's business. Human resources management policies and practices are being developed which are consistent and supportive of the new CSA mission, values and organizational approach. In addition, a new Planning and Reporting Accountability Structure has been developed to reflect the LTSP II and III initiatives, and the SAP R/3 financial management system was implemented to support the CSA strategy and approach. Activities to deal with the Year 2000 information technology issue were initiated in September 1997. Software as well as embedded systems in control, testing, and laboratory equipment are being considered. A Y2K plan has been developed and a Task Force was formed April 1998, to make the CSA fully ready for the millennium.

Management

FINANCIAL REQUIREMENTS FOR 97-98 ($)

Service Line	1997-1998 Planned Spending	1997-1998 Total Authorities	1997-1998 Actual
Management	16,282,000	27,056,000	25,092,000
Total	**16,282,000**	**27,056,000**	**25,092,000**

Nota:
1) Planned Spending corresponds to Main Estimates Budget.
2) Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
3) Includes contributions to Employee Benefit Plans.
4) Difference between Planned Spending and Total Authorities is mostly due to the CSA reorganization. Many management services, which were previously accounted for in different CSA programs, such as financial services and communications, are now included in this Business Line. Since the initial allocation of Planned Spending was based on the old organization structure, Planned Spending in other CSA business lines had to be transferred to the Management Business Line.

The following table compares Management's accomplishments in 1997-1998 against the indicators and expected results extracted from the PRAS as shown on pages 18 and 19.

Management

EXPECTED RESULT	INDICATOR	ACCOMPLISHMENT IN 97-98
Cost-effective management of the Canadian Space Program and the Long Term Space Plans.	Parliamentarians and senior officials are satisfied with the results of the LTSP II. Approval of LTSP III.	Positive feedback received on CSA Performance Reports and on RPP. Government approval to manufacture SPDM and adjustments to CSSP. New PRAS developed. Initiated development of LTSP III.
CSA employees have the appropriate knowledge, tools, processes, and systems to do their jobs.	CSA executives use performance assessment framework to make decisions.	CSA executives use performance assessment framework to make decisions. SAP R/3 financial management system is being implemented.
Effective results-based,open,and transparent relations between the Agency and stakeholders.	Positive feedback from 80% of stakeholders on the state of CSA relations.	Informal survey showed positive feedback.
Effective communications strategies, plans, and public awareness activities that satisfy the needs of the Agency, departments in the Industry portfolio, and space stakeholders.	Positive feedback from internal and external stakeholders.	Positive feedback received from central agencies, the public, stakeholders and the CSA sectors on the effectiveness of the communications strategy and the delivery of services.
A representative, motivated,capable, innovative and productive work force.	Level of implementation by managers of CSA values.	HR performance measures developed in line with the S&T human resources framework. An internal survey led to a CSA baseline on which to improve employee morale and an improvement plan is being implemented. CSA reorganization led to the implementation of a new mission.

SECTION 4: FINANCIAL PERFORMANCE

4.1 FINANCIAL PERFORMANCE OVERVIEW

As can be seen in the tables which follow, actual spending in 1997-1998 was $43.4 million more than originally planned due to:

- **the decision to proceed with the development of the SPDM within the Canadian Space Station Program;**
- **the need to compensate for the lower than anticipated royalty revenue within the *RADARSAT-1* Program. However, RADARSAT sales increased by 123% in 1997, and continued this strong performance in the first quarter of 1998;**
- **the start of the *RADARSAT-2* Program; and**
- **increased spending in the Satellite Communications Program.**

The CSA is today confronted with a situation where completing all of its programs within approved funds is more challenging than anticipated in March 1997, when the LTSP II Mid-Course Adjustments were approved by Cabinet. Cost increases continue to be a concern for programs still governed by "cost-plus" development contracts. The Space Station program has been encountering difficulties that are resulting in unforeseen cost increases. On the revenue side, royalties from the sales of RADARSAT data are not likely to reach the level projected when the program was approved several years ago.

The 1997-1998 actual expenditures are $23.1 million less than 1996-1997 and $69.7 million less than 1995-1996, in line with decreasing funding available within the LTSP II envelope. In future years, the CSA's funding base declines rapidly as LTSP II activities move toward completion and falls, by Year 2000, to a level that cannot sustain a meaningful Canadian Space Program. CSA is now well under way to developing the Long Term Space Plan III, which is critical to the future of the CSA.

4.2 FINANCIAL SUMMARY TABLES

Table 1: Summary of Voted Appropriations

A. Authorities for 1997-1998 - Part II of the Estimates

Financial Requirements by authority ($ millions)

Vote		1997-1998 Planned Spending	1997-1998 Total Authorities	1997-1998 Actual
	Canadian Space Agency			
30	Operating expenditures	47.6	69.0	67.4
35	Capital expenditures	96.9	153.7	133.6
40	Grants and Contributions	36.3	23.4	25.3
(S)	Contributions to Employee Benefit Plans	3.7	3.7	3.7
	Total Agency	184.5	230.8	228.0

Notes: 1) Planned Spending corresponds to Main Estimates budget.
2) Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
3) Difference between Planned Spending and Total Authorities is mostly due to supplementary budgets obtained during the fiscal year for the SPDM as a component of the Canadian Space Station Program for the *RADARSAT-1*, major Crown project, for the program subsequent to *RADARSAT* and for the Advanced Satellite Communications Program.

Table 2: Comparison of Total Planned Spending to Actual Spending

Departmental Planned versus Actual Spending by Business Line ($ millions)

Business Lines	FTEs	Operating	Capital	Voted Grants & Contributions	Gross Voted Expenditures	Statutory Grants and Contributions	Total Gross Expenditures	Less: Revenue Credited to the Vote	Total Net Expenditures
Space Sciences	34	10.0	26.5	0.2	36.6	-	36.6	0.0	36.6
(total authorities)	*45*	*8.8*	*26.4*	*0.2*	*35.4*	-	*35.4*	*0.0*	*35.4*
(Actuals)	42	8.7	26.5	0.2	35.4	-	35.4	0.0	35.4
Space Applications and Industry Development	188	24.0	78.9	36.2	139.0	-	139.0	(7.4)	131.6
(total authorities)	*169*	*57.2*	*118.5*	*25.2*	*175.7*	-	*175.7*	*(7.4)*	*168.3*
(Actuals)	145	36.0	113.0	25.1	175.0	-	175.0	(6.5)	168.5
Management	176	16.3	0.0	0.0	16.3	-	16.3	0.0	16.3
(total authorities)	*176*	*25.8*	*1.3*	*0.0*	*27.1*	-	*27.1*	*0.0*	*27.1*
(Actuals)	157	24.6	0.5	0.0	25.1	-	25.1	0.0	25.1
Total	398	50.2	105.4	36.3	191.9	-	191.9	(7.4)	184.5
	590	*71.8*	*141.6*	*25.4*	*238.2*	-	*238.2*	*(7.4)*	*230.8*
	344	70.2	140.0	25.3	235.5	-	235.5	(6.5)	228.9
Other Revenues and Expenditures:									
Revenue credited to the Consolidated Revenue Fund									(0.4)
(total authorities)									*(0.4)*
(Actuals)									(1.6)
Cost of services provided by other departments									1.6
(total authorities)									*1.6*
(Actuals)									1.6
Net Cost of the Program									185.7
(total authorities)									*231.9*
(Actuals)									228.9

Notes 1) Planned Spending numbers are in regular character (Main Estimates).
2) Numbers in Italics denote Total Authorities for 1997-1998 (Main and Supplementary Estimates and other authorities).
3) Bolded numbers denote actual expenditures/revenues in 1997-1998.
4) Due to rounding, figures may not add to totals shown.

Table 3: Historic Comparison of Total Planned Spending to Actual Spending

Planned Spending versus Actual Spending by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
Space Sciences	42.2	48.6	36.6	35.4	**35.4**
Space Applications and Industry Development	236.8	184.0	131.6	168.3	**168.5**
Management	18.6	18.3	16.3	27.1	**25.1**
Total Agency	**297.6**	**251.0**	**184.5**	**230.8**	**228.9**

Nota: 1) Includes contributions to Employee Benefit Plans.
2) Due to rounding, figures may not add to totals shown.
3) Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
4) Difference between Planned Spending and Total Authorities is mostly due to supplementary budgets obtained during the fiscal year for the SPDM as a component of the Canadian Space Station Program for the *RADARSAT-1*, major Crown project, for the program subsequent to *RADARSAT* and for the Advanced Satellite Communications Program.

Table 4a: Crosswalk between Old Structure and New Structure/Planned Spending 1997-1998

Crosswalk between Old & New structures ($ millions)

	New Structure			Old Structure		
Old structure	**Space Sciences**	**Space Applications and Industry Development**	**Mana-gement**	**Total $**	**FTEs**	**% of Total**
Earth Observation	0.0	22.7	0.0	22.7	25.0	12.3%
Satellite Communications	0.0	28.2	0.0	28.2	33.0	15.3%
Canadian Space Station Program	0.0	51.1	0.0	51.1	66.0	27.7%
Canadian Astronaut Office	6.7	0.0	0.0	6.7	14.0	3.6%
Space Science	29.9	0.0	0.0	29.9	20.0	16.2%
Space Technology	0.0	27.5	0.0	27.5	56.0	14.9%
Executive and Horizontal Coordination	0.0	2.2	16.3	18.5	176.0	10.0%
New Structure						
Total ($)	36.6	131.6	16.3	184.5		
FTEs	34.0	180.0	176.0		390.0	
% of Total	19.8%	71.3%	8.8%	100.0%		100.1%

Note:
1) Satellite Communications includes expenses related to David Florida Laboratory.
2) Expenses related to Space Awareness activities as well as to External Relations are included with Executive and Horizontal Coordination.
3) Includes contributions to Employee Benefit Plans.
4) Due to rounding, figures may not add to totals shown.

Table 4b: Crosswalk between Old Structure and New Structure/Total Authorities 1997-1998

Crosswalk between Old & New Structures ($ millions)

	New structure			Old structure		
Old Structure	**Space Sciences**	**Space Applications and Industry Development**	**Mana-gement**	**Total ($)**	**FTEs**	**% of Total**
Earth Observation	0.0	35.2	0.0	35.2	28.0	15.3%
Satellite Communications	0.0	34.3	0.0	34.3	33.0	14.9%
Canadian Space Station Program	0.0	70.5	0.0	70.5	52.0	30.6%
Canadian Astronaut Office	5.6	0.0	0.0	5.6	14.0	2.4%
Space Science	29.8	0.0	0.0	29.8	31.0	12.9%
Space Technology	0.0	26.4	0.0	26.4	56.0	11.4%
Executive and Horizontal Coordination	0.0	1.8	27.1	28.9	176.0	12.5%
New Structure						
Total ($)	35.4	168.3	27.1	230.8		
FTEs	45.0	169.0	176.0		390.0	
% of Total	15.4%	72.9%	11.7%	100.0%		100.0%

Notes:
1) Satellite Communications includes expenses related to David Florida Laboratory.
2) Expenses related to Space Awareness activities as well as to External Relations are included with Executive and Horizontal Coordination.
3) Includes contributions to Employee Benefit Plans.
4) Due to rounding, figures may not add to totals shown.

Table 4c: Crosswalk between Old Structure and New Structure/Actuals 1997-1998

Crosswalk between Old & New structures ($ millions)

	New structure			Old structure		
Old structure	**Space Sciences**	**Space Applications and Industry Development**	**Mana-gement**	**Total ($)**	**FTEs**	**% of Total**
Earth Observation	0.0	35.8	0.0	35.8	24.6	15.7%
Satellite Communications	0.0	34.2	0.0	34.2	31.0	14.9%
Canadian Space Station Program	0.0	70.5	0.0	70.5	49.0	30.8%
Canadian Astronaut Office	5.6	0.0	0.0	5.6	12.0	2.4%
Space Science	29.8	0.0	0.0	29.8	30.0	13.0%
Space Technology	0.0	26.3	0.0	26.3	40.0	11.5%
Executive and Horizontal Coordination	0.0	1.7	25.1	26.8	157.0	11.7%
New structure						
Total ($)	35.4	168.5	25.1	228.9		
FTEs	42.0	144.6	157.0		343.6	
% of Total	15.4%	73.6%	11.0%	100.0%		100.0%

Nota:
1) Satellite Communications includes expenses related to David Florida Laboratory.
2) Expenses related to Space Awareness activities as well as to External Relations are included with Executive and Horizontal Coordination.
3) Includes contributions to Employee Benefit Plans.
4) Due to rounding, figures may not add to totals shown.

Table 5: Resource Requirements by Organization and Business Line

Comparison of 1997-98 Planned Spending, and total Authorities to Actual Expenditures by Organization and Business Line ($ millions)

	Business Lines			
Organization	Space Sciences	Space Applications and Industry Development	Management	Total
Executive Office	0.0	0.0	1.0	1.0
(total authorities)	*0.0*	*0.0*	*5.4*	*5.4*
(actuals)	0.0	0.0	3.1	3.1
Space Systems	0.0	51.1	0.0	51.1
(total authorities)	*1.4*	*73.7*	*0.0*	*75.1*
(actuals)	1.4	75.7	0.0	75.1
Space Technology	0.0	75.2	0.0	75.2
(total authorities)	*0.0*	*76.9*	*0.0*	*76.9*
(actuals)	0.0	76.7	0.0	76.7
Space Science	39.9	0.0	0.0	39.9
(total authorities)	*38.4*	*0.0*	*0.0*	*38.4*
(actuals)	38.3	0.0	0.0	38.3
Canadian Astronaut Office	6.7	0.0	0.0	6.7
(total authorities)	*5.6*	*0.0*	*0.0*	*5.6*
(actuals)	5.6	0.0	0.0	5.6
Space Operations	0.0	3.4	0.0	3.4
(total authorities)	*0.0*	*16.0*	*0.0*	*16.0*
(actuals)	0.0	16.5	0.0	16.5
Corporate Functions	0.0	0.0	9.8	9.8
(total authorities)	*0.0*	*0.0*	*12.9*	*12.9*
(actuals)	0.0	0.0	12.5	12.5
Executive Function	0.0	1.9	5.5	7.4
(total authorities)	*0.0*	*1.7*	*10.8*	*12.5*
(actuals)	0.0	1.5	9.5	11.0
TOTAL	36.6	131.6	16.3	184.5
(Total authorities)	*35.4*	*168.3*	*27.1*	*230.8*
(Actuals)	35.4	168.8	25.1	229.9
% of TOTAL	15.4%	73.6%	11.0%	100.0%

Notes:

1) Planned Spending numbers are in regular characters (Main Estimates).

2) *Numbers in italics denote Total Authorities for 1997-1998 (Main and Supplementary Estimates and other authorities).*

3) Bolded numbers denote actual expenditures/revenues in 1997-1998.

4) Due to rounding, figures may not add to totals shown.

5) Total authorities for Executive office include funds obtained during the fiscal year for activities related to the preparation of LTSP III and the CSA reorganization.

6) Space systems received an additional 22 million dollars during the fiscal year to include the development of the RPDM as part of the Space Station Major Crown Project.

7) Space Operations received an additional 15 million dollars during the fiscal year to support the operations of *RADARSAT-1*.

Table 6: Revenues to the Vote

Revenues Credited to the Vote by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Revenue 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
Space Sciences	0.0	0.0	0.0	0.0	**0.0**
Space Applications and Industry Development	0.0	6.1	7.4	7.4	**6.5**
Management	0.0	0.0	0.0	0.0	**0.0**
Total Revenues Credited to the Vote	**0.0**	**6.1**	**7.4**	**7.4**	**6.5**

Table 7: Revenues to the CRF

Revenues Credited to the Consolidated Revenue Fund by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Revenue 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
Space Sciences	0.0	0.0	0.0	0.0	**0.0**
Space Applications and Industry Development	2.8	1.4	0.4	0.4	**1.4**
Management	0.0	0.0	0.0	0.0	**0.2**
Total Revenues Credited to the CRF	**2.8**	**1.4**	**0.4**	**0.4**	**1.6**

Table 8: Statutory Payments

Statutory Payments by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998

Canadian Space Agency does not have any Statutory Payments.

Table 9: Transfer Payments

Transfer Payments by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
GRANTS					
Space Sciences	0.2	0.2	0.2	0.2	**0.2**
Space Applications and Industry Development	0.3	0.4	0.8	0.2	**0.2**
Management	0.3	0.2	0.2	0.2	**0.2**
Total Grants	**0.7**	**0.8**	**1.1**	**0.6**	**0.6**
CONTRIBUTIONS					
Space Sciences	0.0	0.0	0.0	0.0	**0.0**
Space Applications and Industry Development	31.5	31.8	35.1	24.4	**24.4**
Management	0.4	0.2	0.1	0.4	**0.3**
Total Contributions	**31.9**	**32.0**	**35.2**	**24.8**	**24.7**
Total Transfer Payments	**32.6**	**32.8**	**36.3**	**25.4**	**25.3**

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

Table 10: Capital Spending by Business Line

Capital Spending by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
Space Sciences	30.5	35.7	26.5	26.4	**26.5**
Space Applications and Industry Development	178.2	130.1	78.9	113.3	**113.0**
Management	3.2	0.0	0.0	1.3	**0.5**
Total Capital Spending	**211.8**	**165.8**	**105.4**	**141.0**	**140.0**

Note: 1) Space Applications and Industry Development business line includes contributions to Employee Benefit Plans for the Canadian Space Station and *RADARSAT*, major Crown projects
2) Due to rounding, figures may not add to totals shown.

Table 11: Capital Projects

Capital Projects by Business Line ($ millions)

Business Lines	Current Estimated Total Cost	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998
Space Sciences						
Space Sciences Projects		30.5	35.7	26.5	26.4	26.5
Total - Space Sciences		30.5	35.7	26.5	26.4	26.5
Space Applications and Industry Development						
Canadian Space Station Program	1,369.1	111.9	89.4	51.1	70.0	70.1
RADARSAT	627.9	48.7	14.1	1.2	14.3	14.0
Subsequent planning of *RADARSAT*	244.8	6.0	6.4	0.0	3.1	3.1
EO Support Program	82.2	3.5	12.6	17.3	14.8	14.8
STEAR Program		5.6	4.4	5.2	6.2	6.1
Building refit/ DFL	8.0	1.1	1.5	2.5	2.5	2.5
Misc. capital projects		1.4	1.6	1.7	2.4	2.3
Total - Space Applications and Industry Development		178.2	130.1	78.9	113.3	113.0
Management						
Misc. capital projects		3.2	0.0	0.0	1.3	0.5
Total - Management		3.2	0.0	0.0	1.3	0.5
Total Capital Projects		211.8	165.8	105.4	141.0	140.0

Note: 1) For the major Crown projects, the sums include contributions to Employee Benefit Plans.
2) STEAR Program, which was formerly part of the Canadian Space Station Program, has been transferred to Space Technologies in 1996-97.
3) Due to rounding, figures may not add to totals shown.

Table 12: Status of Major Crown Projects

Canadian Space Station Program

1. Overview

On January 25, 1984, the President of the United States directed NASA to develop and place into orbit a permanently staffed space station. Friends and allies of the United States were invited to participate in its development and use, to share the benefits, and to promote peace, prosperity and freedom through this cooperative venture. In September 1988, Canada signed a formal agreement with the governments of the United States, member states of the European Space Agency, and Japan to participate in the International Space Station Program. Canada's contribution includes the design, construction, and operation of the Mobile Servicing System, plus responsibilities for the operations and use of the Space Station.

The Canadian Space Station Program received Effective Project Approval in February, 1990. The program defines all the activities necessary to discharge Canada's obligations, including completion of the in-orbit testing and commissioning of Mobile Servicing System, and its operation and utilization for the life of the *International Space Station*.

2. Lead and Participating Departments

Sponsoring Agency:	Canadian Space Agency
Contracting Authority:	Public Works & Government Services Canada
Participating Departments:	None

3. Prime and Major Sub-Contractors

PRIME	
Spar Aerospace	Toronto, Ontario
SUB-CONTRACTORS	
CAL Corp.	Ottawa, Ontario
MDA	Richmond, British Columbia
SED Systems	Saskatoon, Saskatchewan
IMP	Halifax, Nova Scotia
CAE	St-Laurent, Québec
Calian	Kanata, Ontario

4. Major Milestones

The following table outlines the international milestones driving the Canadian Space Station Program:

CANADIAN SPACE STATION	DATE
First MSS element delivery to NASA	Sept 1998
First Space Station element launch (FGB)	Nov 1998
Three person permanent international human presence capability	July 1999
First MSS element launch (SSRMS)	Dec 1999
Second MSS element launch (MBS)	Aug 2000
Third MSS element launch (SPDM)	May 2002
Six person permanent international human presence capability	Mar 2003

5. Progress Report and Explanations of Variances

The Acceptance Review of the Space Station Remote Manipulator System (SSRMS) was performed in October 1997. The SSRMS flight equipment will be delivered to NASA Kennedy Space Center in September 1998. The Acceptance Review for the Mobile Base System is planned for June 1999 with delivery of that flight equipment to NASA KSC in August 1999. Integration and test activities are ongoing in preparation of the multi-element integration testing (MEIT) at KSC starting in November 1998.

The Canadian Space Vision System passed Acceptance Review in December 1997 and flew on STS-89.

Space Station Assembly Sequence changes and schedule slips for the launch of the first Russian and U.S. elements have resulted in delays and changes to the Multi Element Integration Tests at KSC. These changes have forced an extension to the integration cycle of the Canadian supplied elements.

Lack of stability of NASA interface requirements has delayed the development of the Canadian Operation and Control Software. The late definition of requirements has caused significant additional software development and re-work. These changes have challenged the software development professionals, already in short supply, due to the Year 2000 demand. Consequently, the development of the control software for the Mobile Base System is delayed forcing the MBS Acceptance Review from fall 1998 to mid 1999.

The development of the SPDM is holding to schedule. It has completed its Baseline Configuration Review in February 1998, with a Critical Design Review scheduled in the fall of 1998.

The operations training facility at St-Hubert has completed two highly acclaimed astronaut and cosmonaut training sessions. The second ISS crew will start to train in the MSS Operations Complex (MOC) in October 1998.

6. Industrial Benefits

Since 1984, the program has issued about 750 contracts ($919 million), with expenditures benefiting all regions of the country, accruing socio-economic benefits of $2.8 billion and creating 32,000 jobs.

RADARSAT

1. Overview

RADARSAT-1 is a Canadian-led project involving the private sector, several of the provinces, and the United States. This sophisticated remote sensing satellite, carrying Synthetic Aperture Radar, was launched in November 1995 and will operate for about six years. It covers most of Canada every 72 hours, the Arctic every 24 hours. *RADARSAT-1* can gather the data needed for more efficient resource management as well as ice, ocean and environmental monitoring, disaster management and Arctic and offshore surveillance.

RADARSAT-1 also supports fishing, shipping, oil exploration, offshore drilling, and ocean research. The development and operation of this system are expected to provide more than $1 billion in benefits to the Canadian private and public sectors. In addition a total of $84.2 million is expected in revenues to support the development and operations of *RADARSAT-1*. This includes $16.5 million in royalties on worldwide sales of *RADARSAT-1* data, $10 million from RADARSAT International Inc. for equipment, and $57.5 million from provincial governments.

2. Lead and Participating Departments

Sponsoring Agency:	Canadian Space Agency
Contracting Authority:	Public Works & Government Services Canada
Participating Departments:	Environment Canada, Natural Resources Canada

3. Prime and Major Sub-Contractors

PRIME	
Spar Aerospace	Ste-Anne de Bellevue, Québec
SUB-CONTRACTORS	
SED Systems	Saskatoon, Saskatchewan
Lockheed Martin	Longueuil, Québec
CAL Corp.	Ottawa, Ontario
MDA	Richmond, British Columbia
COMDEV	Cambridge, Ontario
RSI	Richmond, British Columbia
Ball Aerospace	Boulder, Colorado, USA

4. Major Milestones

PHASE	DESCRIPTION	DATE
A	Preliminary studies	Completed
B	Feasibility and concept definition	Completed
C1	Systems requirement and preliminary design	Completed
C2	Development and testing up to Qualification Test Review	Completed
D1	Manufacture of the proto flight subsystems up to acceptance testing of the subsystems	Completed
D2	Assembly and integration of the subsystems up to Flight Readiness Review, plus post-launch and commissioning activities up to System Acceptance	Completed
E	Operations	April 1996 to March 2001
	First Antarctic mission	Completed

5. Progress Report and Explanation of Variances

Effective Program Approval was obtained for *RADARSAT-1* in March 1991. The Preliminary Design Review was held in July 1991, marking the end of the C1 phase. A contract for phase C2 to D1 was awarded to the primary contractor in July 1991, with an amendment to cover all the contractors' activities until completion of phase D2. In 1994-95, the manufacturing, assembly, integration and testing were done on all the major subsystems, and contracts were awarded for all the significant subsystems of the ground segment. During 1995-96, the spacecraft was assembled and tested and the full Space-Ground System was qualified. *RADARSAT-1* was launched in November 1995 and began operations in April 1996. The initial system included receiving stations for Synthetic Aperture Radar data in Prince Albert (Saskatchewan), Gatineau (Quebec) and Fairbanks (Alaska). CSA and RADARSAT International Inc. have since signed agreements with network stations in Australia, Norway, the United Kingdom, Singapore, China, Thailand and Japan for the direct reception of the RADARSAT data.

Commercial operations of *RADARSAT-1* commenced in April 1996, following a commissioning period. During its first two years of operations, *RADARSAT-1* has supplied timely and high quality data to RADARSAT International Inc., the private sector company that sells RADARSAT data world-wide, and to the program partners (federal and provincial government departments, NASA and the National Oceanic and Atmospheric Agency). RADARSAT has fulfilled a total of 30,250 user requests. An estimated 68,000 minutes of data from over 12,500 orbits have been acquired. From April 1, 1997 to March 31, 1998, more than 9,000 images were delivered to clients, including 1,500 products in near-real time. The world-wide client base includes more than 400 commercial and government users from 41 countries.

The RADARSAT system was designed to provide four-hour turnaround in the electronic delivery of images to the Canadian Ice Service for producing ice charts for the Canadian Coast Guard. In operation, delivery time is averaging 12 hours from the time the image is acquired by the satellite, and it is often completed within one hour. During 1997, the Canadian Ice Service used over 3,300 images of RADARSAT data and supplied more than 32,000 image products and 8,000 charts to its 300 clients. It has been estimated that RADARSAT is saving more than $6 million per year in data acquisition costs to the Canadian Ice Service.

RADARSAT is archiving substantial volumes of images for future use. The RADARSAT Background Mission continues to achieve some exciting firsts. RADARSAT has provided the first SAR coverage of the world's continents, their continental shelves and the polar caps, as well as some islands and their surrounding oceanographic features. RADARSAT is creating an archive of global multi-mode and multi-season SAR data. The Background Mission is also supplying a global stereo data set of the world`s landmass. Nearly 75% of North America and Western Europe has been covered, providing data suitable for mapping a wide range of terrain conditions.

Between September 9, 1997 and October 20, 1997 RADARSAT undertook the Antarctic 1 Mapping Mission, supplying the first high-resolution radar mapping of the entire Antarctic continent, an area which contains 70% of the world's water supply. It has been a resounding success, far exceeding NASA's expectation both in completeness of coverage and in quality of the images. RADARSAT acquired a total of 8,000 images, 2,000 more than originally planned. The data will be used to study the effects of climatological, glaciological, geological and human activity processes on the Antarctic continent. The Antarctic Mapping Mission fulfils a CSA commitment to NASA and NOAA in return for launching RADARSAT in 1995.

In 1997 sales of RADARSAT data has increased by more than 120 percent over the previous year. Responding to client needs, RADARSAT International is using the Internet to improve access and delivery of products. To open new markets, new products and services have been introduced: RADARMaps, large area mosaics, emergency response subscription service, per sq km pricing, monitoring services and RADARSAT-derived DEMs.

6. Industrial Benefits

SPAR and its Canadian subcontractors created over 2,000 high technology person-years of employment during the construction phase of *RADARSAT-1.* Ongoing RADARSAT mission operations employ 50 people at CSA and 15 at the ground stations in Prince Albert and Gatineau. RADARSAT International has over 80 employees and has generated approximately $14 million of RADARSAT data sales in 1997-98. There are now 170 Canadian companies selling value-added services for an estimated $200 million annually. Employment and revenues in this business are growing at a sustained rate of 20% yearly. Forty percent of the revenues are produced from export sales of products and services.

RADARSAT data appeal to a wide range of users and scientists for applications around the world: ice pressure monitoring in the Gulf of St Lawrence, volcanic activities in Mexico, effects of El Niño in Peru, savannah and rainforest management in Madagascar, wadis and drainage networks in Sudan, coastal mapping in Indonesia, and flooding in North America, Europe and Australia.

Since the RADARSAT Application Development and Research Opportunity (ADRO) Program began collecting RADARSAT data in 1996, more than 2, 500 RADARSAT images have been acquired and supplied to an estimated 248 research and development projects in 39 countries for use in applications such as agriculture, land use, forestry, geology, hydrology, mapping, and ocean and sea ice studies.

The RADARSAT User Development Program has supported 23 industrial project proposals worth more than $8 million for the development of new applications using SAR data. A workshop took place in early 1998 to evaluate the resulting benefits. To date this investment has helped bring 16 products and services to market resulting in over $5 million in revenues and leveraging an estimated $850,000 in RADARSAT data sales. Since 1995 the User Education and Training Initiative has funded 34 projects to develop and market educational and training Earth observation materials. The Earth Observation Pilot Projects Program has supported 21 projects to transfer Earth observation technology to a broader base of industrial and operational users.

Table 13: Loans, Investments and Advances

Loans, Investments and Advances by Business Line ($ millions)

Business Lines	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998

Canadian Space Agency does not have any Loans, Investments and Advances.

Table 14: Revolving Fund Financial Summaries

Name of Revolving Fund ($ millions)

	Actual 1995-1996	Actual 1996-1997	Planned Spending 1997-1998	Total Authorities 1997-1998	Actual 1997-1998

Canadian Space Agency does not have any Revolving Funds.

Table 15: Contingent Liabilities

As of March 31, 1998, the Canadian Space Agency did not have contingent liabilities.

Contingent Liabilities ($ millions)

List of Contingent Liabilities	Amount of Contingent Liability		
	31-Mar 1996	31-Mar 1997	Current as of 31-Mar-98
Claims and Pending and Threatened Litigation			
Litigations:			
MPB Technologies Inc. (T-2056/96)	0.0	0.7	0.0
MPB Technologies Inc. (T-1452/97)	0.0	0.0	0.7
Total - Litigations	**0.0**	**0.7**	**0.7**
Total	**0.0**	**0.7**	**0.7**

Nota: An out-of-court settlement has occurred with MPB Technologies Inc. during the fiscal year 1996-97 concerning file T-2056/96. The cost of this settlement was $652,000.

New legal proceeding in damages was initiated by MPB Technologies Inc. in April 1997 (file T1452/97). The proceeding, originally for $3,000,000.00, follows the execution of a contract. An amended declaration of the plaintiff was produced on October 16th, 1997 for the amount of $4,000,000.00. The parties are presently negotiating out-of-court and the amount of the Contingent Liabilities is now estimated at $700,000.

SECTION 5: CONSOLIDATED REPORTING

The CSA has a nil report in this section.

SECTION 6: OTHER INFORMATION

6.1 CONTACTS FOR FURTHER INFORMATION & WEB SITES

Earth Observation
Florian Guertin
Business Line Coordinator
450-926-4879

Canadian Space Station Program
Alain Poirier
Director General, Space Systems
450-926-4461

Space Science
Barry Wetter
Director General, Space Science
613-990-0799

Management
Jacques Bruneau
Director, Corporate Management
450-926-4407

External Relations
Michel Giroux
Director, External Relations
450-926-4360

Satellite Communications
Virendra K. Jha
Director General, Space Technology
450-926-4600

Canadian Astronaut Program
Berthier Desjardins
Director General, Canadian
Astronaut Office
450-926-4703

Space Technology
Virendra K. Jha
Director General, Space Technology
450-926-4600

David Florida Laboratory
Rolf Mamen
Director General, Space Operations
613-998-2873/450-926-6530

Space Awareness
Jacqueline Bannister
Director, Communications
450-926-4342

Web Site: www.space.gc.ca

6.2 LEGISLATION AND ASSOCIATED REGULATIONS ADMINISTERED

Canadian Space Agency Act (S.C. 1990, c. 13)

6.3 STATUTORY ANNUAL REPORTS AND OTHER AGENCY REPORTS

REPORTS	WEB ADDRESS
Agency Performance Report for the period ending March 31, 1997	**www.space.gc.ca/ENG/Publications/menu.html**
1998-99 Estimates	

6.4 ABBREVIATIONS AND ACRONYMS

ACOA	Atlantic Canada Opportunities Agency
ACTORS	Atlantic Canada Thin-film Organic Semiconductors
AI&T	Assembly, Integration and Testing
ARF	Aquatic Research Facility
ARTES	Advanced Research in the Telecommunications Systems Program
ASTP	Advanced Systems and Technology Program
ASVS	Advanced Space Vision System
CCRS	Canada Centre for Remote Sensing
CEONet	Canadian Earth Observation Net
CFZF	Commercial Float Zone Furnace
CNES	Centre National d'Études Spatiales (France)
CPA	Cold Plasma Analyser
CRC	Communications Research Centre
CSA	Canadian Space Agency
CSP	Canadian Space Program
CSVS	Canadian Space Vision System
DA	Departmental approval
DFL	David Florida Laboratory
DND	Department of National Defence
DUP	Data User Program
EMC	Elecromagnetic Compatibility
EOPP	Earth Observation Preparatory Program
EPA	Effective Program Approval
ERS	European Remote Sensing
ESA	European Space Agency
ESD	Electrostatic Discharge
FBI	Federal Building Initiative
FLEX	Fluid Experiment
FTE	Full Time Equivalent
FUSE	Far Ultraviolet Spectroscopic Explorer

GDP	Gross Domestic Product
GSTP	General Support Technology Program
HR	Human Resources
IFMS	Integrated Financial Management System
IGA	Intergovernmental Agreement
IML	International Microgravity Laboratory
IMP	International Marketing Plan
IR	Infra Red
ISIS	International Satellite for Ionospheric Sounding
ISS	International Space Station
JPL	Jet Propulsion Laboratory
KSC	Kennedy Space Center
LMS	Life and Microgravity Spacelab
LTSP	Long Term Space Plan
MANTRA	Middle Atmosphere Nitrogen Trend Assessment
MBS	Mobile Base System
MCP	Major Crown Project
MEIT	Multi-Element Integration Testing
MIM	Microgravity Isolation Mount
MMLC	Multimedia Learning Centre
MOC	MSS Operations Complex
MOPITT	Measurement of Pollution in the Troposphere
MOTS	Mobile Operations Training Simulator
MOU	Memorandum of Understanding
MRC	Medical Research Council of Canada
MSAT	Mobile Satellite
MSP	Microgravity Sciences Program
MSS	Mobile Servicing System
MSTP	European Manned Space Program
MTPE	Mission To Planet Earth
NASA	National Aeronautics and Space Administration (United States)
NASDA	National Space Development Agency (Japan)
NOAA	National Oceanic & Atmospheric Administration (United States)
NRC	National Research Council of Canada
NSERC	Natural Sciences and Engineering Research Council of Canada
NSPO	National Space Program Office
NSTS	National Sector Team for Space
OPF	Operation Plan Framework
OSIRIS	Optical Spectrograph and Infrared Imaging
OSM	Operational Space Medicine
PAS	Program Activity Structure
PIM	Passive Intermodulation Measurement
POEM/ENVISAT	Polar Orbit Earth observation Mission
PPA	Preliminary Project Approval
PRAB	Program Review Approval Board

PRAS	Planning and Reporting Accountability Structure
PSDE	Payload and Spacecraft Development and Experimentation
PWGSC	Public Works and Government Services Canada
QUELD	Queen's University Experiment on Liquid Diffusion
RF	Radio Frequency
RSI	RADARSAT International Inc.
SAP R/3	(Systems, Products, and Programs in Data Processing - Realtime System version 3)
SAR	Synthetic Aperture Radar
SIFAC	Space Industry Forum in Atlantic Canada
SME	Small and Medium Sized Enterprise
SMS	Supra Thermal Ion Mass Spectrometer
SOSC	Space Operations Support Centre
SPDM	Special Purpose Dextrous Manipulator
SRMS	Shuttle Remote Manipulator System
SSRMS	Space Station Remote Manipulator System
STACI	Space Technology Atlantic Canada Initiative
STEAR	Strategic Technologies for Automation and Robotics
STS	Space Transportation System
SVS	Space Vision System
TMI	Telesat Mobile International
TPA	Thermal Plasma Analyser
TRE	Torso Rotation Experiment
UARS	Upper Atmospheric Research Satellite
VCF	Visual Coordination Facility
VOTE	Virtual Operations Training Environment
VSOP	Very Long Baseline Interferometry Space Observatory Project
WED	Western Economic Diversification
WINDII	Wind Imaging Interferometer