Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

CANADIAN SPACE PROGRAM

PROGRAMME SPATIAL CANADIEN

CSP PSC

The Canadian Space Program: New Initiatives

Canada

THE CANADIAN SPACE PROGRAM: NEW INITIATIVES

The Canadian Space Program is an undertaking with a vision: to launch Canadian space technology into the 21st century and, at the same time, to enrich the Canadian economy by creating new industries and jobs.

The goals of the Space Program are to build on Canada's long-standing expertise in space technology engineering and applications development; to maintain Canada's established position in international cooperation; to ensure that maximum economic and social benefits are obtained from the applications of space technology; and to ensure that Canada maintains a position of excellence in the world-wide scientific exploration of space.

Space technology is a catalyst for the economic development of the industrialized nations of the world. The commercialization of space in many new fields -- mobile communications, remote sensing, materials processing in zero gravity -- is developing rapidly as nations struggle for advantageous competitive positions.

Canada has demonstrated its international competitiveness in the development and use of space technology. Our past success stems from our ability to apply limited resources to areas where the payoffs are the highest. Our space industries have the potential to bring even greater economic benefits to Canada.

In March 1985 the government announced a one-year Interim Space Plan with the objective of maintaining the momentum of the Canadian Space Program pending the development of a long-term strategic space plan. The new Space Program initiatives described herein, when combined with existing space activities, provide Canada with a balanced Space Program whose horizon extends into the 21st century. This long-term program will ensure that Canadians continue to benefit economically and socially from the development and use of space technology. It will maintain Canada's hard-won international reputation for excellence in this frontier area of high technology. It will continue to instill pride in Canadians in our world-class achievements and will serve as a challenge and inspiration to our future scientists and engineers.

HIGHLIGHTS OF THE NEW INITIATIVES

The following table summarizes the new initiatives:

New Initiatives	Estimated Costs ($M)	
	1986/87-1990/91	1986/87-2000/01
1. Support for the implementation by Telesat Canada of a new commercial communications satellite system for mobile users (MSAT) through guaranteed lease of services, market development, and technology development. (DOC)	15	151
2. Participation in the Space Station Program through the provision and operation of a Mobile Servicing Centre for assembly, maintenance and servicing of the Station. (NRC)	169	697
3. Space Station User Development Program for the development of Canadian industrial capabilities to use the Space Station for space-based manufacturing. (NRC)	50	100
4. Remote Sensing Program for the development of advanced technologies and applications for the reception, processing and analysis of radar and other remote sensing data and continued planning for RADARSAT with the objective of obtaining financial commitments from the private sector, provincial and foreign governments. (EMR)	27	77
5. Expanded cooperation with Europe through a long-term continuing relationship with the European Space Agency (including participation in remote sensing and communications development programs) and through participation in the spaceplane program (Hermes) of France. (MOSST, EMR, DOC)	39	123
6. Establishment of the Canadian Astronaut Program on a continuing basis. (NRC)	15	55
7. Additional funding for Space Science. (NRC)	20	70

ANTICIPATED BENEFITS OF NEW INITIATIVES

1. MSAT

MSAT will bring reliable two-way radio telephone and data services to all Canadians anywhere in the country. Over the first generation system life of MSAT (to the year 2000), the estimated benefits in 1985 dollars are: user benefits of $1 Billion, due to increased efficiency of operations; health and public safety benefits of $300M; manufacturing sales of $740M; service provider sales of $1.1B; satellite operator sales (Telesat) of $900M; and 40,000 person years of employment.

An effective domestic telecommunications and transportation infrastructure is one of the most basic and essential elements required for the exercise of national sovereignty. MSAT, through the provision of new air, sea and land communications services will contribute to the enhancement of sovereignty in the Arctic and other remote areas of Canada.

2. Space Station

Economic studies completed to date indicate commercial opportunities for developing space systems and their terrestrial spinoffs resulting from the Mobile Servicing Centre could amount to industry sales for space and earth applications of more than $5B by the year 2000. On the user development side, principally for materials processing, annual revenues could range up to $200M for a cumulative total up to $400M, by the year 2000. It is estimated that up to 80,000 person-years of employment will be created in the high technology sector as a result of Canadian participation in the Space Station Program.

For industry, Space Station provides the opportunity to enhance technical and managerial capabilities, to maintain and forge new links with domestic and foreign industry and for securing new markets through participation in technical areas of strategic importance, such as automation and robotics, and materials processing in space.

For universities, the program provides the opportunity to exploit the unique characteristics of space as a research environment and to establish close links with industry and government, e.g. in the development of materials processing techniques under microgravity conditions. It also provides the stimulus for young scientists and engineers to apply themselves to areas of science and technology crucial to Canada's future development.

3. Remote Sensing Program

The development and use of remotely sensed data provides for more effective management of Canada's natural resources and enhanced agricultural, forestry, ocean and weather information services. Canadian industry is a world leader in the reception, processing and analysis of remote sensing data. This new initiative will assist industry to maintain its position in this field.

Once private sector and other funding is found for the RADARSAT program, the estimated benefits in 1985 dollars would be: $900M in improved crop, atmosphere and ocean forecasting and $600M in the forestry and geology fields. Sales of space and ground technology and related services could reach $600M by the year 2000 with associated employment of 20,000 person-years.

4. Co-operation with Europe

Co-operation with the European Space Agency (ESA) underlines Canada's continuing commitment to industrial collaboration with European partners. This co-operation is of significant value in strengthening economic and political ties with Europe. The association with ESA will continue to provide an important mechanism for Canadian industry to gain access to advanced European space technology and, through partnerships with European industry, access to the European market.

Participation in the study phase of the French spaceplane (Hermes) program will allow Canadian industry to capitalize further on investments to date in the CANADARM program.

5. Canadian Astronaut Program

A continuing service will be provided to the Canadian industrial, scientific and engineering communities by Canadian astronauts. They will perform in space those experiments requiring human intervention or those whose design can be enhanced or made more cost effective by taking advantage of human intervention. The Canadian Astronaut Program will continue to stimulate public interest in advanced technologies and increase awareness both within and outside Canada of Canadian capabilities in space science and technology.

6. Space Science

The Space Science Program serves as an important vehicle to encourage the training of young scientists and engineers at Canadian universities. It contributes to fundamental research, the development of new technologies and processes in industry and the strengthening of links between government, industry and universities. The program also promotes collaboration with other countries and increases access to foreign space technology.

7. Regional Distribution of Benefits

Canadians in all regions of the country benefit from the use of space technology for communications, resource management, navigation, search and rescue, and weather services. The expected regional distribution of the government's expenditures associated with the space initiatives is as follows:

Atlantic Provinces	10%
Quebec	35%
Ontario	35%
Prairie Provinces	10%
British Columbia	10%

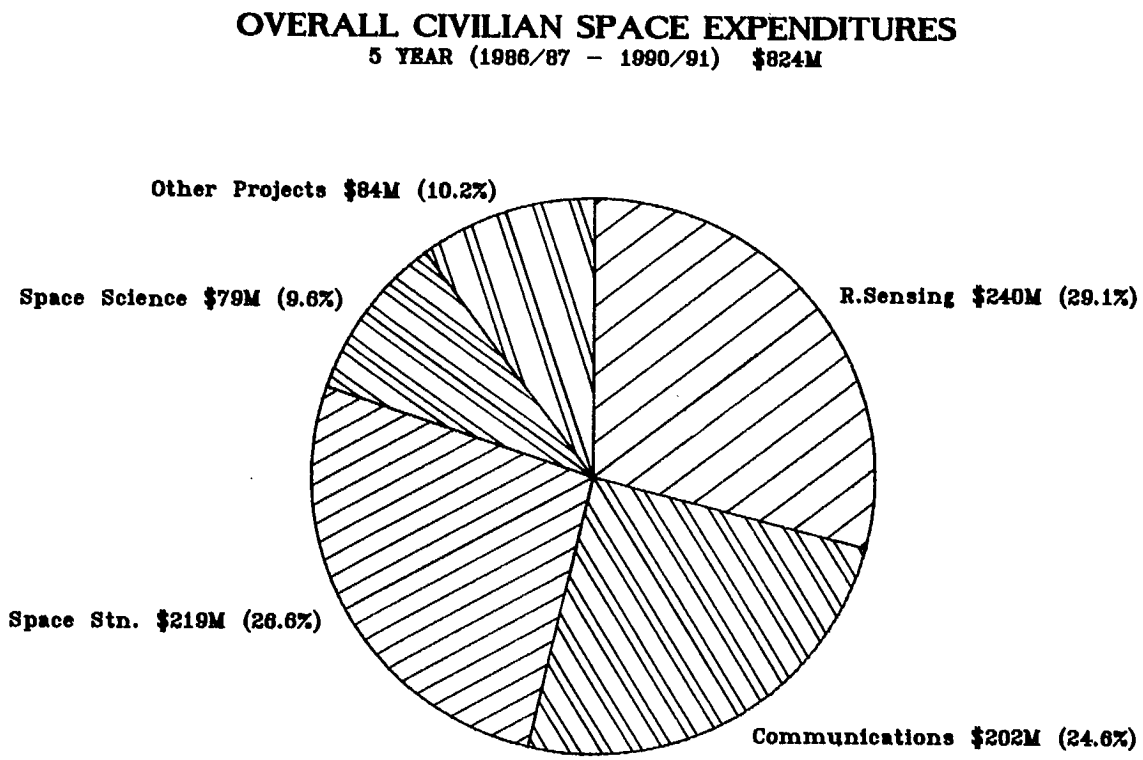
The new initiatives contained in the Canadian Space Program offer excellent prospects for increased regional participation and the distribution of services, manufacturing and applications benefits across the country.

OVERVIEW OF THE TOTAL CANADIAN CIVILAN SPACE PROGRAM

As a result of implementing these new initiatives, the estimated total Canadian Space Program expenditures for the next five years are summarized in the following table and chart.

Total Space Program Expenditures ($M)

CURRENT YEAR	NEXT FIVE YEARS				
1985/86	1986/87	1987/88	1988/89	1989/90	1990/91
158	148	160	170	166	180



1. The Space Communications Program

This program has three components: applications programs, space industry development programs and long range satellite communications technology development.

The main program element is MSAT — a major initiative to support Canadian industry to develop and establish the world's first domestic commercial mobile satellite system in 1990. The MSAT system will be implemented by Telesat Canada to meet the need for voice and data communications for vehicles, aircraft, ships and portable stations anywhere in Canada.

MSAT is of strategic importance to economic development of remote and rural areas of Canada and is a high priority of the Department of Communications for further development of the communications infrastructure in Canada. It will serve national needs and has excellent commercial potential.

The program also includes participation in ESA's communications R&D program and continued participation in the OLYMPUS large communications satellite programs. This satellite is scheduled for launch in 1987.

2. The Remote Sensing Program

Maintaining Canada's capacity to receive, process and enhance remotely-sensed data is of major importance. Canada has been at the forefront of ground station development, data processing and image enhancement and analysis technology since the launch of the first earth resources satellite in 1972.

The Canadian Space Program provides support for radar data use, image processing and analysis. It enables Canada to maintain its world lead in ground infrastructure to use remotely-sensed data.

Canada participates in the ERS-1 (Earth Resources Satellite) program of ESA and plans to participate in the European Space Agency's next generation radar satellite and preparatory sensor development programs.

Planning will also continue towards the development of a Canadian radar satellite (RADARSAT) with the objective of obtaining financial commitments to the program from the private sector, provincial and foreign governments.

3. Space Station Program

Canada's contribution to the Space Station is composed of three elements:

a) the creation of hardware systems for Space Station involving advanced technology;

b) operation of the Canadian hardware systems;

c) the user development program designed to prepare Canadian industry, particularly the non-space industries, to make use of the weightless environment in space for the development of commercial products.

The hardware element of the program involves development of strategic technologies in the areas of automation, robotics, artificial intelligence and expert systems. It will allow Canada to build on its internationally recognized expertise and capability developed as a result of the CANADARM. As well, it will offer this country a unique opportunity for collaboration with the United States, Europe and Japan.

The user development program element will assist in ensuring that Canadian industry is able to capture its share of a large anticipated market for products developed on the Space Station.

4. Space Science Program

The National Research Council's Space Science Program will build on Canada's expertise in space physics, upper atmosphere research, microgravity sciences and astronomy. Projects will be designed jointly with the Canadian space science community. Canadian industry will provide instruments and facilities for major experiments. Space Science research has contributed to the knowledge base required for the exploitation of space for communications and is contributing in large measure to the understanding of weather and atmospheric pollution. Microgravity holds potential for development of new pharmaceutical products, alloys, crystalline materials for microelectronics and other materials.

5. Other Activities

a) The Canadian Astronaut Program

The Canadian Astronaut Program, managed by the National Research Council, has been established on a continuing basis. The original program was established in 1983 to have Canadian payload specialists conduct experiments on three Space Shuttle missions. The first Canadian astronaut to fly, Marc Garneau, conducted experiments in space science, space technology and life sciences during Mission 41-G, October 5-13, 1984. Steve MacLean, the second Canadian assigned to a mission, will conduct experiments on space technology, including the Space Vision System developed by the National Research Council. The Canadian crew for the third mission, focusing on life sciences, has not been announced. With a continuing program, future missions will be planned as Canada's involvement with Space Station evolves. The missions will continue to support space experiments originating from industry, government and universities which benefit from human intervention in space.

b) Co-operation with Europe

Also included in this grouping is Canada's participation in the European Space Agency (ESA). Canada first signed a co-operative agreement with ESA in 1978 and the current agreement, signed in 1984, expires at the end of 1988. The Canadian Space Program provides for continued Canadian association with ESA after 1988 and co-operation in the initial stages of the Hermes project of France.

As well, Canada contributes to ESA's general budget and to two major optional programs: OLYMPUS (Large Communications Satellite) and ERS-1 (Earth Resources Remote Sensing Satellite).

STRATEGIC ELEMENTS OF THE CANADIAN SPACE PROGRAM

Achievement of the Space Program objectives and optimization of the Program to Canada's economic and social development requires the establishment of a series of well-defined strategies. These strategies, which affect the overall program direction, are as follows:

1. International Strategy

International co-operation in space-related activities has been essential in meeting the objectives of Canada's Space Program. International co-operation remains a cornerstone of our space strategy. This co-operation permits Canada to participate in a wide range of projects, to undertake projects at lower cost and provides increased access to new and advanced technologies developed in other countries.

2. Industrial Strategy

The Canadian market for space systems provides the opportunity to develop specific niches of expertise for Canadian industry. Growth and viability for most of our space-related companies depends upon their ability to exploit their expertise and to capture export market sales. The primary goal of the space industry strategy is to assist Canadian industry in the development and marketing of products and services that are competitive in the international marketplace.

3. Regional Development Strategy

More than ever before, the Canadian Space Program has the potential to distribute the service, manufacturing and applications benefits of space technology across the country. The Program is being implemented in a manner that ensures that this potential is realized. The Ministry of State for Science and Technology, in co-operation with the Department of Regional Industrial Expansion, is working with departments, the provinces and the private sector to identify specific opportunities for developing in all regions of Canada industries related to space.

4. Commercialization Strategy

Governments around the world are increasing their support for their national space programs partly because they foresee the increasing commercialization of space. The Canadian Space Program includes activities and policies aimed at encouraging Canadian companies to seek commercial returns from investments in space.

5. Program Balance

The frontier aspects of space make it difficult to predict which activities will produce the most benefits and when. The risks associated with the relatively long gestation periods and the rapidly changing technology dictate the importance of a balanced program portfolio. A sound program should have balance in terms of short, medium, and long-term investments. It should

also allow capitalization on previous investments, follow through on current investments, and explore possibilities for future investments. The Canadian Space Program follows this strategy.

CONCLUSIONS

One of the main high technology areas in which Canada leads the world is the development and use of space technology. By world standards, the Canadian Space Program has been an outstanding success. With a relatively low level of expenditure, we have become one of the world's largest users of space systems and have developed a world-class, export-oriented space industry.

Canada's geography and demography make the application of space technology an essential element of our national life, benefiting Canadians in all regions. Satellite communications are now integral components of our national communications infrastructure, are essential for commerce and the exercise of sovereignty, and provide important cultural links across the country. Remote sensing satellites are improving the management of our natural resources. Weather satellites permit improved weather forecasts which benefit the resource-based industries in particular and are essential to the safety and security of all Canadians. Satellites are also assisting in navigation and in search and rescue operations.

Industrial benefits from the Space Program have been noteworthy. In recent years, our space-related manufacturing industries have been growing in aggregate at more than 50 per cent per year, currently employing more than 3,000 people, with sales of about $300 million in 1984. In addition, the communications and remote sensing operating industries generated revenues of approximately $300 million in 1984. More than 70 per cent of the sales are exported, making Canada one of the few countries in the world where the space industry sells more than the government spends on space. The industries are almost entirely owned by Canadians and the sales of space industries contain an estimated 75 per cent Canadian value-added content. The new initiatives will ensure the continued growth of this industry.

National pride in the nation's technological capabilities is fostered by our space program. The Alouette, ISIS, Hermes and CANADARM programs and the flight of Marc Garneau have shown Canadians and the world that we are among the best in this frontier, high technology field.

Space is a high profile, international arena where the industrially developed nations display their technological prowess for the rest of the world to see. Co-operation with others, particularly the United States and the European Space Agency, has been a significant part of most Canadian space initiatives. Co-operative projects forge lasting links and encourage international industrial partnerships. The CANADARM program, for example, led to follow-on production orders to outfit three shuttles, other business for our industry and the invitation to fly Canadian astronauts on the U.S. Space Shuttle. Furthermore, the high international profile created by our Space Program is an important factor in opening doors for other high technology industries.

The new Canadian Space Program is a statement of the Canadian government's continuing commitment to ensuring that Canada will compete effectively at the cutting edge of space science and technology. It is a program that is expected to create over 100,000 person years of employment and up to $8 billion in revenues and carry Canada proudly into the 21st century.

May, 1986