Canada

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Background Paper

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THE CANADIAN SPACE PROGRAM
PLAN FOR 1982/83 - 1984/85

December 1981

Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

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FACT SHEET

CANADIAN SPACE PROGRAM

EXPENDITURES --- 1981/82 to 1984/85

(MILLIONS OF DOLLARS)

	81/82	82/83	83/84	84/85	TOTAL
PREVIOUSLY APPROVED PROGRAMS					
Communications	22.8	20.8	23.8	18.7	86.1
Remote Sensing	26.3	40.3	30.5	22.9	120.0
Space Science	11.8	19.1	21.1	20.9	72.9
Technology Development	25.4	14.1	13.0	10.5	63.0
Relationship with ESA	1.7	-	-	-	-
Sub-total	88.0	94.3	88.4	73.0	343.7
NEW PROGRAM INITIATIVES					
Communications	-	8.5	9.0	-	17.5
Remote Sensing	-	1.9	4.9	8.9	15.7
Technology Development	8.7	30.4	31.8	22.2	93.1
Relationship with ESA	-	1.8	1.9	2.1	5.8
Sub-total	8.7	42.6	47.6	33.2	132.1
TOTAL SPACE PROGRAM					
Communications	22.8	29.3	32.8	18.7	103.6
Remote Sensing	26.3	42.2	35.4	31.8	135.7
Space Science	11.8	19.1	21.1	20.9	72.9
Technology Development	34.1	44.5	44.8	32.7	156.1
Relationship with ESA	1.7	1.8	1.9	2.1	7.5
TOTAL	96.7	136.9	136.0	106.2	475.8

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FACT SHEET

NEW PROGRAM EXPENDITURES

	Millions of Dollars
(A) Communications Program	
MSAT phase B: engineering studies for the detailed definition of a communications satellite program to demonstrate new services to mobile users in vehicles, ships and airplanes	17.0
Satellite Service Development: Continuation of the successful communications pilot projects using the 12/14 GHz band on ANIK-B	0.5
(B) Remote Sensing Program	
ERS-1 phase B: continuation of Canada's participation in the definition of the European Remote Sensing Satellite	1.4
MOSAICS: development of a data processing system for the precision correction of remote sensing imagery to improve accuracy from 300 metres to 50 metres	9.9
TOPAS Phase 1: development of a remote sensing geographical information system as the first phase of a larger program for integrating satellite and aircraft remote sensing data with other geographical data	4.4
(C) Technology Development Program	
LSAT phases C/D: participation in the design and manufacturing phases of the large satellite program of ESA through provision of solar arrays, payload components, and integration and test of the satellite in Canada	68.3
Subsystem Development: design and manufacture of advanced electronic subsystems and components for export and international joint programs	18.8
R&D Support: support to Canadian space industry for satellite systems R&D and the development of specific products for future communications satellites	6.0
(D) Relationship with ESA: contribution to the general studies program of ESA and establishment of a Space Counsellor position in the Canadian Embassy in Paris	5.8

Minister of State
Science and Technology Canada
The Hon. John Roberts

Ministre d'État
Sciences et Technologie Canada
L'hon. John Roberts

Speech
Discours

NOTES FOR A STATEMENT
BY THE
HONOURABLE JOHN ROBERTS
MINISTER OF STATE
FOR
SCIENCE AND TECHNOLOGY

THE CANADIAN SPACE PROGRAM
PLAN FOR 1982/83 - 1984/85

DECEMBER 9, 1981

Canada

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MANY OF YOU WILL HAVE TAKEN PART IN THE COVERAGE OF THE RECENT FLIGHT OF THE U.S. SPACE SHUTTLE COLUMBIA. MILLIONS OF CANADIANS FOLLOWED ON T.V. THE PERFORMANCE OF THE CANADARM, THE REMOTE MANIPULATOR SYSTEM WHICH IS A KEY COMPONENT OF THE SHUTTLE PROGRAM.

WE HAVE BEEN WORKING FOR TWENTY YEARS TO DEVELOP THE KIND OF COMPETENCE DISPLAYED BY THE CANADARM. IT HAS PAID OFF. WE ARE NOW READY TO GO A STEP FURTHER.

THE NEED FOR ECONOMIC DEVELOPMENT AND SUSTAINED LONG-TERM GROWTH IN CANADA IS URGENT. RECOGNIZING THIS URGENCY, THE GOVERNMENT OUTLINED A MAJOR ECONOMIC DEVELOPMENT POLICY WITH THE BUDGET. THE AIM OF THAT BUDGET PAPER IS TO PROVIDE A LONG-TERM STRATEGY FOR MOBILIZING THE POTENTIAL OF CANADA. THE NEW ECONOMIC DEVELOPMENT STRATEGY WAS INTENDED AS A GUIDELINE BLUEPRINT LEADING TO CONCRETE INITIATIVES. THE DOMINATING THRUST OF THE STRATEGY IS TO CONCENTRATE CANADA'S ECONOMIC EFFORT ON THOSE HIGH-POTENTIAL SECTORS OF THE ECONOMY WHERE WE ALREADY HAVE, OR WHERE WE CAN DEVELOP, A STRONG COMPARATIVE ADVANTAGE IN THE INTERNATIONAL MARKETPLACE. ONE OF THESE KEY PRIORITY AREAS, ONE WHERE TECHNOLOGY HAS GIVEN US THE CRITICAL EDGE, IS THE SPACE SECTOR.

TODAY, AS MINISTER OF STATE FOR SCIENCE AND TECHNOLOGY AND THE MINISTER RESPONSIBLE FOR SPACE POLICY, I WANT TO TELL YOU ABOUT A SIGNIFICANT NEW EFFORT IN OUR SPACE PROGRAM. THIS EFFORT

REPRESENTS THE GOVERNMENT'S DETERMINATION NOT ONLY TO PROMOTE SPACE BUT ALSO, THROUGH THAT, TO REALIZE THE NEW STRATEGY.

THE GOVERNMENT HAS DECIDED TO SPEND AN ADDITIONAL 132.1 MILLION DOLLARS ON OUR SPACE PROGRAM FROM NOW THROUGH 1985. LET ME EMPHASIZE THAT THIS AMOUNT IS OVER AND ABOVE THE MONIES MADE AVAILABLE FOR THE PROGRAM ANNOUNCED LAST APRIL. IN TOTAL, WE ARE GOING TO SPEND 475.8 MILLION DOLLARS ON SPACE PROJECTS OVER THE NEXT FOUR YEARS. THAT IS A BIG PUSH: A 38 PERCENT INCREASE IN FUNDING. IT IS A FIRM INDICATION THAT THE GOVERNMENT IS GIVING A VERY HIGH PRIORITY TO THE SPACE PROGRAM. IT IS ALSO A REFLECTION OF OUR BELIEF THAT HIGH TECHNOLOGY IS CRUCIAL TO CANADA'S ECONOMIC DEVELOPMENT IN THE '80's.

THESE EXPENDITURES WILL HELP PLACE CANADA IN A GOOD POSITION TO COMPETE IN IMPORTANT AND RAPIDLY EXPANDING MARKETS FOR SPACE TECHNOLOGY. CURRENT ESTIMATES OF THE POTENTIAL WORLD MARKET FOR THE MOBILE AND RADAR SATELLITES OVER THE NEXT 20 YEARS ARE OVER $15 BILLION. THE DOMESTIC MARKETS ANTICIPATED FOR THESE SATELLITE PROGRAMS, AND OTHER TELECOMMUNICATIONS AND DIRECT BROADCASTING SATELLITES, ARE OF THE ORDER OF $4 BILLION. OUR EXPECTATION IS THAT, IF THESE MARKETS MATERIALIZE IN THIS WAY, THE CANADIAN INDUSTRIAL SHARE OF THAT COMBINED WORLD AND DOMESTIC MARKET IS CLOSE TO $4 BILLION. THESE PROJECTIONS WOULD SUGGEST A RETURN ON OUR INITIAL INVESTMENT OF SOME 10 TO 1. THIS IS INDEPENDENT OF THE ADDITIONAL REVENUES THAT WOULD ACCRUE FROM USER CHARGES FOR THESE SATELLITE SERVICES.

IT IS ALSO CRUCIAL THAT WE PLAN OUR TECHNOLOGICAL DEVELOPMENT PROGRAMS CAREFULLY. THE NEW INITIATIVES ANNOUNCED TODAY ARE DESIGNED TO STRENGTHEN THE PRIORITY AREAS IDENTIFIED IN THE THREE YEAR PLAN I ANNOUNCED LAST APRIL. OUR REASON FOR STICKING CLOSELY TO THESE MAIN OBJECTIVES IS IMPORTANT.

CANADA'S SPACE STRATEGY BEARS REPEATING:

1. CANADA'S NATIONAL NEEDS FORM THE CORNERSTONE OF OUR SPACE PROGRAM; NEEDS, ESPECIALLY, IN COMMUNICATIONS AND REMOTE SENSING.

2. THE STRATEGY PROVIDES A BASIS FOR BUILDING A STRONG CANADIAN SPACE INDUSTRY INCLUDING THE DEVELOPMENT OF A PRIME CONTRACTOR. SPAR AEROSPACE, OUR PRIME CONTRACTOR, HAS DEMONSTRATED IT IS COMPETITIVE AND IN A GOOD POSITION TO HANDLE MOST OF OUR DOMESTIC MARKET FOR SATELLITES AND TO RESPOND TO THE INTERNATIONAL DEMAND FOR RELATED SUBSYSTEMS. SPAR'S INCREASED ACTIVITIES WILL GENERATE A NEED FOR COMPONENTS AND SUBSYSTEMS FROM CANADIAN MANUFACTURERS ACROSS THE COUNTRY. THE PRIME CONTRACTOR POLICY WILL THUS STIMULATE THE GROWTH OF THE ENTIRE SPACE INDUSTRY AND WILL BRING INCREASED EMPLOYMENT TO SEVERAL REGIONS OF THE COUNTRY. THE NEW PROGRAM IS EXPECTED TO ADD OVER 1000 NEW JOBS TO THE 2,500 ALREADY EMPLOYED BY THE CANADIAN SPACE INDUSTRY. THE GOVERNMENT EXPECTS THAT VIRTUALLY ALL THE INCREASE IN EMPLOYMENT IN SPAR ARISING FROM THIS

DECISION WILL TAKE PLACE AT SPAR'S SATELLITE MANUFACTURING PLANT IN THE MONTREAL AREA. IT ALSO EXPECTS THE PRIME CONTRACTOR TO STRENGTHEN ITS R&D AND MARKETING CAPABILITIES. DISCUSSIONS ON THESE MATTERS WITH THE PRIME CONTRACTOR ARE CONTINUING.

3. INTERNATIONAL COOPERATION IS KEY TO CANADA'S SUCCESS. IN THE PAST WE HAVE WORKED CLOSELY WITH NASA, AND JUST LAST MONTH THE WORLD WITNESSED THE SUCCESS THAT THIS KIND OF JOINT VENTURE CAN BRING. IF INDUSTRY IS TO REMAIN COMPETITIVE, WE HAVE TO INCREASE OUR PARTICIPATION AT THE INTERNATIONAL LEVEL. TODAY'S ANNOUNCEMENT WILL MAINTAIN AND BROADEN CANADIAN COLLABORATION WITH THE EUROPEAN SPACE AGENCY. I WILL BE MEETING THIS MONTH WITH THE HEADS OF NASA AND OTHER AGENCIES TO DISCUSS MUTUALLY BENEFICIAL OPPORTUNITIES FOR SPACE CO-OPERATION WITH THE UNITED STATES.

4. GOVERNMENT, INDUSTRY AND THE UNIVERSITIES MUST WORK TOGETHER NOT ONLY TO MAINTAIN OUR TECHNOLOGICAL AND INDUSTRIAL STRENGTH, BUT TO ENSURE THAT WE DO NOT FALL BEHIND IN THE INTERNATIONAL SPACE RACE. INDUSTRY'S OWN INVESTMENT IN R&D WILL BE IMPORTANT TO THE SUCCESS OF THE PROGRAM.

THESE FOUR ELEMENTS OF OUR SPACE STRATEGY ESTABLISH A FIRM BASIS FOR A DYNAMIC GROWTH INDUSTRY IN CANADA. THAT IS WHY THE INITIATIVES WE ARE ANNOUNCING TODAY ARE SO EXCITING.

YOU HAVE RECEIVED A BACKGROUND PAPER WHICH PROVIDES DETAIL ON CANADA'S SPACE PROGRAM AND ON THE ALLOCATION OF THE ADDITIONAL 132.1 MILLION DOLLARS.

I'D LIKE TO POINT OUT SOME OF THE HIGHLIGHTS.

IN THE FIELD OF COMMUNICATIONS, 17 MILLION DOLLARS HAS BEEN ALLOCATED TO PREPARE A DETAILED PROPOSAL TO DEMONSTRATE THE VIABILITY OF A MOBILE COMMUNICATIONS SATELLITE FOR CANADA. THIS SATELLITE, DUBBED THE MSAT, WILL BE PRE-OPERATIONAL AND WILL BE BUILT TO EXPLORE THE POTENTIAL OF MOBILE COMMUNICATIONS SERVICES TO SHIPS, AIRCRAFT, VEHICLES AND PORTABLE INSTALLATIONS, PARTICULARLY IN RURAL AND REMOTE AREAS. IF SUCCESSFUL, A DECISION TO MAKE IT OPERATIONAL WOULD MAKE CANADA THE FIRST COUNTRY IN THE WORLD WITH A MOBILE COMMUNICATIONS SATELLITE. THE DOMESTIC MARKET POTENTIAL IS IMPRESSIVE, AND THE EXPORT MARKET POTENTIAL IS EVEN MORE ENCOURAGING.

REMOTE SENSING IS VITAL TO OUR ARCTIC ENERGY PROJECTS AND TO SUCCESSFUL RESOURCE MANAGEMENT ACROSS CANADA. WE ALREADY HAVE UNDERWAY THE NECESSARY R&D AND PHASE A STUDIES FOR A DOMESTIC RADAR SATELLITE SYSTEM. THIS INITIATIVE I ANNOUNCED IN APRIL. WE WILL BE CONTINUING OUR PARTICIPATION IN THE DEVELOPMENT OF A EUROPEAN REMOTE SENSING SATELLITE. WE FURTHER INTEND TO IMPROVE THE QUALITY OF THE REMOTE SENSED DATA WE CURRENTLY RECEIVE FROM LANDSAT. WE HAVE ALLOCATED 10.4 MILLION DOLLARS TO THE DEVELOPMENT, WITH

INDUSTRY, OF A DATA PROCESSING SYSTEM WHICH GIVES MORE ACCURATE IMAGERY. 3.9 MILLION DOLLARS HAS BEEN SET ASIDE AS AN INITIAL EFFORT TO BETTER INTEGRATE SATELLITE AND AIRCRAFT REMOTE SENSING DATA WITH OTHER GEOGRAPHIC DATA. THE PROVINCES ALREADY MAKE WIDE USE OF REMOTE-SENSED DATA AND THESE DEVELOPMENTS SHOULD BE OF PARTICULAR INTEREST TO THEM. I WOULD ADD THAT CANADA IS A WORLD LEADER IN GROUND STATION TECHNOLOGY AND PRODUCTION WITH SUCH COMPANIES AS MACDONALD, DETTWILER AND ASSOCIATES LTD OF VANCOUVER AND SED SYSTEMS LTD OF SASKATOON. THE CURRENT SPACE PROGRAM WILL HELP US MAINTAIN OUR LEAD.

THE LSAT, OR LARGE SATELLITE PROGRAM IS AN EXCELLENT EXAMPLE OF THE KINDS OF CO-OPERATIVE VENTURES WE ARE SEEKING AT THE INTERNATIONAL LEVEL. IN FACT, THE LSAT IS THE FIRST MAJOR JOINT PROGRAM WE HAVE HAD WITH EUROPE. IT IS A DIRECT RESULT OF OUR ASSOCIATION WITH THE EUROPEAN SPACE AGENCY, AN ASSOCIATION WE PLAN TO MAINTAIN AND BROADEN. THE TOTAL COST OF OUR PARTICIPATION IN THE LSAT IS $90 MILLION. $68.3 MILLION OF THE ADDITIONAL FUNDS ANNOUNCED TODAY HAVE BEEN ALLOCATED TO CANADA'S PARTICIPATION THROUGH TO 1985.

THIS PARTICIPATION WILL GIVE CANADA ACCESS TO A LARGE SATELLITE PLATFORM FOR FUTURE DOMESTIC AND EXPORT PROGRAMS. IT WILL PROVIDE SALES OPPORTUNITIES FOR OUR SUBSYSTEMS AND COMPONENT INDUSTRIES. IT WILL ULTIMATELY PROVIDE A SIGNIFICANT INCREASE IN CANADIAN INDUSTRIAL ACTIVITY.

A MAJOR JOINT SPACE SCIENCE PROGRAM ANNOUNCED IN 1980 IS CURRENTLY UNDERWAY WITH NASA. SPACE SCIENCE PROVIDES US WITH A BASIC UNDERSTANDING OF THE FUNDAMENTAL NATURE OF SPACE AND IS AT THE CORE OF OUR SPACE EFFORT. IT IS ESSENTIAL FOR THE TRAINING AT OUR UNIVERSITIES OF YOUNG SCIENTISTS AND ENGINEERS WHO WILL BE TAKING JOBS IN OUR FUTURE SPACE PROGRAM.

IN INCREASING ITS FINANCIAL COMMITMENT TO CANADA'S SPACE PROGRAM, THE GOVERNMENT IS REITERATING ITS BELIEF IN THE IMPORTANCE OF SCIENCE AND TECHNOLOGY TO THE SOCIAL, CULTURAL AND ECONOMIC WELL-BEING OF THE COUNTRY; WE ARE REAFFIRMING OUR COMMITMENT TO DEVELOPING A STRONG INDUSTRIAL SECTOR IN HIGH TECHNOLOGY, SO THAT CANADA'S ECONOMIC DEVELOPMENT STRATEGY FOR THE '80'S MAY BE REALIZED. BY CONTINUING TO PLAN AND WORK TOGETHER IN ALL SECTORS - GOVERNMENT, INDUSTRY AND UNIVERSITY - WE WILL ENSURE CANADA'S STRONG POSITION IN SPACE.

FOREWORD

The announcement by the Minister of State for Science and Technology on the space program on December 9, 1981 and this Background Paper are based on proposals for space projects made by the Department of Communications, the Department of Energy, Mines and Resources, the National Research Council, and the Ministry of State for Science and Technology. The proposals were reviewed by the Interdepartmental Committee on Space.

With the announcement of the Federal Budget in November 1981, the government released its policy framework for the Economic Development for Canada in the 1980's. This framework noted that one of the growth areas for the Canadian economy was in the development and exploitation of advanced technology and high productivity goods and services, particularly with respect to major resource development activities. The framework also confirmed the government's intention to support investment activities where the realization of significant development opportunities and economic benefits to Canada as a whole is beyond the capacity of the private sector. The space strategy and expenditure program described herein is one example of how the Government of Canada is taking active steps to implement this policy framework.

INTRODUCTION

The Minister of State for Science and Technology, the Honourable John Roberts, announced on December 9, 1981 that the government was continuing to give high priority to the continued development of the nation's space program. After an extensive review of the possible future scope and directions for the program, the government allocated an additional $132 million for new initiatives during the period 1981/82 to 1984/85. Together with the previously approved programs, these new expenditures mean that the Government of Canada will spend $476 million on space over these four years.

The newly approved space plan for 1982/83 to 1984/85 is described in this Background Paper. The plan continues the priority areas identified in the first three-year plan (1981/82 to 1983/84) announced by Mr. Roberts on April 9, 1981 (reference MOSST Background Paper #19). These areas are: communications applications, remote sensing applications, space science, and technology development. The major new initiatives include:

(a) participation in the Large Satellite program (L-SAT) of the European Space Agency. Through this project, the Canadian Space industry will become, for the first time, major partners with important European high technology companies in the U.K., Italy, the Netherlands, and other countries. The total cost to Canada until 1990 will be some $90 million of which $68.3 million has been allocated up to 1984/85.

(b) phase B of the MSAT program will be undertaken at a cost of $17 million in 1982/83 and 1983/84. This work, managed by the Department of Communications, will involve the engineering and economic studies required to prepare a detailed proposal for a satellite system to provide new communications services for the growing number of mobile communications users in the country.

(c) several projects will be undertaken that will increase the benefits to Canadians of the data from existing or planned remote sensing satellites. These projects will be managed by the Department of Energy, Mines and Resources. $15.7 million has been allocated for this purpose.

SPACE PROGRAM STRATEGY

From the earliest days of the space age, the Canadian government has recognized the vital role it must play in fostering the use of space technology for the economic and social benefit of the country. As a result of this understanding and commitment, Canadians are one of the largest users of space technology in the world (on the basis of satellite capacity per capita) benefiting daily from the application of space technology to communications, weather forecasting, environmental monitoring, and remote sensing for resource management and surveillance. We have achieved an international reputation for excellence in several areas (communications, remote sensing, space science, remote manipulators) and are one of the few countries in the world with a prime contractor capability - that is the industrial capacity and expertise required to design and build complete satellites.

Two basic premises underlie the Canadian space program. The first is that the use of space can contribute significantly to the attainment of social, cultural and economic goals. The second is that there are economic benefits to be obtained from the creation of a strong industry to meet our needs and which is able to compete in the international market place.

Space technologies (and their application to meet needs) are rapidly changing, providing many opportunities for the continuation of the Canadian space program. The challenge is to ensure that our choice of programs reflects the two basic premises in a manner that optimizes the benefits to Canada. The Interdepartmental Committee on Space (ICS) was therefore requested by Cabinet to review the major new programs being proposed by departments, to review the role and prospects of the space industry, and to recommend a long-term strategy for Canada's space program. This comprehensive review took six months and involved extensive consultations with industry. The results of the review form the basis for the space program strategy and expenditure plan announced by Mr. Roberts. The elements of the strategy are as follows.

(a) Continued Exploration of New Applications of Space Technology

Canada will continue to be a major user of space in the future. Because of our geographical size and widely distributed bilingual and multi-cultural population, satellites are admirably suited to the economical delivery of many essential services. Some of these services are provided by the government and thus the government has a strong interest in developing new and economical ways of increasing the effectiveness of the delivery of these services. Even in areas where the government is

not normally the provider of the service, it is often in the public interest for the government to demonstrate the technical and economic viability of new services to the point where commercial operations beneficial to Canada can commence. For these reasons, the exploration of new applications of space technology beneficial to Canada is the cornerstone of the space strategy.

The review of the major service development programs currently under study by departments (MSAT and RADARSAT) identified the potential benefits of these new applications of space technology. Each promises to demonstrate that services beneficial to the continued economic and social development of Canada can be delivered by satellite in a more economical way than alternative means, or in some cases, can only be provided by satellite. Both programs would provide pre-operational demonstration of services (reliable communications to mobile users and ice information respectively) considered essential to the continued exploration and exploitation of resources in the North, including the safe and efficient use of oil and gas tankers. The review concluded that it is worthwhile proceeding with the next step (i.e. phase B, or project definition) in the development of the MSAT program and to continue the phase A and R&D studies for RADARSAT that were announced last April. These two programs promise to be the major applications development thrusts for the Canadian space program for the next ten years.

In addition to the continuation of the two major satellite service demonstration projects, the government has also decided to enhance some of the more operational space programs of departments in order to provide more effective services. In the area of remote sensing, the usefulness of the LANDSAT data for resource management will be considerably enhanced through the development of a new data processing system called MOSAICS (Multi-Observation Satellite Image Correction Systems) and a remote sensing geographical information system as the first phase of a larger program called TOPAS (Terra Observation Pattern Analysis System). In the area of communications, the highly successful ANIK-B pilot project program of the Department of Communications will be extended to further develop new business and other services to operational status.

(b) Continued Development of a Prime Contractor for Satellites

The space program strategy reflects the large potential domestic market for satellite systems during the next ten years. This market is likely to be in excess of $1 billion (1981 dollars). The two Telesat systems currently being procured (ANIK-C and ANIK-D) will require replacement later in this period. During this time, the world-wide use of satellites for direct broadcasting will expand and it can reasonably be expected that Canada will participate in this exciting new application. Also part of the potential market are the two major service demonstration systems just discussed (MSAT and RADARSAT). In addition, the Canadian military is planning major new initiatives in space for the latter part of the decade. This market is a significant opportunity for the continued development of a viable space industry.

The government has confirmed that to obtain the full economic benefits from this potential market Canada should continue to have a prime contractor for satellites. The benefits of such a capability are: (i) a high level and high quality of Canadian content is achieved in domestic programs; (ii) new technologies and proprietary products are generated in Canada leading to significant export sales; (iii) the possibility is opened for collaboration with foreign prime contractors for the exploitation of the expanding international market; and (iv) system level expertise is created which is essential to the development and maintenance of a subsystem design and manufacturing capability throughout the Canadian space industry.

The government is confident of the ability of SPAR Aerospace Limited (SPAR) to continue its development as Canada's prime contractor for satellites. The company took over this role from the government in the mid 1970's, and the recent demonstration of the Canadarm during the second flight of the Columbia marks the successful completion of the Company's first space-related prime contract. SPAR is also nearing the completion of its prime contract with Telesat for the design and manufacture of the ANIK-D satellites. This is the first time that Telesat has procured its satellites from a Canadian supplier: one consequence is that the Canadian content of the ANIK-D satellites (at least 50%) is considerably greater than that of earlier procurements such as ANIK-A (about 13%).

The essence of the strategy for the maintenance of the Canadian prime contractor is to use the prime contractor where appropriate to satisfy the domestic demand for satellites and thereby to develop subsystem and component expertise and products for the export market. The key to success will be the development of advanced technology required by the Canadian prime contractor in the development of mutually beneficial partnership arrangements with foreign prime contractors. Such arrangements would facilitate the export of subsystems and the joint exploitation of the international market for satellites.

Continuation of the prime contractor policy will have significant beneficial effects on many other Canadian space companies through the judicious choice of subcontracts for studies, consultation, and the design and manufacture of subsystems and components. Such a process will assist the continuing growth of the entire space industry which is located in the following provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and Quebec.

The existing space program and some of the new initiatives (e.g. MSAT, LSAT, Subsystem Development Program) when coupled with the prime contractor's expected sales to non-government customers will provide a substantial work load for the prime contractor for at least the next six years.

(c) Strengthened International Relationships in Space

Co-operation with foreign partners in space activities, whether on a bilateral basis (e.g. with the USA) or on a multilateral basis (e.g. with the European Space Agency) is an integral part of Canadian space policy. All of the government's major space projects have been conducted jointly with other nations. This co-operation has permitted Canada to pursue its objectives in space at reduced costs and has given us access to important technology. This international involvement in space has also become a significant element of Canada's foreign policy as space activities gain in international significance, and trade in space-related products increases at a rapid pace.

This successful policy is being extended through closer involvement with the European Space Agency

(ESA). The government has decided to continue participation by Canadian industry in the large satellite (LSAT) and the Earth Resources Satellite (ERS) programs of the European Space Agency. By joining these programs, Canadian industry will be able to develop beneficial commercial relationships with European industry. Substantial follow-on export sales are expected to accrue as a result of our participation in these programs.

To obtain maximum benefit from this expanding relationship with ESA, the government has also allocated funds to continue our general contribution to ESA and intends to establish a Space Counsellor position within the Embassy in Paris specifically to manage our affairs with ESA.

Canadian co-operation with the USA, spanning two decades, has provided advantages to both Canada and the USA. Prime examples of this are the joint space science program, our participation in LANDSAT and SEASAT, the HERMES program, and the Canadarm for the shuttle. Our two countries will continue to share a number of objectives which can be met most effectively through co-operative programs and Canada intends to continue discussions with the appropriate U.S. agencies regarding the possibility of additional joint programs.

(d) Technology Development

Technology development is an essential element of the space program because of the rapidly changing nature of this leading-edge technology. A major thrust of the space plan announced in April was to increase and diversify the technological capability of the Canadian space industry. The new initiatives include several programs that will continue to maintain the technological excellence of Canadian industry and that will enhance our ability to utilize space systems for the benefit of the country. These include the LSAT program, a subsystem development program, and additional support for R&D. Together, these account for about 70% of the funding for new initiatives. These programs are aimed at developing and maintaining an up-to-date technological base in industry and will assist in maintaining the competitiveness of the industry for both domestic and export markets.

IMPLEMENTATION OF STRATEGY

The strategy outlined above will be implemented through a combination of the existing space program and the new program initiatives. This section of the Background Paper summarizes the new initiatives and places these in the context of the total space program. A description of the total space program is beyond the scope of this paper. The interested reader is referred to the Annual Reports of the Interdepartmental Committee on Space or to specific government departments for more information. A listing of the new expenditures is included as Appendix I and a listing of the total space program (new expenditures plus existing programs) is shown in Appendix II. These appendices are summarized in the following two tables.

New Program Expenditures

(millions of budget year dollars)

Program Area	1981/82	82/83	83/84	84/85	TOTAL
Communications	-	8.5	9.0	-	17.5
Remote Sensing	-	1.9	4.9	8.9	15.7
Technology Development	8.7	30.4	31.8	22.2	93.1
Relationship with ESA	-	1.8	1.9	2.1	5.8
TOTAL	**8.7**	**42.6**	**47.6**	**33.2**	**132.1**

Total Space Program Expenditures

(millions of budget year dollars)

	1981/82	82/83	83/84	84/85	TOTAL
Communications Program	22.8	29.3	32.8	18.7	103.6
Remote Sensing Program	26.3	42.2	35.4	31.8	135.7
Space Science	11.8	19.1	21.1	20.9	72.9
Technology Development	34.1	44.5	44.8	32.7	156.1
Relationship with ESA	1.7	1.8	1.9	2.1	7.5
TOTAL	**96.7**	**136.9**	**136.0**	**106.2**	**475.8**

NOTE: the total expenditures for the next three fiscal years (1982/83 to 1984/85) will be $379.1 million.

(a) Communications Program

The objective of this program is to foster the development of new and improved satellite communications for the benefit of Canada. The initiatives include:

(i) Definition Phase (Phase B) of MSAT

$17 million has been allocated to the Department of Communications to prepare a detailed proposal for a mobile communications satellite demonstration project. The project envisages the design, construction and launch as early as 1987 of a pre-operational satellite capable of demonstrating communications services to, and among, mobile users such as ships, aircraft, vehicles, and transportable installations, particularly in rural and remote areas where ground-based facilities are either inadequate or non-existent. Potential users include resource industries, federal and provincial governments, and the general public.

Once in orbit, the MSAT demonstration system would be used for communications experiments, service development and pre-operational services to vehi-

cles, ships, aircraft and compact portable terminals. The post-launch communications program would be aimed at demonstrating and establishing the viability of mobile satellite services and providing limited interim operational service pending launch of a follow-on commercial system in the early 1990's. It would have the following objectives:

- To foster the development and introduction of new satellite telecommunications services and systems for mobile users by supporting demonstrations, experiments, pilot projects and trials designed to develop awareness, knowledge and expertise and by consolidating the results of these activities to assess the viability of these new services and systems;

- To facilitate the introduction of new mobile telecommunications services on commercial satellite systems in Canada by exploring and providing means to aggregate user needs and by providing a vehicle for limited interim service delivery before a follow-on commercial system becomes available;

- To support the advancement of Canadian capability in satellite communications technology and service delivery by assisting Canadian user institutions, industry and the carrier to respond to national needs and international market opportunities; and

- To stimulate telecommunications policy development by identifying issues and providing relevant data.

(ii) Satellite Service Development

$0.5 million has been allocated to the Department of Communications for the further development of telecommunications services through the extension of the successful pilot project program using the ANIK-B satellite.

(b) Remote Sensing Program

The objectives of this program are to promote the use of satellites for resource management and territorial and environmental surveillance, and to establish and maintain up-to-date information sys-

tems that will encourage the effective use of remote sensing satellites. The initiatives include:

(i) Continuation of RADARSAT Studies

The Phase A studies and the R&D program initiated last April (at a cost of $17 million) by the Department of Energy, Mines and Resources will continue. No new funds are required at this time. These are aimed at developing the concepts for a pre-operational radar satellite project to demonstrate the usefulness of a synthetic aperture radar (SAR) sensor for monitoring ice coverage and drift and for assisting in the surveillance of ocean pollution and land resources. The SAR is of particular interest to operations in the Canadian Arctic and coastal waters because of the fact that the sensor produces high resolution, map-like images of the earth and oceans irrespective of cloud, fog, or darkness.

The RADARSAT program envisages the design, construction and launch in the late 1980's or early 1990's of a polar-orbiting satellite carrying a SAR sensor. The data from the satellite would be augmented by radar equipped aircraft. A special ground-based information centre would merge this information with the environmental and meteorological data and transmit it to users such as Arctic oil and gas shipping operators. The satellite would provide coverage of the environmentally hazardous regions in the Northwest Passage and coast of Labrador. Major benefits of the system will also occur in agricultural, geological and oceanographic application of the data.

The objectives of the RADARSAT program are:

- To support energy projects in the Arctic and offshore through the development of an imaging radar satellite system, capable of providing all-weather sea ice information (day or night, through fog and cloud) for the safe and efficient extraction and transportation of Arctic oil, gas and minerals by the late 1980's;

- To provide independent Canadian data on its own land mass for geological exploration, forest management and environmental monitoring, and as an option, world data of major value to the Canadian economy; and

- To give Canadian industry entry to the market for earth observation satellite systems, which is now

in the situation which existed 10 years ago in the telecommunications area.

(ii) Phase B of European Remote Sensing Program

An additional $1.4 million has been allocated to the Department of Energy, Mines and Resources to permit Canada to continue its participation in phase B of the European Remote Sensing Program (ERS). Canada has been participating in this program since 1980 and a recent restructuring and extension of the program by ESA means that the additional funds will be required to maintain our participation in the program. The European Remote Sensing Program is an attractive means for Canada to meet some of its future needs for remote sensing data.

(iii) Multi-Observation Satellite Image Correction Systems (MOSAICS)

$10.4 million has been allocated to the Department of Energy, Mines and Resources for the development with industry of a data processing system for the precision correction of remote sensing imagery. The objective of the program is to improve the usefulness of available data by eliminating errors and improving accuracy (from about 300 metres to 50 metres), thereby facilitating its integration with other high-quality data.

(iv) Phase 1 of the Terra Observation Pattern Analysis System (TOPAS)

$3.9 million has been allocated to the Department of Energy, Mines and Resources for the development of a remote sensing geographical information system. This system will be the first phase of a larger program (TOPAS) which will provide a methodology and procedure for integrating satellite and aircraft remote sensing data with other geographic data. The objective of this program is to provide a more comprehensive data base for resource and environmental management systems in the country.

(c) Technology Development Program

The new initiatives in this program include:

(i) Continuation in the LSAT program of ESA

$68.3 million has been allocated over the period 1981/82 to 1984/85 to permit Canada to participate in the design and manufacturing phases of the LSAT program. LSAT is a multipurpose satellite platform designed as a widely marketable product able to carry a wide range of experimental and applications payloads. Canada has participated in the program since 1979, through the Department of Communications.

Canadian objectives in participating in LSAT include:

- obtaining access to a large satellite platform by the Canadian prime contractor for future domestic and export programs; and
- developing follow-on sales opportunities for spacecraft subsystems and components.

Canadian industrial participation in the program includes:

- spacecraft system design, integration and test at the David Florida Laboratory of the Department of Communications;
- design and construction of the solar array subsystem; and
- provision of some communications payload components.

(ii) Subsystem Development Program

$18.8 million has been allocated to this program. The objective is to support the development and maintenance of the electronic subsystem design and manufacturing capability of the Canadian prime contractor. The program will enhance the capability of the prime contractor to develop competitive and marketable satellite subsystems and products. Possible projects include: follow-on production of three additional communications transponders for the international joint Search and Rescue Satellite (SARSAT) program; advanced technology development for the INTELSAT VI program; additional payload items for LSAT; and advanced work on satellite receivers.

(iii) R&D Support

$6.0 million has been allocated to the Department of Communications for additional R&D support for the Canadian space industry. This support will enable the industry to develop the technology required to meet Canada's need for future satellite communications systems by continuing the accelerated industry R&D program that was announced in April. The program is intended to cover the areas of systems R&D and the development of specific products which are not covered by existing R&D programs.

(d) Space Science Program

In addition to contributing to man's knowledge of his universe, the space science program provides the scientific knowledge that is the basis of Canada's space effort and helps train young scientists and engineers in a variety of space disciplines. A major joint space science program, announced in 1980, is currently underway with NASA and will continue for several more years. Space science is being funded at a level which is approximately 15% of the overall space program, a level which acknowledges the significant contribution space science makes to a vigorous space program.

(e) Relationship with ESA

$5.8 million has been allocated to maintain Canada's contribution to the general studies program of ESA (a prerequisite of participation in major programs of ESA such as LSAT and ERS) and to establish a permanent Space Counsellor position in the Canadian Embassy in Paris. A significant portion of these funds will be returned to Canadian industry in the form of study contracts for ESA. The Space Counsellor will be concerned with looking after Canada's interests in ESA and our bilateral cooperation in space with various European countries.

CONCLUSION

The applications of space technology that will be pursued as a result of these new space initiatives have great promise in the provision of improved communications and information

services essential to most of the major resource development and management activities foreseen in Canada. The space program is at the leading-edge of a number of high technology areas ranging from systems design to micro-electronics. The industrial strategy for space is geared to the continuing development of a successful export oriented high technology industry that is located in several provinces.

A major thrust of the new space initiatives is the undertaking of the next step in the MSAT program. It has also been decided to continue the RADARSAT phase A studies. Full implementation of these programs, however, will be very expensive (it is estimated that each will cost about 400 million budget year dollars spread over four or five years in order to complete). Decisions to proceed with full implementation can only be taken following the conclusion of phase B activities which will, inter alia, investigate ways and means of reducing the cost of the programs to the government.

Another major thrust of the new initiatives is the strengthening of our international relationships in space through the conduct of joint programs. The most significant step in this direction is the decision to join the full LSAT program of ESA. The government has also decided to continue participation in the European Remote Sensing Program. Finally, it is intended to discuss further with NASA and other American agencies the possibility of additional joint programs.

In taking these decisions, the government is reiterating its belief in the importance of science and technology to the well-being and future economic prosperity of the country; it is renewing its commitment to the development of a strong industrial sector in high-technology; it is also selecting space as one sector which is particularly relevant to Canadian needs, and one that deserves specific attention and support. By continuing to plan and to work together - government, the manufacturing industry, the operating industry and universities - Canadians will be able to reap the tremendous potential of space technology.

APPENDIX I

ALLOCATION OF NEW FUNDS (1981/82 - 1984/85)

	MILLIONS OF BUDGET YEAR DOLLARS				
	81/82	82/83	83/84	84/85	TOTAL
TECHNOLOGY DEVELOPMENT PROGRAM					
L-SAT Phases C/D	6.9	24.4	23.8	13.2	68.3
Subsystem Development	1.8	5.0	6.0	6.0	18.8
R&D Support	-	1.0	2.0	3.0	6.0
Sub-total	8.7	30.4	31.8	22.2	93.1
REMOTE SENSING PROGRAM					
ERS-1 Phase B	-	0.4	1.0	-	1.4
MOSAICS	-	1.3	3.2	5.9	10.4
TOPAS (phase 1)	-	0.2	0.7	3.0	3.9
Sub-total	-	1.9	4.9	8.9	15.7
COMMUNICATIONS PROGRAMS					
MSAT Phase B	-	8.0	9.0	-	17.0
Satellite Service Development	-	0.5	-	-	0.5
Sub-total	-	8.5	9.0	-	17.5
RELATIONSHIP WITH ESA		1.8	1.9	2.1	5.8
TOTAL	**8.7**	**42.6**	**47.6**	**33.2**	**132.1**

APPENDIX II

TOTAL SPACE PROGRAM EXPENDITURES (1981/82 - 1984/85)

	MILLIONS OF BUDGET YEAR DOLLARS				
	81/82	82/83	83/84	84/85	TOTAL
Communications Program					
Military Communications and Navigation	3.1	5.3	5.6	4.1	18.1
Search and Rescue Satellite	2.0	1.3	1.9	-	5.2
Civil Aeronautical and Maritime	0.1	0.1	3.6	1.1	4.9
ANIK-B Experimental Program	3.3	2.1	-	-	5.4
Mobile Satellite (M-SAT) Planning	1.7	8.0	9.0	-	18.7
Direct Broadcast Satellite Planning	0.8	0.8	-	-	1.6
David Florida Laboratory	3.0	1.4	1.5	1.7	7.6
Laboratory Equipment	0.3	0.4	0.4	0.4	1.5
High Reliability Laboratory	0.3	-	-	-	0.3
Spectrum and Orbit Planning	0.1	0.1	0.1	-	0.3
Controls Laboratory	0.2	0.1	0.1	-	0.4
EHF Technology Equipment	0.1	0.3	0.2	-	0.6
Operating Costs (DOC)	2.5	3.0	3.3	3.6	12.4
Salaries (DOC)	5.3	6.4	7.1	7.8	26.6
Sub-total	**22.8**	**29.3**	**32.8**	**18.7**	**103.6**

APPENDIX II (cont'd)

TOTAL SPACE PROGRAM EXPENDITURES (1981/82 - 1984/85)

	81/82	82/83	83/84	84/85	TOTAL
Remote Sensing Program					
Provision of LANDSAT Data	2.8	3.3	3.5	3.5	13.1
LANDSAT Station Upgrade	1.6	7.8	4.7	1.8	15.9
MOSAICS	-	1.3	3.2	5.9	10.4
TOPAS (phase 1)	-	0.2	0.7	3.0	3.9
ESA Remote Sensing Program	2.3	2.7	1.0	-	6.0
RADARSAT Planning	3.2	8.9	5.1	-	17.2
Airborne Remote Sensing Applications	2.7	2.6	2.5	2.4	10.2
Remote Sensing R&D	2.8	2.6	2.5	2.7	10.6
Assistance to Users of Data	0.7	0.8	0.9	0.9	3.3
Technology Transfer	0.1	0.2	0.2	0.2	0.7
Oceonographic and Fisheries Applications	0.8	1.0	0.8	0.8	3.4
Meteorological Satellite R&D	1.3	1.6	1.6	1.8	6.3
Provision of Meteorological Satellite Data	4.4	4.5	3.7	3.6	16.2
Monitoring Ozone Layer	0.2	0.7	0.8	0.8	2.5
CCRS Operating Costs	3.4	4.0	4.2	4.4	16.0
Sub-total	**26.3**	**42.2**	**35.4**	**31.8**	**135.7**
Space Science Program					
International Cooperative Projects	4.0	9.4	10.5	9.2	33.1
Research Facilities	5.2	6.7	7.3	7.9	27.1
Herzberg Institute	0.5	0.6	0.6	0.7	2.4
Salaries (NRC)	2.1	2.4	2.7	3.1	10.3
Sub-total	**11.8**	**19.1**	**21.1**	**20.9**	**72.9**

APPENDIX II (cont'd)

TOTAL SPACE PROGRAM EXPENDITURES (1981/82 - 1984/85)

	81/82	82/83	83/84	84/85	TOTAL
Technology Development Program					
LSAT (DOC)	10.2	24.4	23.8	13.2	71.6
Subsystem Development	1.8	5.0	6.0	6.0	18.8
R&D Support (DOC)	2.0	1.0	2.0	3.0	8.0
ANNEX-C and -D Support (DOC)	2.8	1.7	0.4	0.3	5.2
International Technical and Bid Support (DOC)	1.5	1.7	1.8	2.0	7.0
Key Technology Program (DOC & EMR)	3.0	1.0	-	-	4.0
DOC Technology Development Program	3.2	2.8	2.8	4.0	12.8
Space Industry Support (ITC)[1]	3.7	3.8	3.9	4.0	15.4
Gallium Arsenide Device Development[2]	0.1	0.5	0.3	0.2	1.1
Remote Manipulator System (NRC)	5.8	2.6	3.8	-	12.2
Sub-total	**34.1**	**44.5**	**44.8**	**32.7**	**156.1**
Relationship with ESA	**1.7**	**1.8**	**1.9**	**2.1**	**7.5**
GRAND TOTAL	**96.7**	**136.9**	**136.0**	**106.2**	**475.8**

Footnotes

[1] Defence Industry Productivity Program (DIPP), Enterprise Development Program (EDP), and Program for Export Market Development (PEMD).

[2] Joint Program with DND and DOC. Funding shown is DOC share.