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THE 1ST ANNUAL REPORT
OF THE
INTERDEPARTMENTAL COMMITTEE ON SPACE (ICS)

Submitted to:

The Honourable C. M. Drury,
Chairman of the Cabinet Committee
on Science Policy and Technology

February 1, 1970

January 30, 1970

The Honourable C.M. Drury,
Chairman,
Cabinet Committee on Science Policy and Technology.

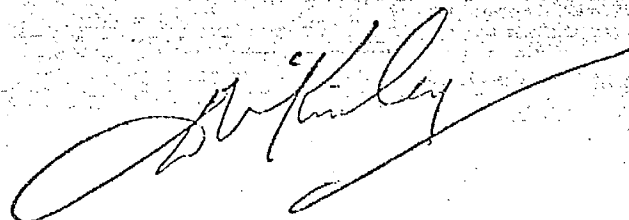
Dear Mr. Drury:

By its terms of reference the Interdepartmental Committee on Space (ICS) is required to report annually on February 1st to the Chairman of the Cabinet Committee on Science Policy and Technology (CCSPT). In compliance with those terms I have the honour to transmit to you, through the Secretary of the CCSPT, two copies of the 1st Annual Report of the Interdepartmental Committee on Space, February 1st, 1970.

The ICS held its first meeting on January 20, 1970. Several items of business raised at that meeting will likely lead to specific proposals and recommendations being offered for your consideration in the months to come, but the Committee members felt that it would be unwise to attempt to include those in the Annual Report. Therefore, you will find that the Report is concerned mainly with a brief review of Canadian space activities and expenditures in 1969, and planned for 1970.

The Secretary of the ICS, Dr. David Low, has done all the work of preparing this Report in the limited time available.

Yours sincerely,



D.W.R. McKinley,
Chairman,
Interdepartmental Committee on Space

DWRMcK/gcf

Attach.

PURPOSE AND TERMS OF REFERENCE OF THE ICS

All federal space activity must draw upon common resources of technology, qualified personnel, industrial capacity and funds. The development of such activity has proceeded along the lines of departmental and agency interests and responsibilities and as a result there are essentially independent space activities in scientific research, defence, communications, resource management and meteorology. The ICS was formed in December, 1969 to provide a means of improving the coordination of planning, the use of resources and the balance of development among activities.

Under its terms of reference, which are appended to this Report, the ICS will advise on policy and planning for Canadian space activity, based on continuing review and assessment, to ensure the coordinated development of government, university and industrial activities and international cooperation.

A more detailed account of many aspects of the past year's space operations may be found in the document "Space and Upper Atmosphere Research in Canada - Balloons, Rockets and Satellites - 1969" by William H. Waters of the National Research Council's Space Research Facilities Branch.

SPACE ACTIVITIES CONDUCTED IN 1969 AND PROPOSED FOR 1970

1. GOVERNMENT

Department of Communications

In the Alouette - ISIS satellite program designed to conduct comprehensive studies of the ionosphere, three successful satellites have been developed and built in Canada over the past eight years and a fourth ISIS B is scheduled to be launched in late 1970. This interval has seen progress in the development of topside sounding satellites from Alouette I with four experiments to ISIS B with twelve experiments. The satellites are now designed and built in Canadian industry under the design authority of the Department's Communications Research Centre. ISIS I launched on 30 January, 1969 is operating about 9½ hours per day and with the use of an onboard programmer and tape recorder is collecting useful data on the ionosphere over previously unexplored regions of the globe.

In support of the ISIS program, the Communications Research Centre operates two telemetry stations situated at Resolute Bay and at Ottawa and a data processing centre also at Ottawa. The Centre has also continued its research in micro-electronics and space mechanics to back up Canadian spacecraft design and development capabilities.

In October, 1969 the government decided that efforts should be diverted from ionospheric studies to satellite technology programs and that the Department of Communications should have responsibility for planning and implementing a communications technology satellite program.

The satellite will be constructed in Canadian industry beginning in 1970 and will demonstrate advanced communications for remote areas, community broadcast and space mechanics subsystems important in the design of later operational satellites.

Department of Energy, Mines and Resources

The Geological Survey of Canada was selected by NASA (National Aeronautics and Space Administration) to receive lunar samples from the Apollo missions. Five Geological Survey scientists have investigated the elemental composition of the lunar material brought back by Apollo XI as a basis for interpreting the information obtained from other studies of the material. The Survey is now working on lunar samples from Apollo XII.

In July 1969, cabinet approval was obtained for the Department to organize an Interdepartmental Committee on Resource Satellites and Remote Airborne Sensing supported by a Program Planning Office. The Office will prepare program forecasts and estimates for a Resource Satellite and Remote Airborne Sensing Program and will plan and recommend an organization to manage the program when approved. The Interdepartmental Committee was set up in September and the Program Planning Office in October. A budget for 1970-71 has been approved, and a number of specialized working groups organized including one to discuss a proposed Centre for Remote Airborne Sensing.

The Division of Geomagnetism, Observatories Branch, is operating four unattended magnetic observatories in northern Manitoba in a cooperative experiment involving NASA's synchronous satellite ATS-5. The experiment is expected to provide important new information on the interactions of the solar wind with the geomagnetic field.

Department of Industry, Trade and Commerce

During 1969, the Department supported some industrial activity in the space field which included the development of meteorological rockets at Bristol Aerospace Limited, the development of ground stations for satellite communication at RCA Limited and the development of transponder testing equipment at Northern Electric. This support is continuing in 1970 with the addition of a development program for space manufacturing equipment at RCA.

Department of Transport

Meteorological Branch

The primary interest of the Meteorological Branch in space has been weather satellites. The Research and Development Project on Automatic Picture Transmission (APT) continued throughout the year and the Satellite Data Laboratory at Toronto International Airport continues to receive, evaluate, study and apply satellite data from the U.S. meteorological spacecraft. Routine daily receptions are archived on magnetic tape and data, in photographic picture form, are being used for operational forecast purposes at Toronto, Montreal and Winnipeg. Pictures are distributed, by mail, for ice reconnaissance at Ice Forecast Central, Halifax, and data are also provided to other interested agencies. The Ice Central uses the satellite photographs to supplement data obtained by aerial ice reconnaissance for preparation of ice forecasts and advisories. The infra-red readout system of the Nimbus III experimental weather spacecraft is providing night time infra-red data in pictorial format. Studies indicate that useful surface temperature data, particularly over water bodies, can be derived.

During 1970, interest will be centred on the infra-red read-out system and in the interpretation of data. It is hoped to modify the present equipment so that three passes giving total North American night time coverage can be obtained using unattended operation.

Telecommunications and Electronics Branch

The Branch is conducting experiments with a U.S. Applications Technology Satellite (ATS-3) in communications between aircraft, ships and earth stations. These experiments will continue in 1970 with ATS-3 and ATS-5 using a monitoring station at Frobisher Bay which will operate in the very high frequency range permitting evaluation of the transmission and reception of signals under auroral conditions.

Studies of the application of satellites to air and marine navigation, communications and traffic control are underway in support of the Branch's participation in the ASTRA (Application of Satellite Techniques Related to Aviation) Panel established by ICAO (International Civil Aviation Organization).

Defence Research Board

At the Defence Research Establishment Valcartier (DREV) there are three groups engaged in space related activities. One group is involved in studies of solar-terrestrial relationships, particularly on the radiative exchange processes in the region from 10 to 60 statute miles where most of the solar energy driving the atmosphere is deposited. A current joint activity with the U.S. Advanced Research Projects Agency is making use of

a high altitude aircraft to study latitudinal effects in the western hemisphere. Aircraft borne experiments will continue in 1970. Much of the work forms part of CRAM (Centre de recherches sur les atomes et les molécules) which includes scientists from DREV and Laval University. DREV supports other atmospheric studies under contract at the Universities of York, Saskatchewan and Montreal.

A second group is concerned with the development of improved solid propellants and high performance rocket motor systems. The development of the Black Brant series of rocket motors was conducted jointly by DREV and Bristol Aerospace Ltd. who are now cooperating on a second program aimed at developing two small rocket motors to be used for meteorological soundings. A third group at DREV is working on the physics of satellite re-entry into the atmosphere.

The Defence Research Board also supports, in conjunction with the Department of National Defence, a program to develop a tactical satellite communications system. Much of the work is undertaken by the Communications Research Centre of the Department of Communications under contract to the Board. The program is conducted in cooperation with the United States and other NATO countries.

National Research Council

During 1969, 24 Canadian rockets sponsored by the Space Research Facilities Branch of the National Research Council, carried 129 experiments to heights ranging from 36 to 525 statute miles to make measurements under

quiet and disturbed conditions in auroral and non-auroral areas. With the exception of four Black Brant rockets launched at Resolute Bay, all launchings took place from the Churchill Research Range.

Experiments supplied by Divisions of the National Research Council which were carried in rockets included plasma probes to measure electron densities at locations within an auroral display, particle collectors, micrometeorite detectors, photometers and cosmic ray and proton spectrometers. Similar experiments are planned for 1970. As part of the program to study charged particles, experiments were also flown on the Alouette - ISIS satellites.

In October, 1969 the United States announced that its direct support of the Range under the existing intergovernmental agreement would be phased out by the end of June, 1970. The National Research Council will continue to carry out a reduced range operation for Canadian experimenters, while retaining a limited capability to launch a few U.S. rockets on a per-shot repayment basis.

The National Research Council will launch four Black Brant III rockets from a temporary launch site at East Quoddy, Nova Scotia, during the March 7, 1970 eclipse of the sun to measure ionization changes in the upper atmosphere.

2. UNIVERSITIES

During 1969, seven Canadian Universities had active space programs using balloons, rockets and satellites.

University of British Columbia

The future of a high altitude balloon program carried out in cooperation with the Defence Research Establishment Valcartier is presently under review. The rocket program to measure cosmic background radiation is continuing.

University of Calgary

Balloon and rocket studies have continued on auroral X-rays in conjunction with simultaneous observations of auroral emissions in the vicinity of rockets made with high speed spatial-scanning photometers. A similar instrument is being prepared for the satellite ISIS B.

Université de Montréal

Work continued in 1969 on the development and testing of the radio frequency electron energy probe. Three rocket flights are planned for 1970.

University of Saskatchewan

Rocket experiments to measure electron densities at 30 - 75 miles, winds at 40 - 75 miles and atmospheric gravity waves were flown in 1969. Supervision of payloads at Churchill Research Range and reduction and analysis of telemetered data have been carried out.

University of Toronto

New instruments which will be flown in April, 1970 have been developed to measure density, temperature and composition of the atmosphere above 35 miles. Work associated with the requirements of earth resource satellites is also underway.

University of Western Ontario

The structure of upper atmospheric space and solar plasmas has been studied using radio waves emitted naturally by the sun and transmitted by both rocket-borne and satellite-borne transmitters.

York University

Rocket experiments to record the spectrum of an aurora and to measure oxygen atom profiles were conducted in 1969 and will continue in 1970. York is cooperating with Culham Laboratory, Imperial College and Harvard College Observatory in a solar eclipse rocket flight from Wallops Island on 7 March 1970.

3. INDUSTRY

Barringer Research Limited

Under contracts from the Department of Energy, Mines and Resources and NASA, Barringer has investigated the high altitude capability of the Barringer Correlation Spectrometer to detect the SO_2 and NO_2 content of the air above cities and industrial areas. In September 1969, a high altitude balloon containing the Spectrometer was floated over Chicago and operated successfully.

Bristol Aerospace (1968) Limited

A total of 36 Black Brant rockets were launched in 1969. Scheduled for early 1970 is the launching of seven Black Brants from the Andoya Rocket Range in Norway for the Max-Planck Institutes of West Germany. In addition to vehicle production, Bristol has developed a complete line

of rocket telemetry equipment including electronic integration and checkout facilities. Because of the increasing use of highly sophisticated and specialized payloads, a payload recovery system for all Black Brant rockets is now under development. Bristol is continuing in 1970 its development work on a small meteorological rocket.

Computing Devices of Canada Limited

Two research programs are currently being undertaken on behalf of NASA which involve experimental verification that the flash of light produced during meteoroid impact can be spectroscopically analyzed to give information on the meteoroid's composition, size and velocity. Tests will be made using Computing Devices' high acceleration test facilities.

Northern Electric Company Limited

In June 1969, the Minister of Communications announced that RCA Limited would be given the major contract for the Program Definition Phase of Canada's Domestic Communications Satellite, with Northern Electric acting as sub-contractor in the design of the communications transponder portion of the spacecraft. It is expected that contracts for construction of the satellite based on the results of the Program Definition Phase will be awarded shortly by Telesat Canada.

Northern Electric is also engaged in research and development aimed at providing space systems, sub-systems and components for domestic and international use. A recent development is an audio-video combining technique which will increase the overall economy of a domestic satellite.

Other developments will enhance the reliability and performance of satellite ground stations.

During 1969, Northern Electric tested a new type of ground station, designed for Arctic and sub-Arctic use, at Bouchette, Quebec. This type of station, known as ARCOM, is principally intended for use at centers in the Arctic that have transmit and receive requirements. A second smaller type of ground station has been developed for television reception in remote areas.

RCA Limited

Current space activity is widely based in the two fields of ionospheric research and communication satellites. For ISIS I which was launched in January 1969, RCA was prime contractor constructing all major sub-systems including the ionosphere sounder experiment and sub-contracting the air-frame and sounder antennas. In addition to being prime contractor for ISIS B due to be launched in 1970, RCA is providing two of the scientific experiments. As a result of technology developed on the ISIS program, RCA is bidding on a NASA contract to provide a low frequency sounder for use on the moon. In June 1969, as previously mentioned, RCA was awarded a contract for the Program Definition Phase of the domestic communications satellite and negotiations are now underway with Telesat for the construction phase.

In February 1969, RCA completed a second ground station at Mill Village, Nova Scotia designed for operation with the INTELSAT system and with NASA's Advanced Technology Satellites (ATS).

The research group at RCA has obtained contracts from Canadian and United States government agencies for theoretical and laboratory investigations of space problems. For the past six months, the group has also been working on a satellite carbon dioxide laser communication system.

Spar Aerospace Products Limited

During 1969, most of the work at Spar relating to space has been in the field of STEM (Storable Tubular Extendible Member) devices. These included the use of STEM devices in the Apollo program and in the British, French and Japanese space programs. Spar also undertook work on spacecraft including the structure and antenna units for the ISIS B prototype and flight units and engineering models for the two optical experiments on ISIS B. On the Telesat program, Spar is participating with RCA Limited in the Program Definition Phase in the fields of spacecraft layout, structural and thermal analysis and the design of the power systems and ground service equipment.

4. TELESAT CANADA

During 1969, government legislation creating the Telecommunications Satellite Corporation (Telesat Canada) was passed and a president and provisional Board of Directors were appointed. Although regulatory control will remain with the government, Telesat is scheduled to be owned jointly by the common carriers, the public and the government. With the establishment

of Telesat Canada, responsibility for the domestic communications satellite program was transferred from the government project office set up in 1968 to the new corporation. As mentioned, the contract and a major sub-contract for the Program Definition Phase were awarded to RCA Limited and Northern Electric respectively and negotiations of the construction contract for the satellite are now underway. Plans are proceeding on the basis of a launch date for early 1972.

5. INTERNATIONAL

INTELSAT

Member nations of INTELSAT assembled at various times in 1969 in Washington to work out a permanent agreement for a global satellite communications system. Members have been divided on the question of the permanent management organization of INTELSAT, particularly on the future role of the U.S. firm COMSAT (the Communications Satellite Corporation), the present system manager. Canada, through representation from the Departments of External Affairs and Communications, has been active in the negotiations which are continuing into 1970.

The Canadian Overseas Telecommunications Corporation (COTC), Canada's designated representative on INTELSAT, operates the Mill Village earth station completed by RCA Limited in February 1969. In 1971, it is anticipated that the INTELSAT III satellite now positioned over the Atlantic will be replaced by INTELSAT IV and that new equipment will be installed at the Mill Village station to accommodate its greater capacity.

United Nations Committee on the Peaceful Uses of Outer Space

Canada is continuing to participate actively in the work of this Committee. The working group on direct broadcast satellites held two meetings in 1969 which considered joint papers by Canada and Sweden and will meet again in 1970. The thirteenth session of the Committee was held in New York in January, 1970.

Canadian Rocket Launchings

A number of experiments were carried in Canadian rockets for the United States, Sweden, France, West Germany and the United Kingdom.

STATEMENT OF FEDERAL GOVERNMENT EXPENDITURES
(\$ MILLIONS) ON SPACE ACTIVITIES, 1969-70 AND 1970-71 (PROPOSED)

Department of Communications

	<u>1969-70</u>	<u>1970-71</u>
Spacecraft Technology (including ground support)	6.181 ¹	6.335 ³
Satellite Communications Systems	0.260 ²	0.911 ⁴
Scientific Research Utilizing Satellites	0.548	0.730
Scientific Research Utilizing Rockets	0.096	0.012
Totals	<u>7.085</u>	<u>7.988</u>

1. \$0.626 million recoverable from Telesat Canada included.
2. \$0.218 million recoverable from DND/DRB not included.
3. \$0.200 million recoverable from Telesat Canada included.
4. \$0.225 million recoverable from DND/DRB not included.

Department of Energy, Mines and Resources

	<u>1969-70</u>	<u>1970-71</u>
Lunar Rock Sample Studies	0.021	0.011
Satellite Geomagnetic Studies	0.023	0.035
Resource Satellites	0.045 ¹	0.640 ²
Totals	<u>0.089</u>	<u>0.686</u>

1. This figure includes \$0.030 million for remote sensor R and D for aircraft and/or satellites.
2. This figure includes \$0.290 million for remote sensor R and D for aircraft and/or satellites and \$0.260 million to prepare for reading out NASA's earth resources satellite (ERTS).

Department of Industry, Trade and Commerce

	<u>1969-70</u>	<u>1970-71</u>
Satellite Communications Systems (Industrial Grants)	0.320	0.786
Rocket Development (Industrial Grants)	0.397	0.545
Totals	<u>0.717</u>	<u>1.331</u>

Department of Transport

	<u>1969-70</u>	<u>1970-71</u>
Space Related Meteorological Activities	<u>0.100</u>	<u>0.100</u>

Department of National Defence/Defence Research Board

	<u>1969-70</u>	<u>1970-71</u>
Rocket Technology	0.100	0.090
Satellite Communications (Amount Undertaken at DOC/CRC)	0.360 (0.218)	0.350 (0.225)
Space Related Research	0.139	0.125
Totals	<u>0.599</u>	<u>0.565</u>

National Research Council

	<u>1969-70</u>	<u>1970-71</u>
Space Research Facilities Branch (Operation of Churchill Research Range and Support of Rocket Program)	4.280	2.220
NRC Scientific Divisions (Rocket and Satellite Experiments)	1.480	1.100
Awards to University Staff	1.250	0.800
Totals	<u>7.010</u>	<u>4.120</u>

TERMS OF REFERENCE

INTERDEPARTMENTAL COMMITTEE ON SPACE

DEFINITIONS:

For the purposes of the Interdepartmental Committee on Space, space is defined as the upper atmosphere and space above a lower limit of 50 Kilometres altitude. Space activity includes research or other operations conducted by means of rockets, satellites, high altitude balloons, or other devices, and including associated ground-based activity.

ORGANIZATION:

- 1. The Committee shall be composed of senior officials, able to speak for their department on policy matters, and representing:

- Department of Communications
- Department of Energy, Mines and Resources
- Department of Industry, Trade and Commerce
- Department of Transport
- Department of National Health and Welfare (Health)
- Defence Research Board
- National Research Council

- 2. Observer status shall be accorded representatives of:

- Science Secretariat
- Treasury Board Secretariat
- Department of External Affairs

- 3. The Chairman shall be named by the Committee.

- 4. The Committee shall have the power to establish sub-committees in areas of special interest, and the sub-committees should include representatives of other departments and agencies, industry, and universities as desirable and necessary.

- 5. The Committee shall report to the Chairman, Cabinet Committee on Science Policy and Technology, through the Secretary, CCSPT.

DUTIES:

1. To review Canadian space activity including that of Federal Government departments and agencies, the universities, and industry and to make recommendations concerning the optimum use of resources, the coordination of space activity and the dissemination of information of such space activity.
2. To consider Federal policy for space activity in relation to national interests, needs and opportunities and to formulate and recommend appropriate plans and proposals.
3. To make recommendations for the promotion of cooperation in the space activities of national and international organizations.
4. To report annually, on February 1st, or more often if desirable, to the Chairman of the Cabinet Committee on Science Policy and Technology.