BRIEFING PAPERS FOR THE SCIENCE AND TECHNOLOGY MISSION TO JAPAN

8 - 15 MARCH, 1972

Ministry of State

Science and Technology

Ministère d'Etat

Sciences et Technologie

Ministry of State for Science & Technology — February 28, 1972

ERRATA

Please make the following amendments to the Briefing Papers for the Science & Technology Mission to Japan, March 8-15,1972.

Page 5

Delete "W.K. Wardroper and Title"

Insert "Mr. J. M. Harrington - Director
Pacific Division
Department of External Affairs
Ottawa, Ontario"

Page 7

Directly above 21, C.B. Lewis insert

"SECTOR VI - TRANSPORTATION"

Page 11

Delete "Dr. J. R. Whitehead and Title."
Below Mr. B. A. Walker insert "(Sector Leader)"

Page 103

In Title, delete "IFORMATION"

insert "INFORMATION"

Page 252

Line 13 - Table 1 has inadvertently been printed on Page 258.

Page 258

Table 1 - This Table should be read in conjunction with the reference to it on page 252, line 13.

Page 273

At bottom of page insert "Published May 1971"

Copy No.

SCIENCE AND TECHNOLOGY MISSION
TO JAPAN
8-15 MARCH, 1972

A cause du temps limité
et du manque de personnel
il nous a été impossible de préparer
ces exposés dans l'autre langue officielle.

Due to a shortage of time
and staff it has not been
possible to prepare this briefing
book in the other official language.

Ministre d'État
Science et technologie

Ministry of State
Science and Technology

Hon. Alastair Gillespie – Minister

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A

SCIENCE AND TECHNOLOGY MISSION TO JAPAN

STATEMENT OF OBJECTIVES

The objectives of the Science and Technology Mission to Japan are:

- to improve the state of scientific research and engineering in both countries;
- to stimulate bilateral cooperation in pure and applied science and technology;
- to provide the basis for an increased exchange of information and personnel on a mutually beneficial basis;
- to encourage the further development of advanced technology and joint collaboration in research and development projects including industrial applications;
- to identify those areas where science and technology may be harnessed in support of quality of life objectives;

In fulfillment of the above, the Mission will:

- compare the systems in existence in each country for the establishment of science policy, and for the conduct of governmental, university and industrial research, including the relationship between these different sectors;
- explore possibilities for exchange of personnel and information, and for joint collaboration in research and development projects;
- investigate and compare the methods employed to stimulate industry to meet the research and innovation challenge in changing technological, environmental and economic conditions;
- identify specific areas of industrial technology in which collaboration might provide mutual benefit to both countries;
- identify future activities which will permit the fulfillment of the Mission's objectives.

B

for release February 25, 1972

Ministry of State for Science and Technology

PRESS RELEASE

A 40-member Canadian mission, led by the Honourable Alastair Gillespie, Minister of State for Science and Technology, will go to Japan early next month to explore ways to expand relations between the two countries in science and technology.

The aim is to identify areas for exchange of information and personnel, for collaborative or or joint activities and for the industrial application of science and technology.

The mission will include senior personnel from government, industry, universities, the provinces and the scientific and technological community. It departs from Vancouver March 5, returning March 15.

Meetings have been arranged with the Japanese for discussions of science policy; information, computers and communications; environmental protection; oceanography and ocean technology; physical sciences, covering geosciences and metallurgy; transportation, including rapid inter and intra urban systems; urban development–especially planning and housing research; food and agriculture, including plant and animal research; fisheries, techniques and artificial cultivation; health sciences, including health care, cancer research and pharmacology; space research covering satellite systems.

C

SCIENCE AND TECHNOLOGY MISSION TO JAPAN

March 8-15, 1972

Leader of Mission

1.	The Honourable Alastair Gillespie	Minister of State for Science and Technology

Mission Members

Sector I – Science Policy

2.	Dr. Aurèle Beaulnes (Sector Leader)	Secretary of the Ministry of State for Science and Technology
3.	Dr. Louis Berlinguet	Vice-Rector, Université du Québec, and Président, l'Association des Scientifique, Ingénieurs et Technologistes du Canada, St. Foy, Québec 10.
4.	Dr. Pierre Bourgault	Dean of Engineering, University of Sherbrooke, Sherbrooke, Quebec.
5.	Dr. G.G. Cloutier	Directeur des recherches, Institut de recherches de l'Hydro Québec, Varennes, Québec.
6.	Dr. S. Wagner	General Director, Office of Science and Technology, Industry, Trade and Commerce, Ottawa.
7.	Mr. W.K. Wardroper	Director General, Economic and Scientific Affairs, Department of External Affairs, Ottawa.

Sector II – Information, Computers and Communication

8.	Dr. H. Von Baeyer (Sector Leader)	Director General, Canadian Computer Communications Task Force, Department of Communications, Ottawa.
9.	Dr. Donald A. Chisholm	President, Bell Northern Research, Ottawa.
10.	Dr. R.S. Rettie	Executive Director, External Relations, National Research Council, Ottawa.

Sector III – Environmental Protection

11.	Mr. K. C. Lucas (Sector Leader)	Assistant Deputy Minister, Environmental Protection Service, Department of the Environment, Ottawa.
12.	Mr. T. W. Beak	President, T. W. Beak Associates, Consultants, Toronto.
13.	Dr. Pierre Dansereau	Directeur Scientifique, Centre de recherches écologiques de Montréal, Montréal.
14.	Dr. L. Gertler	Department of Environment, University of Waterloo, Waterloo, Ontario.

Sector IV – Oceanography and Ocean Technology

15.	Mr. Douglas N. Kendall (Sector Leader)	President, Hermes Electronic Limited, Nova Scotia.
16.	Dr. B.D. Loncarevic	Director, Atlantic Geoscience Centre, Bedford Institute, Bedford, Nova Scotia.
17.	Dr. S. Tabata	Senior Scientist, Department of the Environment, Fisheries Research Board, Biological Station, Nanaimo, British Columbia.

Sector V – Physical Sciences

18.	Dr. W. Gauvin (Sector Leader)	Research Manager, Noranda Research Centre, Pointe Claire, Québec.
19.	Dr. C. H. Smith	Assistant Deputy Minister, Science and Technology, Dept. of Energy, Mines and Resources, Ottawa.
20.	Dr. Gordon Trick	Director, Research and Technology, Department of Industry and Commerce, Province of Manitoba, Winnipeg.
21.	Mr. C.B. Lewis (Sector Leader)	Director of Programme Planning Transportation Development Agency Ministry of Transport Montreal, Que.

22. Mr. W. H. Paterson — General Manager,
Subway Construction,
Metropolitan Toronto Transportation Commission,
Toronto.

23. Mr. Ian Ross — Swan Wooster Engineering Company,
1525 Robson 9,
Vancouver, British Columbia.

Sector VII – Urban Development

24. Dr. H. P. Oberlander (Sector Leader) — Secretary of the Ministry of State for Urban Affairs,
Ottawa.

25. Mr. Guy Legault — Director of Planning,
City of Montréal,
Québec.

26. Mr. Donald Wilson — Vice-President,
Engineered Buildings Limited,
Calgary.

Sector VIII – Food and Agriculture

27. Dr. B. Migicovsky (Sector Leader) — Directeur General,
Research Branch,
Department of Agriculture,
Ottawa.

28. Mr. L. Bissonnette — Sous-ministre adjoint,
Ministère de l'Agriculture,
Québec.

29. Dr. Fenton McHardy — Dean,
Faculty of Agriculture and Forestry,
University of Alberta,
Edmonton.

30. Dr. K.F. Neilsen — Director of Marketing and Agronomy,
Western Cooperative Fertilizers Ltd.,
Calgary.

Sector IX – Fisheries

31. Dr. R. R. Logie (Sector Leader) — Secretary,
Environmental Advisory Council,
Department of the Environment,
Ottawa.

32. Mr. W. O. Morrow — President,
National Sea Products Limited,
Halifax.

Sector X – Health Sciences

33. Dr. Maurice LeClair (Sector Leader) — Deputy Minister (Health),
Department of National Health and Welfare,
Ottawa.

34. Dr. Marc Colonnier — Département d'Anatomie,
Faculté de Médecine,
Université d'Ottawa,
Ottawa.

35. Dr. Romano D. Deghenghi — Vice-President and Director of Research,
Ayerst Laboratories,
Montreal.

36. Dr. Maurice McGregor — Dean,
Faculty of Medicine,
McGill University,
Montreal.

Sector XI – Space Research

37. Dr. J. R. Whitehead (Sector Leader) — Assistant Secretary of the Ministry of State for Science and Technology,
Ottawa.

38. Mr. J. D. MacNaughton — Vice-President,
SPAR Aerospace Products Ltd.,
Toronto.

39. Dr. F.J.F. Osborne — Director,
space Research,
RCA Limited,
Montreal.

40. Mr. B.A. Walker — Director General,
Technological and System Planning,
Communications Department,
Ottawa.

Mission Coordinating Group

41. Mr. C. R. Baker — Mission Coordinator,
Science Adviser,
Ministry of State for Science and Technology,
Ottawa.

42. Mr. Kenneth Kelly — Director,
Information Services,
Ministry of State for Science and Technology,
Ottawa.

43. Mr. L. G. Ramsey — Mission Administration,
International Affairs Branch,
Ministry of State for Science and Technology,
Ottawa.

44. Miss M. Ducharme — Secretary,
Ministry of State for Science and Technology,
Ottawa.

45. Miss A. Lemire — Secretary,
Ministry of State for Science and Technology,
Ottawa.

46. Miss Becky McGavin — Secretary,
Ministry of State for Science and Technology,
Ottawa.

D

PROGRAMMES

A. MINISTERS PROGRAMME

B. DAILY PROGRAMMES AND ITINERARIES FOR EACH SECTOR TEAM

C. DETAILED GENERAL PROGRAMME (TO REPLACE SUMMARY PROGRAMME NOW IN BRIEFING BOOK)

NOTE:

DOCUMENTS A B & C ABOVE WILL BE ISSUED AT LATER DATES

SUMMARY OF THE GENERAL PROGRAMME
FOR THE
SCIENCE AND TECHNOLOGY MISSION TO JAPAN MARCH 8-15, 1972

Saturday, March 4

5:00 p.m.	– Depart Ottawa Ministry of Transport Aircraft Gate 5, Uplands
6:00 p.m.	– Arr Toronto – meet in VIP Lounge
7:10 p.m.	– Depart Toronto – Air Canada Flight 851
9:00 p.m.	– Arr Vancouver
9:15 p.m.	– To Hotel Vancouver

Sunday, March 5

9:30 a.m.	– Mission briefing in Hotel Vancouver Conference Room
12:00 noon	– By bus to airport
1:30 p.m.	– Lv Vancouver CP Air Flight 401

Monday, March 6

6:05 p.m.	– Arr Tokyo

Tuesday, March 7

9:30 a.m.	– Briefing in Hotel Conference Room
P.M.	– Free

Wednesday, March 8

9:00 a.m.	– Plenary Meeting
p.m.	– Plenary Session
p.m.	– Sector Teams meet with Japanese Counterparts

Thursday, March 9

7:30 a.m.	– Selected Sector teams have breakfast briefing with Minister
a.m.	– Specialized meetings of Sector Teams
A.M. – P.M.	– Minister's appointments and possibly special luncheon (small group).
P.M.	– Sector Teams hand in daily report to coordinator.

Friday, March 10	
7:30 a.m.	– Selected teams have breakfast briefing with Minister
a.m.	– Specialized meetings of Sector Teams
A.M. – P.M.	– Minister's appointments and possibly special luncheon (small group)
P.M.	– Sector Teams hand in daily report to coordinator.
6:00 p.m.	– Canadian reception at Hotel
Saturday, March 11	
9:00 a.m.	– Mid-mission report meeting.
Sunday, March 12	–
	– Free
Monday, March 13	
7:30 a.m.	– Selected team have breakfast briefing with Minister
a.m.	– Specialized meetings of Sector Teams
A.M. – P.M.	– Minister's appointments and special visits – Press Briefing
P.M.	– Sector Teams hand in daily report to coordinator
Tuesday, March 14	
7:30 a.m.	– Selected Teams have breakfast briefing with Minister
a.m.	– Specialized meetings of Sector Teams
A.M. – P.M.	– Minister's appointments and special visits
10:00 p.m.	– Final reports by teams to Mission coordinator
Wednesday, March 15	
9:00 a.m.	– Mission meeting in Conference Room – Sector reports presented & discussion on results of mission
p.m.	– Plenary meeting. Summary reports by Canadian and Japanese Sector leaders. Press conference
Evening	– Mission disperses on individual basis during period March 15-17

NOTE:

– Detailed General Programme and Itineraries will be issued to delegates later

E

Prepared by the Department
of External Affairs

VISIT TO JAPAN BY THE MINISTER OF STATE FOR SCIENCE AND TECHNOLOGY

JAPAN – GENERAL FACTS

Introduction

Japan is one of the major nations of the modern world, exceeded in importance and influence only by the United States, the Soviet Union, and in some respects the People's Republic of China. Economically, it has all the attributes of a superpower, ranking third in the world with a GNP of close to $200 billion (1970), and a real average growth rate over the past decade of over ten percent annually. Covering an area of 142,338 square miles, it has a population of 103 million.

Japan is a parliamentary democracy with a multi-party system, and has been ruled since 1945 by a succession of relatively stable conservative coalitions. The present government, formed by the Liberal Democratic Party, has a large majority in both Houses of the Diet, and is expected to continue in power for the foreseeable future.

The Japanese economy is based largely on its manufacturing industries, and is a net exporter to the world market. In 1970, its total exports stood at US$19,363 million, while imports reached US$18,873 million (1970 exchange rates).

Canada's Relations with Japan

Although trade and economic interests provide the most tangible ties between the two countries, Japan and Canada share many other common interests as neighbours across the Pacific, both having highly developed economies and industrious, literate and technically educated populations.

Japan was the third country with which Canada established diplomatic relations with the opening of a Legation in Tokyo in 1929. Diplomatic relations were severed with the entry of Japan into World War II in 1941, but were re-established after Canadian ratification of the San Francisco Peace Treaty in 1952.

The present Canadian Ambassador to Japan, His Excellency H.O. Moran, resident in Tokyo since 1966, is a former Director-General of Canada's External Aid Office and a former High Commissioner to Pakistan. The Japanese Ambassador to Canada, His Excellency Shinichi Kondo, was formerly Assistant Vice Minister of Foreign Affairs in the Japanese Foreign Ministry and had served in Ottawa on an earlier posting.

Political and Cultural Relations

Canada's interests in Japan cover virtually the whole range of subjects normally arising between developed countries with substantial political, commercial and other ties. Japan is overwhelmingly the major power in East Asia, and has a rapidly growing role in the political and economic affairs of Southeast Asia. Japan's dynamic economy and increasing importance as a source of development assistance make it clearly in Canada's interest to maintain close and friendly relations.

Japanese foreign policy has undergone a substantial transformation in recent years. The "low posture" which characterized Japan's external activity in the post-war years has been largely discarded. Japanese foreign policy will doubtless continue to have a high economic content but the Japanese have served notice that they intend to play an active role in Asia with policies that will serve both their economic and political interests.

The whole range of bilateral and multilateral questions of interest to Canada and Japan are reviewed at periodic meetings of the Canada/Japan Ministerial Committee, established during the visit to Canada in June 1961 by the Japanese Prime Minister. It was agreed at that time "that in view of the increasing importance of Canadian/Japanese relations, there should be established a Canadian/Japanese Ministerial Committee which would not be a negotiating body but would provide a valuable means of contact between Ministers of the two countries". Since its first Tokyo meeting in 1963, the Committee has met six times alternately in Japan and Canada, most recently in Toronto in September 1971. Subjects discussed between Canadian and Japanese Ministers and officials at these meetings have included the international situation with specific reference to Asia and the Pacific area, nuclear disarmament, bilateral air relations, atomic energy, the possibility of scientific and technological exchanges between Canada and Japan, and development assistance. The major part of the discussions focuses, of course, on the world economic situation with specific reference to problem areas in Japan/Canada trade and financial relations.

In addition to their bilateral relations Japan and Canada share many interests in common as responsible members of the international community. At the United Nations both countries have served in recent years on the Security Council and have taken a particular interest in subjects such as development assistance and disarmament. Both are members of the Committee of the Conference on Disarmament.

Less officially, a considerable number of Japanese students are studying in Canada, mainly at the post-graduate level, and each year a number of Japanese scientists are awarded post-doctoral research fellowships by the National Research Council of Canada. Canadian scientists also visit Japan frequently to attend conferences and hold discussions with their Japanese counterparts in fields where Canada and Japan share special knowledge or expertise.

There have been exchanges in non-scientific fields as well. The Japanese Government each year offers two scholarships to Canadian students for study at Japanese universities under the Ministry of Education scholarship programme. In the field of performing arts, the brilliant young Japanese conductor, Seiji Ozawa, conducted the Toronto Symphony Orchestra from 1966-69. Yosuf Karsh, the Canadian photographer, toured the major cities of Japan in 1970 with a selection of his *Portraits of Greatness*.

Expo '70 provided Canada with a unique opportunity to send to Japan a sampling of some of the best of its varied cultural groups such as "Les Feux Follets", the National Ballet, the Montreal Symphony Orchestra, and the Charlottetown cast of the musical adapted from the well-known Canadian novel "Anne of Green Gables". The Canadian participation at this first worlds fair ever held in Asia was considered to be an overwhelming success. In 1972, Canada will participate in the Winter Olympics at Sapporo. In addition, a travelling exhibit is being mounted, which will cover all the major centres of Japan over a twelve-month period, showing films and static exhibits about Canada.

Economic and Commercial Relations

Trade naturally serves as one of the strongest links between Japan and Canada, two countries which are among the world's leading trading nations. Japan ranks as Canada's third most important trading partner after the United States and Britain, and Canada has been Japan's third most important supplier after the United States and Australia. Bilateral trade between the two countries has grown from $132 million in 1953 (the year before Japan's accession to the GATT and the signing of the Canada-Japan Trade Agreement) to about $1,400 million in 1970.

A wide range of metals and minerals together with cereals and forest products have traditionally led Canada's exports to Japan. In 1970 about 5% of the total consisted of fully manufactured or finished goods; in contrast, during the same period more than 90% of Japanese exports to Canada were finished goods. The most important items Japan sells to Canada are motor vehicles including motorcycles, television and radio sets, tape recorders, commercial communication equipment, sheet metal, pipes, tubes and fittings, toys, sewing machines and textiles of all types. By agreement between the two governments shipments of certain Japanese goods, primarily textiles, have been subject to voluntary limitation to avoid disruption of the Canadian market and enable Canadian manufacturers to adjust their production to other lines.

In recent years important long-term contracts have been signed between Canadian suppliers and Japanese industry for the supply of Canadian coking coal and uranium to provide much needed energy to Japan's industrial and private sectors. Long-term contracts for the supply of coking coal to the Japanese steel industry were the basis for a large increase in output in the mines of Western Canada and over the next 15 years will result in the sale to Japan of as much as billion dollars worth of coal. Other important bulk commodities being exported or to be exported from Western Canada to Japan under long-term contracts are copper concentrates from British Columbia and Manitoba, potash from Saskatchewan, wood pulp, newsprint and lumber from British Columbia, and, of course, wheat and oil seeds from the three Canadian prairie provinces. Consideration is being given to the construction of slurry pipelines, designed to carry dry bulk commodities such as potash from the prairies to Canada's west coast ports. In 1969 the first contract was concluded for the sale of pelletized iron ore from the Quebec-Labrador region to Japan's steel mills and copper is already the Province of Quebec's leading export product to Japan; uranium oxide from Ontario is also being shipped to Japan under long-term contracts.

Japanese and Canadian businessmen have co-operated with those of the other economically developed countries of the region in forming the Pacific Basin Economic Co-operation Committee. The aim of this body is to promote economic collaboration among the member countries – including expansion of trade and investment, exchange of industrial technology, promotion of tourism, joint studies, and promotion of cultural and scientific exchange. The member organizations have also joined in establishing the Private Investment Company of Asia (PICA) which provides capital and technical assistance to developing countries in Southeast Asia. In addition to this broad grouping there are also regular institutionalized exchanges between members of the Canadian Manufacturers Association and the Canadian Chamber of Commerce with their Japanese counterparts – Keidanren, Japan Chamber of Commerce and Industry, Japan Foreign Trade Council and Japan Committee for Economic Development.

Since Japan's adherence to the GATT in 1954, Canada and Japan have co-operated in the move toward freer world trade under the auspices of that Agreement. On the other hand, bilateral problems in the field of commercial relations have included: (a) the concentration of Canadian exports in raw and semi-finished goods which create far fewer jobs for Canadian workers than Japanese exports to Canada create for Japanese, and (b) the voluntary restraints system by which the Japanese agree to limit exports of certain goods in order to avoid disruption of the Canadian market. While restraints are unpopular with the Japanese, Japan is aware that they are much milder than restrictions applied by most other developed countries on imports of sensitive Japanese products. The restraints Japan applies in Canada's case cover a small and declining share of their exports; on all other manufactured items they have unrestricted and quota-free access. This is in sharp contrast to the numerous quotas and other restrictive practices our exporters encounter in Japan.

For a variety of reasons there has until recently been relatively little direct investment between Japan and Canada. The economics of both countries have been expanding since the war at a rapid rate and neither has had large amounts of surplus capital for foreign investment. In addition, the Japanese Government has limited foreign investment in Japanese industries as well as Japanese investment in foreign countries, and this has had a dampening effect on potential investment flows between Canada and Japan.

There are indications that Japanese investment will increase considerably in the next few years. Investment in Canada has to date been focused primarily on the extractive resource industries such as copper, pulp and paper, potash, petroleum and coal, but there has also been Japanese involvement in a steel wire plant in Vancouver, and a motor car assembly plant in Nova Scotia where Isuza and Toyota automobiles are being assembled for the North American market.

Aid

Canada/Japan Co-operation in Economic Assistance

Japan participates actively with Canada in international fora such as the DAC, UN, UNCTAD, and the IBRD. In other aid and development activities, Canadian and Japanese interests are closest in four main areas. These are the Asian Development Bank, the Colombo Plan, the Mekong Committee and the United Nations Development Programme.

Despite her economic power, Japan's ability to influence events and promote regional stability have been inhibited by her comparatively modest provision of grant aid and the "hard" terms on which development loans have been offered. Many Japanese officials claim that the OECD target of one percent of GNP devoted to foreign aid is unrealistic because Japan ranks nineteenth in the world in per capita income. On the other hand, as the only "developed" Asian country and with an embarrassingly high balance of payment surplus in recent years there have been heavy demands on Japan for additional development funds. As a result Japan has recently been quite forthcoming with short-term funds for development purposes.

Immigration

Japanese immigration in the early part of this century made a vital contribution to the agricultural and industrial development of British Columbia.

In 1923 as a result of revision of the so-called Gentleman's Agreement between the two governments, the number of Japanese immigrants was limited to 150 per year; five years later the quota was made to include wives and children of Canadian residents. During World War II many Japanese-Canadians were interned and most were moved away from the West Coast and resettled across Canada; after the War the non-naturalized Japanese and many Japanese-Canadians were repatriated to Japan. There are now about 30,000 Japanese-Canadians scattered across the country, with the greatest concentrations in Toronto and Vancouver. In 1962, following a general revision of the Immigration Act and regulations, Japanese possessing training or skills in demand in Canada became eligible for entry on the same basis as other immigrants. In 1965, in order to facilitate the entry of qualified Japanese, a visa office was opened in Tokyo and the volume of immigration doubled the following year. Because of Japan's current prosperity and the absence of population pressure due to the low post-war birth rate, there is little demand for emigration.

The number of arrivals from Japan since 1965 is as follows:

1965	1966	1967	1968	1969	1970
209	509	930	693	766	799

F

LIST OF BILATERAL AGREEMENTS IN FORCE BETWEEN CANADA AND JAPAN

AGREEMENT BETWEEN CANADA AND JAPAN FOR AIR SERVICES

Signed January 12, 1955

AGREEMENT BETWEEN CANADA AND JAPAN FOR COOPERATION IN THE PEACEFUL USES OF ATOMIC ENERGY. (WITH AGREED MINUTES)

Signed July 2, 1959

PROTOCOL TO THE AGREEMENT BETWEEN CANADA AND JAPAN FOR CO-OPERATION IN THE PEACEFUL USES OF ATOMIC ENERGY

Signed July 2, 1959

ARRANGEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF JAPAN FOR THE SETTLEMENT OF CANADIAN CLAIMS UNDER ARTICLE 18a OF THE TREATY OF PEACE WITH JAPAN

Signed September 5, 1961

EXCHANGE OF NOTES BETWEEN CANADA AND JAPAN CONCERNING THE ENTRY TO CANADA FOR A LIMITED PERIOD OF JAPANESE AGRICULTURAL TRAINEES

Signed March 28, 1957

AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF JAPAN CONCERNING APPLICATION OF THE CANADA PENSION PLAN TO LOCALLY ENGAGED EMPLOYEES OF THE GOVERNMENT OF JAPAN IN CANADA

Signed September 22, 1967

EXCHANGE OF NOTES BETWEEN CANADA AND JAPAN PROVIDING FOR THE RECIPROCAL EXEMPTION FROM INCOME TAX OF EARNINGS DERIVED FROM THE OPERATION OF SHIPS

Signed September 21, 1929

CONVENTION BETWEEN CANADA AND JAPAN FOR THE AVOIDANCE OF DOUBLE TAXATION AND THE PREVENTION OF FISCAL EVASION WITH RESPECT TO TAXES ON INCOME.

Signed September 5, 1964

EXCHANGE OF NOTES BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF JAPAN PROVIDING FOR THE ENTRY INTO JAPAN OF CANADIAN CITIZENS AND INTO CANADA OF JAPANESE NATIONALS EITHER WITHOUT VISAS FOR LIMITED PERIODS OR WITH VISAS FOR EXTENDED PERIODS AND FOR DESIGNATED PURPOSES

Signed September 5, 1964

AGREEMENT BETWEEN JAPAN AND THE GOVERNMENTS OF THE U.K., CANADA, AUSTRALIA, NEW ZEALAND, UNION OF SOUTH AFRICA, INDIA AND PAKISTAN CONCERNING CEMETERIES, GRAVES AND MEMORIALS OF THE ARMED FORCES IN JAPAN DURING THE WAR OF 1941-45

Signed September 21, 1955

AGREEMENT BETWEEN CANADA AND JAPAN CONCERNING COMMERCE.

Signed March 31, 1954

G

FACT SHEET – JAPAN

Area and Geography

Japan consists of four main islands and a number of smaller ones, together covering 142,726 sq. miles, equivalent in area to Newfoundland, including Labrador and stretching between latitudes 31 and 46 degrees north. The four main islands from North to South are Hokkaido, Honshu, Shikoku and Kyushu.

About 80 percent of the country is mountainous, with heights averaging 9,000 ft. Japan lies within an earthquake belt and quakes of minor intensity are frequent.

Climate

Tokyo has a climate similar to that of New York or Washington. During summer, the temperature rises to about 95 F. and in winter falls to about 10.

Temperature in March

- Maximum 53
- Minimum 36
- Days of rain – 13

The seasons are well defined and coincide with those of Canada.

Local Time

There is fourteen hours difference between Ottawa (EST) and Tokyo. For example, when it is noon (EST) in Ottawa, Tokyo time is 2:00 a.m. the next day.

Population

With a population estimated at just over one hundred million, Japan ranks as the seventh most populous country in the world. Density of population is approximately 700 persons per square mile. The most densely populated areas surround Tokyo, Yokohama, Nagoya, Osaka, and Fukuoka. Nearly 70 percent of the population live in urban areas.

Principal Religions

Shintoism (ancestor worship) and Buddhism (of which there are a number of sects) are the principal religions of the Japanese.

Various forms of Christian religion are, however, practised in Japan, and in most large cities, notably Tokyo and Kobe, a visitor should have no difficulty in finding a church of his choice.

List of Churches

St. Ignatius Church – 7 Kioi-cho, Chiyoda-ku – Roman Catholic, Japanese – Sundays, weekdays: 5–7:30 a.m.

St. Alban's – 10 Shiba, Sakae-cho, Minato-ku – Anglican Episcopal, Sundays: 8, 9:30, 11 a.m. and 6 p.m. – Wednesdays at 7:30 a.m. – English

Tokyo Baptist Church – 33 Hachiyama-cho, Shibuya-ka – English 9:45 a.m., 11 a.m. and 7 p.m.

Tokyo Union Church – 7-7, 5-chome, Jingu-mae, Shibuya-ku, Interdenominational, English – 9, 10:30 a.m.

St. Joseph's Friary – Roppongi Crossing – Roman Catholic, English

Jewish Community of Japan – 8-8, 3-chome, Iliroo, Shibuya-ku Friday evenings, Saturday, 9:30 a.m. Holidays

St. Paul's Lutheran Church – 15-2, 1-chome, Tama-cho, Fuchu-shi, English, Sundays at Nihon Toshi Centre at 11 a.m.

Japanese Trade with Canada

Japan is Canada's third most important foreign market after the United States and Britain. By the same token, Canada is Japan's third largest trading partner, after the United States and Australia.

Customs and Exchange Regulations

The monetary unit is the Yen and the present official exchange rate is about Y 306 to the Canadian dollar.

Y1,000 – $3.06 (Canadian)

Coins:	Y1	Y50
	Y5	Y100
	Y10	
Notes:	Y100	($0.30)
	Y500	($1.53)
	Y1,000	($3.06)
	Y5,000	($15.30)
	Y10,000	($30.60)

Currency and Exchange Control

Visitors must declare their holdings of foreign currency on arrival, whether notes or traveller's cheques. The record of currency brought into the country is then affixed to the visitor's passport and, on showing this to retailers, articles such as cameras, binoculars and radios may be purchased without incurring commodity tax.

There is no restriction on the amount of yen currency visitors may take into Japan, but not more than Y20,000 may be taken out. On leaving the country, yen may be reconverted only once into the original currency up to the amount recorded on the document issued by banks and authorized money exchangers at the time of conversion.

Banks in Japan will accept U.S., Canadian, and Australian dollars, Sterling, and most West European currencies. Traveller's cheques can be cashed at the principal foreign exchange banks and at hotels. All payments, however, must be made in yen.

Japanese Social Customs

The more important foreign businessmen visiting Japan are likely to be offered lavish hospitality by their counterparts.

While the Japanese do not expect foreigners to understand the finer points of their etiquette, they do like people who make the effort. Be prepared to take off your shoes and proceed either in socks or in slippers when entering a Japanese style restaurant or house. It is never correct to walk on a straw-matting floor in shoes, and in Japanese buildings and homes, even indoor slippers are worn only in the halls.

Most Japanese meals consist of a series of small dishes. Naturally, the polite thing to do is to eat what one is offered but your hosts are understanding if a foreigner explains that he finds a particular dish, for example, raw fish, unappetizing.

It is customary to exchange visiting cards with new acquaintances. This is particularly useful to the foreign visitor who is likely to have difficulty in remembering more than a few Japanese names at a time. Bring a substantial number of business cards with you. These cards should be printed with a Japanese translation on one side. The Ministry of State for Science and Technology will provide you with such calling cards.

Most Japanese businessmen are enthusiastic golfers, and are delighted to arrange a game (and the loan of clubs) for their foreign business contacts. A game of golf is an excellent way to cement a personal friendship in Japan. Green fees are very high and courses are out of town, so allow plenty of time for travel. There is no such thing as a "quick" game of golf in Japan.

Tipping

Limit your tipping to sky caps and railway station redcaps only, at Y100 per piece. Tipping elsewhere is not the custom and is not welcomed. You will find service charges added on to your bills at most places to compensate for the tips.

Language

Language is likely to be the single biggest problem you will encounter on your trip to Japan. The number of Japanese who speak fluent English is not great and knowledge of other foreign languages is extremely limited. In Tokyo, and to a lesser extent Osaka, a few people have an understanding of English but outside these centres, you are really on your own.

Be sure to have explicit instructions written down in Japanese before you embark on any trip either inside or outside the cities. Don't expect to get by with a few words of Japanese if the going gets tough. Japanese is a difficult language to use even in its elementary form.

The Business Interview

When meeting Japanese, there is no hard and fast rule about whether to bow, shake hands or offer a visiting card first. It is best to take your cue from the person you are meeting.

Your first view of a typical Japanese office will be intriguing. When you enter, you will find yourself in a large office with rows of desks stretching off almost to the horizon. Section chiefs and department heads rarely have their own offices, but are located in key positions around the room in the midst of this sea of desks.

Your business interview may be conducted in a separate cubicle or more likely in a small cluster of chairs located in the middle of the room close to the desk of the department head. In either case, the setting will be similar. You and your interpreter will be arranged on one side of a low coffee table in low-slung chairs. Your hosts will assemble on the other side of the table. Strength in numbers is the rule and you can expect to confront up to half a dozen Japanese businessmen on the opposite side. You will be served small handle-less cups of Japanese green tea (no sugar, no cream). After the first twenty cups, it's quite enjoyable!

If you haven't had experience using an interpreter, think about it beforehand. Get used to the idea of speaking in simple, uncomplicated phrases with pauses after every two or three sentences to allow for consecutive interpretation. Have plenty of literature. The man you are speaking to might not be familiar with your company. It will be a help to give him some general background information on its history of growth and development, and the reputation you enjoy both at home and in export markets.

Expect to take time before getting around to direct questions and, above all, avoid a high pressure approach. A quiet presentation is much better received. Make sure that the person you see has an opportunity to ask all questions he wants before you make a move to leave. If possible, leave a brochure which gives a summary of your products and operations. He probably won't have understood everything you have said, even through your interpreter, and your literature will give him something to study.

Gift Giving

Gifts or "Presentos" as they are more often called, are used frequently in Japan. To master the are of gift-giving among the Japanese is a lifetime study in itself. Nevertheless, you will undoubtedly find that among the very polite Japanese people there will be a few who will be exceptionally helpful to you and to whom you will want to repay their kindness. On the business side, you may think it worthwhile to give small gifts to people who have helped you or to people whose interest you would like to cultivate.

Here are a few tips. Don't give Japanese gifts. Try to give something novel – especially something Canadian, something they would not likely receive from Japanese or other foreigners. Great importance is attached to the value of the gift, so it's a good idea to present things whose value is not immediately apparent. Gifts do not have to be expensive, but unique items are appreciated.

Entertainment and Night Clubs

All kinds of Western and Japanese entertainment and food are available. Western-style clubs and food, both popular with the Japanese, tend to be expensive. The steak dinner for two with a drink beforehand, but no wine or liquor, costs \$30.00 to \$40.00. Clubs are another story. Most of the entertainment, aside from restaurants, theatres, and hotel floor shows is for men only.

Tokyo has tens of thousands of clubs, all designed to separate the customer from his loose change. Most are for men only, but they have hostesses waiting to make your stay more pleasant. Normally in the larger clubs and bars there is a cover charge and then a charge for each girl who spends time with you on a minimum cost per hour. But each time a new girl sits beside you, you pay the minimum rate even if she's there only 10 minutes before leaving you to sit with one of her "regular customers" who by chance has come in. This adds up to a lot of money for the unwary or even the wary.

Internal Transportation

Taxis

You will probably take taxis for most of your trips around the cities. Before you set out, be sure that your taxi driver knows exactly where you want to go since both communications and directions are difficult. If in doubt, have someone write out the directions and draw a map for you to give to the driver. Taxis are inexpensive, plentiful and the most convenient way to get around in cities. Remember, don't tip the driver.

Buses

Aside from organized bus tours, it is better to avoid public buses altogether since very little English is spoken by drivers or passengers and route signs and maps are written mainly in Japanese.

Cars

We do not recommend driving yourself in Japan. Cars with drivers can be hired at all leading hotels but they are not cheap.

Trains

Excellent train service is available throughout Japan. There are many fast trains that service all major points in the country. Be sure to reserve seats well ahead of time. Reservations can be made through travel agents or the Japan Travel Bureau. Your hotel front desk will help you.

Planes

For longer trips within Japan, you might want to take advantage of the frequent, top-flight air services. Again, reserve ahead of time through your travel agent or the Japan Travel Bureau.

Clothing

In all seasons, it is better to have rain protection of some sort. For summer, light tropical clothing is essential, particularly as Tokyo society makes very few concessions to the semi-tropical summer weather and men are required to wear shirts, ties and jackets throughout. For winter, a light overcoat is enough protection.

Medical

Japan is a healthy country. Modern medical facilities are available in the large cities and the services of English-speaking doctors and dentists can be obtained at most international hotels. The water is safe to drink anywhere in Japan and one need take no more precautions over foodstuffs than would be considered prudent in any major Canadian city.

The Imperial Hotel

Address:	1, 1-chome, Uchisaiwaicho, Chiyoda-ku, Tokyo.
Cable Address:	IMPHO TOKYO
Telex:	222-2346
Telephone:	(03) 504-1111
Management:	T. Inumaru, President & General Manager 5 minutes by car from Tokyo Station 20 minutes by car from Haneda Airport
No. of rooms:	Western-style 1,400
Total capacity:	2,400
Facilities:	The Imperial Hotel has central heating; air-conditioning; banquet rooms; international conference room; travel agents; airlines' office; Theater Restaurant "Imperial"; parking lot for 700 cars. The Hotel arcade contains a shopping complex of 41 stores.

Transportation

Although Japanese is difficult for visitors to speak, impossible to read, English is widely understood. Gestures help. When asking directions, have hotel desk clerk write address down beforehand in Japanese. Street naming and numbering are haphazard. Buildings are numbered in the order in which they were erected. Have hotel write any address down in Japanese. A taxi driver can then get you to your destination.

H

Canadian Science and Technology Mission

List of Sector Chiefs and Liaison Officers

January 27, 1972

Sector	Chief	Liaison Officer
I	Ei ichi Nagasawa Administrative Counselor, Minister's Secretariat, STA	Katsuhisa Ida Deputy Head, International Affairs Div., Promotion Bureau, STA
II	Masaki Kuramoto Head, Promotion Div., Promotion Bureau, STA	Mutsuhiro Miura Information Office, Promotion Bureau, STA
	Morihiko Hiramatsu Head, Electronics Policy Div., Heavy Industry Bureau, MITI	Kotaro Shimo Deputy Head, Electronics Policy Div., Heavy Industry Bureau, MITI
	Ichiro Miura Counseller of Telecommunications, Administrative Directors' office of Telecommunications, MPT	Kenichiro Torigoe Administrative Directors' office of Telecommunications, MPT
III	Hidesaku Washisu Councillor, Minister's Secretariat, EA	Yoshihide Mende General Affairs Div., Minister's Secretariat, EA
IV	Yoichi Takebayashi Director, Marine Development office, Research Coordination Bureau, STA	Yoshitaka Kotani Marine Development office Research Coordination Bureau, STA
V	Kiichi Takahashi Head, Technological Research and Information Division Agency of Industrial Science and Technology Miti	Kiichi Takahashi
	Shuji Tamura Deputy Head, Technological Research and Information Division Agency of Industrial Science and Technology Miti	Shuji Tamura
VI	Tomohito Araya Chief, International Cooperation office, Policy Div., Ministers' Secretariat, MT	Ichiji Uda International Cooperation Office, Policy Div., Ministers' Secretariat, MT
VII	Akira Mizuno Head, International Cooperation Section, Planning Bureau, MC	Hideo Tokuhiro Deputy Head, International Cooperation Section, Planning Bureau, MC

Sector	Chief	Liaison Officer
VIII	Kunio Kagayama Director-General, Agriculture, Forestry and Fisheries Research Council Secretariat, MAF	Yasutaka Uchiyama Deputy Head, Administration Div., Agriculture, Forestry and Fisheries Research Council Secretariat, MAF
IX	Tomonari Matsushita Director of Research Department, Fishery Agency, MAF	Tokuya Kikuchi Research Planning officer, First Research Div., Fishery Agency, MAF
X	Mamoru Tsunashima Counselor and Chief Liaison Officer of International Affairs, Minister's Secretariat, MHW	Takumi Sakaki Liaison office of International Affairs, Minister's Secretariat, MHW
XI	Teruo Ichinose Administrative Counselor for Space Activities, Research Coordination Bureau, STA	Kaoru Mamiya Space Planning Div., Research Coordination Bureau, STA

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CANADIAN SCIENCE AND TECHNOLOGY MISSION
JAPAN
MARCH 1972

SECTOR (I) Science Policy

A. Government organization for science policy
B. University/industry/government cooperation
C. Industrial incentive programs, cooperation between government and industry
D. Science and technology transfer to underdeveloped countries
E. Role of design in industrial development
F. Information base for decision making

SECTOR (II) Information/Computer/Communication

A. Present general situations of Information/Computer/Communication
B. Science library including availability of information, computerized networks, language problems
C. Mini Computers
D. Data transmission systems including dedicated networks and digital versus analog system
E. Interface between computers and communications
F. Others (Administrative Information Network, etc.)

SECTOR (III) Environmental Protection

A. Policy on Environmental Protection including interministerial Coordination of Environmental Programs
B. Air Pollution
   (i) Legislation for air pollution
   (ii) Air quality standards and criteria
   (iii) Emission standards
   (iv) Monitoring and surveillance
   (v) Other topics
   (motor vehicle pollution, sulphur content reduction program, etc.)
C. Water Pollution
   (i) Legislation for water pollution
   (ii) Water quality standards and criteria
   (iii) Emission standards
   (iv) Monitoring and surveillance
   (v) Heavy metal pollution and monitoring (Mercury, Cadium, Selenium)

(vi) Water quality network

(vii) Solid waste Management

(viii) Marine Pollution

(ix) Oilspills clean-up technology

D. Coordinated Approach in Sample Industry

SECTOR (IV) Oceanography and Ocean Technology

A. Marine technology including instrumentation and pollution studies

B. Ocean data networks employing buoys, coastal stations and ships including: (1) philosophical approach to monitoring and surveillance; (2) data exchange; (3) sea areas of interest; (4) equipment and instrumentation

C. Coastal engineering and construction technology

D. Offshore exploration and engineering technology for oil, gas and mineral resources

E. Sea ice studies

F. Marine chemistry technology and methodology

G. Extraction of minerals from the sea

SECTOR (V) Physical Sciences

1. *Physical Sciences (Geology, Mining and Metallurgy)*

A. Geology of Pacific rim countries

B. Exploration techniques

C. Ferrous and non-ferrous ores and ferro-alloy

D. Uranium bearing tertiary lavas

E. Ceramic technology

F. Iron and steel technology including blast furnaces, basic oxygen furnaces, continuous casting and electric steelmaking

G. Gravity Measurements including earth tides, crustal tilt

H. Volcanology

I. Urban Geology including slope stability, landslides, earthquake hazards

J. Metallurgical and materials research on welding, fatigue, structural steels, and composites

2. *Physical Sciences (Organic Chemistry)*

A. Chemical technology

SECTOR (VI) Transportation

A. Interurban transportation including new technology:

(i) Tracked air cushion vehicles

(ii) Hovercraft

(iii) STOL aircraft

(iv) Magnetic levitation

(v) Conventional rail problems at high speed

(vi) Electric traction equipment

B. Transport control and automation in congested areas (Surface and Marine)

C. Solids pipelines

D. Shipbuilding research, development and construction technique with particular emphasis on how safety is built into tankers (design, construction, navigation equipment, etc.)

E. Port facilities

F. Aerospace electronics technology

G. Aircraft research, development and construction techniques

SECTOR (VII) Urban Development

1. *Regional and Urban Planning*
   A. Governmental systems for metropolitan and regional organizations
   B. Physical and sociological implications of environmental problems created in large and high density metropolitan area
   C. Impact on urban development of new and existing interurban transportation (additional: urban highway system)
   D. Urban planning and development
2. *Housing and Building*
   E. Housing and building research
   F. Physical services for housing
   G. Construction industry organizations

SECTOR (VIII) Food and Agriculture

A. Outline of agriculture research

B. Agriculture research management

C. State and problems of agriculture and animal industry research
   (i) Utilization and storage (vegatables, fruit, grain, meat and dairy products)
   (ii) Pest control
   (iii) Animal health and disease

D. Food sanitation problems

SECTOR (IX) Fisheries

A. Deep Sea Fishing Techniques

B. Artificial Cultivation

C. Exploration of Marine Living Resources

SECTOR (X) Health Sciences

A. Delivery of Health Care

B. Population Control

C. Cancer Research

D. Basic Medical Research

E. Drug and Pharmaceutical Technology

F. Extraction Technology of Anti-biotic Resources from the Sea

SECTOR (XI) Space Research

A. General

(i) National Space Development Policy including Organization and Budget

(ii) Long-range Vision or Plan

(iii) International Cooperation

B. Technical

(i) Communication Satellite System

(ii) Broadcasting Satellite System

(iii) Aerosatellite System

(iv) Geodetic Satellite System

(v) Data Analysis related to Earth Resources Satellite System

J

PROGRAMME ARRANGED BY
JAPANESE SCIENCE AND TECHNOLOGY AGENCY

NOTES

(a) This programme does not include such events as briefings, social functions etc., which are given in the General Programme section (Consult index).

(b) Some minor adjustments may occur to this programme before the mission arrives in Japan.

(c) Detailed programmes for each Sector will be issued separately in Japan.

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SECTOR (I) SCIENCE POLICY

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	10:30 – 12:00	Council for Science and Technology	– Group Meeting	
	14:00 – 16:30	Science and Technology Agency	– Group Meeting	
Friday, March 10	10:30 – 12:00	Agency of Industrial Science and Technology, Ministry of International Trade and Industry	– Group Meeting	(Participant) Dr. Nobuhito Ohta, President of AIST
	14:00 – 17:00	Science Council and Japan Society for the Promotion of Science	– Group Meeting	Ministry of Education
Saturday, March 11				
Sunday, March 12				
Monday, March 13		Each member of this group will be scheduled to join one of other groups.		

SECTOR (I) SCIENCE POLICY (Continued)

Date	Time	Place	Event	Remarks
Tuesday, March 14	10:30 – 12:00	Science and Technology Agency	– Group Meeting	
	P.M.	Each member of this group will be scheduled to join one of other groups.		
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	Agenda to be advised

Science and Technology Mission
to Japan, 8-15 March 1972

Prepared by The
Japanese Science and Technology Agency

SECTOR (II) INFORMATION – COMPUTER – COMMUNICATION

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00 14:00 – 15:00	Ministry of Foreign Affairs	– Opening Plenary Meeting – General Briefing on Japanese Science Policy and its Organization	Agenda to be advised
Thursday, March 9	10:30 – 12:00	Science and Technology Agency	– Group Meeting	
	12:30 – 16:30	Japan Information center of Science and Technology, NAGATACHO	– Visit	Lunch at the center
Friday, March 10	9:30 – 12:00	Ministry of Posts and Telecommunications	– Group Meeting (Computer and Communication)	
	14:00 – 15:00	Data Communication Exhibition Center, Kasumigaseki Building	– Visit	
	15:00 – 16:00	Data Teleprocessing Center, Kasumigaseki Telephone office	– Visit	
	16:00 – 17:00	Private Bank, AOYAMA	– Visit (On-line Banking System)	
Saturday, March 11				
Sunday, March 12				

SECTOR (II) INFORMATION – COMPUTER – COMMUNICATION (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	9:00	LV. Hotel		
	10:00 – 12:00	Musashimo Electric Communication Laboratory, MUSASHINO		Lunch at the laboratory
	14:00 – 16:00	Institute of Information Technology, HAMAMATSUCHO	– Visit	
	16:00 – 17:00	Japan Information Processing Development Center, SHIBA	– Visit	
Tuesday, March 14	9:30	LV. Hotel	– Visit	
	10:30 – 16:00	FUJITSU Company, KAWASAKI	(Computer Technology)	Lunch at the company
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

SECTOR (III) ENVIRONMENTAL PROTECTION

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	10:00 – 10:30		– Group Meeting – Policy of Environmental Protection	
	10:30 – 12:00		– Air Pollution	
	14:00 – 16:00		– Water Pollution – Coordinated Approach in Sample Industry	
Friday, March 10	10:00	LV. Hotel		
	12:00 – 16:00	IDEMITSU KOSAN Co., Oil refinery and GOI industrial district and surrounding area, GOI, CHIBA	– Visit	Lunch at the company
Saturday, March 11				
Sunday, March 12				

SECTOR (III) ENVIRONMENTAL PROTECTION (Continued)

Date	Time	Place	– Event	Remarks
Monday, March 13	9:30	LV. Hotel		With Sector VII
	10:30 – 12:00	CHITOSE Waste Disposal Facility, CHITOSE, SETAGAYA		
	14:30 – 16:00	Air Pollution Central Center, HAMAMATSUCHOYO		
Tuesday, March 14	10:00	LV. Hotel		
	10:30 – 12:00	OCHIAI Sewage Treatment Plant, OCHIAI, SHINJUKU		
	14:30 – 16:00	National Research Institute for Pollution and Resources, AKABANE		
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

SECTOR (IV) OCEANOGRAPHY AND OCEAN TECHNOLOGY

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	8:00	LV. Hotel	– Visit (Coastal engineering and construction Technology)	
	10:00 – 16:00	Port and Harbour Technical Research Institute, KURIHAMA, KANAGAWA		
Friday, March 10	10:00 – 12:00	Science and Technology Agency	– Group Meeting	
	14:00 – 16:30	Ocean Research Institute, University of Tokyo NAKANO	– Visit (Exploration and engineering technology for mineral resources)	
Saturday, March 11				
Sunday, March 12				

SECTOR (IV) OCEANOGRAPHY AND OCEAN TECHNOLOGY (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	10:30 – 12:00	Polar Research center of National Science Museum ITABASHI	– Visit (sea ice studies)	
	14:30 – 17:00	Ship Research Institute, MITAKA	– Visit (Marine technology including instrumentation)	
Tuesday, March 14	10:00 – 12:00	Japan Petrolium Development Cooperation, AKASAKA	– Visit (Offshore exploration and engineering technology for oil and gas)	
	14:00 – 16:30	Meteorological Agency, OHTEMACHI	– Visit (Ocean data networks and marine chemistry)	
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

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Prepared by The
Japanese Science and Technology Agency

SECTOR (V) PHYSICAL SCIENCES

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00 14:00 – 15:00	Ministry of Foreign Affairs	– Opening Plenary Meeting – General Briefing on Japanese Science Policy and its Organization	Agenda to be advised
Thursday, March 9	10:30 – 12:00 14:00 – 16:00	Agency of Industrial Science and Technology MITI National Research Institute for Metals NAKAMEGURO	– Group Meeting (Fundamental Research) – Visit	
Friday, March 10	10:00 – 12:00 14:00 – 16:00	Institute of Industrial Science, University of Tokyo ROPPONGI Geological Survey of Japan HONJO, TOKYO	– Visit – Visit	
Saturday, March 11				
Sunday, March 12	night	(Stay in KYOTO)		

SECTOR (V) PHYSICAL SCIENCES (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	10:00 – 12:00	Disaster Prevention Research Institute, KYOTO University, KYOTO (Trip to NAGOYA)	– Visit	12:24 LV. KYOTO "HIKARI 38" 13:11 AR. NAGOYA
	14:00 – 16:00	NIHON GAISHI Co.-(insulator product), NAGOYA	– Visit	
Tuesday, March 14	10:00 – 12:00	Government Industrial Research Institute, NAGOYA	– Visit	
	14:00 – 16:00	NIPPON Steel Corporation, NAGOYA (Trip to TOKYO)	– Visit	16:51 LV. NAGOYA "HIKARI 60" 18:55 AR. TOKYO
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

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Prepared by The
Japanese Science and Technology Agency

SECTOR (VI) TRANSPORTATION

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00 14:00 – 15:00	Ministry of Foreign Affairs	– Opening Plenary Meeting – General Briefing on Japanese Science Policy and its Organization	Agenda to be advised
Thursday, March 9	8:00 10:00 – 16:00	LV. Hotel Port and Harbour Technical Research Institute KURIHAMA, KANAGAWA	– Visit (Port Facilities)	
Friday, March 10	9:00 10:00 – 12:00 13:30 – 17:30	LV. Hotel National Aerospace Laboratory, MITAKA Railway Technical Institute, KUMITACHI	– Visit (Aerospace Electronics Technology) – Visit (Tracked Air Cussion Vehicles, Conventional Rail Problems at high Speed, etc.)	
Saturday, March 11				
Sunday, March 12				

SECTOR (VI) TRANSPORTATION (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	9:30	LV. Hotel		
	10:00 – 12:00	Japan Society of Promotion of Machine Industry, SHIBA	– Visit (Computer-Guide Vehicle System)	Lunch at the Society
	14:30 – 17:00	Ship Research Institute, MITAKA	– Visit (Shipbuilding Research, Development and Construction)	
Tuesday, March 14	8:30	LV. Hotel		
	13:00 – 15:00	(Trip to NAGOYA) Mitsubishi: Heavy Industries Nagoya Factory, NAGOYA	– Visit (Air Craft Research, Development and Construction Technique)	9:00 LV. TOKYO "HIKARI 19" 11:00 AR. NAGOYA
		(Trip to TOKYO)		16:51 LV. NAGOYA "HIKARI 60" 18.55 AR. TOKYO
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

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Prepared by The
Japanese Science and Technology Agency

SECTOR (VII) URBAN DEVELOPMENT

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	10:00 – 12:00	Ministry of Construction	– Group Meeting (Regional and Urban Planning)	
	14:00 – 17:00		– Group Meeting (the same as above)	
Friday, March 10	10:00 – 12:00	Building Research Institute, SHINJAKU	– Visit (Housing and Building Research)	
	14:00 – 17:00	Tokyo Expressway Corporation TORANOMON	– Visit (Expressway Systems)	
Saturday, March 11				
Sunday, March 12				

SECTOR (VII) URBAN DEVELOPMENT (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	10:00 – 12:00	Waste Disposal Facility, CHITOSE	– Visit	With Section III
	14:30 – 17:00	Tama New Town, Tokyo	– Visit	
Tuesday, March 14	10:00 – 12:00	Ministry of International Trade and Industry	– Group Meeting (Housing Industry)	(Participants) Nobuyoshi Namiki Chief, office of Housing Industry
	13:00	LV. Hotel		
	14:30 – 17:00	DAIWA House Co. RYUGASAKI, IBARAGI	– Visit	
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

SECTOR (VIII) FOOD AND AGRICULTURE

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	10:00 – 12:00	Ministry of Agriculture and Forestry	– Group Meeting (Outline of Agriculture Research and Agriculture Research Management)	
	13:30 – 16:30		– Group Meeting (State and Problems of Agriculture and Animal Industry Research)	
Friday, March 10	10:00 – 12:00	Ministry of Health and Welfare	– Joint Group Meeting (Food Sanitation Problems)	(Participants) Officials of A.F.F. Research Council,
	13:30 – 17:00	National Food Research Institute Government Warehouse, and FUKAGAWA	– Visit	Officials of Ministry Health and Welfare
Saturday, March 11				
Sunday, March 12				

SECTOR (VIII) FOOD AND AGRICULTURE (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	8:00	LV. Hotel (Trip to ODAWARA)	– Visit	8:30 LV. TOKYO "Kodama 115" 9:14 AR. ODAWARA
	10:00 – 11:30	Branch of KANAGAWA Prefectual Horticulture Experiment Station, NEBUKAWA (Trip to Shizuvka)		
	14:00 – 16:00	IHARA Agricultural Cooperative, SHIMIZU (Trip to NAGOYA)	– Visit	13:06 LV. ATAMI "Kodama 137" 13:40 AL. SHIZUOKA 17.24 LV. SHIZUOKA "Kodama 153" 18.35 AR. NAGOYA
Tuesday, March 14	8:00	LV. Hotel		
	9:00 – 11:00	Aichi Prefectural Agriculture Experiment Station NAGAKUTE, AICHI		
	12:00 – 17:00	TOYOKAWA Irrigation Project Area, TOYOHASHI (Trip to TOKYO)	– Visit (Including Greenhouses Horticulture Farm)	17:05 LV. TOYOHASHI "Kodama 156" 19:25 AR. TOKYO
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

SECTOR (IX) FISHERIES

Date	Time	Place	Schedule	Remarks
Wednesday, March 8	9:00 – 12:00 14:00 – 15:00	Ministry of Foreign Affairs	– Opening Plenary Meeting – General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	9:30 – 10:00 10:30 – 12:00 14:00 – 16:00	Fishery Agency Tokai Regional Fisheries Research Laboratory, TSUKISHIMA	– Group Meeting – Film Show on Japanese Fishery – Group Meeting (Deep Sea Fishing Techniques, Artificial Cultivation, etc.)	
Friday, March 10	5:30 – 7:00 10:00 – 12:00 14:00 – 16:00	TOKYO Central Wholesale Fish Market, TSUKIJI Ministry of Health and Welfare Japan Fisheries Association, AKASAKA	– Visit – Joint Group Meeting (Food Sanitation Problems) – Group Meeting (Deep Sea Fishing Techniques)	
Saturday, March 11				
Sunday, March 12				

SECTOR (IX) FISHERIES (Continued)

Date	Time	Place	Schedule	Remarks
Monday, March 13	11:30 – 14:00 15:00 – 16:30	(Trip to Shimizu) Far Seas Fishery Research Laboratory, SHIMIZU Yaizu Fish Market, YAIZU (Trip to SHIZUOKA)	– Visit – Visit	9:10 Lv. TOKYO "Kodama 357" 10:40 Ar. SHIZUOKA Lunch at the Laboratory 14:00 Lv. Laboratory by car 17:00 Lv. YAIZU 18:00 Ar. SHIZUOKA, Stay Overnight
Tuesday, March 14	10:00 – 12:00 15:00	Yaizu Prefectural Fishery Laboratory, YAIZU Numazu Prefectural Fishery Laboratory, NUMAZU (Trip to TOKYO)	– Visit – Visit	9:00 Lv. SHIZUOKA by Car 13:30 Lv. YAIZU by Car 17:00 Lv. NUMAZU by Car 17:51 Lv. MISHIMA "Kodama 396" 19:00 Ar. TOKYO
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs.	– Review of the Mission – Closing Plenary Meeting	

Science and Technology Mission
to Japan, 8-15 March 1972

Prepared by The
Japanese Science and Technology Agency

SECTOR (X) HEALTH SCIENCES

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00 14:00 – 15:00	Ministry of Foreign Affairs	– Opening Plenary Meeting – General Briefing on Japanese Science Policy and its Organization	Agenda to be advised
Thursday, March 9	10:00 – 12:00 14:00 – 17:00	Ministry of Health and Welfare Heart Institute Japan, SHINJUKU Cancer Institute, Japanese Foundation for Cancer Research, SUGAMO	– Group Meeting (Delivery of Health Care) – Visit	
Friday, March 10	10:00 – 12:00 14:00 – 17:00	Institute of Population Problems Institute of Medical Sciences, University of Tokyo Institute of Public Health TOKYO	– Visit SHIROGANEDAI	
Saturday, March 11				
Sunday, March 12				

SECTOR (X) HEALTH SCIENCES (Continued)

Date	Time	Place	Event	Remarks
Monday, March 13	10:00 – 12:00	Ministry of Health and Welfare	– Group Meeting (Drug and Pharmaceutical Technology)	
	14:00 – 16:00	SANKYO Co., Ltd. SHINAGAWA	– Visit	
Tuesday, March 14	10:00 – 11:30	Institute of Microbial Chemistry, Microbial Chemistry Research Foundation, OHSAKI	– Group Meeting (Extraction Technology of Anti-biotics Resources from the Sea	
	14:00 – 17:00	MEIJI SEIKA Ltd. ODAWARA	– Visit	12:45 LV. TOKYO, "Kodama 141" 13:34 AR. ODAWARA 17:23 LV. ODAWARA "Kodama 148" 18:05 AR TOKYO
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission – Closing Plenary Meeting	

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SECTOR (XI) SPACE RESEARCH

Date	Time	Place	Event	Remarks
Wednesday, March 8	9:00 – 12:00	Ministry of Foreign Affairs	– Opening Plenary Meeting	Agenda to be advised
	14:00 – 15:00		– General Briefing on Japanese Science Policy and its Organization	
Thursday, March 9	9:00	LV. Hotel Technical Research Laboratory, NHK, SETAGAYA	– Visit	Lunch at NHK Laboratory
	14:00 – 15:00	Institute of Space and Aeronautical Science, University of Tokyo (KOMABA)	– Visit	
Friday, March 10	9:00	LV. Hotel		
	10:00 – 11:00	– National Aerospace Laboratory MITAKA	– Visit	
	11:15 – 13:30	– Electric Communication Laboratory, MUSASHINO	– Visit	
	14:00 – 15:50	– Radio Research Laboratory, KOGANEI	– Visit	Lunch at Laboratory
	16:00 – 16:30	– Kodaira Branch of National Space Development, KODAIRA		
Saturday, March 11				

SECTOR (XI) SPACE RESEARCH (Continued)

Date	Time	Place	Event	Remarks
Sunday, March 12				
Monday, March 13	9:30	LV. Hotel		
	10:00 – 12:00	– National Space Development Agency of Japan, HAMAMATSUCHO	– Visit	
	14:00 – 16:00	– Space Activities Commission, Science and Technology Agency	– Visit	
Tuesday, March 14	10:00 – 12:00	Science and Technology Agency	– Group Meeting	
	14:00 – 16:00			
Wednesday, March 15	14:00 – 17:00	Ministry of Foreign Affairs	– Review of the Mission	
			– Closing Plenary Meeting	

Sector I – Science Policy

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SECTOR I – SCIENCE POLICY

Overall Canadian policy seeks to make optimum use of science and technology in the pursuit of national objectives – cultural, social, political and economic – both domestically and abroad.

The situation in Canada is strongly influenced by our federal and bicultural nature in that many aspects of science and technology in public affairs are the prerogatives of the provincial governments. Among the most important of these are education, natural resource development and medical care.

History

The development of science policy machinery in Canada began in 1916 with the establishment of the Privy Council Committee on Scientific and Industrial Research which included all Ministers with major responsibilities for scientific activities. The Chairman of this Cabinet Committee has, over the years, been recognized as the Minister with the prime responsibility for science policy. The P.C.C.S.I.R. has seen bursts of activity at about ten-year intervals. To advise this Committee, the Government, at the same time, appointed a non-governmental Advisory Council now known as the National Research Council.

By 1949 the growth of scientific activities in Government departments and agencies led the Privy Council Committee to create an Advisory Panel on Scientific Policy to advise it on intra-governmental research and development. This Committee is composed of the permanent heads of the science-based departments and agencies.

In 1962 the Glassco Commission on Government Organization criticised the existing science policy machinery, largely on the basis that the National Research Council which, during World War II had acquired major operational responsibilities, could not and in fact did not advise the Government on the scientific activities of other agencies. In response to the recommendations of the Commission, the Government then proceeded with the creation of a Science Secretariat in the Privy Council Office (1964) and with the establishment of the Science Council of Canada (1966). At the same time, the statutory requirement for the National Research Council to advise on all matters of science and technology was deleted from the NRC Act. In 1968 the Science Council became a Crown Corporation with its own secretariat.

Ministry of State for Science and Technology

In August 1971, the Prime Minister announced the appointment of a Minister of State for Science and Technology, and the functions of the Science Secretariat were transferred to the new Ministry. The Science Council of Canada now also reports to the new Minister of State for Science and Technology rather than the Prime Minister as it has in the past.

The Minister of State for Science and Technology is responsible to formulate and develop policies with respect to:

(a) the most appropriate means by which the Government of Canada may, through measures within its fields of jurisdiction, have a beneficial influence on the application and development of science and technology in Canada,

(b) the coordination of programs and activities regarding science and technology with other policies and programs of the Government of Canada, and

(c) the fostering of cooperative relationships with respect to science and technology with the provinces, with public and private organizations, and with other nations.

The Ministry, which is just six months old, comprises five seperate divisions, each headed by an Assistant Secretary who reports to the Secretary. The five divisions are:

Information and Analysis

Policy Planning

Industrial Research and Development

International Affairs

Organization and Administration,

Science advisors are attached to the first four divisions, and are responsible for research and the formulation of policies for submission to the government.

Productive consultations have already been established between the Ministry, private industry, the universities and the other levels of government. A particular concern of the Ministry is the development of a long-term industrial strategies for the benefit of Canada as a whole. The Ministry will accordingly review the criteria for research and development carried out within government agencies, and see whether certain programs can be entrusted to private industry, the universities or other research institutions. Some of the considerations which led to the proposal to create the Ministry of State for Science and Technology are reported in the excerpt from the House of Commons debates forming part of the briefs for Sector I.

Other organizations contributing to national science policy formulation:

At present the following organizations have a varying impact on the formulation of a national science policy:

i) *Privy Council Office* – From time to time, special studies for the Prime Minister are conducted within the Privy Council Office by the Secretariat for Priorities and Planning and the Secretariat for Federal Provincial Relations.

ii) *The Treasury Board* is a statutory Committee of Cabinet Ministers. It is supported by a large staff of public servants and its Secretary is one of the most powerful public servants. The Treasury Board staff has authority to approve expenditures and to monitor departmental programs and plans. It is also responsible for collective bargaining, and job classification in the Public Service.

iii) *The National Research Council* was established in 1916 to give the government over-all advice on the promotion of scientific research in Canada. Over the years, the National Research Council became the major granting body for research in the universities, developed its own laboratories in the sciences and engineering, and became the adhering body to most of the scientific unions associated with ICSV. Later some of the activities of NRC were assigned to independent organizations, e.g. the Defence Research Board, Atomic Energy of Canada Ltd., and the Medical Research Council.

The role of NRC relating to university/industry/government cooperation, and information exchange is described in ANNEX A.

iv) *The Science Council of Canada* with membership drawn from private industry, universities and government, conduct studies and makes recommendations on medium to long-term issues in science policy. It is an independent body which is free to publish its findings and recommendations whether they be favourable to or critical of the government. It reports to the Minister of State for Science and Technology, but is not a part of the Ministry.

v) *The Senate Special Committee on Science Policy,* which began its review in 1967, has recently published Volume 2 of its report which contains numerous and significant recommendations. The review was the most thorough ever conducted of Canadian science, and data are voluminous.

vi) *The granting councils:* the National Research Council (natural sciences and engineering), the Medical Research Council, the Canada Council (social sciences and humanities). The policies of these granting Councils have an important effect in Canada. They are generally left to determine their own policies and roles, but the Government can regulate activities through control of the budget and of the Council memberships.

vii) *The Department of Industry, Trade and Commerce* The role of this Department and its Office of Science and Technology in promoting the greater use of research and the application of advanced technology is described in ANNEX B.

viii) In addition to the above organizations, there are scores of interdepartmental committees and advisory boards having widely varying impact on policy. There are also numerous federal-provincial councils and committees, both at the ministerial and official levels.

ix) Of the external sources of advice, the *OECD Review of Canadian Science Policy* has been valued for its objectivity; valuable as "ourselves as others see us"; and worth heeding because of its "economic sponsorship".

x) *The International Council of Scientific Unions* and its member organizations have significant impact on Canadian scientists, but little direct effect on the deliberations of Cabinet.

SECTOR I – SCIENCE POLICY – NATIONAL RESEARCH COUNCIL

University/Industry/Government cooperation

The National Research Council of Canada has the responsibility for advancing the economic, social and cultural development of Canada by research and effective use of scientific and technological resources, and ensuring the delivery of the resultant benefits to Canadians. To this end it operates laboratories, supports research in universities and in industry, and operates a series of supporting services including a national scientific and technical information system. Within one organization programs can be carried out involving all three performing sectors, university, industry and government. The governing body, the National Research Council of Canada, consists of four permanent members (the President and three Vice-Presidents), plus seventeen voluntarily serving members appointed for three years. These are drawn from industry and from the universities.

Industrial incentive programs, cooperation between government and industry

The National Research Council of Canada operates an Industrial Research Assistance Program (IRAP), designed to promote the establishment of new research items in industry and to strengthen company research programs, and companies with sufficiently meritorious research project proposals receive a grant covering the salary costs of the research.

Information base for decision making

The National Research Council of Canada, following a governmental directive, established in 1971 an Information Exchange Centre for federally supported research in universities. A consolidated data base has been developed which will allow the publication of a single volume listing all grants and projects federally supported in universities by approximately twenty agencies and departments. The Centre can also make financial analyses by discipline, region, purpose, etc. In addition titles and, potentially, abstracts will form part of the data base and can be retrieved by key-word searching in order to determine what research is being done in Canadian universities on specific topics. The extension of this capability to research and other scientific activities carried on within government departments and agencies is obvious, as are the possibilities of extending the coverage to any or all research in Canada no matter how supported.

During the past twenty-five years science and technology has become very much more important to the economy of all countries and in particular for industrialized countries such as Canada.

The Department of Industry, Trade and Commerce has as part of its mandate the responsibility to promote the efficient and sustained economic growth of manufacturing and processing industries in Canada. In more specific terms a major function of the Department as set out in the Government Organization Act, 1969 is:

> "to promote and assist product and process development and increased productivity, the greater use of research, the application of advanced technology and modern management techniques, the modernization of equipment, the utilization of improved industrial design and the development and application of sound industrial standards in Canada and in world trade."

The role of the Office of Science and Technology in meeting these departmental objectives is to ensure that the best possible use is made of the resources allocated to the Department for science and technology purposes. This involves providing advice to senior management on scientific and technical matters affecting departmental policy, plans and programs; assessing, interpreting for, and advising senior management on the implications to the Department of the action and proposals of other departments and agencies in the field of science and technology particularly as they relate to industry: and carrying out future science and technology planning for the Department including the techno-economic studies and technological forecasting, necessary to determining departmental courses of action, modifying existing, and introducing new programs.

The current duties of the office can be defined in general terms as follows:

1. To provide advice, information and analyses to senior management, on all matters considered to affect the impact of science and technology on industry, and with respect to related departmental or government policy, plans and programs.
2. To carry out technical evaluations as appropriate of proposals submitted by industry for assistance under the Department's research and development assistance programs.
3. To provide industrial technological advice on proposals submitted by industry for assistance under NRC's Industrial Research Assistance Program and DRB's Defence Industrial Research Program, and on request, to other departments concerning proposals affecting the technological competence of Canadian industry.
4. To provide scientific and technical advice, information and expert support to all branches of the Department.
5. To prepare departmental long range technological plans and programs.
6. To study the innovation process and make comparisons of Canadian industrial performance with that of other countries, so as to provide the basis for new and improve existing departmental policies, plans, and programs.
7. To formulate plans and policies, and to implement new programs and modifications to existing technological and incentive programs, for the encouragement of research, development and innovation by Canadian industry and to evaluate the effectiveness of such programs.
8. To maintain contact with the science and technology communities in industry, universities and government so as to maintain scientific and technical competence, to obtain opinions concerning the effectiveness of the Department's technological programs and incentives; and to obtain information required to formulate departmental technological policies, plans, programs, and strategy.

9. To assume the Department's increasing responsibilities with respect to the Standards Council of Canada and the Metric Preparatory Commission.
10. To provide the lead role with respect to the Department's scientific and technological activities and interest in the international sphere.
11. To provide chairmanship of the PAIT Advisory Committee and the Policy Review Committee for IRDIA.
12. To represent the Department on interdepartmental committees such as IDAP, DIR, DIP, Space, International Systems of Units, and the NRC Advisory Committee for Applied Research and Engineering and on boards of directors such as those of the Canadian Patents and Development Limited, NRC Division of Building Research, and the Centre for Applied Research and Engineering Design.
13. To provide the Secretariat for the Interdepartmental Committee for Innovation.
14. To manage the Product Innovation Activity of the Department.

SECTOR I – SCIENCE POLICY

EXTRACTS FROM HOUSE OF COMMONS DEBATES
VOL. 115 NUMBER 157 3rd SESSION
21 JUNE 1971

GOVERNMENT ORDERS

Science and Technology

Provision of Ministry of State

On the order:

June 18, 1971–The following proposed motion:

That the following Address be presented to His Excellency the Governor General of Canada:

"To His Excellency the Right Honourable Roland Michener, C.C., C.D., Governor General and Commander-in-Chief of Canada.

May it please Your Excellency:

The House of Commons, having considered the proposed text of the Order in Council laid upon the table of the House on June 18, 1971, in relation to the establishment of a Ministry of State for Science and Technology, prays that the making of the said Order in Council be approved."–The Prime Minister.

Hon. C. M. Drury (for the Prime Minister) moved:

That the following Address be presented to His Excellency the Governor General of Canada:

"To His Excellency the Right Honourable Roland Michener, C.C., C.D., Governor General and Commander-in-Chief of Canada.

May it please Your Excellency:

The House of Commons, having considered the proposed text of the Order in Council laid upon the Table of the House on June 18, 1971, in relation to the establishment of a Ministry of State for Science and Technology, prays that the making of the said Order in Council be approved."

He said: Mr. Speaker, in moving the adoption of the proposed text of an order in council for the establishment of a ministry of state for science and technology, I would like to take the opportunity to review briefly where Canada stands and has stood in the matter of the organization for science in national policy.

It was only in the last decade–the sixties–that countries first began to consider science as a significant factor in national policy and to seek organizational structures to recognize this fact. As members are aware, it was the Royal Commission on Government Organization, the Glassco Commission appointed in 1960, which first made a comprehensive study of this subject in Canada and reported on it in January, 1963. As a consequence, as early as 1964 the government of the day established the science secretariat within the Privy Council Office to provide a focus for policy co-ordination of those matters which had a significant content of science and technology.

About the same time, a major study was made on behalf of OECD by a distinguished group of international consultants headed by a Pierre Piganiol, formerly Délégué Général de la Recherche Scientifique of France. The report of this group had a major influence on the creation of science policy bodies in many countries and was consistent with what had already been proposed in Canada.

With your permission, Mr. Speaker, I should like to refer to a number of important observations in this report of experts. I quote:

A nation needs a comprehensive and consistent policy for the support and advancement of science, because there are more opportunities to advance science and technology than there are resources available to exploit them all. The term "science policy" is abiguous. It too often connotes only a policy limited to the needs of science per se, and excludes the effects of science and technology on the full spectrum of national policies.

...Maximum exploitation of scientific opportunities requires programs that combine concern for the growth of science itself and provision for the rapid, deliberate application of its fruits to human welfare. That is the substance of science policy in the full sense, as denoting consideration of the interactions of science with policy in all fields.

In 1966 Parliament adopted a related proposal of the government based on recommendations of the Glassco Commission, when it passed the Science Council Act and created an advisory body somewhat analagous to the Economic Council. The Science Council has a special responsibility in scanning the horizon of scientific and technological developments and is expected to make publicly known the results of its studies and its opinions on scientific and technological matters. In a speech at the inaugural meeting of the Science Council, the former Prime Minister, the Right Hon. Lester Pearson said:

As governments must be pragmatic, a declared and emphasized aim of government support for science is to foster economic growth; to improve our standard of living and our way of life. To this end, we want to know that the very best available scientific knowledge and resources are being brought to bear on problems—new and challenging problems—such as water resources and water pollution; transportation; urban planning and development; automation and employment; public health; poverty in all its guises and ramifications. I have emphasized these practical applications of science. I am also well aware that it would be folly to overlook the importance of basic research. Some of man's greatest advances have come from the results of research that had no immediate practical aim—so some of our best brains must always be free to explore, to search out whatever lies beyond our present intellectual horizons.

[Mr. Drury.]

While the demands of the sixties were great, we find on entering the seventies that national aims are changing and that economic growth is no longer regarded as an end in itself but as a means to achieve social progress. Increasingly, we regard science and technology as tools to use in achieving our broad social and economic goals. While the old preoccupations remain, new ones appear and our challenge is to meet them with the techniques and the organizations appropriate to them.

In a Review of Science Policy in Canada, published in 1969, the OECD examiners critically studied the Canadian situation and recommended, among other things, that there should be a minister of science without departmental responsibility or other conflicting functions.

Hon. members will also know that in the other place a special committee on science policy was appointed in November, 1967, and that it has been re-established each subsequent session. This committee under the chairmanship of the Hon. Senator Maurice Lamontagne has performed a very valuable service. At its public hearings factual information and opinion and advice have been received from many organizations, including government departments and agencies, and from distinguished scientists, not only Canadians but from other countries as well. This committee has published only the first volume of a two-volume report, and it is clear from the conclusions of this volume that the government's proposal to appoint a minister of state for science and technology and to equip him with expert staff to assist him in discharging his responsibilities, is consistent with these conclusions.

In appointing a new minister of state, it is not intended to fragment the responsibilities of other ministers and the various departments and agencies for which they are responsible. Science and technology pervade almost everything with which the government deals—defence, health, agriculture, the environment, the post office, transportation and so on. The ministers responsible for these many activities will continue to carry full responsibility for them, including the science activities which are essential to them.

APPENDIX "A"

PC 1971 – 1695
11 AUGUST 1971

WHEREAS science and technology vitally affects the well-being of Canadians and the future of Canadian society as a whole;

AND WHEREAS many of the policies and programs of the Government of Canada substantially influence directly and indirectly the development of science and technology in Canada;

AND WHEREAS the close cooperation of departments and agencies of the Government of Canada is required to ensure that the development and use of science and technology advances in a manner beneficial to all Canadians;

AND WHEREAS the need for policies directed towards the most effective use of science and technology in the achievement of Canada's national goals has become increasingly urgent;

AND WHEREAS it appears to the Governor in Council that the requirements for formulating and developing such policies warrant the establishment of a special portion of the public service presided over by a minister charged with that responsibility.

NOW THEREFORE His Excellency, the Governor General in Council, on the recommendation of the Prime Minister, pursuant to sections 14 and 15 of the Ministries and Ministers of State Act, is pleased to direct that a proclamation do issue establishing a Ministry of State for the purpose of formulating and developing policies in relation to the activities of the Government of Canada that affect the development and application of science and technology, to be known as the Ministry of State for Science and Technology and to be presided over by a Minister of State to be known as the Minister of State for Science and Technology.

HIS EXCELLENCY IN COUNCIL is further pleased to specify that the Minister of State for Science and Technology shall formulate and develop policies with respect to

(a) the most appropriate means by which the Government of Canada may, through measures within its fields of jurisdiction, have a beneficial influence on the application and development of science and technology in Canada,

(b) the co-ordination of programs and activities regarding science and technology with other policies and programs of the Government of Canada, and

(c) the fostering of cooperative relationships with respect to science and technology with the provinces, with public and private organizations, and with other nations.

HIS EXCELLENCY IN COUNCIL is further pleased to specify that the Minister of State for Science and Technology shall, in relation to the formulation and development of the aforementioned policies, have such duties as may be assigned to him by law, and without limiting the generality of the foregoing, shall assist departments and agencies of the Government of Canada in the formulation and development of advice to the Governor in Council with regard to

(a) the optimum investment in, and application of, science and technology in pursuit of national objectives,

(b) the organization of the scientific establishment in the public service of Canada,

(c) the allocation of financial, personnel and other resources to Canadian scientific endeavours, and

(d) the extent and nature of Canada's participation in international scientific activities and the co-ordination of related domestic activites.

HIS EXCELLENCY IN COUNCIL is further pleased to specify that the Minister of State for Science and Technology may

(a) initiate and undertake such research, analysis and policy studies as may be required to further knowledge and understanding of the impact of science and technology on society, and

(b) determine and promote the use of methods for assessing the effectiveness of scientific policies and programs.

The role of the proposed minister of state will be principally one of advising the government on virtually all matters relating to science and technology, including notably, advice on how best to harness the potential of activity in these fields to national goals. His policy-formulating roles will be characterized by activities such as advising, monitoring, forecasting and co-ordinating. The ministry of state will not concern itself only with advice on policies relating to the application and development of science and technology, but also with the co-ordination of programs and activities in science and technology with other policies and programs of the government. The proposed ministry of state will seek to foster co-operative relationships in respect of science and technology with the provinces, with public and private organizations and with other nations.

As social priorities turn more toward the quality of life, the uses of science and technology dictated by past priorities and preoccupations appear threatening to many. For some, this dissatisfaction turns to condemnation, not of the use of science and technology but of science and technology themselves. Yet these difficulties are not inherent in science and technology but result rather from their unguided development.

The proposed minister of state for science and technology will therefore be expected, amongst other things, to develop and use forecasting methods to try to foresee, wherever possible, both the short-term and the long-term consequences of utilizing various technologies and to advise the government, and more particularly the departments concerned, of his findings. It is hoped that we can thus avoid some of the undesirable consequences of the misuse of technology which have sometimes been encountered in the past. Nevertheless, if we are to make progress toward our broadened social goals more, not less, science will be required; more, not less, technology will be demanded. Our ability to restore and maintain the quality of the environment depends upon more knowledge and better technology. So, too, does our ability to advance health care, education, or the amenities of urban living.

The ministry of state for science and technology will be concerned with the identification of all of the government's expenditures on science activities and the objectives to which they relate. The minister will be advising on the priorities for such expenditures taking into account the significance of these science activities in support of our national goals.

The minister of state for science and technology will be concerned with international developments related to his responsibilities. In this connection, the OECD ministerial meeting planned for next October to discuss science policy in the '70's will provide an opportunity to discuss with other countries the continuing advances that Canada has been making in the field of science policy.

It is our intention to utilize science and technology still more effectively in carrying out all of the functions of government. The route to this objective may not be a short one. There is an ancient Chinese saying: "A journey of one thousand miles begins with the first step." To reach our destination we must set out, and the government believes the creation of the ministry of state for science and technology and the appointment of the minister of state constitute that necessary first step.

SECTOR I – SCIENCE POLICY

JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE

Introduction

The Japan Society for the Promotion of Science (JSPS) is a special juridical person having as its purpose to contribute to the advancement of science: by making grants in aid for scientific research, by providing support to researchers, by promoting the implementation of international cooperation in science, and by conducting other activities for the promotion of science. Originally it was established in 1932 as a private foundation with the endowment granted by His Majesty the Emperor and the grant-in-aid provided by the Government. Its programme was composed mainly of providing excellent researchers with necessary funds, managing industry-university cooperative research committees, publishing scientific books, and so on. However, in September 1967 JSPS was reorganized by law into a special juridical person under the supervision of the Minister of Education. The purpose of this reorganization was to set up an institution aiming at carrying out the national policies for the advancement of science more smoothly and more flexibly than otherwise. The activities of JSPS are mainly funded by the Government.

More precisely, JSPS aims at contributing toward the progress of Science by supporting scientific researches, assisting researchers in obtaining research facilities and equipments, and implementing international cooperative science projects.

JSPS does not itself operate laboratories, conduct research, or carry out educational programmes. It provides funds to individual scientists and researchers or to their groups.

Activities

Major activities of JSPS are summarized as follows:

Fellowships for Japanese Researchers and Scientists

Fellowships are provided to post-graduate researchers and university professors, with a view to increasing the number of well-trained scientists and engineers, or to offer the opportunities for scientists to conduct joint researches.

a. Post-graduate fellowship

In order to help post-graduate researchers continue and upgrade their researches and also to secure an adequate number of well-trained scientists to meet the demand of universities, research institutions, and so on, fellowships are provided to young researchers who have completed doctor's course satisfactorily.

b. Visiting professorship

Professorship are provided to university professors, senior researchers and those equivalent to them by which they can conduct joint researches, especially in the field of science where interdisciplinary cooperation is deemed necessary.

Fellowships for Foreign Scientists and Researchers

Post-doctoral fellowships and visiting professorships are also available to foreign scientists and researchers under the Post-doctoral Fellowship Programme and the Visiting Professorship Programme for foreign scientists and researchers.

a. Post-doctoral fellowship

Post-doctoral fellowship for Foreign Researchers was created in 1964. Under this Programme foreign researchers who hold degrees equivalent to Japanese university doctorate may stay in Japan for study at universities or similar institutions. The tenure of the fellowship is one year starting from October 1 each year and the application is made through research supervisors in charge at the host institutions, and accepted in May and June by JSPS. The fellowship covers the round trip as well as research and living expenses.

b. Visiting professorship

Visiting Professorship Programme was inaugurated in 1959 to meet the urgent need for international cooperation in scientific research felt in most fields of science. Application for this programme is received in November-December every year from Japanese scientists who want to invite foreign scientists with excellent achievements to stay and conduct cooperative research for several months in Japan. When the application is approved the invitee will be provided with a grant to cover the expenses for the round trip and maintenance in Japan. The number of invitees is around 40, in 1970.

International Scientific Cooperation Programme

JSPS has been acting as one of the implementing agencies of the U.S.-Japan Cooperative Science Programme and the U.S.-Japan Educational and Cultural Cooperation Programme, under which it supports cooperative researches and scientific seminars which are organized by the joint effort of American and Japanese scientists.

The counterpart agencies in the United States are the National Science Foundation for the former and the Social Science Research Council for the latter.

JSPS also has a number of cooperative research projects which are conducted jointly by Japanese and foreign scientists. A few examples are: the Cosmic Ray Research at Mt. Chacaltaya, Bolivia, conducted by Japanese, Bolivian and Brazilian scientists; the Marine Biology Research, under which JSPS support Japanese biologists to conduct biological research at the Zoological Station at Naples in cooperation with other foreign biologists studying at the Station. JSPS is also operating institutes for regional study at Teheran and Nairobi where Japanese scientists stay and conduct research in their specific fields.

Information Service

One of the major functions of JSPS is to provide scientific information requested by Japanese as well as foreign scientists. As it is only a few years since its reorganization, activity in this area is still in a developing stage. JSPS plans to publish various directories concerning learned societies, research institutions, research subjects of Japanese scientists and information centres of humanities and social sciences, and to establish a referral center for humanities and social sciences.

Publication Service

Publication service is also one of JSPS' main functions. It has published some two hundred titles in the last twenty years, not a few of them being highly evaluated among the scientific communities concerned. JSPS also publishes a monthly journal entitled "Gakujutsu Geppo (Japanese Scientific Monthly)", in Japanese. It carries such articles as the recent trend of scientific researches in various fields of science in Japan, reports on international scientific meetings, international cooperative research activities, information concerning scientific and technological administration, current activities of JSPS, etc.

Industry-University Cooperation

Since its inauguration in 1932, JSPS has made efforts to promote scientific cooperation between industries and universities, and organized more than 100 research committees which met to discuss problems in various fields of science where industry-university cooperation was deemed necessary. Some of these research committees are still very active, and their activities have been highly evaluated by both industrial and scientific circles.

Science and Technology Mission
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Prepared by the
Ministry of State for Science and Technology

SECTOR I – SCIENCE POLICY

EXTRACTS FROM

THE FUNDAMENTALS OF COMPREHENSIVE SCIENCE & TECHNOLOGY POLICY FOR THE 1970'S

A Report Made in Response to the Prime Minister's
Inquiry No. 5

April 21, 1971
Council for Science and Technology
Prime Minister's Office
Tokyo, Japan

Chapter 1 Attitude to be Taken in Developing Science and Technology Policy

It is widely recognized that in the 1960's science and technology has played an extremely important role in Japan's remarkable economic growth and the promotion of the living standard of its people.

The development of science and technology has not only contributed greatly to the development of industry and promotion of national life in a variety of forms such as new systems and products, renovated manufacturing processes and newly developed resources but also led to the progress of data processing and conveyance, transportation and communication, induced marked changes in the mode of our thinking and living and triggered a social revolution involving the ascendancy of information.

In the 1970's, as pointed out in the new Economic and Social Development Plan, our society and economy are expected to become even more complex and information oriented. In such social and economic conditions, science and technology are expected to play an even greater role than before. For example, to meet the need for an industrial structure productive of high added value, economical of raw materials and free of environmental pollution – a structure characterized by concentration of brains –, development of innovative technology is essential. Also to preclude the danger of environmental pollution, traffic accidents, nature disruption and so forth being aggravated by disorderly urben development, it is necessary to build up a system of science and technology adapted to special conditions in Japan.

Science and technology are expected to progress with far greater force than in the past and accelerate social and economic changes in the future. However, the greater the impact of science and technology, the more pressing the necessity for us to ponder the role or the significance of science and technology in the promotion of human welfare and develop science and technology policy on the basis of such reflection. The environmental problems, a major social problem today, while stemming from a host of intricately intertwined factors, are undoubtedly ascribable, though indirectly, to our failure to predict environmental pollution and to conduct adequate scientific and technical activities against it which has been caused by rapid and disorderly concentration and accumulation of population and industrial plants, although science and technology have made possible mass production and mass consumption of resources and provided useful technical means for activities in industry. The current debate on how science and technology should be stemmed from the failure of science and technology to prevent pollution, although it certainly is not the prime cause of pollution, inasmuch as science and technology exist in the interest of human welfare.

Furthermore, future developments in the field of life sciences are expected to make feasible external fertilization, control of genes and ultimately synthesis of life, while a combination of life sciences and engineering may lead to the emergence of machinery capable of biological reactions and controls. These are problems affecting the very dignity of man.

Environmental pollution has raised the question, "What does science and technology mean for man? " The same question will be raised, in a deeper and more serious sense, in the cases of life sciences. The more rapid the development of science and technology, the greater its impact on human life. Policy for science and technology, therefore, should be based on respect for human life and human rights and directed toward promotion of human welfare through selection of research and development priorities and technology assessment.

On the other hand, much use has been made of science and technology in promoting harmony and friendly relations between nations through international technical exchanges and assistance. In the future, science and technology will play an increasingly great role in this field.

As research and development activities become large in scale, highly sophisticated and comprehensive, the government has a major role to play in research and development. As illustrated by big science projects, even a single research and development project requires the investment of enormous financial and manpower resources as well as organized efforts of specialization. Evidently such research and development activities exceed the limits of capabilities of an enterprise or industry.

Reflecting the fact that science and technology have become an important factor in social changes and that the state has a growing role to play in promotion of science and technology, policy for science and technology, as part of the state policies, will gain in importance increasingly. The science policy for the 1960's, as indicated in the Council's report of October 1960, was aimed at elevating general scientific and technological standards in Japan largely through promotion of investigative research activities and having their results contribute toward social and economic development. The science policy for the 1970's, on the other hand, should be based on the viewpoint that the use of science and technology is for the betterment of human well-being and aimed at having science and technology meet specific social and economic needs through prescriptive research and development activities. Through the efforts exerted in the 1960's, Japanese scientific and technical standards have risen to such an extent that it is now possible in many cases to conduct research and development prescriptively in response to specific needs and organize projects and manage research and development according to specific needs.

In developing science and technology policy which has thus gained in importance, it will be necessary to take the following into consideration with attention paid to changes in factors surrounding science and technology:

(1) To lay great store on the attitude of respecting man and make efforts in assessing the impact of science and technology on society.

While science and technology played a major role in social and economic development in the 1960's, they have also been a factor responsible for current social strains such as urban problems and public hazards because the central concern has been greater economic efficiency and countermoves to negative effects of science and technology have been inadequate.

In the 1970's it will be necessary to consider the negative effects of science and technology and develop science policy based on the respect for man. For this purpose, it is important to forecast and assess both the positive and negative effects of science and technology so as to lead or change the course of science and technology in a desirable direction.

(2) To attach importance to scientific and comprehensive approaches in coping with social and economic situations which are expected to become increasingly complex.

With the advancement of society and economy and with the diversification of views of value, social and economic phenomena have turned unprecedentedly complex and the speed of their changes has also increased.

For this reason, problems that need to be solved with the use of science and technology have also become complicated, and any attempt at solving these problems made by scientists and engineers would not be fully successful were it not for collaboration among many disciplines. Hence, the importance of scientific and comprehensive or interdisciplinary approaches to problem solving.

(3) To see to it that basic science and applied technology will develop in harmony.

Because science and technology have become specialized on the one hand and interrelated on the other and because basic science has made rapid strides in recent years, there has been a pronounced tendency toward interdependence or inter-influencing between basic science and applied technology or among different fields of science. It is, therefore, important to foster cooperation and harmony between science and technology.

(4) To put emphasis on cultivation of capabilities for developing highly original technology to meet changing situations at home and abroad and to meet social and economic needs.
If Japan is to keep sufficient power for international competition in coping with internationalization of economy, it will be necessary to develop certain key technologies

and exchange technologies with other countries on an equal footing as a strategic means to further elevate its technological standards. On the other hand, it has become difficult for Japan to depend on other countries for the kind of technology needed to solve problems attributable to a high-density society like Japan. In this sense, it is highly important to cultivate capabilities for developing highly original technologies.

(5) To give due consideration to the relationships of science policy to other national policies with the expansion of the role of science and technology.

Reflecting the fact that science and technology have become an important factor in social changes, science and technology have come to exert major influence on various policies of the state. Due consideration of the relationships between science and other policies is thus imperative.

(6) To clarify and define the state's role in promoting science and technology so that the state can play its role effectively.

The state has an expanding role to play in accelerating research and development, promoting the spread of scientific and technical information, nurturing scientific and technical talent and aiding developing nations. On the other hand, the private sector, with increased financial capacities and research and development capabilities, now finds itself capable of performing on her own an increasing part of research and development programs for which it had been dependent on the state in the past. In view of the situation, it is considered important to review and define the state's role in the promotion of science and technology so that the state can more effectively play its role.

(7) To attach greater importance to international cooperation in science and technology in view of the rise in Japan's international status.

Japan has been developing her international cooperation in science and technology convinced that science and technology should contribute to the welfare of mankind. In substance, however, such cooperation has not necessarily been adequate partly because of geographic conditions of Japan and partly because of the language barrier.

As Japan's international status has become elevated, however, there has been strong demand that Japan plays a role suitable for an advanced nation from the standpoint of international solidarity. Hence, it will be necessary to give greater consideration to our assistance to developing nations and exchanges with other advanced nations in the world.

(8) To foster greater capacities for information processing and meet expected changes in situations flexibly.

As the value of information heightens, a large volume of information spreads, and public views of value tend to diversify, rapid and abrupt changes are expected to occur in various sectors of society. It is, therefore, necessary to promote man's capacities for processing information through utilization of computers to make possible co-existence of different views of value and to develop men's ability to adapt to radical social changes. In developing science policy also it will be necessary to adopt a broad and flexible attitude toward any change in the situation.

(9) To emphasize the view that nature or earth is finite in view of the growing impact of human activities.

Man has been consuming natural resources on the assumption that they are unlimited. He has not met any serious trouble because his activities have been small in scale. The same thinking has been at the root of our scientific and technical systems.

Human activities have expanded both in scale and scope of late and consequently the view that nature is boundless has now become untenable. It is necessary to adopt a new viewpoint that nature or earth is finite and take an attitude of effectively utilizing our limited resources from a global viewpoint or of maintaining ecological balance.

Chapter 2 Objectives of Science and Technology Policy

The objectives or goals of science and technology policy for the 1970's based on the viewpoints discussed in Chapter 1 are as follows:

1. To meet social and economic needs in the field of science and technology and contribute to their realization.

   The needs are (a) development of the qualities of man, (b) improvement of the people's living, (c) consolidation of social and economic foundations and preservation of the environment, (d) efficient development of economy and (e) fulfillment of international obligations.

   These needs can be made more specific as follows in consideration of their national significance, technical feasibilities for their realization and the role of the state in their promotion.

   – *Development of the qualities of man*

   To elicit and develop latent faculties of man (so as to heighten our joy of life)

   – *Improvement of the people's living*

   a. Improvement of medical care (so as to save man from all diseases and enhance his health)

   b. Improvement of living conditions (better dietary life through the supply of food which is both safe and of good quality, better housing through the abundant supply of inexpensive housing, healthy and pleasant living environment, protection of consumers)

   – *Consolidation of social and economic foundations and preservation of environment.*

   a. Increasing transport capacity (establishment of extensive and vertical traffic and transport system)

   b. Facilitating information processing and transmission (speedier processing and transmission of a large volume of information)

   c. Securing energy and other resources and their effective utilization (meeting increasing demand for energy through development and utilization of atomic energy, taking steps to secure needed resources)

   d. Preserving the quality of environment (early control of air pollution, water pollution, etc., prevention of environmental pollution, protection of natural environment)

   e. Preventing disasters (prevention, prediction and control of diasters of frequent occurrence)

   – *Efficient development of economy*

   a. Modernizing agriculture, foresty and fisheries (Efficient and stable supply of products through mechanical and systematic production)

   b. Modernizing and rationalizing the manufacturing industry and fostering new industries (Development of automation and other labor-saving processes and fostering of new industries characterized by concentrative use of brains to cope with internationalization of economy, labour shortage, shifting to an informationized society etc.

   – *Fulfillment of international obligations*

   a. Assistance to and cooperation with developing nations.

   b. Exchanges with advanced nations.

   c. Participation in international agencies.

2. To develop the seeds of science and technology.
   - To foster the growth of the new seeds and buds of science and technology which, though currently out of the public view, are expected to become social and economic requirements in the long run or are expected to lead society and economy.
   - To bring up such fundamental science and technology as are at the base of science and technology for meeting social and economic needs as well as new scientific and technological developments.
3. To promote basic science
   - To cultivate the ground for the development of the seeds of science and technology
   - To help toward the fulfillment of the basic human desire – the quest of truth.

These are the goals of science policy under which efforts should be made to achieve harmonious development of science and technology.

The present chapter will deal with the objective of research investment, the objectives of research, development and applications, and one of the objectives in fulfilling international obligations, that is, cooperation with developing nations. Goals of science policy other than these will be discussed in other chapters.

Section 2 Objectives of Research, Development and Applications

Research and development play a major role in the attainment of the objectives of science and technology policy. Expectations and demands placed on them are, therefore, very great. Accordingly, we believe that the greatest task imposed on research and development is to effectively achieve the goals of science policy mentioned in Section 1 so as to contribute to the enhancement of the people's welfare. As research and development for "meeting social and economic needs" and for "nurturing the seeds of science and technology" on the one hand and research for "promoting basic science" on the other require mutually different policies and methods of their development, they will be dealt with in two separate categories.

1. Important Fields of Research and Development and National Projects

Of the fields of research and development for meeting social and economic needs and for nurturing the seeds of science and technology, the following are to be developed on the responsibility of no one else but the state:

a. Research and development needed in smoothly conducting administrative affairs as in traffic safety, environmental protection and disaster prevention, research and development developed internationally in accordance with international treaties or commitments and other R&D programs originally related to state affairs.

b. Research and development in fields like medical care and public welfare in which the state is to play a major role and which can hardly be undertaken by the private sector.

c. Research and development in the interests of agriculture, forestry and fisheries as well as small and medium enterprises which can hardly be undertaken by themselves.

d. Research and development in the pioneering fields of science and technology.

e. Basic research that may lead to future technological innovations and research and development that serve as the basis for future scientific and technological development that can hardly be undertaken by the private sector alone.

While much is being expected of the state in promoting research and development, effective allocation of limited financial and manpower resources requires giving priority to fields of research and development for which there is strong demand from society and the economy and whose outcomes are expected to affect the people in general or which will produce great spin-off effects.

The fields of research and development to which the state is to give priority will be called the "important fields of research and development".

While it is generally considered appropriate to leave management of specific research and development programs to research institutions once budgetary measures for execution of research and development in important R&D fields have been taken by administrative authorities, there are those research and development projects which need to be treated as "national projects" as their goals are identified and their conduct is managed by administrative agencies (including those special corporations set up exclusively for managing and development the national projects). Scientific research at universities is not, however, covered either by important R&D fields or by national projects. Their autonomous participation in the conduct of research and development in these fields, especially where their participation is required, is desired.

1. Important Fields of Research and Development

The fields listed below are those areas of science and technology which are considered requisite to resolving problems which have already come to the surface or are expected to arise in the future. In this age of rapidly changing needs, however, it is necessary constantly to strive to comprehend them and to introduce additions or modifications in these fields of research and development with a flexible attitude.

(1) Improvement on Man's Qualities

If man is to adapt himself to rapidly changing social environments without feeling a sense of alienation and lead a life worth living by properly choosing his way of life so as to contribute to social progress, it is important that qualities of man be further improved. Man's qualities can be improved by providing him with the opportunity of giving full play to his natural endowmnents and their potentialities. Man's qualities are also greatly influenced by his surroundings.

While science and technology conducive to the improvement of man's qualities are still in their early stages of development, they are expected to play an increasingly important role in this field.

From this standpoint, we think that themes of research and development requiring immediate attention include maintenance and improvement of man's mental and physical capacities, interrelationships between productive activities, and recreation, and optimum environmental conditions of human life.

(2) Promotion of Medical Care

In this field, an increase in the incidence of adult diseases and mental disorders is likely to pose a major problem in the future. Accordingly, effort is needed to efficiently meet the sharply increasing demand for medical care with consideration paid to such a change in disease structure.

From such a viewpoint, we think that research and development in this field should focus on the following:

a. Prevention and treatment of diseases of high mortality including apoplexy, cancer and heart diseases as well as mental and nervous disorders and diseases caused by pollution

b. Substitute organs and systems of the human body such as artificial internal organs and artificial blood as well as new methods of diagnosis and therapeutics utilizing electronics, precision engineering, information theories, etc.

c. Development of new vaccines and safety of drugs

(3) Improvement of Living Conditions

While systems of food processing and distribution have rapidly expanded consequent upon the rise in the level of food consumption, preservation of the quality, nutritive value and freshness of food and improvement of food marketing and distribution systems have received attention. Recently special attention has been paid to the safety of food.

With regard to housing, efforts are required to develop a revolutionary system of housing production and supply and introduce modern concepts of city planning in order to supply inexpensive and comfortable housing and better living environments.

On the other hand, from the standpoint of consumer protection, importance is being attached to measures to secure the consumers the safety of products they use.

From this standpoint, we consider the following specific areas need to receive immediate attention:

a. Food distribution and the securing of the safety of food

b. Nutrition

c. Quantity production of inexpensive and comfortable houses

d. City planning for developing an efficient system of comfortable life

e. Safety and performance of commodities used by the consumer

(4) Increase of Traffic and Transport Capacities

In this field, urbanization and further economic development will call attention to the need for traffic safety and for greater capacities of transport within and among cities as well as between Japan and other countries.

From this standpoint, we consider the following areas need to receive immediate attention:

a. Super high speed railways for heavy-load transportation

b. Large-scale civil engineering projects such as construction of colossal bridges and undersea tunnels

c. Aeronautics suited to conditions of our country

d. Automatic and systematic operation of traffic and transportation as well as traffic safety and control

(5) Information Processing and Conveyance

With social and economic development and the rise in the standard of living, the volume and the flow of information will increase in the manner of geometric progression. In order to facilitate the processing and transmission of a large volume of information, it will be necessary to develop computer technology and communication channels as well as to improve communication between man and machine.

From this standpoint, immediate attention should be given the development of advanced systems of information processing and conveyance.

(6) Securing of Energy and Other Resources and Their Effective Utilization

To meet the growing demand for energy and to secure its cheap and stable supply, efforts should be continued for the development and utilization of atomic energy, and effective development and utilization of other energy resources. At the same time, greater efforts should be made to develop accident and pollution countermeasures attendant upon energy utilization.

With regard to mineral resources, the demand for which is also expected to increase, greater efforts should be made for the development of resources, efficient utilization and re-utilization of resources and substitution of abundant for scarce resources. Especially, to secure a stable supply of mineral resources, it is essential for Japan to develop resources abroad either independently or jointly with other countries. For such undertakings, development of new techniques is desired.

The demand for water resources is also great and the securing of such resources is considered of special importance.

As for forestry resources, it is necessary positively to cultivate and protect them so as to increase timber production and preserve the land and protect the environment.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Utilization of atomic energy centering on the development of power reactors and nuclear fuel as well as safety of nuclear energy
b. Conversion, storage and transport of energy
c. Development of resources on the continental shelf
d. Efficient utilization of unutilized resources as well as effective exploration of resources.
e. Development and efficient utilization of water resources including desalting of sea water and comprehensive development of water resources
f. Promotion of multi-faceted functions of forests.

(7) Preservation of the Environment

Preservation of the environment is a matter of extremely great importance which is likely to develop into a question affecting the existence and survival of mankind. The need for preservation of our environment will become stronger in the future. Of the various environmental problems, those on air and water pollution are of special gravity.

Hereafter there will be great need for ecological studies of our environment and for measures to prevent pollution and protect the natural environment.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Prevention and prediction of environmental pollution
b. Effects of environmental factors on man and organisms
c. Protection of the natural environment

(8) Disaster Prevention

Natural, industrial and urban disasters are likely to cause heavy damages once they should occur because of the high density of population and industrial plants. Hence the great need for adequate preventive measures. Prevention of labor disasters will also be of growing importance for the improvement of the environment of workers.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Prediction of earthquakes and localized downpours, weather modification and other themes on prevention of natural disasters
b. Prevention of urban disasters
c. Prevention of labor and industrial disasters

(9) Modernization of Agriculture, Forestry and Fisheries

The population engaging in agriculture, forestry, and fisheries is expected to decrease steadily from now on. In order to secure a cheap and stable supply of food in this situation, it will be necessary to foster high-productivity agriculture, forestry and fisheries through introduction of large facilities and equipment and agricultural processing.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Large-scale mechanization of agriculture and biological, physical and chemical controls in agriculture
b. Large-scale stock-farming
c. Labor-saving in forestry
d. Fish culture

(10) Rationalization of Industry and Promotion of New Types of Industry

The situation surrounding industry is expected to undergo major changes in the future such as intensive use of technology and information in the manufacturing industry and shortage of labor. To meet the situation, efforts should be made for rationalization of industry through development of new processes and labor-saving devices and for promotion of new types of industry through development of innovative techniques and products.

On the other hand, small and medium enterprises are expected to be greatly influenced by pressures from developing nations intent on catching up and by shortage of labor. They will be required to switch over to products of a high degree of processing.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Rationalization of the manufacturing industry and development of new industries
b. Elevation of the technical level of smaller enterprises through introduction of automation and labor-saving devices in production processes

(11) Pioneering and Fundamental Fields of Science and Technology

Research and development activities in the pioneering fields of science and technology are bound to encounter many difficulties simply because of the revolutionary nature of the technology they are designed to create. If these difficulties are overcome, the research and development efforts expended will stimulate other fields of science and technology and exert the so-called spin-off effects. On the other hand, research and development efforts designed to create new materials are of extreme importance in that such efforts will buttress a number of other research and development programs. Such efforts will directly lead to the elevation of general science and technology standards.

From this standpoint, we consider the following as important areas of research and development requiring immediate attention:

a. Utilization of atomic energy as power and heat sources and utilization of radiation
b. Space development through the launching and utilization of rockets and satellites
c. Ocean development through exploitation of marine resources and utilization of oceanic space
d. Nuclear fusion
e. New materials
f. Soft science
g. Life science
h. Basic electronics and information science
i. The state of extremity such as superhigh temperature, superhigh pressure and extreme low temperature
j. Standards and criteria

Of the above-listed important areas of research and development, science and technology for environmental protection and preservation, soft science and life science are new areas and their promotion and development are being urgently required. Therefore, measures required for promotion of these three important areas will be specially discussed in Chapter 3.

2. National Projects

Of the themes of research and development in the important areas of research and development, those whose implementation is an urgent and important requirement of the state and which meet the following requirements – such as development of satellites and rockets for launching satellites and development of pattern information processing systems – should be identified as "national projects" with the administration setting their goals and managing their implementation:

a. Execution of the project requires a comprehensive and systematic research and development organization concentrating research and development capabilities in many fields of science and technology.

b. Execution of the project requires an input of a large amount of funds and a long period of time.

c. The project is such as can be programed on the basis of established processes and definite timetable for attaining goals.

2. Promotion of Basic Science

While it is difficult to predict when and how basic scientific research can prove of use to society, the history of science reveals that it is on the basis of sustained efforts in basic research that a scientific and technological wonder or break-through is achieved at a certain later date. In this sense, promotion of basic science should represent an important element of science policy.

While the present report is emphatic in its assertion that science and technology for the 1970's should meet social and economic needs, this does not distract the importance of basic research. It can even be said that the more science and technology are oriented toward social and economic needs, the greater the need for promotion of basic science will be. In conducting research and development for meeting social and economic needs, it is necessary to grasp such needs before they actually arise. In an age of rapid changes in the social and economic situation, however, it is difficult perfectly to grasp future needs. In many cases such needs will have to be dealt with quickly as they develop. In this case, success or failure in dealing with the situation is largely determined by the level of basic science and technology. The higher the level of basic science and technology, the greater the possibility of successfully meeting the situation.

Apart from the above-mentioned aspect, promotion of basic science can help satisfy man's instinctive desire to seek truth. Also at a time when people are seeking a life worth living and are beginning to pay attention to the need for qualitative improvement of their spiritual life, basic science merits special attention.

Basic scientific research can be fruitful only if it is conducted in an atmosphere of freedom in which one can give full play to his originality. It is essential, therefore, that the primary policy goal in promoting basic science should be providing researchers with an ideal research environment.

Section 3 Objective in Fulfilling International Obligations

International obligations in science and technology cover cooperation with developing nations, exchanges with advanced nations and participation in international organizations. Of these, technical cooperation with developing nations is considered of special importance in developing our science policy in the future.

Developing nations are still at a low level of living and their economic gap with advanced nations tends to become wider. Aware of the danger that if the situation were left as it is, world peace and social and economic progress might be impeded, advanced nations are endeavoring to assist the developing nations either through international agencies or through bilateral arrangements. The technical cooperation program, being implemented as a form of such assistance activities, is aimed at assisting in the development of these countries and promoting the welfare of their peoples by training scientific and technical personnel in those countries and making available to them the kinds of scientific and technical know-how needed by them.

Assistance to the developing nations by the advanced nations has been primarily in the form of financial aid. However, because of a shortage of personnel in the recipient nations endowed with technical or managerial abilities, it has been difficult to link such financial assistance to economic development.

Consequently, as shown in the "UN Second Development Decade", the UN and other international organizations are beginning to attach importance to such cooperative arrangements as planting and nurturing the seeds of science and technology in the developing nations.

Developing countries are placing great expectations on the Japanese cooperation programs, and as Japan has announced its intention to increase her aid to developing nations to the equivalent of 1 percent of her gross national product by 1975, it is all the more necessary for Japan to step up her assistance to these nations.

Actually, however, Japanese aid toward developing nations, particularly in the field of science and technology, is far from adequate. The percentage accounted for by technical cooperation in the bilateral development aid in 1969 was considerably small compared with other countries affiliated with the Development Assistance Committee of OECD.

It is necessary for Japan to strive to expand her scientific and technical cooperation with developing nations with the objective of fulfulling her obligations as an advanced nation.

Chapter 4 General Measures (Excerpts)

1. Expansion and Development of Research Activities

As recommended in our Report of October 1960 and our Opinion of August 1966, it is necessary to increase research expenditures, expand and develop research facilities and equipment, improve the research environment and train and secure research manpower as well as to make efforts to systematize research and development, give flexibility to research organization, improve research management systems and foster independent research institutes in the private sector.

2. Nurturing Scientific Talent and Improving Ways to Treat Research Personnel

In the 1970's, the quality of research manpower would receive greater emphasis. Therefore, in addition to those possessing a high level of professional ability who are always in great demand, those versed in interdisciplinary areas as well as qualified research supervisors need to be trained and secured. It is also necessary to re-develop the capabilities of scientists and engineers.

Efforts should also be made to improve ways to treat research workers in government by increasing their salaries, giving due consideration to their special status and character in government, and improving ways to treat support personnel.

3. Facilitating the Flow of Scientific Information

It is necessary to strive for (a) establishment of a national system for information circulation, (b) cooperation with international systems for scientific information, (c) training and securing information specialists and (d) development and standardization of information processing techniques. These were recommended in our report in response to Inquiry No. 4.

4. Stepping up International Exchanges in Science and Technology

In the light of the increase in number of research and development themes requiring international cooperation for effective performance, it is necessary to expand research cooperation with advanced countries, promote researcher exchanges and increase Japanese participants in international conferences.

With the enhancement of Japan's international position, we have been called upon to expand our technical cooperation with the developing nations. To meet the demand, it is necessary to strive for research cooperation, cooperation in science and technology education, provision of scientific and technical information, receiving trainees and securing personnel for cooperative projects. In doing these things, it is particularly necessary to introduce the project formula.

Appendices

A. Outline of the Council for Science and Technology

1. Function and Composition

In accordance with the Law No. 4, 1959, the Council for Science and Technology (Kagaku Gijutsu Kaigi) was established in the Prime Minister's Office in February 1959 as an advisory body to the Prime Minister in order to contribute to the comprehensive development of the Government's policies for science and technology.

According to the Law, the Prime Minister is required to consult with the Council, whenever he deems it necessary in order to coordinate the policies of the various administrative agencies concerned, in regard to:

(a) The basic and comprehensive policies for science and technology in general (excluding those involving humanities only).

(b) Long-range and comprehensive goals for research in science and technology.

(c) Plans for the promotion of research of special priority, in order to achieve the goals.

(d) Items of special importance which are to be referred to the Science Council of Japan (Nippon Gakujutsu Kaigi) and in the advice and recommendations received from that Council.

The Prime Minister is required to pay respects to any reports received from this Council as a result of such consultations. In the early stage of its establishment, the Council was in principle authorized to initiate its activities only upon receipt of specific inquiries from the Prime Minister. In view of the necessity to cope rapidly with the ever-changing development of science and technology in recent years, the Law was amended in July 1964 in order that the Council could present additional views and comments, as appropriate, even after the Council had once submitted its report to the Prime Minister regarding the questions referred to it.

The Council consists of a Chairman and ten Members. The Chairman is the Prime Minister. The other members are: Finance Minister, Education Minister, Minister of the Economic Planning Agency, Minister of the Science and Technology Agency, President of the Science Council of Japan and five members appointed by the Prime Minister with the consent of the House of Representatives and the House of Councilors, from among men of outstanding knowledge and experience in science and technology under the provisions of Article 6, paragraph 1, item 6 of the Law.

The Chairman may, if necessary, nominate other State Ministers to participate in the Council's conferences as temporary members.

In addition, the Council may have Specialist Members nominated from among men of profound learning and experience and from staff members of the concerned administrative agencies in order to examine special problems by the respective Panels.

Members of the Council for Science and Technology

Chairman:	Prime Minister	His Excellency Eisaku Sato
Members:	Finance Minister	His Excellency Mikio Mizuta
	Education Minister	His Excellency Saburo Takami
	Minister of State for Economic Planning	His Excellency Tosio Kimura
	Minister of State for Science and Technology	His Excellency Wataru Hiraizumi
	President of the Science Council of Japan	Dr. Fujio Egami
		Dr. Noboru Shinohara
		Dr. Kankuro Kaneshige
		Dr. Harusada Suginome
		Mr. Toshio Doko
		Dr. Benzaburo Kato

(As of August 1971)

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SECTOR II – INFORMATION–COMPUTERS–COMMUNICATIONS

TELECOMMUNICATIONS IN CANADA (A)

The needs to expand and diversify telecommunication services in Canada and between Canada and other countries continue to grow at an unprecedented rate. Large interconnected networks of telephone, telegraph, radio and television facilities, and data services, are undergoing continual expansion, technological change, and development. The special challenges of the country – its size, its topography, its climate, its demography; are all factors which will influence the development of telecommunications in Canada.

Canada, with a population of 21 million, and spreading over 4000 miles, has more than 10 million telephones in service.

Through the facilities of fully automatic exchanges, over 98 per cent of Canadians can dial anywhere in Canada or the United States without requiring the services of an operator.

Telephone services are provided by approximately 10 major telephone companies, each operating exclusively in a particular geographic area. Eight of these major companies have collaborated in establishing the Trans-Canada Telephone System whose function it is to provide nationwide long distance telecommunication services. Long haul transmission facilities are in the form of microwave, tropospheric, radio and cable systems. There are almost 1,700 telephone companies in Canada, providing service to virtually all households and business establishments in the country.

Other than for service to the United States, Canadian international telephone, telex, and telegraph traffic is serviced through the facilities of the Canadian Overseas Telecommunication Corporation (COTC), a Crown Corporation. The Trans-Canada Telephone System Network is available to every telephone system in Canada, and via the COTC, calls can be routed to virtually anywhere in the world.

The year 1971 was an important milestone in the development of Canadian communications. Telesat Canada, a corporation jointly owned by government and private enterprises, moved a step forward in the establishment of the Canadian domestic satellite communication system. By the end of 1972 the world's first commercial domestic communication system based on geostationary satellites will be in operation. One of the major benefits will be the ability to provide telephone, television and radio services to remote locations in the extreme northern regions of Canada.

In April 1971, the Department of Communications in cooperation with the U.S. Space Agency commenced an experimental project that will carry Canadian technology into the second generation of communications satellites. The launching is scheduled for 1975.

The Canadian Overseas Telecommunications Corporation made arrangements to expand our transatlantic cable system. The new cable will have a capacity of about 1,840 voice channels, the equivalent of two television channels.

Co-axial cables of 20,000 voice channels are being laid in Canada and semi-electronic exchanges completely designed and manufactured in Canada, were introduced into the Canadian system. This is a major step towards the all electronic exchange equipment which will, one day, manage video, data, voice and alpha-numeric services.

The Canadian Government is fully aware of the potential role of computers in national development. The Government in concert with all interested parties in Canada is currently engaged in a major effort to exploit this high-technology area. A Task Force was created by the Department of Communications in December 1970 – the Canadian Computer/Communications

Task Force. This Task Force was directed to "speedily develop and recommend specific policies and institutions that will ensure the orderly, rational, and efficient growth of combined computer/communications systems in the public interest". Its full report will be available in the Spring of this year.

The post-industrial era is now being referred to as the era of telecommunications. During the next ten to fifteen years, and possibly by the end of the decade, this industry is likely to become among the two or three largest in many of the technologically advanced countries. In Canada's case, for example, it is estimated that by 1980 annual revenue will reach 4.2 billion dollars or between 2 and 3 percent of the estimated Canadian GNP for 1980. Large capital investments in the tens of billions of dollars over the next decade will require a corresponding expansion of the electronic manufacturing and computer software industries. By 1980 it is expected that the number of computers in Canada will grow to 14,000 from the current 3,600 and the number of terminals to 370,000 from the present 60,000.

In March 1971, the Trans Canada Telephone System announced the creation of a nationwide digital data network to meet the telecommunications requirements of the Canadian computer industry. A unique, Canadian designed transmission system representing a significant advance in digital technology is expected to be in service by 1976. This second generation system will provide a regenerative digital network which will permit direct computer access. However, the CN/CP* network now provides broadband switched data/voice services.

Telecommunication services between Canada and Japan now include Television, Telephone, Telegraph (Public Message), Telex, Leased Circuits and Datel 600 (Wideband Data).

Telephone circuits are provided between Tokyo and Vancouver via the Intelsat Pacific Satellite. Two circuits were established in 1970 and a further two in 1971. In addition, eight telephone circuits are carried on submarine cable through the Japan-Hawaii cable which meets COMPAC (The Commonwealth Pacific Cable established between Canada and Australia in December 1963), at Hawaii for connection to Vancouver. Telegraph circuits have also been established by this route.

Direct telecommunication between Canada and Japan was first provided in June 1957 when 30 Kilowatt radio transmitters located at the Canadian Overseas Telecommunication Corporation station at Cloverdale, B.C., were placed in service.

Two telex, one public message and one leased telegraph circuit were provided. Two public telephone circuits were opened later and the combined radio services continued to operate with a reliability factor of better than 99-0/0 until the Corporation's west coast radio facilities closed down on July 31st, 1965, following the opening of the Commonwealth Pacific Cable (COMPAC) between Canada and Australia.

In addition to bilateral discussions which occur as the occasion arises, both COTC (Canada) and KDD (Japan) participate in Intelsat forums concerned with the planning and operation of satellite facilities in the Pacific. They have also participated in recent meetings dealing with the planning of future Pacific cables.

We foresee that the growth rate that has been experienced since the introduction of direct telecommunication services, including data transmission, will continue. The only exception is public telegraph service for which the worldwide demand is no longer expanding due to the increased usage of Telex and telephone services.

Most equipment used in Canada is of Canadian manufacture, although some foreign equipment is employed. The two largest manufacturers of switching equipment are Automatic Electric (Canada) Ltd. and Northern Electric Co. Transmission equipment is manufactured by

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*CN/CP– Canadian National/canadian Pacific Telecommunications.

several companies, the market being highly competitive. A large proportion of home radio receivers, however, is of Japanese origin. A Japanese TV manufacturer has joined with a Canadian company to produce TV sets in Canada.

Canadian and Japanese experts in data communications are cooperating through their participation with other countries in the new ITU International Consultative studies on Data Networks.

SECTOR II – INFORMATION - COMPUTER – COMMUNICATION (A)

COMPUTER INDUSTRY

Part A – Background

The Canadian computer manufacturing industry is made up primarily of subsidiaries of foreign parents. The dominant firm is IBM Canada with some 2/3 of the market.

Five years ago little manufacturing and no R&D was performed in the computer industry in Canada. The major activity consisted of selling and servicing imported equipment.

The Department of Industry, Trade and Commerce concluded that the resultant growing trade imbalance, as well as, the lack of employment opportunities for Canada's highly trained human resources were not in the national interest. To overcome these problems the Department initiated short term and long term corrective action as follows:

Short Term: encourage established suppliers to increase Canadian manufacturing and R&D on rationalized basis with parent.

Long Term: develop an indigenous industry specializing in peripherals for which a significant Canadian demand exists.

Of the total business machines industry, computers and peripherals account for approximately 2/3 of the imports and almost all exports.

While these numbers do not reflect the total impact of our short term solution, they nevertheless indicate the trend in which the industry is moving. We are very confident that once it is fully implemented, we will have achieved a balance of trade in the computer sector.

However, inasmuch as we will be relying on imported technology, we will not be solving our balance of payments problem with the above short term solution. The solution of that problem requires the formation of an indigenous industry as per our long term solution.

The difficulty that we have experienced to date with our indigenous industry is that substantial amounts of capital are required to finance equipment leases. In fact at least one company is now going through a complete re-organization to overcome the financial problems which it encountered as a result of lease financing.

Part B – Questions

1. How does Japan support its emerging computer software industry?
2. Is computer software considered a product similar to hardware products and as such supported in a similar fashion?
3. How successful is Japan's computer company which finances the leasing of Japanese made computers?

SECTOR II – INFORMATION–COMPUTER–COMMUNICATION (B2)

NHK TECHNICAL RESEARCH LABORATORIES

Radio broadcasting in Japan was inaugurated in March 1925 at a temporary station in Tokyo. The following year, radio broadcasting was undertaken by a unified nation-wide public service organization, which became known as Nippon Hoso Kyokai (NHK), or the Japan Broadcasting Corporation. In 1950, commercial broadcasting stations were established in all parts of our country, but NHK remained as the sole public service broadcaster. NHK now operates five networks, including two radio and two television services and one FM service. NHK's financial resources comprise subscription fees collected from some 23 million households.

NHK's activities include 1) domestic services; 2) overseas service, operated under the name of Radio Japan and which presents programs directed to all parts of the world in 23 different languages; 3) cooperation with overseas broadcasting organizations in their coverage of Japanese events; 4) program exchanges; 5) training of personnel dispatched by overseas broadcasters; 6) cooperation in surveys preliminary to construction of television networks and 7) participation in such international organizations as the ABU (Asian Broadcasting Union) and EBU (European Broadcasting Union).

NHK early established an electronic computer system for production and transmission of programs for its five domestic networks and its overseas service. Fully implemented in 1968, it is known as NHK-TOPICS (for Total On-Line Program and Information Control System).

The establishement of NHK's Technical Research Laboratories took place in 1930, only five years after the establishement of NHK itself. The Loboratories have provided guidance to the embryonic electronic industry of Japan through development of broadcasting and receiving equipment designed to promote speedy popularization of broadcasting.

Soon after establishment, the Laboratories commenced research in television in anticipation of the medium's future potentiality. In 1937, Dr. Kenji Takayanagi and his staff were invited to the Laboratories to carry on in-depth research. As a result, a kinescope tube and an iconoscope tube (TV camera tube) were successfully made on a laboratory basis. Since NHK had plans for commencing a television service on the occasion of the Olympic Games scheduled for Tokyo in 1940, it began experimental telecasting in 1939. Unfortunately, however, both the Olympics and the TV service had to be canceled on account of the war.

Research in television were resumed in 1946, experimental telecasting in 1950 and full-scale service was inaugurated in 1953.

It may be said that Japan's electronic industry achieved its rapid growth in large part due to television broadcasting, and the NHK Technical Research Laboratories may well be considered as an agency notably guiding the development of television. Several outstanding contributions made to television will now be outlined.

TV Cameras and Camera Tubes

The image orthicon developed by RCA played for many years the leading role as the television camera tube. The NHK Technical Research Laboratories also succeeded in making image orthicon tubes in 1953. These were used in television cameras the following year. In 1967, the Laboratories successfully developed high-sensitivity image orthicons using magnesium oxide targets and multi-alkali photocathodes. The development of these new tubes made possible pickup of scenes under dim lighting, and, in 1968, the Metropolitan Opera House of New York authorized, for the first time, telecasting of an operatic performance.

NHK early noted the potentiality of the transistor, developed by Bell Laboratories in 1948, in the growth of broadcasting techniques. And, while application of transistors had been under study, the Technical Research Laboratories succeeded in developing the world's first transistorized television camera in 1959.

In 1964, the Laboratories also perfected a new kind of color television camera—the separate luminance type—using two-image orthicon tubes. This was built more compactly than the conventional cameras using three-image orthicons, and, in addition, they delivered better pictures than the conventional types. This new color camera was used for the first time in telecasting the opering ceremony of the Tokyo Olympiad in 1964. The idea involved in the separate luminance color camera was followed by the development of still newer cameras, one of which was used for pickups at the Mexico Olympiad four years later. This camera used the one-image orthicon for the luminance channel and three plumbicons for the chroma channel. It was highly effective in outdoor pickup work under a wide light range.

A color camera mountable on a helicopter was developed in 1970. This camera was provided with an antenna that automatically turned towards the base station. This camera weighed only 23 kilograms (about 50.6 pounds) and was controllable from the ground under the digital command system. It was first used last year to telecast the opening ceremony of the Japan World Exposition.

International Exchange of TV Programs

Olympic broadcasts have been internationally relayed via satellites since the 1964 Tokyo games. In that same year, the communication satellite had not been provided with mechanism suitable for color television relays, but NHK's Technical Research Laboratories developed special terminal devices, sent the devices and some engineers to the American receiving base and succeeded in relaying color programs via Syncom III.

In order to make possible program exchanges with the European countries using TV standards different from those in Japan, the Laboratories proceeded, in 1965, with researches aimed at developing an all-electronic TV standard converter. In 1968, real time conversion of monochrome TV standards was successfully achieved in the course of a program exchange project with Australia. In 1970, real time conversion from NTSC to PAL or SECAM systems and vice versa became possible. The converter is now used for exchanging television programs with countries using European TV standards. NHK also cooperated with KDD (Kokusai Denshin Denwa Co., Ltd. or Japan Overseas Radio and Cable System), in the manufacture of equipment required for the Yamaguchi Ground Station.

Extension of TV Networks

At present, NHK simultaneously broadcasts two television programs (General and Educational) from more than 1,000 transmitting stations. These stations claim 96.5 per cent coverage. NHK's Technical Research Laboratories have been engaged in investigating ways and means of improving the reliability of these transmitting stations, and, in 1969, subminiature translators using integrated circuits were adopted.

Also, in anticipation of possible extension of television channels to the UHF region, NHK's Technical Research Laboratories in 1956 set up experimental color television stations for studying transmitting techniques in this region. When the UHF system was permitted for key stations in 1967, NHK provided the commercial broadcasters and equipment manufacturers with guidance in the highpower transmitting techniques in this region.

Audio Engineering and Acoustics

The NHK Technical Research Laboratories have developed various types of audio equipment, in addition to broadcasting microphones during the early years of its operation. The latest achievement is the contact talking system using miniature condenser microphones. They were used during the Pre-Olympics held in Sapporo this February.

NHK has also cooperated with other organizations in the acoustic designing of studios and halls. The experience resulting from designing its own studios and a number of public halls is now serving as data for further researches in this field. The most recent work undertaken included acoustical design of a number of Expo '70 pavilions. Acoustics engineers of NHK are now engaged in the designing of the multi-purpose hall to be constructed at the NHK Broadcasting Center in Tokyo. This hall will have a seating capacity of 4,000.

Two-Sound TV

A study for providing two sound channels for telecasts was started at the Technical Research Laboratories about 1965. The system offered possibilities of presenting foreign programs in both the original and Japanese languages. It also permits stereophonic presentation of musical television programs. As a result of careful field tests involving techniques and compatibility with existing television receivers, experimental telecasting under the new system was inaugurated in 1969 in Tokyo and Osaka.

Satellite Broadcasting

Now that communication satellites have become normal means of communication in our daily life, utilization of satellites for broadcasting purposes has become a matter of world-wide interest. The NHK Technical Research Laboratories have also engaged in the study of picture- and voice-transmitting systems, UHF and SHF wave propagation and low-noise receivers. They have additionally designed a multi-purpose satellite broadcasting system suitable for use by ABU member organizations.

With the cooperation of the Radio Research Institute of the Ministry of Posts and Telecommunications and of NASA, experiments in picture- and sound-transmitting systems using ATS I (for Applied Technology Satellite) were undertaken in 1970. Also, with the cooperation of Radio and Television Malaysia, measurements of solar radio wave attenuation due to rain are being pursued.

While the NHK Technical Research Laboratories undertake large numbers of other research projects, they are all aimed at attaining improvement in existing broadcasting services as well as in developing future systems.

The basic research division was separated and reorganized in 1965 as the Broadcasting Science Research Laboratories. This new organization is composed of the Solid State Research Group and the Audio-Visual information Processing Research Group. The latter is a unique group engaged in the study of problems related to audio and visual senses of human beings, which form the gateway to broadcast reception from the viewpoints of physiology, psychology and electronics.

The results of studies at the NHK Technical Research Laboratories and the NHK Broadcasting Science Research Laboratories are not only utilized directly for NHK's broadcasting services, but also are made public through academic journals and publications of research institutions. Technological Collaboration is additionally extended to outside organizations, as evidenced in a number of examples cited here.

By DR. KENJI HIWATASHI
(Reprinted from MOVIE/TV MARKETING, COMMUNICATIONS '71)

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (B)

SCIENCE LIBRARY INCLUDING AVAILABILITY OF INFORMATION, COMPUTERIZED NETWORKS, LANGUAGE PROBLEMS

The National Research Council of Canada operates the National Science Library which has the largest collection of scientific and technical information in Canada. The National Science Library has developed an extensive Current Awareness Service called CAN/SDI, for the selective dissemination of current citations and journal articles of interest to specific subscribers. It has a specialized data base which is remotely accessible, containing information on environment quality. The NSL provides hard copy through many other libraries to scientists and engineers in all parts of the country. The NSL and the Council's Advisory Committee on Scientific and Technological Information are actively engaged in the study of problems created by Canada's bilingual character; these studies include machine translation and the access in either English or French to an unilingual data base.

A new National Science Library building is in the course of construction and embodies provision for the most modern techniques for handling documents and retrieving information, and includes provision for a dedicated computer.

The National Research Council of Canada also operates a Technical Information Service, specifically designed to respond to the information needs of small industries. Its sections include technical enquiries, technical documentation, and industrial engineering. The Technical Enquiries Section depends on the resources of the National Science Library. The Technical Documentation Section uses a computer to match information profiles of persons in industry to specially selected technical briefs. The Industrial Engineering Section offers advice to small industries on new or improved manufacturing techniques.

SECTOR 11–INFORMATION–COMPUTERS–COMMUNICATIONS (D)

TRANS-CANADA TELEPHONE SYSTEM
COMPUTER/COMMUNICATIONS

The first phase of a nationwide digital communications system, designed to directly link computers in all parts of the country, is being completed. The Trans-Canada Telephone System's digital system will cost $100 million by the time and the final phase is completed in 1976, with most of the equipment and expertise originating within this country.

The system will be built in three phases:

Phase 1 will be completed in 1972 from Halifax to Vancouver. It is a digital system using existing transmission equipment and will cost $3 million.

Phase 2 is a high-capacity buried coaxial cable from Quebec to Windsor to be built during 1974-76.

Phase 3 is another digital system based upon existing microwave networks to extend the capacity of the coast-to-coast system.

High-capacity coax cable will be carrying the heavy central Canada traffic by 1976. This will be a multitube coax cable developed by Northern Electric, installed underground from Quebec to Windsor, Ont. called the LD-4 long haul digital coaxial cable system, it consists of the actual cable plus multiplexers and codecs.

Sub-systems include a DE-2 channel bank for toll-quality voice transmission using 8-bit PCM, master-group codec to allow the transmission of 600-channel mastergroup signals over the cable, TV codec to process a video signal for transmission over the cable, three levels of digital multiplexers to combine several low-rate digital bit streams into one high-speed bit stream and, in the future, a video telephone codec.

Other sub-systems are the cross-connect bays that permit access to lines in between major processing points and digital regenerative repeaters that reshape, retime and regenerate the digital signal every 6,000 ft. along the cable or at the terminals.

The system will be supervised by an alarm and control system for all the line and terminal equipment and there is also a protection switching system to protect against prolonged traffic loss if a one-channel failure occurs.

Programmable interface services are used to make the new digital networks effective and efficient in communication with customer computers. TCTS have developed a mini-computer-based subsystem, called the SCCS for software controlled communication services.

The SCCS will act as a translater between the network and customers by putting data in formats compatible with either computers or communications links. It will give the customer data in whatever form he needs and will accept data in any format irrespective of speeds or codes used.

The significant point about the SCCS is flexibility – it is software programmed, not hard-wired as has been the practice to date. Hence if the network or the customers' loops change, requirements can be accommodated by program changes.

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (D)

COMMUNICATION SYSTEMS – COMMUNICATIONS RESEARCH CENTRE, OTTAWA

To develop tools and methodology for network and systems evaluation and synthesis including:

(i) Modelling and simulation of systems and subsystems
(ii) Analytic optimization techniques
(iii) Network control and adaptive techniques, and
(iv) System dynamics.

This will be a major new CRC program area and will be built up to cope simultaneously with long term communications systems studies, and quick response to requests for specific system simulations.

Prepared by the
Department of Communications

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (E)

CANADIAN UNIVERSITIES COMPUTER NETWORK
(CANUNET)

The Concept

During the past decade, extensive computing facilities have been acquired by many Canadian universities. These represent a major investment in terms of both equipment and trained personnel. But even for the wealthiest universities the expenditures are becoming prohibitive and for the smaller ones they constitute a major obstacle to the provision of adequate computing capability. In addition, the vast and ever expanding spectrum of computer applications and the growth of specialized data banks, make it extremely difficult, if not impossible, for any single university to provide the full range of services that are desired by both students and faculty.

As a result of these problems, a number of universities in several provinces have been attempting to rationalize expenditures by developing plans for regional computing networks. One such plan was prepared during 1970 by the University of Quebec and another by the Computer Co-ordination Group of the Committee of Presidents of the Universities of Ontario. Likewise in the United States a network involving about a dozen American universities and not-for-profit institutions has now been operational for about eighteen months and plans are underway to expand it to Great Britain via a communications satellite link.

The basic concept underlying such networks is one of "resource sharing", in which the computing capabilities including equipment, programs and data bases of each participating organization are made available via communications links to all other participants.

In the case of a Canadian University Computing Network, for example, the ultimate embodiment would provide every student and faculty member in every campus in Canada with access to the university libraries and the information processing capabilities of all Canadian university computing centres.

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (E)

CANADIAN COMPUTER/COMMUNICATIONS TASK FORCE

The Canadian Computer-Communications Task Force was established in November 1970. The main purpose of the Task Force is to speedily develop and recommend specific policies and institutional arrangements that will ensure the orderly, rational and efficient growth of combined computer/communication systems in Canada.

Specific items under consideration are:

- identifying national needs for computer services
- recommending governmental policies
- recommending plans for systems to fill social needs
- examining the expected sociological impacts of actions recommended.

The Task Force will apply cost-benefit analysis to particular networks that might be able to provide such services as legal, financial, medical and consumer information. The final report of the Task Force is expected in the Spring of 1972.

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (E)

INFORMATION SCIENCES – COMMUNICATIONS RESEARCH CENTER, OTTAWA

(a) To provide a continuing assessment of the significance of advances made in the fields of information storage, processing and display, and also to contribute to these fields through in-house and extramural research programs.

(b) To investigate the performance of communications or information transfer systems and, in cooperation with other groups, determine their effectiveness in practical situations. This work should also lead to identification of the greatest technological, sociological and economical short-comings of proposed systems. Experimental pilot projects will provide one of the principle foci for research in information sciences.

A limited teleconferencing pilot project is under consideration: group-interaction via a video and/or facsimile link will be investigated. The objective of the research is to develop a valid set of evaluation criteria for advanced systems of this kind before they are deployed extensively in the public domain.

(c) To determine the most appropriate means of implementing the wideband information distribution networks which will be required for the rapidly expanding use of computer and data services in Canada, as well as for the introduction of wired-city type services to the public.

(d) To investigate applications for inter-active computer systems.

(e) To investigate the techniques of building and using interactive computer systems, particularly involving graphical display. To develop applications of these techniques.

(f) To investigate computer software modularization and portability.

Suggested Use – Sector II, E. (a) information to be left with the Japanese
(b) Input to the Briefing Book

Prepared by the
Department of Communications

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (A)

TELECOMMUNICATIONS IN JAPAN

Telecommunications in Japan, unlike Canada are in the hands of a public company, Nippon Telegraph and Telephone Public Corporation, inaugurated in 1952 by the Japanese Government, in an effort to rebuild the systems that had been destroyed or deteriorated during the war.

The result of their expansion program has been remarkable, while their forecasts for the next seven year period are planned to almost double current subscriber lists. It is interesting to note that the subscriber has an obligation to purchase bonds in the company amounting to some 30,000 yen, this would almost be equal to one and a half weeks average salary for a worker!

In keeping with their tradition Japan has successfully demonstrated (during Expo 70) such equipment as Picture-phone; Data Banks for Industry and Commerce; Automobile Registration, National Facsimile and Public Data Systems. Other developments have included plastic, paper and foam insulated cables in which they have united their non-ferrous metal and petro-chemical industries.

The development of stored program electronic switching has ranged from the DEXI (1966) space division switching system to the DEX21 (1968) final prototype of the central office switching system combining local and toll switching functions. It is anticipated that some 400 of these units will be in service by 1977.

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATION (A)

"COMPUTERS, COMMUNICATIONS AND GOVERNMENT"

Notes for a speech by

HON. ROBERT STANBURY

Minister of Communications

at a dinner meeting of the

CANADIAN INFORMATION PROCESSING SOCIETY

Montreal Chapter

7:30 p.m., Tuesday, January 11, 1972

Sheraton Mount Royal Hotel

Montreal

Last September, shortly after I became Minister of Communications, I had the pleasure of opening the Canadian Computer Show in Toronto. There I reaffirmed my Department's commitment to the rapid development of the computer/communications industry in Canada. Since then I have had opportunities to discuss the myriad challenges of this new field with government officials and industry leaders in Europe and the United States as well as Canada, and during the coming weeks I hope to pursue these discussions with provincial ministers. After these few months of deepening personal involvement in the intricacies of this most complex of all industries, I am convinced that fulfulling the promise of the computer utility represents one of the greatest challenges that Canadians face – perhaps the greatest we have faced.

Ensuring the aggressive and imaginative exploitation of our new computer and communication resources for the benefit of all Canadians could well be our supreme challenge, dwarfing in both importance and scale even the audacious commitment to build the Canadian Pacific Railway that was made by an infant Canada, a hundred years ago. The reasons for this importance are familiar to all of you. For the past several years enthusiasts all over the world have vied with one another on hundreds of public platforms in describing the science-fictionish wonders which they saw just over the horizon of the future. Now, I am not really qualified to judge which of these infinite possibilities are science fiction and which are science fact. But I am certain that the universal availability of computer power, at the heart of the predictions, is bound to have an impact on the quality and nature of human society as far reaching and perhaps more fundamental than that of the industrial revolution of the nineteenth century.

To say that something is possible is not the same as saying that it is desirable, and the ultimate products of the computer/communications revolution could just as easily be evil as good. Technology is essentially neutral. It is what men do with it that determines the quality, and the technical advances that have made possible computer networks could become the ultimate instruments of society's total control. Potentially they offer both governments and private organizations the means for creation of an Orwellian world in which dissent would be all but impossible and conformity the price of survial.

Whether computer networks are used for such perverted purposes, or to multiply our capabilities and lift our country to unprecedented levels of achievement, depends on decisions that we must make and policies that we must adopt in the very near future. In this process we must keep our eyes not only on the Gross National Product but also on the Net Human Benefit.

You are aware that the federal Government, with other interested parties including the provinces, is engaged in a major effort designed to answer what the Telecommission Report on Computer Utilities termed a "fundamental policy question":

> "How can Canada best exploit the computer utility concept to make the potentially revolutionary benefits of computer power available to the entire public and at the same time provide effective safeguards against the misuse of that power? "

An important step in our search for answers to this question was the creation in December, 1970, of the Canadian Computer/Communications Task Force under the distinguished direction of Dr. Hans von Baeyer. The cabinet directed to the Task Force to:

> "speedily develop and recommend specific policies and institutions that will ensure the orderly, rational and efficient growth of combined computer/communications systems in the public interest."

I am happy to report that the work of the Computer/Communications Task Force is on schedule and I expect that Cabinet will have its full report as promised this spring. It should provide us with the factual basis – technical, economic and social – for development of what the announcement of the Task Force's establishment termed "an integrated network of Canadian computer utilities".

Such a network, I think, would be really a network of networks, consisting of hundreds or even thousands of essentially independent organizations ranging from government departments and crown corporations to independent private data processing companies. This concept is the antithesis of the monolithic monopoly structure that the conventional wisdom usually associates with the term "public utility". What I envisage instead is a highly decentralized, flexible infrastructure of institutions, hardware and software within which a multitude of networks and a virtually unlimited variety of competing services can grow and flourish in such a manner that they are equitably and conveniently accessible from any part of Canada.

This would seem consistent with what the original directive which led to creation of the Task Force listed as the minimum objectives for any national system:

- The most rapid expansion of services and systems possible without unduly disturbing our ability to meet other urgent social priorities.
- Service of public as well as private interests.
- The widest possible range of services to all social and regional groups in every part of Canada.
- Maximum Canadian control and ownership.
- Adequate protection of privacy, right of access and freedom of speech in all elements of the system.
- An overall system design flexible enough in concept and implementation to minimize problems of obsolescence and permit the rapid incorporation of improvements resulting from technological change.

I wish it were possible tonight for me to discuss with you the precise recommendations of the Task Force and the government's reaction to them. However, as I mentioned a moment ago, the Task Force report will not be available for several months yet. Its recommendations are still in the preliminary draft stage and there is no government reaction yet to report. On the other hand, from conversations with members of the Task Force and other experts, I have been able to formulate a few tentative general conclusions of my own which I assure you cannot qualify as Cabinet leaks.

One thing which comes through loud and clear is the enormous importance in both material and social terms of the computer/communications industry to the future of our country. Most authorities now agree that during the next ten to fifteen years this industry will likely become one of the two or three largest in many technologically advanced countries. In Canada's case, the Task Force's median figure for the industry's 1980 annual revenues is 4.2 billion dollars, or between 2% and 3% of the estimated Canadian GNP for 1980. At a recent OECD meeting in Paris, the Japanese delegation estimated that by 1985 the computer/communications area would account for 6% of the Japanese Gross National Product. At the fall meeting of the American Academy of Engineering there was general agreement that data processing and communications would be the two key industries of this decade. It does not seem far-fetched to forecast that information processing power per capita may well become the principal determinant of a nation's wealth, and transfer of information and processing power a major item of international trade.

The direct economic impact of the computer/communications industry is, however, only one of many reasons for its importance, and is more than matched by the striking pervasiveness of its services and products. There is scarcely an activity of modern society that will not in some way be affected by remote access information systems. Insurance, health, government, reservation services, libraries, banking, to name but a few areas, are even now becoming major customers. As we move into the latter years of this decade and the early Eighties, we are likely to see a total transformation of many key sectors of the economy and widespread use of information terminals in the home.

The growth of such an all-encompassing high technology industry in Canada would also have a dramatic indirect impact on the economy as a a whole.

This could take many forms. First, of course, is the productivity multiplying effect that widespread computerization can have on both our manufacturing and services industries. In fact, computerization is the sina qua non for the future economy of plenty and its offspring, the post industrial society, with all that this term implies in the way of an infinitely better life for all of us.

Just as important is the bootstrapping impact which the burgeoning of such an industry could have. Enormous capital investments in the tens of billions of dollars over the next two decades will be required, including a major expansion of our electronics manufacturing and computer software industries. In some respects, the impact could be compared with that of the space program in the United States. Unlike the space program, however, all the products involved in the creation of computer/communications networks will stay on earth and continue to contribute to the well-being of our society for decades to come. A down-to-earth space program.

The dynamic character of the computer/communications field is another indisputable and extremely important factor that must be kept in mind when policies are being formulated. Technical change in the computer field has been continuous and pervasive for more than twenty years, and during that time has produced four complete generations of computers. In the process, it is not only components and systems that have changed but also the structure, nature and function of the organizations and industries that produce or use them.

There is every expectation that the current breakneck pace of change will continue and even accelerate over the next decade or more. So it is vital that we avoid rigid policy frameworks that would have the effect of imprisoning industry in concepts and technologies that technological advance might soon render obsolete. Innovation must be stimulated rather than discouraged and we must avoid measures which might dry up native sources of risk capital for new enterprises and force us to live in the cramped quarters of the status quo. Any policies which governments adopt must be distinguished by great flexibility and the capacity for both government and industry reacting quickly to changing conditions.

Another set of conclusions arise from the fact that, in the systems with which we are concerned here, the normal boundaries between data processing and communications become blurred. This has led to often heated debates about the appropriate roles of communications carriers and data processing organizations in the provision of remote access data processing services. Basic policy questions were raised and have been under intensive study by the Computer/Communications Task Force. These included questions like:

- Should communications common carriers be permitted to provide public data processing services?
- In the event that the carriers are permitted entry into the data processing business, then:
  - What services should they be permitted to offer; i.e. raw computer power only or a full range of software services as well?
  - Should such services be tariffed?
  - Should such services be provided by the carrier itself – "horizontal" diversification – or should they be offered through a separate corporate affiliate – "vertical" diversification?
- Should carrier customers be permitted to provide their own terminal equipment subject to suitable standards for the protection of the network and other customers?
- Should data processing and other organizations be permitted to establish additional data communications networks or provide special communications services like third party switching or multiplexing in competition with the carriers? If the answer is yes, should the carriers be required to interconnect with these new networks?

Now, without prejudging the precise nature of the Task Force recommendations with respect to these questions, it seems clear to me that there are some basic factors which must bear heavily upon government policy decisions in this area. One is the need for large investments of scarce national resources, both human and material, if Canadians are to reap the maximum benefit from the promise of the computer utility. This appears to lead us logically to the conclusion that we should not arbitrarily exclude any organizations from participating in the commercial data processing business unless their entry would have an adverse impact on competition or be incompatible with recognized social goals or established criteria for Canadian ownership and control. In the particular case of the federally-regulated telecommunications carriers, however, it seems to me that their participation should be acceptable only through a completely arms-length affiliate subject to the sorts of controls that were postulated in the Telecommission Report on Computer Utilities.

Turning now to the equally contentious issues of foreign attachments and third party multiplexing, we are faced with such problems as:

- The desirability of encouraging both rapid innovation and the widest possible use of terminals by the general public as well as business;
- The need for reducing the cost of terminals by eliminating such devices as customer modems and expensive protective and other connecting equipment;
- The need for new types of data transmission services, such as transaction oriented and other distance independent schemes;
- The urgent need for immediate, dramatic reductions in the cost of Canadian long distance data transmission if true national markets for our Canadian service bureaus are to develop and we are to avoid losing major portions of our business to the United States.

I recognize and applaud the recent initiatives of CN/CP and the Trans-Canada Telephone System in their plans for new advanced services and data transmission networks. If implemented quickly, they should go a long way toward meeting criticisms that have been expressed by members of the remote data processing service industry to the Task Force. Nevertheless, I feel that steps need to be taken to liberalize some of the existing restrictions on third party multiplexing and foreign attachments, and in the latter case to ensure that interconnection standards are set by a public body rather than by the carriers alone.

Of course, we must be careful that in our zeal to liberalize and encourage competition in the data communications field we do not end up by undermining or even destroying the economic base for the critically important regular communications services upon which all of us depend. But I tend to believe that competition and liberalization will in the long run result in lower overall costs and better service for everyone, provided there is careful monitoring by the appropriate federal and provincial regulatory bodies.

This brings me to some conclusions about the role of governments, and here we are faced with one crucially important fact. In most countries governments are already so intimately involved with computers and communications, as both operators and users of systems, that they constitute the most important single factor in determining the pace and scale of future developments. Both in absolute terms and relative to other elements of the community, government expenditures are enormous.

In Canada, for example, the total expenditures on computer services during 1970 have been estimated as $800 million of which the government share (including universities) was $183 million, or about 24%. Of the government portion, the federal Government accounted for $84 million, the provinces $63 million and universities and municipalities combined, about $35 million. Of particular significance in the case of the federal Government is the rate of increase which has been averaging 26% per year for some years now and which, if maintained, will push the federal expenditures beyond $200 million per year by 1975.

Obviously, the judicious applications of government purchasing policies for computer services can have an enormous impact on the way in which the industry develops. It is therefore essential that such policies be strongly imbedded in and responsive to our overall national policies for computer/communications.

The Task Force figures for 1980 revenues which I quoted earlier are median estimates based on current trend extrapolations. They are extremely sensitive to government policies, and a deliberate policy of encouragement and stimulation could make them very much higher. On the other hand, even the conservative estimates of growth are unlikely to be realized unless supplier, user and government actions are coordinated toward increasing the Canadian presence in the computer/communications field. This might involve: counteracting trends towards obtaining goods and services from foreign sources; stimulating Canadian technology in appropriate areas of endeavour; supporting the marketing function for Canadian products and services domestically and internationally in order to achieve the necessary economies of scale; attempting to minimize costs to users so there is more effective and extensive use of computer/communications technology; and, in carefully selected areas, government participation in or assistance to the operation of certain socially vital networks.

It is both essential and urgent that there be planning and coordinated action by governments at all levels as well as by industry with the goals of

- meeting human social and economic needs;
- achieving optimum employment of investment capital and other scarce resources;
- promoting innovation, and
- fostering of scientific, technical, marketing and management capacities.

Finally, when considering planning in the Canadian context, the unique characteristics of our environment need to be emphasized. The special problems and opportunities posed by such factors as: our unusual geographic conditions and demographic and industrial distribution patterns; our regional differences and disparities; our cultural diversity and official bilingualism; our federal system and our private enterprise economy in which the public sector plays an important role.

Theories, policies and experiences of other countries are not necessarily relevant to the solution of Canadian problems. New, uniquely Canadian solutions must be found if we are to cross sucessfully – in human terms as well as technological – the threshold into the post industrial world.

Being uniquely Canadian ourselves, we should be able to find those solutions. I am confident that we can and we will – with the help of our computers.

SECTOR II – INFORMATION – COMPUTERS – COMMUNICATIONS (A)

"COMPUTERS ARE REVOLUTIONIZING OUR WAY OF LIFE . . ."

THE HONORABLE C.M. DRURY
PRESIDENT OF THE TREASURY BOARD
GOVERNMENT OF CANADA

(FEBRUARY, 1971)

The theme of computers and their better utilization is currently of great relevance to the Government of Canada.

It is also very timely in that the Government of Canada at the present time is carrying out two major reviews of its computer resources and utilization policies. The first one is being carried on by the Department of Communications, whose "Computer/Communications Task Force" is taking a close look at Canada's future requirements for electronic data processing, and data transmission.

While this study focuses on Canada's computer policy at the "national" level, a second Task Force has been launched by Treasury Board to examine the Governments' Electronic Data Processing policies on the "internal" level. Specifically, this Task Force will be looking at electronic digital computer systems which are used for business data processing, scientific computing, information processing in the Government, regardless of their size or capacity. Excluded from this study are special purpose computer systems in which computers are used solely as an integral part of such systems as process control loops, military weapons, and scientific experiments. I would like to stress the importance which is being attached to this study, for by virtue of its scope, it is hoped that the Government will at last have a concrete set of proposals on which to develop and implement a computer policy.

This current and, I must admit, abnormal interest being shown by the Federal Government in computer systems is in fact a purely selfish interest. For modern Government is becoming a very complex business because of its rapid growth and because of the ever-increasing scope of the problems which are encountered day after day. The decisions which one makes can only be as good as the information which is available to the decision-maker. The supply of good information is therefore becoming increasingly important as Government involves itself in more and more areas of Canadian life – be they commercial, social, political, or whatever.

It is unreasonable to expect, therefore, that Government can be managed effectively unless it is adequately supported by the techniques of modern information technology. I do not believe that any of us need to be persuaded that we are in the throes of a global information explosion. That the dissemination of extraordinary quantities of information has become an accepted and necessary practice in Government management is undeniable. That this is associated with the rapid expansion in the use of computers is equally undeniable.

Our society is therefore becoming increasingly involved with the effective use of these distributors of information, and with the techniques by which information can be rapidly assimilated by the decision-makers. It is therefore not only the quantity of data produced which is of importance, but also the clarity of the information which the computers ultimately assemble and which serves as a basis for decisions.

These problems assume extremely large proportions when applied to the scale of operations of something like the Government of Canada, where the problem of dealing with data and information of such obvious bulk is further complicated by the constant conflict in each Department between its own responsibilities and those of the collectivity. For, while it is commendable and necessary that Departments develop their own computer systems according to their own needs, it is also important that they keep in mind the overall Government objectives which can only be achieved through interdepartmental cooperation.

In recognition of this need, there has been an increase in awareness in the Public Service that computers are employed to achieve national objectives by providing governmental services to the public; and that they are not there merely to demonstrate the efficiency with which Departmental programs can be administered. The coordination of EDP programs between more than one Department in the health and welfare area is an excellent example of this recognition.

I would like to mention some examples of efficient use of EDP in the Federal Government. Improved error detection in the processing of income tax returns by the Department of National Revenue's Computer System has yielded an additional $40 million annually in taxation revenue for the Federal Government. By reconciling clearings of Government cheques received from the chartered banks and by keeping an up-to-date record of Government balances with the chartered banks, the Government is saving around $30 million annually. Government Census have been operated for many years by the Dominion Bureau of Statistics' computers.

These are good signs, and there are many, many more. Together, they illustrate the high degree of dependence which the Government of Canada is placing upon EDP to discharge its responsibilities to the public. But with regard to the management of EDP; is the Government, and I refer here to the Cabinet and to the senior echelon public servants, discharging its responsibility to the taxpayer by properly managing this relatively new activity?

There are a number of practical and urgent questions which we should be asking ourselves. For example, is the government getting a proper return on its investment? We are now spending something like $100 million per annum on computer activities, with a growth rate between 25% – 30%. Cumulatively, the Government has spent over $700 million on EDP, and this figure will likely be doubled by 1975. The Government feels that the taxpayer has a right to know more about these expenditures than merely the type of services which the computers provide. For example, he is entitled to know where and how his money is being spent; if the performance of EDP is adequate, and by what standards; and the future role which the Government envisages for EDP. In anticipation of these questions, the Government should be asking itself whether its current and forecast expenditures on EDP are in proportion to the public's needs. Are they too much? Or are they not enough?

A second very relevant question is whether the Government is fully aware that the implications of computerization go far beyond the computer itself. For one cannot measure this electronic revolution by the dollars and cents which have been spent, nor by the volume of data which pours out daily. It is not just a revolution in manpower-saving or in the collection of data or in the adoption of a number instead of a name for every man, woman, and child which we are experiencing. Rather, it is a revolution in information which is having and which will continue to have enormous repercussions on our way of life. Daily decisions on anything from where to buy a new appliance to which hospital has a suitable doctor and a vacant bed will be made instantly and with a minimal chance of error by everyone. Computers are fast becoming a way of life. For example, one can have a terminal installed in one's home for only $100 a month. The effects of computers (or more properly the effects of computerization on our society) will be just as significant as was the impact of the automobile. The Government cannot therefore lag behind in either its exploitation of computers or in its appreciation of their effects on society.

There are many more questions which we should be continuously asking ourselves, such as whether the Government has learned from its mistakes in this area? Has it learned how to organize and manage computer systems to achieve optimum results? Asking the right questions can make the difference between success or failure.

It is now about 20 years since the Government of Canada first used computers, and a full 8 years since the Glassco Commission made a thorough review of their use in Government. We have accepted their presence, but have we perceived their potential? Since the Government of Canada is by far the largest employer of computers in this country (some 10% of the 2,500 digital computer systems which are installed in Canada are for the use of the Federal Government), there is only one course to take – we must make the computer work the way we want it to work, and we must realize its full potential?

We know from the experiences of the private sector and from other Governments that there exist certain established patterns for success or failure. Perhaps the most important of these is the attitude of management towards computer systems, which experience tells us can be either the major road block or the driving force behind their development and proper use. This is certainly no less true in Government than in the private sector. I believe therefore that it is managements' responsibility to inform itself in practical terms of the potential of computers, to find out what they can do for their departments, and what they can do for the public, for the taxpayer.

Involvement by top level management in computers can be justified by their cost alone. If we add to this the enormous potential which computers hold for providing information to the decision-makers, then the importance of management involvement becomes obvious. Once they are informed, the Ministers and their Deputies could perhaps better discharge their responsibility by establishing clearcut objectives for EDP to ensure that the various computer systems are focused squarely on the major problems of the Government. Mechanisms should be set up to review and challenge the plans and programs of computer managers and operators. The performance of EDP must be monitored, and its progress must be charted in order that we can examine and evaluate the yield on our investment. We must insist on significant tangible benefits, and we must start now.

Experience during the past two decades in this and many other countries has shown that computers can make a tremendous impact on the effectiveness of Government programs. However, after a cursory examination of the effect of EDP on some of the programs of the Government of Canada, I am left with the impression that this "impact" can be adverse as well as beneficial, and there is no doubt that insufficient attention by senior management would be one of the reasons.

Examples of the inefficient use of computers in Government, cannot be glossed over, for they are costing taxpayers a lot of money. Nor can we ignore the probability that the more services we entrust to computers, the greater the damage will be when errors in programming occur. We have already agreed that computers are inevitably going to play a greater role in Government so there is no time to lose in setting up review mechanisms to make sure that they perform with a high degree of infallibility.

For when one considers the kind of services which EDP is going to be required to perform in the next 10 years or so, one is almost tempted to call a halt to this progress as long as it experiences difficulty with the comparatively simple programs of today. For example, consider how dependent we will all be on EDP when it performs the following functions; the administration of a "cashless" society, with all its ramifications on our national economic system; the administration of a national medical information network whereby a patient's medical history will be available to any doctor in any place; individualized computer-assisted instruction which could effectively displace the concept of a class-room; it will be able to implement a politician's dream by setting up simulation models through which new policies can be tested for public reaction. From the marriage of communications and computer systems, we can expect global information networks and improved readings on world meteorological conditions, to mention only a couple.

Can our computer systems achieve these goals under the present conditions? EDP is no different from any other human endeavour in that you only get what you pay for. Unless we are willing to pay the price by providing the necessary leadership and manage this activity properly, our experience with computers will likely be costly and frustrating. However, if we start playing our essential role, I am confident that important tangible benefits will follow.

It is to ensure an improved and sustainable performance and to facilitate the work of the Departmental managers and the computer experts that the Government has set in motion a policy review. It will examine the whole spectrum of EDP activity, notably the resources, the procurement procedures, the future requirements, the monitoring of performance, and the coordination of systems towards national objectives. Its purpose is essentially threefold: first, it would ensure an effective planning of computer systems oriented towards Government services; second, it would ensure an efficient use of EDP resources in the Government; third, both of these would enhance the chances of obtaining an optimum return on the investment.

I would like to stress the importance which senior management in Government is attaching to the improvement of the efficiency and effectiveness of the services which are provided to the taxpayer. Electronic Data Processing, by virtue of its vital role, must be reviewed and analysed by management so that it may make a greater contribution to the improvement of Government programs and to the achievement of our national objectives.

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Sector III – Environmental Protection

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Prepared by the
Department of the Environment

SECTOR III – ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PROTECTION IN CANADA

JANUARY 28, 1972

As a developed country, Canada shares with Japan an interest in the further development of its industries while at the same time protecting and improving the environment. For us industrial growth with its accompanying technological advance is not only seen as being compatible with sound environmental protection but is also seen as inevitably becoming the indispensable ally for future environmental understanding and improvement. In other words the same advancing technology which contributed to the deterioration of our environment can be equally redirected to halt this deterioration and to bring about a safe environmental condition.

In recent years the Federal Government has taken an aggressive approach to environmental protection; particularly to anti-pollution measures. Since 1970, the Government has presented one bill designed to protect the atmosphere over Canada, and five major pieces of legislation aimed at the preservation of our waters and seas. It is currently planning more. This legislation allows the Departments of Government to develop new environmental strategies and to act against pollution through the creation of regulations governing the release of environmental contaminants and the formulation of ambient quality objectives for air and water.

In recognition of those instances when jurisdiction over pollution matters is primarily a provincial matter, provisions have been made for closer working relationships with the provinces, to arrive at preventative and control standards which are compatible with an overall national approach. Additionally, cooperative environmental strategies involving Canadian Provinces, American States and the two Federal Governments are being more closely integrated.

It is plainly acknowledged that no one Department or no one government acting alone, can attempt all of the activities required for a successful defense of the environment. The design in the formation of Canada's Department of the Environment and its protection responsibilities reflects this acknowledgement. The Department came into official existence in June, 1971. The major Federal agencies concerned with conservation of the countries living resources and much of the governments anti-pollution legislation came together in it. One of the Departments initial thrusts has been in the development of regulations to control pollution at the point source. The use of the biosphere as a limitless sink for dumping and dilution of wastes is no longer acceptable. Industry is now encouraged to actively develop new pollution control techniques. This is encouraged through capital cost allowances or accelerated depreciation under the Income Tax Act and through exemption from the Excise (Manufacturing) Tax Act for pollution control equipment. Similarly, new incentives to encourage industry to readjust to these new concepts are being explored.

In connection with finance, the Canadian Government considers that the cost of pollution control should be considered as an ongoing cost business. This means that any new industrial plant must install the best available pollution control equipment at the time of its construction. This equipment is considered in the same light as any other piece of equipment essential to the plant's proper functioning. At the same time it is recognized that older plants are in a special category. They must take on the responsibility of adopting the best anti-pollution equipment available; but, they are given a time schedule tailored to their individual situation in which they can adjust to the new concepts. These older plants must be able to eventually operate profitably with this equipment if they are to be viable in the long run.

The environmental protection responsibilities of the Department of the Environment are executed by its Environmental Protection Service. Therefore this service is expected to anticipate, define, solve and act on real or potential threats to the Canadian sector of the environment. It does this through the following:

(1) The development of preventative and protective codes, procedures, protocols and regulations.

(2) Implementation of remedial measures and complementary programs and subsequently monitoring and evaluating their efficacy in restoring or enhancing environmental quality.

(3) Provision of a Federal focal point for consultation, negotation and information in matters of environmental concern for the public, industry and other levels and Department of Government.

(4) The development of Federal facilities and works into models of exemplary pollution control and environmental engineering practice.

To better illustrate how Canadian environmental protection policy is applied, the following are some of the current activities of the Environmental Protection Service:

(1) In consultation with the Provinces and concerned industries, development of more new industrial effluent regulations under the authority of the Fisheries Act.

(2) Cooperation with the Provinces in the identification of air pollutants and the development of air pollution control regulations, techniques of monitoring and methods of abatement through the Canada Clean Air Act.

(3) Implementation of 'Water Management' plans and the administration of the nutrient provisions in the manufacture and important of laundry detergents under the authority of the Canada Water Act.

(4) Fulfillment of the Canadian Obligation under the terms of the Canada/U.S. bilateral agreement on water quality certification in shellfish growing areas and participation in Canada/U.S. activities under the International Joint Commission water reference.

(5) Participation in the formulation and implementation of water pollution control regulations under legislation such as the Canada Shipping Act, the Northern Inland Waters Act, the Arctic Waters Pollution Prevention Act and the Navigable Waters Protection Act, administered by other Federal Departments.

(6) Administration of the technical acceptance portion of the Accelerated Capital Cost Allowance for pollution control equipment under the Income Tax Act.

(7) Development of protocols for the testing of chemicals that might be dangerous if released into the environment and the disposal of hazardous substances.

(8) Participation in Environmental Advisory Services on major developments such as those proposed for grants under the Regional Development Incentives Act administered by the Department of Regional and Economic Expansion.

(9) Investigation of noise pollution; its sources, monitoring and control.

(10) Cooperation with external agencies and international organizations in data collection and information exchange.

(11) The development and promotion of new waste treatment technology; including a new solid management program and recycling studies.

(12) Contingency planning for effective environmental crisis management.

(13) Participation in the development, formulation and monitoring of air emission regulations under legislation such as the Motor Vehicle Safety Act, the Railway Act, the Aeronautics Act and the Canada Shipping Act by other Federal Departments.

(14) The development of a complete inventory of pollution problems associated with federal facilities and works, and the operation of an assessment and monitoring program to evaluate and resolve such problems.

Physically, the Environmental Protection Service is a relatively small organization. It can be small because it does little of its own basic research. Instead the Service relies heavily on its sister research and technical services, and on the information available from other Federal Agencies*, other Governments, industry, private institutions, citizens groups, and individuals, to guide its protection activities.

For these reasons, the Canadian Department of the Environment is particularly interested in consulting with the Japanese Environment Agency on all aspects of Environmental Protection. Japan is world famous for its industry, its technology and its Science. From the recent meetings in Canada between Japanese and Canadian officials, a high regard has developed for Japanese Environmental thinking and protection strategies. It is evident that Canadian environmental thinking can benefit greatly from consultation with the Japanese Government in these matters. It is hoped that our experiences will be able to benefit Japan as well.

In the following pages, a number of areas of particular interest for Environmental Canada are briefly outlined. These by no means constitute a definitive listing of our interests. Rather, we hope they will serve as initial contact points from which we can expand our discussions for the mutual benefit of our two countries and of all the global environment.

Water Pollution

The Department of the Environment is presently writing a series of national, industrial effluent regulations for the control of water pollution from industry. These individual standards are written in terms of units of deleterious substance per unit of production and specify limits for each processing operation within a plant. They are not receiving water, assimilative capacity standards since it is recognized that the safe assimilative capacity of a specific body of water for many substances, is difficult to define at present. Instead, these regulations are based on the ability of the best existing, proven techniques to control pollution. As such, they reflect the realistic best pollution control that can be expected and are, therefore, subject to regular review and readjustment as technology improves. The regulations also recognize that existing plants are in a different situation than planned one. New plants are expected to incorporate the very best available pollution abatement equipment into their design while existing plants are given individual time schedules for improvement and compliance with the regulations.

Pulp and Paper Industry regulations are now in effect, and the chloralkali industry as well as the petroleum refining industry regulations will be announced shortly. Regulations are now being developed for the mining and the food processing industries. Of particular interest to Canada are the Japanese experiences with; waste characteristics, waste treatment practices, quality of effluent, waste monitoring, and by-product recovery in the starch, and the fish processing industries. Similarly, any Japanese experiences with mine effluent and with nitrogenous waste pollution due to agriculture area of interest.

Metallic elements in general and heavy metals in particular, are in a very special category in the development of our effluent regulations. Canadian experience with heavy metal contamination of our aquatic ecosystems has been primarily with mercury. The two major industrial sources of this contaminant have been identified. Subsequently, through an intensive cooperative effort with these industries and the provincial governments, mercury losses have been reduced by 90%. The eventual targeted level for mercury loss from these sources is zero. However, problems still remain with the decontamination of heavily polluted waterways such as the St. Clair river, and with the elimination of mercury from contaminated fish.

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*eg: The National Research Council of Canada established in 1970 an Associate Committee on Scientific Criteria for Environmental Quality. This Committee will examine and analyze most recent scientific information in an attempt to compile quantitative assessments of the hazards resulting from various levels of pollution and from this to recommend environmental criteria.

Following this experience, the Department of the Environment has begun a series of surveys to determine the kind, sources, and extent, of other toxic elements in the environment. Consequently, the Department is particularly interested in any Japanese experiences with cadmium, selenium, and the metallic elements in general.

This toxic element survey is, of course, only one of the survey and monitoring programs the Department is initiating. There are a number of survey and monitoring programs in progress which are needed to generate data to assess, maintain and enhance environmental quality. It is expected that the number of these programs will increase substantially in the next few years and that the need for sophisticated monitoring and surveillence equipment will increase with it. In Canada particularly, there is a need for accurate sampling and continuous monitoring equipment which is less labour intensive than present systems. Automatic sampling, or robot, monitors are used extensively in problem areas. For example, a system of eight robot units, capable of measuring specific conductance, pH, temperature, turbidity, dissolved oxygen, chloride, and stage height, was recently, installed to monitor the effects of industrial and agricultural pollution on one of our problem rivers.

In conjunction with systems like this, more sophisticated sampling programs are often carried out. So the requirement for specialized sampling equipment and better instrumentation is increasing as well.

Throughout the water quality network, sampling is not always so intensive. In remote uninhabited watersheds, readings may be taken only three or four times a year. Naturally the kind of readings taken varies with the different sampling purposes. Bacterial and biological measurements are made in special areas, such as shellfish beds and recreation areas; but, sampling of biological parameters has not been a regular practice in all Federal programs. In future these will be included. It is hoped that enough data will eventually be collected to make a good estimate of water quality standards for most of our waterways.

Even though water quality standards are considered an uncertain undertaking at present, there is a definite need for these. The Federal and Provincial Governments enter into cooperative, long range, water quality management agreements for the complete control of all sources of water pollution in designated watersheds. Several of these comprehensive water quality management plans are now being developed across Canada. It is recognized that where industrial density is particularly high, the national, industrial effluent regulations (Fisheries Act) may not be sufficient to maintain water quality. Therefore, water quality standards, from which effluent restrictions for individual plants can be formulated, are a necessity. The criteria which could be used as a basis for water quality standards formulation, methods of determining individual plant regulations, and any problems associated with monitoring, detecting and application of standards in general, are of particular interest. Similarly any investigations of synergistic effects of two or more pollutants which would necessitate restricting the types of industries allowed to utilize the same body of water, are of particular interest. Any opinions, comments and criticisms of different types of water quality standards and criteria would be welcomed.

It is recognized that destructive incidents cannot always be averted – even with the best of planning. Canada has therefore been developing a number of contingency plans for swift containment and cleanup actions in the event that incidents such as the 'Arrow' oil spill in Chedabucto Bay, Nova Scotia, occur again. Studies are currently in progress on special booms to contain oil spills, and vessels equipped with the Canadian designed and produced "Slicklicker" device are now a part of our oil spill clean up capability. The Department of the Environment has an ongoing program for the evaluation of new clean up techniques and is consulting in the development of guidelines for pollution control at oil terminal storage and transhipment facilities. Finger printing and remote sensing techniques form an integral part of the extensive interdepartmental investigations of oil. The initiation of gas chromatigraphic techniques to analyse a wide variety of crude oils, neutron activation analysis, and studies of the trace elements in oils, are a part of this. These investigations are felt to be particularly important to the preservation of our coastal waters from oil tanker spills and offshore drilling site accidents.

Oil is not the only concern in our efforts against marine pollution. Nitrogen has been indicated as the limiting factor rather than phosphorus in salt water systems. So domestic sewage takes on a special significance in these areas. Steps are being taken now to form coastal management agencies in cooperation with other Government organizations. Generally, Canada is extremely concerned with the health not only of our own coastal waters but also of the worlds oceans. We are giving much support to this in a number of forthcoming international conferences.

The Migratory Birds Convention Act

This Act prohibits, by regulation, placing; any oil, oil wastes and substances harmful to migratory birds, into any waters frequented by migratory waterfowl.

National Harbours Board Act

This Act is applicable only to certain harbours named therein. Certain of the Harbour Boards by-laws prohibit the discharge into harbour limits of anything which may damage vessels or property, or cause a nuisance, or endanger life or health.

The Navigable Waters Protection Act

Prohibitions in this Act prevent discharge of saw mill wastes or dumping of stone and other material, likely to sink to the bottom and thereby interfere with navigation, into navigable waters. Additionally, construction of any work in navigable waters must have Ministerial approval of site and plans.

Air Pollution

The Bill which established the Clean Air Act was introduced into Parliament in the early spring of 1971, and was given Royal assent on June 23. The Act was officially proclaimed on November 1, and is therefore, the first Act sponsored by the Department of the Environment.

The Act has three major objectives. The first and foremost of these is to promote a uniform approach across Canada. At the present time there is a great diversity in expertise and legislation among the ten provinces. The opportunity therefore exists for "pollution havens" and unfair competition from jurisdictions who might be tempted to lure industry by a permissive attitude toward pollution. This is a situation that the Act is intended to prevent.

A second major objective of the Act is to make provision for the mechanisms and institutions needed to ensure that all measures to control air pollution can be taken, and finally, the Act attempts to delineate a leadership role for the Federal Government. It does this in a number of areas where Federal involvement is necessary. These include such things as the compilation of a national inventory of source emission data; the coordination of a National Air Pollution Surveillance Network; the establishment of National Air Quality Objectives; the prescription of National Emission Standards and Guidlines; the control of Air Pollution from all works, undertakings and businesses under Federal legislative authority; and the control of the composition of fuels that may be produced in Canada or imported into the country. These are tasks that can and should be handled at the Federal level either because of constitutional considerations or simply because we are in the best position to handle the job.

The approach is one of Preventative Management, using both the best practicable technology and the air resource management concept. One section of the Clean Air Act which relates directly to the air resource concept allows the Government to prescribe National Air Quality objectives.

Under the provisions of the Clean Air Act, the Minister has recently proposed objectives for five major pollutants – sulphur dioxide, particulate matter, carbon monoxide, photochemical oxidants and hydrocarbons. A sixth pollutant, nitrogen oxide is under consideration. These objectives have been recommended by a committee of Federal and Provincial experts after an examination of the scientific data describing their effects on various receptors.

The Act is unique in that it calls for three levels of ambient air quality objectives – maximum desirable, acceptable and tolerable – for each major pollutant. The lowest concentration, or desirable level, defines a long term goal for air quality and provides a basis for an anti-degradation policy in the unpolluted parts of the country. The middle or maximum acceptable level corresponds in concept to the secondary air quality standards recently announced by the United States and to air quality objectives in use by some of the provinces. It represents the realistic objective today for all parts of Canada. When this objective is exceeded, control action by a regulatory agency is indicated.

Federal Legislation for Water Pollution Control

Fisheries Act

This Act has been the major legislation for the control of pollution in Fisheries waters for over 100 years. In the Spring of 1970, it was revised and updated to permit the formulation of specific, industrial effluent regulations. Some of these regulations have already been drafted while others are being written now. Powers are also provided which enable the Minister of Fisheries (the Minister of the Environment) to review construction proposals for industrial plants which, might release deleterious substances into waters inhabited by fish waters, and, with Cabinet concurrence, to request modification of these plans, or prohibit construction altogether. The Minister can also request information from existing industries which are suspect and request suitable anti-pollution measures be taken by them. Since the Fisheries Act is national in its application, it is a deterrent to the formation of pollution havens.

The Canada Water Act

The Canada Water Act provides for long term comprehensive water planning and water quality management in specific problem areas. Since the Federal Government's constitutional authority to deal with water pollution where Fisheries are not involved is generally indirect, the Canada Water Act provides for the creation of Federal-Provincial arrangements for "Comprehensive Water Resource Management" to ensure optimum use of water resources for all Canadians. Certain bodies of water can be designated Water Quality Management Areas and can be administered by jointly conceived Federal-Provincial agencies. The Act also deals directly with the Control of nutrients harmful to natural waters by prohibiting the manufacture or import of products containing excessive amounts of these substances. In this area the Federal Government acts directly and without Provincial involvement.

Northern Inland Waters Act

The implementation of this Act is purely a Federal responsibility since it applies to the Northern Territories under Federal jurisdiction. It contains provisions similar to those of the Canada Water Act and, therefore, compliments the Federal Fisheries Act in the North.

Arctic Waters Pollution Prevention Act

In recognition of the delicate ecological balance existing in the Arctic, this Act takes special precautions to provide the very necessary comprehensive protection required to regulate the exploitation of, both sea and land based resources and the transportation of these to market.

The Canada Shipping Act

Recent amendments to the Canada Shipping Act provide improved Federal powers for protection south of the 60th parallel. Vessels entering Canadian waters are required to meet certain standards of construction, maintenance, pilotage, navigational equipment and pollution control facilities in order to prevent the occurrence of accidents with dangerous environmental consequences. Provision is also made for a maritime pollution fund which makes emergency money available to immediately compensate victims of any such disaster.

Animal Contagious Diseases Act

This act prohibits the throwing overboard from vessels the carcasses of any diseased or slaughtered animals and is applicable in any Canadian inland waters and in a marine belt of 10 miles. It also contains provisions controlling the manner and location of ship discharge of manure, garbage and other refuse.

The National Parks Act

This Act contains provisions for the writing of regulations for; the protection of fish and to remedy or prevent water pollution in national parks.

The top level of "maximum tolerable" is intended to indicate the onset of an imminent danger requiring immediate abatement action. The air pollution episodes which sometimes result when pollutants accumulate during adverse weather conditions would fall within this category.

The Clean Air Act provides for the Government to prescribe national emission standards if the emission of an air pollutant would constitute a significant danger to health or is likely to result in the violation of an international agreement. There will, no doubt, be some argument over the legal interpretation of 'significant danger'. Such standards, although universal in their application will refer to specific categories of sources. This provision will be used initially to control extremely hazardous pollutants such as mercury, asbestos and beryllium. Its extension to the more common pollutants will depend to a large degree on studies still to be carried out.

The Act also provides for the operation of a network of sampling stations across Canada to monitor the ambient atmosphere. This is a joint Federal/Provincial cooperative program and is presently limited to particulate matter (dustfall, soiling index in COH units, and suspended particulate matter) and sulphur dioxide (by sulphation rate and chemical analysis). This network involves 236 instruments in 36 cities and is being expanded rapidly. Its recordings will also encompass more pollutants in the future. These stations may be owned and operated by the provinces, owned by the Federal Government but operated by the Provinces, or owned and operated by the Federal Government. The data is complied in Ottawa and published monthly.

The stations in this network are located to reflect the pollution level as experienced by the majority of Canadians and for this purpose, instruments are located where people live, that is, in cities and towns and in areas of average pollution. These are not necessarily the best location for monitoring instruments which are sited with respect to the highest levels of pollution associated with specific areas or sources.

The control of motor vehicle pollution from new vehicles is exercised by the Department of Transport under the provision of the Motor Vehicle Safety Act, with the help and advice of the Department of the Environment.

In Canada, air pollution has traditionally been a Provincial responsibility. However, since motor vehicles are involved in international and interprovincial commerce, a national control program is desireable. The provinces must still play a role in controlling and regulating the operation of the motor vehicle once it has been sold.

Schedule E of the Motor Vehicle Safety Act prescribes emission standards for all new vehicles sold in, or imported into, Canada. These standards have been developed in cooperation with the Environment Protection Agency of the United States. They are scheduled for increasing stringency in future years. It is recognized that there is a need to maintain Canadian standards similar to those in the United States due to our close proximity and to the existence of the U.S./Canada auto pact which involves the free movement of new vehicles across the border. In addition, traffic in Canadian cities differs little from comparable United States centres even though the total number of cars in Canada is far less than the United States.

The Canadian control is based, essentially, on self certification by the manufacturer even though the Federal Government has set up a test facility which monitors a selection of the new cars offered for sale and follows the behaviour of the control system throughout the useful life of the selected vehicles.

Solid Waste

Although the provincial and municipal governments must deal directly with the majority of Canada's rapidly accumulating solid waste disposal problems, the Federal Government has a very active interest in these problems as well. This interest stems not only from the Federal responsibility to promote good environmental protection practices generally, but also from the Federal intention to develop comprehensive waste management systems for its own facilities and works. It also stems from the recognition that many of the air, water and land pollution problems encountered through the administration of a number of federal acts, could be eliminated entirely if good waste management systems were used.

At present, the Department is embarking on a research and innovation program in new methods and technology in this field. A storage and retrieval system on solid waste management techniques is being developed, and a survey of the existing solid waste problems across Canada is under way. Also included in this program are investigations into market development for recycled products, and assistance in the design construction and maintenance of some pilot, recycling plants.

The Federal interest is in complete systems, from the logistics of collection and storage to the development of new recycling and disposal methods. Of particular interest at present, are new methods for separation of recyclable products, and for useful disposal of inert remnants. Eventually, through this new program, the Federal Government will be able to provide expert and comprehensive guidance on the establishment of these systems across Canada.

Prepared by The
National Research Council of Canada

THE PROGRAM OF THE NATIONAL RESEARCH COUNCIL OF CANADA ON SCIENTIFIC CRITERIA FOR ENVIRONMENTAL QUALITY

SECTOR III – ENVIRONMENTAL PROTECTION

The Problem

It is generally agreed that man is spoiling his environment and that action must be taken to arrest and reverse this process. The environmental deterioration results from the release of energy (heat, light, sound and microwaves), chemicals (products of combustion, pesticides and assorted industrial chemicals including radionuclides), and organic materials (bacteria, sewage wastes from agriculture and food processing).

Authorities with the responsibility of controlling the pollution of air, water and land have an urgent need of standards of quality for assessing not only existing operations but also proposed future activities. These standards which form the numerical bases of regulatory activities must be selected by competent authorities after consideration of the balance between feasibility and net economic benefits on the one hand and risks of damage on the other.

In the present context the words "scientific criteria" are used to include the quantitative assessment of these risks as well as the fundamental principles and scientific knowledge on which the assessment is based. The scientific criteria should be numerical guidelines for as many contaminants as possible, based on the best information available and promulgated by a committee of unbiased experts.

Although unknowns still outweigh the knowns in this field, there is a considerable body of knowledge and decisions already in existence and it is increasing rapidly. Thus there is needed an information centre to collect and dispense this information as it becomes available and as it is needed.

NRCC's Contribution to a Solution

In order to meet these needs the National Research Council of Canada (NRCC) conceived a programme to develop scientific guidelines for defining the quality of the environment.

The NRCC is a departmental Crown corporation reporting to a designated Minister of Cabinet. It has no executive or regulatory functions in connection with the environment. The general functions and activities of NRCC are best summarized by the following breakdown of expenditures (in millions of dollars) for 1970-71:

Assistance to University Research (Grants)	53.1
Scholarships and Fellowships	9.4
Industrial Research Assistance (Grants to Companies)	6.8
National Research Council Laboratories (In-house Research in Pure and Applied Science)	51.5
Scientific and Technical Information Dissemination (STID)	4.9
Associated Administrative Costs	6.9

The programme of NRCC on environmental criteria consists of three elements:

a) The NRC Associate Committee on Scientific Criteria for Environmental Quality.

b) A Secretariat in the NRCC Division of Biology to work with the Associate Committee.

c) A Documentation and Information Centre which forms part of the Scientific and Technical Information Dissemination system (STID).

This programme was approved by the Cabinet of the Government of Canada in May 1970. The present activities in each of the three elements are described below.

The Associate Committee

The NRCC has used the mechanism of an Associate Committee with success for many years to obtain expert advice on important national problems, especially of an interdisciplinary nature. Members of an Associate Committee are selected for their personal expertise relevant to the problem and are drawn from university, industry and government where the appropriate expertise may be found throughout the country. The Committee may constitute subcommittees of specialists to deal with particular problems. Members of the Associate Committee and its subcommittees serve voluntarily and receive no remuneration other than the expenses of attending meetings. The Committee is dissolved when its task is completed. The function of the Associate Committee is to advise the President and Council.

Following this pattern the Associate Committee on Scientific Criteria for Environmental Quality consists of twenty members from federal and provincial governments, industries and universities in all parts of Canada. The Associate Committee held its first meeting in October 1970 and has formed a subcommittee for each of the following areas of study:

- Air pollution
- Water pollution
- Biological pollution
- Metals and other elements
- Pesticides and halogenated hydrocarbons
- Physical energy phenomena
- General problems

These subcommittees have commissioned monographs or scientific reviews, to be prepared by the Secretariat on the following subjects:

- Air Quality Criteria for Particulate Matter
- Water Criteria for Discharges from Pulp and Paper Mills
- Noise
- Fluoride
- Mercury
- Lead

These first monographs, and others which will follow, are being prepared by the Secretariat with the help and advice of the appropriate subcommittee. The monographs will assemble the scientific information that now exists for the development of criteria.

Each monograph will review the effects of an environmental contaminant and be focused on the production of a summary of effects which will, for example, contain the following information and will form the basis of the scientific criteria:

- Chemical or physical form of the pollutant
- Species at risk
- Route of exposure, e.g., ingestion or inhalation
- Nature of the effects

- Metabolism, including retention, excretion, translocation and organ accumulation as functions of time
- The dose-effect curve for biological effects with the dose expressed, preferably, as exposure in μg-days per Kg. Special attention should be given to threshold doses and possible linearity of the plot.
- Modifying factors
  - acute and chronic exposure
  - age of the organism
  - environmental factors
  - synergisms
  - tolerance and sensitization
  - prophylaxis and therapy
- Important gaps in knowledge

In considering the scientific information available for the preparation of criteria the subcommittees have identified many gaps in knowledge which can only be filled by the results of research. They have also received numerous proposals for research from universities and industries. From all these they have identified the following 30 as having the highest priorities:

1. Implementation and maintenance of an interactive Canadian environmental information system (QUIC/LAW)
2. Biological, chemical and biochemical effects of pesticidal seed dressings on seed-eating birds (replacements for mercury, aldrin, dieldrin, heptachlor)
3. Replacement for mercury for treatment of corn and peas in Eastern Canada (thiram). Effects on bird reproduction (pheasants)
4. Epidemiology of mercury accumulation by Canadians
5. Auditory and non-auditory effects of noise
6. Noise disturbance of sleep
7. Physical response of plants to air pollutants
8. Environmental fate of replacements for DDT (dursban and/or abate) for mosquito control
9. Studies on acute and sublethal effects of PCB's on representative aquatic organisms
10. Fate and ecological distribution of picrolam – a herbicide used for woody plant control
11. Effects of sulphur compounds in water or water chemistry and aquatic biota
12. Representative pulp and paper mill waste waters: studies on sublethal effects over the entire life cycle of a representative species of freshwater fish
13. Cadmium on aquatic organisms
14. Petroleum tainting of fish
15. Cd-Zn relationships
16. Effect of Zn on fish populations
17. Binding of Me-Hg to protein
18. Particle size of aerosols
19. Materials balance of PCB's in Canadian environment
20. Release of priority metals into the environment
21. Survey of hearing loss by farmers
22. Photochemical reactions model
23. Analysis of noise complaints

24. Presbycusis among Indians and Eskimos
25. Metals accumulation in the environment
26. Removal of mercury from sediments
27. (a) Psycho-social effects of noise
    (b) Bioassays of chemical mutagens
28. Correlation blood-Pb analysis
29. Heavy metal poisoning registry
30. Systems analysis of metals

Money has been identified in the budget of NRCC for the support of research projects to assist the Associate Committee and its Secretariat in their development of scientific criteria.

The Secretariat

The Environmental Secretariat forms one group (consisting at present of six professionals and three supporting staff) in the Division of Biology in the National Research Council Laboratories. This Division has a total staff of 110, an annual budget of $2 million, and other groups in Radiation Biology, Environmental Biology, Cell Culture, and Biomathematics.

Members of the Secretariat are occupied with preparing the monographs described on pp. 4 and 5 and acting as secretaries to the Associate Committee and its subcommittees. They cooperate with the National Science Library in the design and operation of the Information Storage and Retrieval System by assessing and selecting items for inclusion.

Information Storage and Retrieval

This system is maintained and operated jointly by the National Science Library and the Environmental Secretariat, the latter being at present the greatest user of the facility.

The NRCC is responsible in Canada for a national system of scientific and technical information in science (including medicine) and engineering. This function is carried out by the National Science Library (NSL) with a staff of 116 and a budget of $2 million as well as by a part of Technical Information Services (TIS) with a staff of 36 and a budget of about $0.5 million.

Four kinds of information are to be stored in the Environmental Information System:

1. Bibliographic references to published papers on pollution and environmental science.

   Literature references are obtained by machine processing of tapes prepared by Chemical Abstracts Service and the Institute of Scientific Information; to these will soon be added material from Medlars and Biological Abstracts. Manual inputs are also received from the Environmental Secretariat and other government scientists. In addition to the usual means of computer search, the pollution file is searchable as well by means of the on-line interactive system developed by Queen's University and known as "QUIC/LAW". The University of Ottawa computer facilities are presently being used for storage and retrieval by the latter system.

2. Bibliographies on pollution and environmental science.

   Material is provided by the NSL, the Environmental Secretariat and the subcommittees.

3. Legislation, regulations, standards and criteria.

   This includes material from national authorities throughout the world and from provincial and municipal authorities in Canada.

4. An inventory of pollution research in Canada.

   This is being compiled by the Environmental Secretariat. It will provide information essential to those providing financial support for such research in order to avoid duplication of effort and to identify subject areas in need of support.

A number of branches of the Canadian Government as well as the Canadian Council of Resource Ministers have offered to contribute material now held in their repositories and to provide references to their new publications as they appear. A cooperative programme has been arranged with the corresponding information system in Sweden.

One of the principal objectives of this information system is to provide one facility in the federal government from which scientific and technical information about the environment and about environmental research in Canada can be obtained.

The needs of regular subscribers to the main National Science Library information system are met by constructing an "interest profile" for each individual. This profile is then used to select current references which are sent weekly as a computer print-out.

Isolated requests for routine information can be dealt with rapidly and effectively by using the telephone and the on-line interactive system. Special or difficult requests may have to be answered by the Environmental Secretariat or specialists in other departments of government.

10 August 1971

NRC LAUNCHES ENVIRONMENTAL PROGRAM

BY G.C. BUTLER*

SECTOR III–ENVIRONMENTAL PROTECTION

In recent years scientists of the National Research Council and its Laboratories have been concerned about environmental problems because:

– They were keenly aware that the quality of our environment is deteriorating.
– There were many meetings devoted entirely to detailing how bad things are without proposing any remedial action.
– There were many committees which involved scientists in thinking about environmental problems for, at most, a few days a year. There was not enough professional participation involving full-time studies by scientists.
– Many scientists were making emotional appeals for corrections of the situation and were abandoning strict logic in the development of their arguments.
– There did not seem to be any clear idea of what constitutes pollution.
– There is a frightening lack of knowledge of the biological effects of chronic exposure to low levels of pollutants and food additives.
– Many people were demanding that more research be done without an accurate idea of what research is going on now.

Stimulated by these concerns, the NRC conceived a program to develop scientific guidelines for defining the quality of our environment. After consultations with all the interested Federal Government Departments and one or two committees, the plan was submitted to the Cabinet and approved in May of this year.

The NRC study of pollution consists of three elements:

a) The NRC Associate Committee on Scientific Criteria for Environmental Quality.
b) A Secretariat in the NRC Division of Biology to serve the Committee.
c) A Documentation and Information Centre in the National Science Library.

The **Associate Committee**, consisting of the following membership, met for the first time in mid-October, 1970: W. S. Hoar (Chairman), Head, Department of Zoology, University of British Columbia; G. C. Butler (Vice-Chairman), Director, Division of Biology, NRC; P. M. Bird, Director, Environmental Health Directorate, Department of National Health and Welfare; D.S. Caverly, Ontario Water Resources Commission; N.E. Cooke, Canadian Industries Limited; C. de Laet, Canadian Council of Resource Ministers; H. L. Hogge, Director, Division of Environmental Health Services, Alberta Department of Health; H. Hurtig, Research Coordinator (Pesticides), Department of Agriculture; W. E. Johnson, Director, Freshwater Institute, Fisheries Research Board, Winnipeg; M. Katz, Department of Chemistry and Division of Natural Science, York University; J. A. Keith, Head, Pesticides Division, Canadian Wildlife Service; M. Laird, Head, Biology Department, Memorial University; H. D. Paavila, Canadian Pulp and Paper Association; L. Piché, Université de Montréal; J.-A. Roy, Ministère de la Santé, Gouvernement de Québec; L. P. Roy, Laval Industrial Association; E. R. Tinney, Policy and Planning Branch, Department of Energy, Mines and Resources; C. C. Walden, Head, Division of Applied Biology, British Columbia Research Council; I. Hoffman (Executive Secretary), Head, Environmental Secretariat, Division of Biology, NRC.

*Director, Division of Biology, National Research Council of Canada and Vice-Chairman, NRC Associate Committee on Scientific Criteria for Environmental Quality.

The Committee, working through a number of subcommittees, and with the full-time assistance of the Secretariat, will examine and analyse the best and most recent scientific information in an attempt to make quantitative assessments of the biological hazards resulting from various levels of pollution and from this to recommend maximum permissible levels for pollutants. Initially it will consider such subjects as radiation, noise, pesticides, heavy metals and bacteria. Its publications will provide source material for regulatory bodies (federal, provincial or municipal) which have the responsibility to prepare standards and regulations for the control of environmental pollution.

The total number of scientists required for membership of the Associate Committee and its subcommittees will soon exceed fifty. One of the indirect benefits of the involvement of the Canadian scientific community in focused studies of environmental problems will be an increased level of awareness and sophistication on the part of our scientists.

During its studies the Associate Committee will discover gaps in our knowledge which can only be filled by research. One of its responsibilities will be to stimulate the initiation and conduct of such research.

The **Secretariat** forms part of the Biology Division of the National Research Council and is at present housed in the Sussex Drive laboratory of NRC. Its full-time staff consists of four professionals, one technician, and a secretary. Additional scientists who will soon join the group will be loaned by government departments and industry. Others will be employed on a part-time basis for specific studies.

The Secretariat will review a variety of subject areas in the field of environmental pollution, compile bibliographies, publish reviews of the literature and prepare the initial recommendations of maximum permissible levels for consideration by a subcommittee of the Associate Committee. There exists now a large backlog of material to be studied in this way and new subjects for study will arise as new forms of pollution are recognized. One responsibility of the Associate Committee will be to assign relative priorities to the subjects for study.

The accumulation of knowledge in the Secretariat, adequately described in NRC reports, will be an important resource for environmental and toxicological science. It should be available, not only to NRC and its committees, but to anyone interested. It is foreseen that, if it does its work well, a considerable expansion of the Secretariat will be required in years to come. Yet because it is housed in a large scientific organization which can provide many of the ancillary services, its annual operating expenses will probably not rise beyond half a million dollars.

The **Documentation and Information Centre** will be operated by the National Science Library in the Scientific and Technological Information system with the assistance of the Secretariat. Much of the current literature on pollution arrives on punched or magnetic tape. This can be scanned for key words in the titles and the resulting lists of publications sent to subscribers to the service. New material which does not arrive on tape but which is discovered by personal searching by Library or Secretariat staff or by NRC scientists will also be converted to the same form of storage on tape.

The Centre will store, and provide information on, three other types of material:

- bibliographies compiled by reviewers of the pollution literature;
- Canadian research projects in progress in the field of pollution;
- criteria, objectives, standards, regulations and legislation for environmental protection which exist anywhere in the world.

All this material will be kept on magnetic tape capable of being searched by the IBM 360/67 computer, the results of the search to be printed out as a list of references.

A number of collections of reference material in pollution exist in universities and government departments. It is hoped that eventually the operation of these can be made compatible with the NRC Centre so that all the available information in Canada can be obtained from one inquiry.

An Associate Committee of the NRC has for many years provided one important mechanism for studying, coordinating and promoting research on a problem of national importance. A relevant example is the Associate Committee on the National Building Code which has a twenty-five year record of achievement in preparing, revising, updating and publishing the National Building Code. Although adoption of the Code is voluntary, more than 85% of Canadian municipalities have incorporated the provisions of the Code into their by-laws. It is possible that a similar approach may also be fruitful in the attainment of uniform environmental quality standards throughout Canada.

It will doubtless be some years before a comprehensive set of scientific criteria of environmental quality can be produced. Nevertheless, it is a necessary first step if we are to have rational environmental quality standards and ultimately also uniform nation-wide standards. The measure of the success of the NRC program will be the extent to which it is used by regulatory authorities.

This Newsletter contains invited articles considered by NRC management to be of timely significance. The views and opinions are, of course, those of the respective authors.

Cette publication est aussi disponible en français sur demande. Ottawa 7, Canada.

NRC ASSOCIATE COMMITTEE ON SCIENTIFIC CRITERIA FOR ENVIRONMENTAL QUALITY

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Addendum to "Environmental Situation in Japan"
(Revised)

CANADIAN EYES ONLY

ENVIRONMENTAL PROTECTION – JAPAN

OPPORTUNITIES FOR SALES OF CANADIAN EQUIPMENT AND SERVICES FOR POLLUTION CONTROL

At the June meeting of the Minister's Advisory Council and the Japanese Economic Mission to Canada, Japanese participants suggested Canada might assist Japan in solving its industrial air and water pollution problems. It was indicated that now $600 million/year is being spent on pollution control in Japan, a figure which will increase to $3 billion/year by 1975/76. It is anticipated that this subject may be raised again during the January mission.

To spearhead and coordinate pollution control in Japan, the Diet established the Environmental Agency on July 1, 1971, with terms of reference similar to those of the Environmental Protection Service of Environment Canada. Among its more important objectives are included the reduction of industrial air, water and noise pollution. The significant enabling legislation, Japan's "Basic Law for Environmental Pollution Control", was enacted in August, 1967. Major amendments were made in 1970.

In a statement submitted to OECD, Japan stated that the "polluter must pay" principle should be applied in the long run. However, the Japanese Government had indicated it will provide assistance to industry to encourage them in installing pollution abatement facilities so as to increase resources available for investment in pollution control. The Japanese Ministry of Foreign Affairs states in their March 31, 1971, report to the United Nations . . .

"In order to encourage the enterprise to install pollution control facilities, long-term, low-interest loans are made available by the Environmental Pollution Control Service Corporation, The Japan Development Bank, the Small Business Finance Corporation and so on. In addition, favorable tax treatment is given for smoke and soot treatment facilities, waster water treatment facilities, fuel oil desulphurization facilities and the like".

Possible Canadian Exports to Japan

Industrial Air and Water

Industrial air and water pollution control is an engineering market. Effluent improvement is accomplished through process change, permitting raw material and chemical recovery, and through final effluent treatment. The first involves modifications to existing industrial plants. The second involves a large portion of civil works such as lagoons, gas burners and smoke stacks, with some specialized equipment. In virtually all cases, installations are custom designed and fabricated, with virtually all fabrication being available and competitive in Japan.

Canada can offer:

a) specialized engineering service – about 3% by value of facilities. This would normally be accomplished through a joint venture or working arrangement with a Japanese engineering firm. Such a working arrangement would have to be established for a number of projects to make it attractive to a Canadian consultant.
b) specialized sampling and monitoring equipment (although some might be copied or manufactured in Japan under license should a significant volume demand develop).
c) medium technology systems and products of unique design, such as Polcon aeration systems or B.C. Research Council designed black liquor oxidation and scrubber systems.

Sales to date in Japan include Polcon (Montreal) aeration systems and Barringer Research (Toronto) monitoring systems. T.W. Beak Consultants Limited (Montreal) are negotiating a working arrangement with Toray/Mitsui to do seven projects in Japan. Toray/Mitsui is a part of the large Mitsui conglomerate.

Marine Oil Pollution

In this field, Canada has moderate exportable strength.

a) oil sinking agent – International Oil-Lok Control Limited manufactures a specially treated product designed to sink oil slicks so as to prevent damage to shorelines, beaches, etc. The sunk oil can be naturally degraded or can be dredged up.

b) oil spill removal devices - R.B.H. Cybernetics Patents and Processes Limited (Victoria) and Annand Steel (Truro) manufacture devices suitable for recovering oil slicks. These might be used individually or in conjunction with oil sinking agents, dispersants or containment booms.

Municipal Sewage Treatment, Solid Waste Disposal and Incineration

Canada has good strength in municipal sewage treatment, solid waste disposal and incineration. However, an assessment has not yet been completed of Canadian competitiveness in Japan. However, as many items are of a type which could be readily manufactured or fabricated under license using cheaper Japanese steel and labour, we are not fully confident of Canadian competitiveness at this time.

Impact of Pollution Control Regulations

Pollution is a significant problem in Japan's metal smelting refining industries. Pollution Control regulations have been used as the stated reason for implementing a force majeure against contracts with Canadian mining companies. However, their use coincides with a slackening in the Japanese economy.

Talking Points

To assist Japanese industries in reducing pollution, Canada can offer specialized consulting and engineering services, sampling and monitoring devices and a limited range of systems and products of unique design. Canada has an excellent capability in containment and treatment of marine oil spills so as to minimize environmental damage.

There is a number of general and specific questions for which answers might be sought:

- What directions is Japanese research taking in pollution control?
- What specific deficiencies currently exist in Japan in the areas of solid wastes disposal, municipal sewerage treatment and air pollution?
- What has been Japan's progress in the development of oil spill removal technology and government and industry contingency plans?
- What has been the Japanese progress in developing automatic monitoring equipment, sensors and networks for water basins (not plant effluents) and the water quality parameters to be measured. Present methods of monitoring and the responsibilities of various levels of government are also of interest. (This is of interest from the point of view of introducing in Japan, Canadian monitoring technology which is now under development by Leigh Instruments with co-operation from The Inland Waters Branch and CCIW and with PAIT funding).
- What are water quality standards for food plant and pulp and paper mill effluents and the present extent of effluent treatment? Air standards for atmosphere polluters?
- Do government loans and subsidies to industry for pollution control work have any restrictions (explicit or implicit) on the use of imported equipment?

- A list of the major Japanese manufacturers of air and water pollution monitoring or abatement equipment and their products. (The 2nd Anti-Pollution Exhibition is taking place at the Tokyo international Trade Center on March 25-30, 1972. It is possible that such information would have been prepared for the Exhibition).
- What are the opportunities for Canadian consulting engineers, bearing in mind:
  a) Independent Canadian consulting capability exists for industrial and municipal waste treatment facilities.
  b) Canadian expertise and experience is being applied to environmental impact studies concerning major projects.
  c) Canadian consultants are willing to collaborate with Japanese firms in seeking solutions to specific problems?

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Science and Technology Mission
to Japan, 8-15 March 1972

Prepared by the
Department of the Environment

SECTOR III – ENVIRONMENTAL PROTECTION

THE ENVIRONMENTAL SITUATION
IN
JAPAN
(Revised)

Background for the
Environmental Protection Sector
of
The Canadian Science and Technology
Mission to Japan
March, 1972

The news media, sensing a new national mood, have stepped up demands for strict (and costly) pollution controls and higher expenditures on roads and housing.

The seriousness of the country's mood can be judged by incidents that have occurred this summer.

At the annual meeting of a major corporation blamed for discharging dangerous industrial waste, protesters thrust the funeral plaque of a cremated pollution victim in front of the chairman as he presided over the meeting.

Such direct confrontations would normally be abhorred by the Japanese.

(Financial Post Japan Report 28/8/71)

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The Basic Law for Environmental Pollution Control

Prior to 1967, some specific national legislation as well as a number of local ordinances existed. However, a uniform national approach was needed. *"The Basic Law for Environmental Pollution Control"* was therefore enacted in 1967 to protect the health of the people and to protect the living environment through the establishment of fundamental action policies. This law does principally four things:

(1) It defines the responsibility of the national government, local governments, private enterprise and the citizenry for control of pollution.

(2) It prescribes the measures to be taken by the national and local governments for environmental protection.

(3) It prescribes environmental quality standards for air, water and noise and provides for specific industrial standards.

(4) It lays out procedures for settling pollution related disputes, institution of relief measures, apportionment of pollution costs, etc.

Environmental legislation, formulated after its passage, follows the intent and prescriptions laid down in this law. It is the *"Basic"* environmental law.

By 1970, accelerating pollution in all areas necessitated an extraordinary session of the Diet (December, 1970). During this session 14 amendments or enactments were made and are included in the following appropriate pollution categories. The Basic Law itself was also amended to include:

(1) the addition of soil pollution to the pollution categories.

(2) the responsibility of industry for the disposal of wastes and of government to supply public waste disposal facilities.

(3) the specific conservation by governments of green areas and natural resources in concert with their anti-pollution activities.

Air Pollution

Air pollution is conceded to be quite serious in Japan. Sulphur oxides, carbon monoxide, nitrogen oxides, particulates, etc., are generally increasing in the atmosphere although some areas have recorded decreases since the introduction of their local air pollution control measures. The general increase is attributed to the continuing density increase of industries in already highly populated industrial areas and to the increase in fossil fuel consumption. Sulphur oxides are the main pollutants and have been monitored, with nitrogen oxides, since 1964. The emission standards for sulphur oxides are scheduled for revision. Nitrogen oxides are earmarked for extensive study and national emission standards; especially since they have been linked to the occurrence of serious photochemical smogs.

Of the heavy metals, Lead and Cadmium in particular are receiving special attention. The national network of air monitoring stations has been monitoring these two elements along with Zinc since 1968. Cadmium is scheduled for national standards consideration since chronic cadmium poisoning from contaminated water and food supplies has been indicated as the cause of "Itai Itai" disease.* Lead will be eliminated from gasoline by 1975. Auto exhaust emission controls are already scheduled, to halt the rapid increase of carbon monoxide levels from this source. Soot and particulate matter standards exist and are similarly under scrutiny for tighter control. Hydrocarbons containing carcinogenic substances, and oxidants in general, are of growing concern.

The 1970 amendments to the *Air Pollution Control* law extend smoke and soot emission regulations from specifically designated areas to the entire country.

*Note: Cadmium as the cause of Itai disease is the Official Position. The Scientific community gererally, feels it was a contributing factor; but, only one of several, and not sufficient in itself to produce all of the disease symptoms. Public sentiment is very much in favour of the Official Position.

Prefectural governments are empowered to set more stringent local standards (SO_x excepted*) and to request the shutdown of plants and the restriction of traffic if local atmospheric conditions warrant this. Emission standards violators face prison terms as well as financial penalties. They now can be prosecuted if standards are exceeded whereas, previously, an official warning had to be given and disregarded before a prosecution could be made. Cadmium and other toxic substances are now included in the redefinition of smoke and soot. Regulations regarding dust generated by crushing or demolition operations have been extended.

The 1970 amendments to the *Road Traffic* law allow prefectural safety committees to curb vehicular traffic as previously mentioned, and to request local government heads to submit traffic damages data. The local Governor may also request the safety committee to curb traffic.

The amended *Agricultural Land Soil Pollution Prevention, Etc.*, law may also be applied to air pollution. It empowers the Minister of Agriculture and Forestry to request heads of other administrative agencies to take measures to prevent pollution of designated "agricultural land soil pollution control areas".

Current directions in air pollution include encouragement of the use of low sulphur fuels and promotion of low sulphur crude oil imports. Air pollution meteorological centres are to be established. A progressive restriction on automobile emissions has been laid down. The restrictions will also be applied to older cars. Buffer zone green belts are to be established. A high priority has been given to detection and monitoring technology as well as data accumulation and analysis. There is generally much activity in all areas of air pollution research since this is one of the older Japanese concerns and still is one of the most damaging.

Noise

Noise pollution was recognized in the Basic Law for Environmental Pollution Control. Under the 1969 *Noise Regulation* law, necessary control was applied to noise emanating from factories and construction sites in urbanized districts. The 1970 revisions extend this coverage to any residential areas and to hospital and school areas. The law has also been broadened to permit the establishment of allowable limits for automotive noise under the *Vehicles for Road Transport* law. The same law permits prefectural public safety committees to restrict traffic flow if noise or vibration levels from traffic increase sufficiently. Local governments must supply data on this area if requested to do so. It is planned to increase measures for control of aircraft noise and to thoroughly investigate psychological, physiological and technological factors involved in devising noise standards.

Offensive Odours

It is recognized that offensive odours constitute environmental pollution in that they may be aesthetically disturbing and not conducive to psychological health. Therefore, a Bill for *The Control of Offensive Odours* has been presented to the Diet. Further research into this area is planned from both the human and the technological aspects with a view to national standards.

Soil Pollution

Due to the high regard for land in Japan, soil pollution, although recently discovered is regarded with great concern. This pollution came about as a result of the continuing air and water contamination. It is a good indicator of the seriousness of the general environmental situation.

The dangers of soil pollution have been divided into two categories: human health hazards from contaminated produce, and plant poisons. Heavy metals are the cause in both cases. Cadmium, lead and arsenic are the potential food contaminants while copper and zinc impede crop growth. In 1969, an estimated 3% of the total agricultural land was believed to be contaminated; a majority of this by two or more substances. An extensive survey is scheduled to determine the exact extent of this.

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*Emission standards are determined on the basis of existing pollution levels regionally. Other pollutants will have national standards.

The importance of soil pollution was officially recognized through its addition to the categories of pollution in the *Basic Law for Environmental Pollution Control* in 1970 and the addition of provisions to combat it. The *Agricultural Land Soil Pollution Prevention,* Etc. Law (1920) permits prefectural governments to designate "Agricultural Land Soil Pollution Areas" and to implement strategies to control the deterioration, pursuant to the approval of the Minister of Agriculture and Forestry. This Minister can request heads of other administrative agencies to take special measure under the Acts they administer to prevent further harm to these lands. The threat of agricultural chemical residues in the soil has also been recognized. As a result, efforts are being made to promote the use of low toxicity, non-persistent chemicals as well as to reinforce regulations concerning their use. Amendments to the *Agricultural Chemicals Regulation* law establish more stringent screening criteria for chemical registration and authorizes the responsible Minister to cancel the registration or further restrict the use of chemicals which may be harmful. *The Poisonous and Deleterious Substances Control* law was also amended to provide for the prescription of technical standards for the transportation, storage, handling and sale of these substances.

The new *Waste Disposal and Public Cleansing* law (1970) divides wastes into industrial wastes and general wastes. Industrial wastes must be amenable to treatment when discarded and standards of collection, transportation and treatment must be adhered to; a waste management research and technology development program is under way. The existing waste treatment system, pertaining to the collection, transportation and treatment of household garbage, was retained but the responsibilities of the local governments and individual citizens are extended.

In addition to the agricultural land survey, research into the conservation of these lands, and into the effects of certain substances, such as the effects of hydrogen fluoride on plants, is scheduled. Research into the movements and effects of heavy metals naturally has a high priority.

It is noteworthy that the Japanese are very concerned with proper land use in that they seek to prevent the loss of valuable agricultural land to other uses. A program also exists for the movement en masse, of livestock farms away from dangerous industrial centres and from water resources with they may pollute. The efficient and optimum utilization of space is a primary Japanese concern.

Radioactive Pollution

Possible radioactive contaminants are tightly controlled in Japan. The following two laws provide the necessary control: "the *Law on the "Control of Nuclear Material, Nuclear Fuel and Atomic Reactors"* and *"the Law on the Control of Radiation Hazards by Radioisotopes, etc."* Additionally, the Science and Technology Agency has been investigating the levels of radioactive fallout from foreign nuclear weapons testing and is conducting research activities concerning the prevention of environmental contamination by radioactive substances, the safety of atomic energy facilities and the prevention of radiation hazards affecting the human body, etcetera. A number of Departments are involved in the various aspects of radioactive control and studies. An Atomic Energy Commission, under the jurisdiction of the Prime Minister's Office, plans, reviews, and decides on nuclear fuel matters and the prevention of accompanying hazards. A Radiation Council, also under the Prime Minister's office, studies technical standards related to the prevention of radiation hazards. There are strict requirements for the disposal of radioactive wastes.

Water Pollution

The waters of the major rivers, lakes and coastal areas are all considered polluted in one way or another. City rivers are contaminated by small to medium industries and by household wastes. B.O.D. counts generally exceed safe limits. Rural rivers are polluted mainly by specific groups of industries such as pulp factories, starch plants and breweries. The inland sea, ports and harbours are contaminated by ships' effluent and garbage in addition to the inland sources.

Coastal areas where tidal action has little effect are in particularly poor condition. Agricultural land has sustained considerable damage as well. For example, cadmium poisoning from contaminated food and water supplies was found during the "Itai Itai" disease investigations. Similarly alkyl mercury compounds in fish are responsible for "Minamata" disease. The fishing industry has been particularly affected by oily effluents which render fish unfit to eat due to their offensive taste and smell. Stunted fish larvae and retarded shellfish growth rates reflect the seriousness of water pollution on the fishing industry generally. The loss of recreational areas and the odours emanating from polluted waterways are considered particularly damaging to the psychological and physiological well being of citizens. In short, the damage from water pollution is considered to be serious, nationwide and increasing.

Recent actions to curb water pollution are many. The 1970 amendments and proposals did away with the system of only designating special areas for water pollution prevention activities. The new *Water Pollution Control* law provides for national effluent standards. As with air pollution legislation, the prefectural governments may apply more stringent standards if local conditions warrant them. Infringement of these standards constitutes an offence punishable by penal as well as financial penalties. The prefectural governments are obliged to maintain a year round surveillance of water quality conditions and are responsible for the maintenance of good water quality. Provision has been made for a network of Water Quality Monitoring Stations. Special measures can be taken to prevent water pollution if designated "Agricultural Land Soil Pollution Control Areas" are threatened. Possible water pollution by agricultural chemicals has been recognized in recent amendments to the *Agricultural Chemicals Regulations* law. Amendments to the *Natural Parks* law requires that anyone wishing to discharge effluent into lakes and swamps in designated areas must obtain permission from the government beforehand. The restrictions on extracting for use in buildings are increasing*. Plans are underway to construct industrial water works in these areas and to make it mandatory for industrial plants to switch to the use of this water.

Sewerage

A shortage of useable land and a large population combined with short, small rivers make purification of sewage a very important item in Japan. However, sewage purification was slow to develop since for many years human excrement was valued as fertilizer. The introduction of cheap commercial fertilizers brought an end to the use of "night soil" but tremendously increased the demand for purification facilities. The 1970 amendments to the *Sewerage Act* provide for the establishment of construction and operating standards for public sewerage systems.

Prefectural governments formulate comprehensive sewerage plans for whole river basins and construct trunk sewers and sewage treatment plants. Local governments (cities, towns, villages) construct their own systems. These governments are all responsible for maintaining the standards of the *Water Pollution Act* and the *Sewerage Act.* Land owners may be required to construct sewers on their own lands and industries must provide pretreatment plants to bring their liquid wastes to standard before they are admitted to public sewers. Local governments may levy charges for the industrial use of public facilities. The projected, continued, rapid population density increase in urban centres is expected to keep sewerage systems and purification techniques a priority. Presently biological treatment is preferred for sewage purification. (Activated sludge treatment accounts for 50%, percolating filters 25% and primary sedimentation 16%). Dumping of sludge on low lying lands prevails in 62% of the cases while it is used agriculturally as a soil conditioner or fertilizer in 19% of the systems and is dumped into the ocean 6% of the time. When used as a soil conditioner it is usually in cake form from an aerobic sludge digestion tank. Sludge incineration is also used in large cities. Some experimental uses of the ash residue have been investigated since there is a shortage of low lying land suitable for sludge disposal. Phosphorus and nitrogen removal from sewage has been recommended for some areas where lake eutrophication is feared. On the whole, purification and sewerage systems are currently a very active and varied field of study in Japan.

*Ground can sink as a result of this practice. For example, in the Tokyo area, some ground sank to sea level.

Marine Pollution

The *Marine Pollution Prevention* law was passed in 1970. It aims to not only control marine pollution but also to conserve the ocean. Wastes and effluents in addition to oil are recognized as ships' pollutants and offshore facilities are included under its jurisdiction. Regulations for oil spills are reinforced and each ship is required to have an oil pollution control manager and an oil pollution control system. Ships, in principle, are prohibited from discharging wastes into the sea (there are certain exceptions). All waste disposal activities are to be recorded and reported to appropriate authorities. It is planned to promote the construction of treatment facilities for discarded oil. Ships are obligated to report oil spills at sea and may be ordered to take certain measures as a consequence of such actions. Surveillance and policing systems are to be reinforced and research and development in this area encouraged.

It is recognized that the ocean is the terminal point for water pollutants and that once damaged, it will be almost impossible to revive. Since sea water carries pollutants around the globe, international cooperation and agreements are sought to conserve the ocean. Much emphasis will be placed on this at Stockholm in 1972 by the Japanese.

Financial and other Incentives

The national government provides loans and subsidies for Pollution Control Works through the Environmental Pollution Control Service Corporation and government-related banking institutions which are substantially extending their lines of credit for projects related to pollution control. The area of these loans will also be extended to cover industrial waste treatment facilities. In the field of taxation, the coverage of the special depreciation system for pollution control facilities has been expanded and the rate of depreciation has been raised. Authorization has been given for quick depreciation of the bearing of the cost of public pollution control works (*Entrepreneurs Bearing of the Cost of Public Pollution Control Works* law). Custom duties deductions for heavy oil, scheduled for desulphurization, have been raised. A deduction has been granted for low sulphur crude oil as well. A Bill amending the *Small Business Credit Insurance* law was passed in 1971. Within the framework of the small business credit insurance system, the Bill provides for a new kind of pollution control insurance, independent of ordinary insurance, to deal with the increasing demand of small businesses for funds in connection with their pollution control activities.

A Bill concerning *Special Government Financial Measures for Pollution Control Projects* was presented this year (1971). It assigns cost percentages born by government subsidies with respect to local pollution control projects. Those projects covered are the following: construction or reconstruction of public sewerage for industrial wastes, establishment of buffer zone green belts, construction of waste disposal facilities, relocation of public compulsory education institutes, cleaning of rivers, ports and harbours, improvement of polluted agricultural land, and the construction and procurement of local pollution monitoring facilities, etc. The government cost share will be raised from one third to one half or more depending on the project. Provision is also made for emergency aid to clean up polluted areas and procure monitoring equipment as well as provide funds for certain non-standard projects. It also authorizes the government to underwrite local bond issues made to finance projects covered by special government subsidies. One half of the cost of redemption of the principal and the payment of the interest of such local bonds can be included in the basic financial requirements designated as grants in aid of local governments.

The "Polluter must Pay" principle

Provisions in the *Basic Law for Environmental Pollution Control* stipulate that an enterprise shall bear all or part of the necessary costs of state or local government projects of clean up pollution caused by that enterprise. The nature and amount of the costs include the method of determining the cost. Other necessary matters related to the bearing of such costs are to be laid down in other laws.

The 1970 *Law for The Punishment of Environmental Pollution Crimes Relating to Human Health* characterizes the acts which cause dangers to human health through the discharge of toxic substances as a result of business activities as the basic type of punishable act. It establishes provisions for allocating the responsibility for these acts to specific persons such as managers and owners of the businesses, and provides punishments for these acts.

The Law concerning *Entrepreneurs' Bearing of the Cost of Public Pollution Control Works* classifies the pollution control projects undertaken by the various levels of government which the businesses are totally or partially responsible for financing. It also provides for apportionment of the percentage of total costs between the entire community of businesses responsible and, in the case of default of payment, authorizes the governments to "compulsorily" collect the apportioned amount.

The Bill on *the Establishment of Organizations for Pollution Prevention in Specified Factories* aims at creating a pollution control organization within specified factories. It defines the type of factory subject to this legislation and requires that these designated factories appoint a superintendent of pollution control who will be registered with the prefectural governor as well as a pollution control manager, responsible for technical matters, who must also be registered with the governor. It also provides for the appointment and registration of further pollution specialists and specified that these people must have qualifications as prescribed by cabinet order. The governor may order the dismissal of these people if he deems them incompetent.

Note of interest: although the papers reviewed refer to penal provisions for environmental criminals, these are not clearly defined. However, during the Canada-Japan meeting on Environmental and Pollution problems in June 3 & 4, 1971, Mr. Lucas (EPS) inquired about punishments for non-compliance with Government directives to clean up industrial pollution. Mr. Kido (Head, Environmental Pollution Countermeasures H.Q.) replied that, in normal cases, fines and a 6 month maximum of imprisonment could be applied, but in cases of "gross or intentional negligence" a five-year maximum term was provided for.

NOTE

The following information, under "The Recent Establishment of the Environment Agency", was taken from a Japanese abridgement of the Bill to establish that Agency. The Bill has been passed, the new Minister (OISHI) appointed and the Environment Agency established (July 1, 1971).

The Recent Establishment of the Environment Agency

As an interim measure, the Headquarters of Countermeasures or Environmental Pollution was established within the Cabinet and was placed under the directorship of the Prime Minister in July of 1970. It was responsible for the legislation placed before the extraordinary session of the Diet (December, 1970). The Headquarters proved effective so the establishment of a permanent government agency with similar responsibilities was deemed advisable.

The Bill on the Establishment of the Environment Agency was placed before the Diet in 1971 after Cabinet approval. The Bill recommended that this agency be attached to the Prime Minister's Office and that its head would be a Minister of State called the "Minister of Environment". In addition to a secretariat, the Environment Agency would have four departments: a department of Planning and Coordination, a department of the Protection of Nature, a department of Air Pollution Control and a department of Water Pollution Control. The Agency would also establish a National Environmental Pollution Research Institute (before the end of fiscal 1973), a Training Centre for Pollution Control Personnel (before the end of 1972) and three councils. These councils would be the central council on Environmental Pollution Control, the National Parks Council and the Central Council for Birds and Animals.

All services under the National Parks Bureau, the Secretariat of the Minister of Health and Welfare (such as enforcement of the National Parks Law), and the services relating to the protection of birds and animals under the jurisdiction of the Guidance Bureau of the Forestry Agency would be transferred to the new Environment Agency.

The Environment Agency would have the responsibility for the administration of the functions relating to the following environmental pollution control laws:

(1) Air Pollution Control Law

(2) Water Pollution Control Law

(3) Agricultural Land Soil Pollution Prevention, Etc. Law

(4) Noise Regulation Law

(5) Industrial Water Law

(6) Law concerning the Regulation of Pumping up of Ground Water for use in Buildings

(7) Agricultural Chemicals Regulation Law (only such parts of the Law as are related to environmental pollution control)

(8) Waste Disposal and Public Cleansing Law (only such parts of the Law as are related to the establishment of standards governing the ways of final disposal of wastes)

(9) Marine Pollution Prevention Law (only such parts of the Law as are related to the establishment of standards concerning areas for dumping wastes and the ways of dumping, except the wastes generated in the course of daily lives of those who live in ships or seabased facilities).

(10) Sewerage Law (only such parts of the law as are related to the establishment of standards for the treatment of matters such as sludge, etc.).

(Other duties)

(1) To assist the Prime Minister in the exercise of his authority to give the instruction of the basic guidelines for planning the Environmental Pollution Control Programs and to approve such programs under the Basic Law for Environmental Pollution Control

(2) Functions relating to the establishment of environmental quality standards

(3) Implementing Special Concerning the Relief for the Injured by Environmental Pollution

(4) Implementing of the Law Concerning Entrepreneurs' Bearing of the Cost of Public Pollution Control Works

(5) Supervision of the Environmental Pollution Control Service Corporation

(6) Functions relating to international cooperation (except those under the jurisdiction of the Ministry of Foreign Affairs)

(7) Collection and compilation of statistical and other data including data concerning scientific studies of the health damages by environmental pollution, functions for research and investigation relating to affairs under the jurisdiction of the Environment Agency.

(8) Education and training (including those given at the request of local government bodies) give to its personnel in matters relating to its administrative responsibilities.

The Minister of Environment could request heads of other government agencies to provide necessary data and explanations. He could make recommendations to these heads and ask them to submit a report on the measures they have taken in accordance with his recommendations. He could also recommend that the Prime Minister direct and supervise the administrative activities of other agencies.

The Environment Agency would plan, programme and promote the basic policies related to environmental conservation. It would coordinate the concerned individual agency services and their budget for the contracts given by individual agencies to the national research institutes for specific and relevant projects. (This does not include university research money)

Related Changes

Since the Japanese Government wishes to promote international cooperation among all countries now faced with pollution problems, a Councillor of the Ministry of Foreign Affairs has been appointed as an ambassador charged with the affairs of environmental pollution and will attend intergovernment conferences dealing with these problems.

A Maritime Pollution Control Division was added to the Maritime Safety Agency and Maritime Pollution Surveillance Centres were established.

A Bureau of Sewerage and Sewage was established in the Ministry of Construction in recognition of the vital importance of these systems in controlling Water Pollution.

SAFEGUARDS AND MONITORING SYSTEMS

Monitoring Air Pollution

The conventional methods employed for the determination of the degree of air pollution have depended on the observation of fall-outs in deposit gauges, dust jars, and so forth and the detection of sulfur oxides by the lead dioxide method. These methods, however, which yield results that can be analyzed only once a month, are useful only for the survey of long-term tendencies in increase or decrease of pollution; they are quite unsuitable for the present situation, where it is necessary to be able to know the state of pollution from moment to moment; an automatic method would be necessary for any effective action to be taken on the basis of data obtained at shorter intervals. Indeed, the automatic method would be absolutely essential to closely follow the changing phenomena in areas where possibilities of serious pollution are foreseen, or to compare simply and efficiently differences in the extent of pollution between different areas.

In fact, the "Environmental Standard of Sulfur Oxides," adopted at a Cabinet meeting in February, 1969, obligates the use for the time being of automatic data-collecting recorders that operate by electric conductivity. With regard to exhause fumes of automobiles, their carbon monoxide content is the target of monitoring on the basis of the "Air Pollution Prevention Law." In order to substantially enforce the "Environmental Standard of Carbon Monoxide," adopted at the February, 1970 Cabinet meeting, the authorities concerned are at present engaged in the completion of a nation-wide network of automatic data-collection recorders.

Local Monitoring of Sulfur Oxide Content

In designated areas, classified as such on the basis of the Air Pollution Prevention Law, prefectures and cities designated by ordinance are conducting, in obedience to relevant law, monitoring by means of automatic data-collecting recorders of the content of sulfur oxides, floating dust, direction and velocity of wind, temperature, relative humidity, and so on. As of September, 1970, 225 observation stations were in operation in 18 prefectures and in 12 designated cities; of these, 191 stations were connected by a wireless or closed-circuit telemeter system to local monitoring centers. Monitoring center-based observation cars equipped with a wireless communication system are also mobilized. At monitoring centers in certain areas like Osaka Prefecture, Chiba Prefecture, etc., computer data-processing is playing an important role. To cope with the acute situation as polluted areas continue to expand ever further, possibilities of setting up a monitoring system with a large scope of observation covering more than just one administrative unit are being studied with promise.

Local Monitoring of Carbon Monoxide Content in Automobile Exhaust Fumes

As of September, 1970, 23 automatic data-collecting recorders in eight prefectures including Tokyo and Osaka were in operation under the direction of local municipalities, to check the carbon monoxide content of automobile exhaust fumes.

Also, local police boards are conducting, as part of the control on non-roadworthy vehicles prescribed by the Road Traffic Control Law, spot checks of cars for the carbon monoxide content of their exhaust fumes. (The Japanese Police have at their disposal throughout the country 1,687 fume density detectors, 360 fume-reading devices besides the carbon monoxide content determination devices, for the control of public nuisance caused by vehicles.)

National Air Sampling Network (N.A.S.N.)

In 1965, the government set up national air sampling stations in major cities throughout the country for the purpose of collecting basic data necessary in establishing environmental standards as well as for the centralization of such data for analysis of the state of air pollution across the nation. As of September, 1970 such stations were in service at 11 key points including Sapporo, Tokyo, Kawasaki, Nagoya, Osaka, Amagasaki, Kurashiki, Ube, Kita-Kyushu, Ichihara, and Matsue; two more stations are expected to be set up by the end of 1970, and 20 such stations will be operating at important strategic points by 1973.

These stations are equipped with self-registering apparatuses for direction and velocity of wind, temperature, and relative humidity; automatic data-collecting and recording devices for such contents as sulfur oxides, floating dust, nitrogen oxides, hydrocarbons, oxidants, carbon monoxide, etc.; and data-processing systems to coordinate and record the readings, which are then analyzed for assessment by the government. Local prefectures are responsible for the management of these stations.

The N.A.S.N. method is employed at these stations in the collection of data so that these may be available for valid international comparison.

Monitoring Water Pollution

Although at present the monitoring and checking of the state of pollution in public water basins are, on occasion as necessity arises, conducted by water-utilizing organizations such as the water supply authorities, commercial fisheries, river administrators, and prefectures on the basis of a list of specific check points,* no overall monitoring system is yet in operation. Thus the data obtained from observation and testing at these public water basins fall short of serving as a "monitor" of the polluting sources in factories, industrial plants, and so forth. Under these circumstances, ways and means are being studied to reform the existing Water Pollution Control Law into a Water Pollution Prevention Law (tentative name). Thus, it would become possible to establish a general framework for wider-scope monitoring and observation under the direction of local prefectures. Some prefectures have already started experimenting with automatic devices and apparatuses, but for a well co-ordinated, effective system, better automatic apparatuses will be needed; research is currently under way for the pioneering of a new model.

*A typical water quality check list covers the following points:

(1) Survey of water pollution: turbidity, chromatic characteristics, pH, DO, BOD, COD, $KMnO_4$ consumption, NH_4-N, presence of colitis germs and of noxious elements such as Cr, As, etc.

(2) Check on water supply source: turbidity, chromatic characteristics, pH, Cl, presence of colitis and other germs, $KMnO_4$ consumption, NH_4-N and other items, all prescribed by relevant Ministry of Health and Welfare ordinances.

(3) Check on the presence of specific noxious elements: total Hg, organic mercury, Cd, Zn, Pb, etc.

(4) Check on waters consumed by commercial fisheries: turbidity, pH, water temperature, oil, presence of acute noxious elements, etc.

The "Safeguards and Monitoring Systems" section is taken from the article "Urgent Environmental Problems in Japan" by the Japanese Government Headquarters for Environmental Pollution Countermeasures. The article is published in the Following:

Managing the Environment, (1971), by Kneese, Rolfe and Harned (edit.): Praeger Publishers, N.Y., for the Atlantic Council of the United States and Battelle Memorial Institute

The major documents used for the attached abstract include the following:

Canada. Department of External Affairs

Minutes of Canada-Japan Meeting on Environmental and Pollution Problems, 1971

DIAGRAM OF ORGANIZATION

Environmental Pollution Prevention Service Corp.

- Minister of State for Environmental Affairs
  - Central Council for Countermeasures against Environmental Pollution
  - Nature Park Council
  - Central Birds & Animals Council
  - Vice Minister
  - Administrative Vice Minister
    - National Research Institute of Pollution (to be established by March, 1974)
    - Training Institute for Environmental Pollution Control (to be established by March, 1973)
    - Minister's Secretariat
      - Secretarial Sec.
      - General Affairs Sec.
      - Accounts Sec.
      - 1 Councillor
      - 2 Secretaries
    - Planning Cordination Bureau
      - Planning Adjustment Sec.
      - Preventive Plans Sec.
      - Environmental Pollution & Health Sec.
      - Research Adjustment Sec.
      - Environmental Pollution Information Room
    - Nature Conservation Bureau
      - Planning Sec.
      - Projects Sec.
      - Recreation Facilities Sec.
      - Wildlife Protection Sec.
    - Air Pollution Control Bureau
      - Planning Sec.
      - Air Control Sec.
      - Special Pollution Sec. (noise, vibration, odor)
      - Automobile Pollution Sec. [illegible]
    - Water Pollution Control Bureau
      - Planning Sec.
      - Water Quality Control Sec.
      - Water Quality Regulation Sec.
      - Soil & Agricultural Sec.

(English translation is unofficial)

Japan, Government. *Annex to the Situation of the Environmental Pollution in Japan and the Countermeasures Thereof.*
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SECTOR IV – OCEANOGRAPHY AND OCEAN TECHNOLOGY

MARINE TECHNOLOGY IN CANADA

The interest and activity in oceanology in Canada continues to increase. Canadians are beginning to recognize that they live in a maritime country and that the extensive offshore area and its associated resources offers many challenges and opportunities.

Oil and gas on the continental shelf is receiving much attention and there has been a steadily increasing activity, particularly in exploration.

Recent estimates place the hydro carbon potential of Canada's continental shelf out to a depth of 200 metres at 56 billion barrels of oil and 336 trillion cubic feet of gas for the Atlantic east coast shelf alone. Much of Canada's continental shelf extends to water depths considerably in excess of 200 metres.

Exploration permits for oil and gas on the continental shelf now exceed 1 million square miles. These permits have been issued in water depths ranging down to 4000 metres in the Scotian Shelf region and outwards from shore to a distance of about 425 miles in the Flemish Cap region.

On the East Coast, there has been about $140 million spent to date on exploration, with about $45 million spent on marine seismic work and about $95 million on exploratory drilling. The total expenditure obligations represented by existing offshore exploration permits on the East Coast, West Coast and Hudson's Bay (for a period of up to 12 years) is estimated to be about $1.75 billion for exploration activity.

In the Arctic, there has been about $23 million spent to date on exploration primarily on marine seismic activity. Assuming that all exploration permits are renewed and retained until maturity the minimum expenditure commitments total about $700 million for exploration activity.

Legislation and Administration

There are a number of general programs of assistance which also have application in the field of ocean technology for commercial purposes.

1. The Shipbuilding Construction Subsidy Regulations administered by the Department of Industry, Trade and Commerce, provides for shipbuilding subsidy for vessels, including those used in the exploration and exploitation of offshore mineral resources.
2. Industrial Research and Development Incentives Act – administered by the Department of Industry, Trade and Commerce.

   This program provides a general incentive for research and development in the form of direct grants available to all Canadian industrial firms performing research and development. Basically, the Act provides for grants of 25% of capital expenditures made in Canada in the year on research and development and 25% of the amount by which eligible current expenditures made in Canada in the year for research and development exceed the average in the preceding five years.
3. The Industrial Research Assistance Program – administered by the National Research Council.

   Its purpose is to stimulate interest of industry in research and promote the establishment of new industrial research teams or the expansion of existing research projects.
4. The Program for the Advancement of Industrial Technology – administered by the Department of Industry, Trade and Commerce. It is designed to stimulate industrial growth

by the application of science and technology to the development of new or improved products and processes for commercial markets at home and abroad.

The basic aim of the program is to help industry upgrade its technology and expand its innovation activity by underwriting specific development projects which involve a significant advance in technology, and which, if successful, offer good prospects for commercial exploitation.

Proposed National Policy in Oceanology

The Science Council of Canada, an advisory agency of the Government of Canada on scientific matters has submitted Report No. 10 "Canada, Science and the Oceans" 1970, containing its views and recommendations as they concern policies for the development of marine science and technology.

The Science Council has proposed that there be a national focus on the oceans through a Major Program in Marine Science and Technology. It considers that a "systems approach" to the multiple use of the marine environment is required in order to optimize the benefits which the oceans can offer to Canadians. Since marine science and technology will have to play a major role in the development of Canadian marine resources, it is essential to concentrate on important fraction of new national scientific and technological effort in this area.

Because of the increasing activity in the marine field, the Science Council believes that the formulation of national policy in this area can best be achieved through advice offered by a National Board on Marine Activity with representatives from government, industry and university. This national advisory committee would pass its recommendations directly to the policy making level of government. Other organizational aspects were covered in the proposals.

One of the major projects proposed was the establishment of the Canadian Ocean Development Agency, a Crown Corporation, as being the most effective mechanism to establish a solid technological base as rapidly as possible. It would be the focal point for ocean technology in Canada, and could quickly undertake to organize marine development and innovation projects. Its budget might be in the order of $50 million annually.

Oceanographic Science Organization and Management

The organization of Oceanography in Canada is unique insofar that we have an informal authoritative body without jurisdictional status, called the Canadian Committee on Oceanography (CCO), the members of which assess the value of oceanographic projects both individually and collectively. The members consist of senior management representatives from each of five Federal Departments, having direct interest in Oceanography through permanent research institutes and operational studies, the Directors of the four principal university "Oceanographic" institutes in Canada and a number of observers. The observers include representatives from an additional nine Federal Departments. Each member must have the authority to commit his agency to action as the CCO has no authority of its own except through the actions of its members.

To facilitate its work, the CCO has three regional working groups, one on each coast and one on the Great Lakes, and a special group handling studies of ice in navigable waters. This organization of oceanography is not, however, comprehensive of the whole field of marine science. Responsibilities which lie wholly within the terms of reference of Departments are developed therein. Obviously, industrial interests will pursue lines dictated by their own commercial and economic interests.

The Marine Sciences Branch holds governmental responsibilities in hydrography and oceanography and has extensive research and operational facilities on both coasts and, for hydrography, on the Great Lakes.

Ocean Research

The Marine Sciences Branch, Department of the Environment, predicts tides and tidal currents using the results of harmonic analysis. Such analysis cover a span of one year for tides whenever possible; while for tidal currents, maximum use is made of the data available. In the estuary of the St. Lawrence River, where navigation is critical, tidal data are reported synoptically to the relevant responsibility centers.

Continuing watch for the occurrence of tsunamis in the Pacific Ocean is maintained on the west coast of Canada, through participation in the Tsunami Warning Network where water levels are monitored against the predicted levels. The occurrence of such discrepancies can be checked directly by telephone from Honolulu or Ottawa.

Measurement of ocean waves presently underway around the Canadian coasts will prepare the way for more accurate wave forecasting facilities for engineering, resource management, and transportation needs.

The rapid expansion of offshore technology and resource development and the subsequent need for the management of coastal zones both in the industrial and environmental fields requires a detailed knowledge of oceanographic parameters. Canadian scientists are gathering and evaluating these data to the occupation of oceanographic stations and by means of oceanographical cruises. Canadian oceanographers have carried out coastal and deep water observations in their own regional ocean areas and also on a global scale. The ocean technology utilized is of a high standard as exemplified by the recent "HUDSON 70" cruise circumnavigating the Americas. The laying and recovery of oceanographical instruments for measuring physical parameters such as waves, tides and currents, chemical constituents of the oceans and biological parameters takes place on a routine basis. Data from the oceanographic cruises and programs are archived at the Canadian Oceanographic Data Centre in Ottawa.

In addition to the above, oceanographic research takes place within the Fisheries Service of the Department of the Environment, operating relevant programs through their research institutes and vessels. Geophysical and geological research in the marine environment is undertaken by the Department of Energy, Mines and Resources. Other federal agencies investigate oceanography in specialised areas.

Some Canadian universities are deeply involved in oceanographic studies, in particular, the University of British Columbia (Physical Oceanography); the University of Dalhousie (biological oceanography) and McGill University (Arctic studies).

A list of oceanographic research establishments is appended.

Marine Pollution

In Canada an awareness is growing concerning the environmental precautions that must be taken to protect the coastal waters not only from possible sources of pollution due to the development of oil deposits on the continental shelf but also from existing contributing factors such as urban sewage, industrial wastes, ocean dumping, estuarine flow and tanker traffic. Steps are being taken to form coastal management agencies that will be able to coordinate and control the diverse interests involved.

Regulations have been developed for enactment under the terms of the Fisheries Act for the control of mercury discharges from chloralkali manufacturing plants in Canada. These regulations limit the discharge of mercury from such plants on the basis of allowable waste loading per unit of production. Similar industrial control regulations are being developed for the pulp and paper industry. These regulations are nearing completion and will specify allowable discharges per ton of production of a wide range of contaminants including suspended solids, oxygen consuming materials, toxic materials and others. The main thrust in the pulp and paper field has been through the activities of a joint government-industry research committee that is responsible for contract research which is being undertaken in the private sector with Federal

Government financial support. This programme is funded by the Federal Government to the amount of $1,000,000 per year for a period of five years and includes research of pulp and paper manufacturing technology that will lead to pollution reduction, as well as research on the treatment of pulp and paper wastes and projects that are intended to provide a better understanding of the effects of pulp and paper pollution.

Fingerprinting of oils is an integral part of the investigations of oil, water systems, where extensive cooperative effort is being expended by a number of Federal departments and agencies. These include the initiation of a gas chromatographic technique to analyze a wide variety of crude oils undertaken by the Fuels Research Branch of the Department of Energy, Mines and Resources. Neutron activation analyses studies of the trace elements in oils is just being completed by the Commercial Products Division of Atomic Energy of Canada. The Defence Research Board is carrying out studies on infrared remote sensing. The Department of Communications is using radiometer techniques on oil spills. These investigations are believed to be the most relevant of those being conducted by Federal departments and agencies to this subject.

Although the Government of Canada is involved in numerous research projects regarding mining waste disposal a significant activity at the present time is the study of base metal mining operations in northeastern New Brunswick and their impact on the fisheries resources of the region. Studies in this area include 1) examination of the biological effects of base metal wastes, 2) the inplant and mine site control of waters and wastes waters to minimize pollution, and 3) the treatment of mining wastes by chemical methods, by an exchange, etc., to remove trace quantities of toxic metals and the development of rehabilitation procedures and requirements to insure ecological protection following the closing of a mining operation.

Research is being undertaken on the treatment of fish processing wastes. This research is primarily in the applied stage with the intention of developing onsite operational procedures for specific pollution sources.

Canada is extremely concerned with the health of the world's ocean and is giving much support to such international programmes and conferences such as the Stockholm Conference and the Law of the Sea and the IMCO Conferences.

List of Oceanographic Institutes

Dr. W.L. Ford,
Director,
Atlantic Oceanographic Laboratory,
Bedford Institute of Oceanography,
Dartmough, Nova Scotia.

Dr. L.M. Dickie,
Director,
Fisheries Research Board of Canada,
Bedford Institute of Oceanography,
Dartmouth, Nova Scotia.

Dr. A.W. Mansfield,
Director,
Fisheries Research Board of Canada,
Arctic Unit,
505 Pine Avenue West,
Montreal 18, Quebec.

Dr. K.R. Allen,
Director,
Fisheries Research Board of Canada,
Biological Station,
Nanaimo, British Columbia.

Dr. J.M. Anderson,
Director,
Fisheries Research Board of Canada,
Biological Station,
St. Andrews, New Brunswick.

Dr. W. Templeman,
Director,
Fisheries Research Board of Canada,
Biological Station,
St. John's, Newfoundland.

Dr. G.A. Riley,
Director,
Institute of Oceanography,
Dalhousie University,
Halifax, Nova Scotia.

Dr. G.L. Pickard,
Director,
Institute of Oceanography,
University of British Columbia,
Vancouver, British Columbia.

Dr. M.J. Dunbar,
Director,
Marine Sciences Centre,
McGill University,
Montreal, Quebec.

Brigadier H.W. Lane,
The Arctic Institute of North America,
Montreal, Quebec.

Dr. A.E. Collin,
Director,
Marine Sciences Branch,
Department of the Environment,
615 Booth Street,
Ottawa, Ontario.

Dr. R.W. Stewart,
Director,
Pacific Region,
Marine Sciences Branch,
Department of the Environment,
512 Federal Building,
Victoria, British Columbia.

Dr. N.J. Campbell,
Chief Oceanographer,
Division of Oceanographic Research,
Marine Sciences Branch,
Department of the Environment,
615 Booth Street,
Ottawa, Ontario

Science and Technology Mission
to Japan, 8-15 March 1972

Prepared by the
Department of the Environment

SECTOR IV – OCEANOGRAPHY AND OCEANTECHNOLOGY

JAPAN'S PROGRAM FOR MARINE SCIENCE AND TECHNOLOGY DEVELOPMENT

The Council for Marine Science and Technology was organized in 1961 in the Prime Minister's Office in order to investigate matters related to marine science and technology. The Council submitted two reports on marine science and technology development to the Prime Minister in 1961 and 1963.

In July 1969 five priority programs mentioned below were selected:

I Comprehensive basic survey of the continental shelf around Japan.

II Investigation and research into the marine environment and management of oceanographic information.

III Development of aquacultural techniques in experimental, culture fields.

IV Development of remote-controlled underwater oil drilling rigs and related facilities as well as the development of relevant technology.

V Research and development of new and common techniques for marine development.

In addition to the above-mentioned major projects, the following projects were also recommended as important.

(1) Development of technology for utilization of sea water.

(2) Exploration of manganese nodules and other mineral resources deposited on the deep ocean floor.

(3) Development of technology for intensive utilization of marine protein resources.

(4) Exploration of unexploited or unutilized marine living resources.

The detailed program for execution was drafted for each project by the Interministerial Marine Science and Technology Committee, which was set up in August 1969 to facilitate the activities of ministries dealing with marine science and technology.

Five major priority projects and the additional four projects mentioned above have been broken down into smaller subprojects in the execution program as follows. These subprojects were scheduled to be achieved within seven or eight years and may be revised as necessary each year.

I Comprehensive Basic Survey and Study of the Continental Shelf around Japan

The continental shelf surrounding Japan is expected to reveal a high potential for exploitation of various living, mineral and sightseeing resources as well as for spatial utilization and seismological prediction. In order to realize this potential comprehensive and basic surveys and studies of the continental shelf are deemed essential.

This project is broken down as follows for actual execution.

(1) Topographical and geological survey and study of the continental shelf.
   (a) Tectonic study of the continental shelf surrounding Japan.
   (b) Bathymetric, geomagnetic, gravitational and seismic survey of the continental shelf surrounding Japan and the publication of a basic map of the sea.

(2) Basic study on the deposit of mineral resources on and in the continental shelf surrounding Japan.

(3) Study of the techniques for more precise topographical and geological survey of the sea-bottom.
   (a) Technique for submarine geological research.
   (b) Photographic techniques for surveying sea-bottom topography and development of required equipment and materials.
   (c) Automatic on board operations in topographical and geological survey and study of the sea-bottom.
   (d) Techniques for marine geodesic study.
      (1) Study and development of methods and equipment for accurate positioning.
      (2) Study and the development of geomagnetic instruments.

II Investigation and Research into Marine Environment and the Management of Oceanographic Information

Breakdown of the project is:

(1) Study and survey of the marine environment.
   (a) Basic study and survey of the marine environment
      (1) Study of the mechanism of ocean circulation and fluctuation.
      (2) Waves in the open ocean.
      (3) Oceanic and atmospheric interaction
      (4) Production mechanism of marine living organisms.
      (5) Physical oceanographic and meteorological studies and surveys in the coastal sea area of Japan.
      (6) Water quality of the ocean.
   (b) Marine environmental study and survey of specific sea areas.
      (1) Yellow Sea, East China Sea and South China Sea
      (2) Sub-Arctic sea area
      (3) Western part of the North Pacific
      (4) Japan Sea

(2) Augmentation of the observation network for marine environmental study and survey and system for managing marine-related information.
   (a) Augmentation of the observation network.
      (1) Augmentation by deploying robot buoys.
      (2) Development of automatic observation and telecommunications apparatus to install onboard ship, and its deployment.
      (3) Development of expendable bathythermograph and its deployment.
      (4) Development and deployment of instruments, for meteorological and physical oceanographical observation in coastal ocean areas.
      (5) Augmentation of survey vessels.
   (b) Augmentation of the system for managing marine-related information.
      (1) Study of the management system.
      (2) Transmission of marine-related information by electromagnetic wave.
      (3) Augmentation of the organization for managing marine related information.

III Study on the Development of Aquacultural Fisheries

This project aims at developing fisheries through culturing specific living resources and increasing their supply in order to meet the increasing demand caused by improved and diversified food intake in Japan. The developmental studies will be conducted in:

(1) Comprehensive and basic aspects of the ecology and physiology of fish and shell fish and of their environment.

(2) Ecological conditions related to the survival and the establishment of fish and shell fish living in shallow water and the improvement of environmental conditions together with the development of required techniques, and,

(3) Experimental raising of salmon, tuna and other fish aiming at industrialization by employing large-scale culturing facilities.

IV Development of Remote-controlled Underwater Oil Drilling Rigs and Related Facilities as well as the Development of Relevant Technology

This project intends to:

(1) Develop drilling rigs which are submersible in the water except for minor parts, and which operate by remote control. Since the development of such drilling rigs may require a long period of time, it is also intended in the short run to improve the stability and drilling efficiency of conventional drilling rigs.

The project is broken down as follows:

(a) Developmental research for remote control drilling rigs workable at greater depths.

(b) Sea surface drilling equipment and the development of required techniques.

V Study and Development of New and Common Techniques Requisite to Marine Development

It is intended in this project to promote studies of:

(1) New and basic techniques such as marine electronics

(2) Diving techniques and

(3) Techniques for marine facilities construction which serves as basis for the utilisation of coastal areas.

It is also intended to promote the augmentation of large scale experimental facilities for joint use, including experimental sea areas for conducting various experiments. The detailed subjects included in the project are as follows.

(1) Study and development of basic and pioneering technology.

(a) *Marine electronics*
  (1) Study of pulse cord modulation communication by employing supersonic wave.
  (2) Study of underwater communications equipment employing superlong waves.
  (3) Study of the sea surface and underwater communication systems employing superlong waves.
  (4) Study of underwater pattern recognition systems.
  (5) Study of the physical properties of materials used in electronic equipment.

(b) *Energy technology studies*
  (1) Battery for marine equipment
  (2) Electric power generation by sea wave motion.
  (3) Electromagnetic propulsion mechanics

(c) *Marine robot technology*
  (1) Marine exploratory robot
  (2) Attitude control system of underwater equipment.

(2) Development and augmentation of large-scale experimental facilities.

(a) Augmentation of experimental sea area for common use

(b) Development of undersea habitat.

(c) Development of diving simulator.

(d) Construction of intense hydropressure experimental tanks

(e) Operation of a research submersible and the development of submersibles for deeper water.
  (1) Operation of research submersible "Shinkai"
  (2) Development of deep sea submersibles.

(3) Study on the Development of Diving Technology

(a) Basic study on diving technology
(1) Medical scientific study of underwater human work and living.
(2) Human engineering study of underwater work
(3) Development of underwater tools and diving apparatus.

(b) Study of safety in underwater working and of underwater habitat.
(1) Safety standards for underwater work.
(2) Safety in hyperbaric environment.
(3) Testing methods for diving apparatus.

(c) Education and training methods for diving techniques.

(4) Study and development of marine facilities and structures and of relevant technology.

(a) Basic study of marine environmental conditions affecting marine facilities and structures.
(1) Characteristics of coastal waves
(2) Scoring and silting of marine structures by sediment transportation.
(3) Basic study of sea floor soil properties.
(4) Shock proofing of marine facilities and structures.
(5) Surveying methods in the ocean

(b) Study of the design and planning techniques or marine civil engineering and architectural structures.
(1) Structural design of marine civil engineering and architectural structures
(2) Planning of marine architectural structures.
(3) Living and environmental conditions of such marine architectural structures.

(c) Basic study of designing and building techniques for mobile marine facilities and structures.
(1) Hydro-dynamic characteristics of mobile facilities and structures.
(2) Setting method of legged facilities and structures
(3) Mechanics for positioning and securing stability of floating type facilities and structures.
(4) Safety of mobile marine structures.

(d) Study of the materials employed for marine facilities and structures and associated technology.
(1) Corrosion proofing of materials for marine facilities and structures.
(2) Buoyant materials for marine facilities and structures
(3) Hydroconcrete.

(e) Study of the techniques for constructing marine facilities and structures.
(1) Large-aperture hole digging for underwater footing.
(2) Cracking rock layers by electromagnetic wave or high pressure water jet.
(3) Underwater digging and leveling of the ocean floor.
(4) Development of the technology for underwater civil engineering machines.
(5) Ensuring safety in marine operations.

(f) Development of marine facilities.
(1) Development of extendable tube for observing the ocean floor.
(2) Study of the construction of offshore power plant.
(3) Study of trial construction of sea floor oil storage tanks.
(4) Study of marine airports, marine cities, and marine recreational bases.
(5) Technology for floating type breakwaters.

VI Additional Projects

In addition to five major projects mentioned above the following projects are also included in the first comprehensive program.

(1) Development of technology for efficient utilization of sea water.
   (a) Technology for desalting of sea water and utilization of residual products.
   (b) Technology for extracting soluble elements in sea water.

(2) Study of the exploitation of sea floor mineral resources.
   (a) Study of the exploitation of manganese nodules and other mineral resources deposited on the deep ocean floor.
   (b) Study of the exploitation of sand beds.

(3) Development of technology for intensive utilization of marine protein resources.
   (a) Exploitation of new foodstuffs and food materials.
   (b) Study of the utilization of Euphausia shrimp.
   (c) New protein foods.

Areas for Investigation

The areas studied by the Mission members should include the following, which are of particular interest from the point of view of the potential export of Canadian equipment, possible cooperation, and Canadian marine science and technology policy.

(1) The relationship between government, industry, academic institutions, and banking in the planning and implementation of marine technology development programs.

(2) The source and extent of annual funding for each project in the Program for Marine Science and Technology Development.

(3) The performance specifications for the Japanese Underwater Drilling System, the status of the project, and the work planned through 1975. (See attachment 1 for the information currently available).

(4) Work being conducted by government or industry (if any) to develop an underwater petroleum production or storage system.

(5) The extent and trend of use of submerisbles in Japan and Japanese plans and capability for submersible development.

(6) Japanese plans and programs to develop and deploy an oceanographic and meteorological data buoy system on Japan's continental shelf.

(7) The scope and funding of Japan's man in the sea diving and habitat program.

(8) The type and source of in-situ and other instrumentation for the measurement of marine physical, chemical, biological parameters.

(9) The needs in Japan for marine pollution monitoring equipment.

(10) The role of government marine science research laboratories in the Japanese development program.

Attachment 1

REMOTE CONTROLLED UNDERWATER DRILLING SYSTEM

(as of March 1971)

Mr. Yoshio Tadenuma, Senior Officer for Development Program, Agency of Industrial Science and Technology, Ministry of International Trade and Industry, provided the following information on the project. This particular project is one of six large projects which are 100% Government-financed (the number was to increase to nine projects by April 1, 1971). To utilize top-level brainpower in Japan, the actual work is being carried out by Government scientists at MITI's laboratories (the total number of laboratories is 15), private sectors and university professors.

The project commenced in the fiscal year 1970 – actually in August, 1970. It is an eight year program and the first five years (fiscal year 1970 to fiscal year 1974, namely April 1970 to March 1975, is for system design to which 5 billion Yen or approximately $14 million Canadian funds is budgeted and the latter three year period (from April 1975 to March 1978) is for model manufacture, testing and modification if necessary, to which 9 billion Yen or approximately $26 million Canadian funds is earmarked. Therefore, the total costs of the project is 14 billion Yen or approximately $40 million Canadian funds. (The budget for FY 1970 and FY 1971 was about $433,000 and $1.7 million.)

The Agency of Industrial Science and Technology is an organization of the Ministry of International Trade and Industry. Therefore, the budgeting comes under the jurisdiction of MITI.

They are now at a stage of system design and are, therefore, not able to make any particulars available except that their idea is to place a rig on the sea bottom instead of above sea surface, and drill as deep as 9,000 metres as opposed to the current U.S. capability of 7,000 metres. They are now making studies on temperature and pressure increases for this operation and evaluations on equipment. They are thinking of remote control and making studies to evaluate its capability by developing related technology and equipment.

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SECTOR V – PHYSICAL SCIENCES

A. Geology of Pacific Rim Countries

The Geological Survey of Canada, a branch of the Department of Energy, Mines and Resources conducts geological surveys and research in the Canadian Cordillera and Pacific Continental Shelf to define the geological framework of the region, to estimate the potential for minerals and fuel resources, to facilitate the exploration and discovery of such resources, and to evaluate the best and safest use of the terrain. Most of the work is undertaken by scientists from the Cordilleran and Pacific Margin Section in Vancouver, B.C. and some from the Institute of Sedimentary and Petroleum Geology in Calgary.

In view of the unifying nature of the prevailing Global Plate Tectonic Theory, whereby the spreading Pacific ocean floor slides past parts of the bounding continental masses and slides under other parts, the geological events in one region along the Pacific Rim are related to those in other regions along the Rim. Consequently the geological evolution of all the Pacific Rim countries is of vital concern to scientists working in the Canadian Cordillera and *vice versa.*

The geology of the Canadian Cordillera and that of Japan has some similarities; an abundance of volcanic rocks and granite masses, paired belts of metamorphic rocks, occurrences in common of special and important fossil groups, and some similar types of base metal deposits.

Canadian geologists share similar interests with Japanese geologists regarding the understanding of volcanic processes, their relationship to granite masses, and both of these to metallization of copper, molybdenum, lead and zinc. Japanese geologists charged with obtaining sufficient supplies of raw materials for Japanese industry are no doubt vitally concerned with metallogenic concepts and mineral exploration strategy for base metals, iron, and coal in the Canadian Cordillera – a region already supplying these commodities to Japan.

B. Exploration Techniques

The Geological Survey of Canada is not specifically concerned with mineral exploration as such but the Resource Geophysics and Geochemistry Division pursues activities which are very relevant to exploration. These are:

(a) the acquisition and/or development of new and improved geophysical and geochemical methods and instruments;

(b) control studies to test the feasibility and application of new methods;

(c) systematic geophysical and geochemical surveys, using methods which have been proved by the control studies.

(a) *Method Development*

Within this framework, there are a relatively large number of relatively low cost projects in the preliminary stages of laboratory experimentation and planning. These include geochemical, electromagnetic, magnetic, radiometric and seismic methods. Method development is partly conducted in-house and partly contracted to university and industry.

(b) *Control Studies*

Control studies involve operational use of methods under development in the widest possible range of geological situations. The Division stresses airborne methods because of the high cost of ground exploration over most of Canada. New airborne methods have to be controlled by ground investigations. The Division possess two aircraft for experimental surveys, a multi-purpose "Skyvan", and a "Queen Air" which is dedicated to high-sensitivity magnetometer work. Over the last three years the most extensive control studies have related to high-sensitivity gamma-ray spectrometer surveys, high-sensitivity magnetometer surveys, EM surveys, experimental photography, and infrared scanning imagery.

(c) *Systematic Geophysical Surveys*

The systematic surveys are undertaken by contractors working to specifications established by the scientists of RGG Division. The work consists principally of aeromagnetic surveys with some geochemical, EM and radiometric work also being supervised.

As far as circumstances permit, the staff of the RGG Division endeavour to provide a focal point for mineral exploration technology developments in Canada.

C. Ferrous and Non-ferrous Ores and Ferro-alloys

We are aware that in Japan, air and liquid pollution has reached harmful levels and that as a result, considerable work is being done in pollution control. Similar problems exist in Canada, in particular, pollution from ore dressing and metal recovery plants. We would be interested in discussing smelter gas treatment and liquid effluent control methods with the Japanese as well as advances in metal extraction techniques such as hydrometallurgy, solvent extraction and continuous smelting.

D. Uranium-bearing Tertiary Basins

Uranium resources of Japan total, as of 1 January 1970, some 2,7000 short tons U_3O_8 at $10 per pound. All these reserves occur in two deposits, the Ningyo-toge and the Tono, both of which, together with most of a hundred other occurrences, are in the Tertiary basins of Japan. A new deposit, however, that shows some promise, the Toyota, is in Cretaceous sediments, but is apparently genetically related to andesite dykes.

The Tertiary uranium deposits occur in basal channel deposits composed of conglomerate, arkose, and sandstone in a Neogene succession of carbonaceous lake sediments and semi-alkalic volcanic rocks. The basement rocks are Cretaceous granitic rocks and Paleozoic formations. Uranium minerals are uraninite, coffinite, ningyoite, autunite, and other secondary minerals. Associated minerals are pyrite, montmorillonite and other clay minerals. Most geologists believe that uranium, derived from the weathering of the underlying granite, was absorbed from circulating ground waters by carbonaceous material and fixed to clay minerals and hydrated iron oxide.

Because of the similarity of Tertiary basins of B.C. to those of Japan, and the successful use of car borne radiometric equipment by means of which all the important Japanese deposits were discovered, this method was used in southern B.C. by prospecting teams of the Power Reactor and Nuclear Fuel Development Corporation of Japan. One deposit of moderate promise was found and partly drilled, but no further exploration has been done on it since 1970.

E. Ceramic Technology

The Canadian Government has supported research and development in the field of ceramics in its own research laboratories, in Universities and Industry. Initially interest centered upon barium titanate-based materials for sonar transducer operations. Later emphasis was placed upon lead zirconate titanate-based materials and research had been done in Industry to prepare reproducible materials which also retain their characteristics at high hydrostatic pressure.

For thin and thick film circuits work has been carried out on high density, smooth, flat alumina substrates. Higher temperature materials and substrates for microwave applications are also desirable. For the future, piezoelectric substrates for surface-wave propagation circuitry are needed.

Work on ferrites has been supported. Main interest at present is on the preparation of magnetic oxides with circular structure for use on magnetic tapes.

Generally we are interested in processing techniques for the preparation of ultra pure materials, ultra fine particles, intimate mixing of materials, and highly reactive processes to enable us to prepare materials with reproducible characteristics and which are reliable with long term stability. The Mission would be interested in visiting Japanese institutions conducting research and development along these lines, as well as production operations if possible.

F. Iron and Steel Technology including Blast Furnaces, Basic Oxygen Furnaces, Continuous Casting and Electric Steelmaking

The Canadian and Japanese steel industries are both considered to be highly sophisticated, and world leaders in particular spheres of iron and steel production and manufacturing. Both industries could stand to benefit by significant mutual exchanges of technology in areas where each country excels particularly. The following fields of technology represent some of the strong points for each country's steel industry.

Canada

High grade pellet burdens in blast furnaces
Fuel and oxygen injection in blast furnaces
Ultra-low slag volume B.F. practice
Advanced direct-reduction technology
Advanced electric furnace steelmaking practice
Advanced basic oxygen steelmaking technology
Advanced oxygen-blown open hearth steelmaking practice
Continuous steel strand casting (mini-mills)
New product developments etc.

Japan

Self fluxing sinter in blast furnaces
Fuel injection in blast furnaces
Hot reducing gas injection in blast furnaces
Very high blast temperature B.F. practice
High top Pressure B.F. practice
Advanced coke oven technology
Continuous iron & steel making
Advanced basic oxygen steelmaking technology
Highly automated steelmaking facilities
Highly automated hot & cold rolling mills
Continuous steel strand casting (large mills)
New product developments, etc.

G. Gravity Measurements including Earth Tides, Crustal Tilt

The Japanese are world leaders in applications of measurements of crustal tilt and earth tides to problems relating to earthquake and landslide prediction and generally to loading on a comparatively local basis. While we in Canada have expertise in these fields generally we are not nearly as advanced as the Japanese in the fields of application mentioned above. We ask therefore that any understanding reached with Japan should include provision for the exchange of scientists for periods of up to one year. Any such arrangement will have benefit for Japan as well, because of our experience with regional (i.e. covering large areas) investigations such as tidal loading in the Bay of Fundy and crustal uplift due to isostatic readjustment upon deglaciation (e.g. central Canada in the region centred around Hudson Bay).

H. Volcanology

The volcanic terrains of Japan and Canada are to a large extent complemtary. In Japan the surface manifestations and seismicity of active volcanism are well expressed. Canada lacks active volcanoes but is favoured with a great variety of volcanic deposits in varying stages of disintegration from deeply dissected cones to steeply tilted and bevelled volcanic successions of enormous thicknesses. Taken together the two environments provide a field of study that ranges from the surface to the deep roots of volcanic piles.

A prime objective of volcanological studies in Canada is to aid in the search for ore deposits. Chief among those of volcanogenic origin are copper sulphide and copper-zinc sulphide deposits which are generally related to a late acidic phase of volcanism. Two varieties predominate. In Archean volcanic belts of the Canadian Shield the deposits are characteristically stratiform and are closely associated with rhyolitic flows that mark the upper parts of typical mafic to acid volcanic successions. These are very similar to the Kuroko deposits of Japan from which much useful data has been derived. They tend to cluster about "volcanic centres" that are rich in rhyolite flows. In Mesozoic andesite successions in the Cordilleran copper sulphide deposits are typically associated with acidic plutons which are regarded as a late phase of volcanism.

Other volcanogenic metal deposits in Canada include native copper and copper sulphide deposits in plateau basalts of Lake Superior and Coppermine River areas and iron formation and associated gold deposits of the Archean volcanic belts. These latter are widely regarded as exhalative phases of the volcanic succession and characteristically occur at the stratigraphic level of the acidic flows.

Canadian studies in volcanology have benefited greatly from the excellent work done on the young volcanoes and volcanic rocks of Japan. A few examples will illustrate this point. The petrographic zonation in the the Japanese Islands parallel to the continental margin that was recognized and related to the Benioff zone by Kuno and Sugimura is currently serving as a model for Canadian orogenic belts, particularly the Cordilleran, where similar zoning might be expected. Studies of ash flow tuffs, of increasing importance in both the Cordilleran and Canadian Shields, owes much to the work of Matumoto, Aramaki and others on Japanese deposits, particularly those from Aso caldera. Descriptions of Japanese submarine ash flows by Fiske and Matsuda were instrumental in recognizing equivalent deposits in Archean volcanic rocks here. The similarity of Kuroka and Canadian Archean massive sulphide deposits, already mentioned, has contributed greatly to the recognition of the volcanogenic nature of the latter.

I. Urban Geology

Projects of the Geological Survey of Canada in urban growth areas are directed toward the development of earth science information systems for use by planners, developers and administrators as well as by the geotechnical professions.

Data for the information system is obtained from syntheses of existing surface and borehole information as well as from specialized field activities of geological mapping, drilling and sampling, surface and borehole geophysical surveys and laboratory analyses of the physical characteristics of earth materials. These data are subsequently processed for computer storage and retrieval either in the form of a tabular output or as a map by use of the SYMAP technique. The use of a computer oriented information system permits rapid access to earth science information for all or part of an urban area and also enables revisions and additions to the data bank to be made easily.

Sensitive marine clays of the Ottawa and St. Lawrence Valleys underlie one of the most populous areas of Canada. The clays are prone to flow and other types of landslides and thus present a hazard to urban areas. Investigations are in progress to identify the extent of the landslide hazard and to evaluate the geological factors that contribute to the instability of slopes in marine clays.

J. Metallurgical and Materials Research on Welding, Fatigue, Structural Steels, and Composites

Foundry Research

There are several areas of research in the foundry in which an exchange of information and the development of joint projects could be mutually beneficial. Some of these are:

(a) The effect of grating design on metal flow characteristics and on defect formation in castings.

(b) The reuse of moulding sands and the techniques by which their useful life can be extended.

(c) The role of solidification in improving cast metal properties and the exploitation of solidification control techniques to accomplish a desirable mode of solidification.

(d) The development of newer coating techniques for the investment casting industry and the use of such methods in producing larger castings.

Welding

Japanese research in the field of steel weldability has assumed importance, and this is recognized by the International Institute of Welding. In particular, advances have been made in weldability tests incorporating variable restraint, the prediction of weldability based on carbon-equivalent formulae, and assessment of the effect of hydrogen. These factors have also received some attention in Canada, particularly in the laboratories of the Mines Branch. This would provide a fruitful area for collaboration, and the results could have significant economic importance, because of the continuing trend to introduce new and stronger steels for example in bridges and pipelines, for which welding procedures must be developed to minimize costs.

In the past decade or so, Japanese heavy industry and particularly shipbuilding has flourished mainly because of the extensive use of new techniques such as one-side submerged arc welding, and relatively new methods such as electroslag and related processes, on a scale unmatched elsewhere. It would be beneficial to Canada to collaborate in this field, though initially we would have less to offer.

Fatigue of Metals

The resistance of engineering materials to failure by fatigue under cyclic loading imposes a major limitation in the design of structures and components, and Japanese research in this field has been quite prolific. One aspect of this multi-discipline field which would be suitable for bilateral cooperation is the study of fatigue damage and non-destructive methods for its early detection. The study would involve the use of various techniques for surface examination, such as electromagnetic radiation, acoustic waves and electron emission.

Environmental Cracking

The study of the resistance to environmental cracking of engineering alloys should be of mutual interest. The particular aspect of this problem proposed for collaborative work is concerned with the behavior of alloys under stress in a marine environment. Objectives would include the evaluation of the environmental cracking susceptibilities of titanium and high strength alloys and their weldments, the improvement of their behavior by heat treatment, compositional variation, and cathodic protection, and investigation of the failure modes, including stress corrosion and hydrogen embrittlement.

Oil and Gas Pipelines

The structural integrity and efficiency of oil and gas pipelines, for the northern regions of Canada in particular, is of major importance and Japanese interests in this and associated fields, such as pressure vessels, are considerable. Joint studies might usefully be carried out on the development of high strength steels of improved performance and reliability, on the establishment of realistic fracture toughness criteria for specific service and environmental conditions, on the effect of variations in chemical composition and processing procedures from the rolling mill to the end product, and on low-cycle fatigue characteristics and sub-critical crack growth. While the main interest relates to pipelines, the work will result in obvious benefits to the general structural engineering industry.

Composite Materials

The Canadian Government is encouraging the development of expertise in the composite materials field, particularly in high-performance composites. At the present time Canadian universities, research institutes and private companies are carrying out research and development projects with graphite epoxy, boron-epoxy, boron-aluminum, mica composites, glass fibre prepregs, glass-epoxy pipe, graphite fibre/graphite matrix composites, etc.

The capability of applying high-performance composites to airframe and space components will be necessary to industrial development and production in the future. The translation of this capability to submersible equipment and pressure vessels should be a subsequent development. The application of medium-performance composites of graphite, mica or high-quality glass to transmission pipe, auto body components, parts of electrical equipment and construction materials offers an extensive commercial potential.

The Ministerial Science and Technology Mission to Japan would be interested in visiting universities, research institutes and manufacturing plants involved with research, development and production of composite materials.

N.R.C. Interest in Physical Sciences

The Division of Building Research of the National Research Council of Canada has an active program in its geotechnical section, concerned with stability of soil under the action of frost, snow and ice, and under permafrost conditions. It also is concerned with avalanches and landslides. In addition, the National Research Council sponsors the activities of the Canadian National Committee on Earthquake Engineering whose current Chairman is Professor Sheldon Cherry of the University of British Columbia. This Committee acts as an advisory committee to NRC on earthquake engineering as well as representing Canada in international conferences.

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SECTOR VI – TRANSPORTATION

A. Interurban Transportation – Including New Technology

A major interest here is in fulfilling the long term requirements for transportation in the "Canadian Corridor" stretching from Windsor to Quebec City. Studies have been conducted on the likely demand for passenger transportation in this part of Canada over a 20 year period from 1970. Various technologies are being examined with a view to satisfying the demand. Some experimental work is underway in several of these areas.

(i) Tracked Air Cushion Vehicles:

Work in Canada may be divided into 3 categories. The Transportation Development Agency has undertaken cost studies aimed at establishing TACV track costs per mile in various terrain. The National Research Council is conducting experimental work in which various configurations of TACV track are being exposed to snow and ice, and in which the build-up of both is being related to the track geometry. At the University of Toronto Institute for Aerospace Studies, a research project is underway in which various dynamic stability problems will be investigated on several types of air cushion configuration in which noise characteristics and skirt material behaviour will be assessed.

(ii) Hovercraft

Although the tracked hovercraft would be the particular type of vehicle considered for interurban transportation, hovercraft in general are receiving a significant amount of attention.

Canada is actively involved in identifying roles on how air cushion vehicles can economically support the transportation system as a transportation mode. Government and industry is engaged in the development of a range of air cushion craft from single seater vehicles to a 100 ton pay load air cushion transporter barge. The most significant current development is a joint program by the Canadian Government and Bell Aerospace of Canada in the production of the 25 ton ACV "Voyageur". The Voyageur prototype is currently undergoing certification trials and likely roles include search and rescue, coast guard buoy tender, ferry, military lighter weapons system platform and arctic re-supply freighter.

The Canadian Coast Guard use a British SRN-5 hovercraft very successfully for search and rescue operations and are contemplating increasing the numbers of ACV's in that role.

Air cushion technology research and development figures prominently in governmental, industry and academic sectors of transportation. Propulsion, skirt materials, noise characteristics and various operational roles are included in the investigations underway.

Existing legislation and regulations are difficult to apply to this new technology and if an attempt is made anomalies may occur. Special legislation to deal with air cushion vehicles is necessary.

(iii) STOL Aircraft

Canada has embarked upon a project which will lead to the introduction of a STOL service between Ottawa and Montreal in the spring of 1973. Sites have been selected which will give about 5 minutes access to the downtown core of Montreal and 15 minutes access to the Ottawa core. The service will use de Havilland Twin Otters with modifications and equipment to permit them to conform to the safety and reliability of service requirements of civil air transport regulations.

The aircraft will be equipped with area navigation equipment and a microwave landing system which will give the service good reliability in poor weather conditions as well as providing maximum flexibility in keeping these STOL Aircraft clear of conventional air traffic.

The six Twin-Otters to be used will provide 22 return flights per day with the schedule designed to cater to peak hour demands of travellers. The flight time of the Twin Otter on this route will be approximately 40 minutes, as compared to the conventional aircraft flight time of about 30 minutes. However, the door-to-door time for a traveller whose origin and destination are in the downtown core is about 75 minutes as compared to 120 minutes for the same trip using the conventional service.

The STOL service is part of a larger federal government project in which various applications are being studied as well as the formulation of a program to best take advantage of the considerable capability of Canadian industry in STOL air transport systems.

(iv) Magnetic Levitation

A project is underway at the Canadian Institute of Guided Ground Transport, Queen's University, Kingston, in which the application of super-conducting magnets to vehicle suspension is being studied. The initial phases of the work cover optimization of the magnet geometry, studies of the potential for integrating a linear synchronous motor with the lift magnets, and the design of a test facility for the measurement of magnetic lift and drag forces.

(v) Conventional Rail Problems at High Speed

Work has been underway for some years in Canada at the National Research Council and in the leading railway companies. More recently the Canadian Institute of Guided Ground Transport in Kingston, Ontario, has begun work on a number of related problems.

A topic of particular interest is the dynamic behaviour of the train and track as a system. The dynamic behaviour of particular rail cars has been investigated at some length. More recently the stability of a hydraulically banked truck has been examined. The problem of train/track interaction is receiving particular attention from the point of view of heavy unit trains, where the effects of speed, track curvature, braking etc., are being examined coupled with an in-depth look at the whole track structure including ballast and sub-grade. Various test cars are in use including a track recorder car, an instrumented research car and a vehicle for measuring forces in the rail as the train passes over.

Other work includes the detailed simulation of long trains in an effort to optimize locomotive placement and control characteristics. The National Research Council is also working on problems concerning the welding of rails and prevention of the malfunction of railway switches in winter conditions.

(vi) Electric Traction Equipment

Canadian expertise is limited to traction motors, but there is an interest, particulary from public transit companies in various forms of traction control systems, particularly chopper controls. There is a similar interest in investigating the potentialities of linear induction motors for all types of guided ground transit systems.

B. Transport Control and Automation in Congested Areas

Although there is an interest in all forms of traffic control in Canada, the most extensive experience in this country relates to the control of shipping on the St. Lawrence Seaway between Lake Erie and Montreal. Traffic negotiates a series of reaches, locks, bridges, anchorages and turning basins. The system is a combination of two way and one way facilities. Traffic can flow through some lakes, rivers and wide reaches in both directions simultaneously, through others such as locks, bridges and various reaches only one way at a time. Over some moveable bridges, vehicular traffic has priority at certain times of day. There are of course variations in vessel size and speed, and the random nature of the arrival of vessels complicates matters. The traffic control system was evolved to develop the means of acquiring, recording, manipulating and transmitting all data related to the above elements. It permits controlling traffic, measuring performances, producing statistics and planning for the future.

Control is centralized by section. St. Lambert controls the Montreal/Lake Ontario section and St. Catharines the Welland Section. Within each section a Superintendent clears the vessels for entry or exit. Controllers establish radio contact for dispatch from facility to facility within the system. Basically the system is computer controlled with defined vessel position reporting points within the system and appropriate read-outs to controllers and lock masters.

Future interest lies in further automation, the problems of detecting and identifying ships automatically at certain points within the system are now receiving attention.

C. Solids Pipelines

Two major research efforts are underway in Canada under Ministry of Transport sponsorship.

At the Saskatchewan Research Council, a facility including pipes of up to 12 inches diameter in loops of about 300 ft has been set up, with comprehensive instrumentation. Sand slurries have been pumped through the equipment initially, in order to provide a reference datum. Tests will proceed on slurries of coal, iron concentrates, sulphur and potash. The basic data sought is a relationship between pressure loss and concentration, particle size distribution etc. The effects of gradients will also be examined.

At the Research Council of Alberta a project is underway to investigate the movement of commodities in capsule form in a pipeline in a liquid carrier. Capsules might be coal, sulphur or even compressed domestic refuse. Small scale instrumented facilities have existed for this work in Edmonton for some years, but recently a ten inch experimental line has been commissioned. The emphasis in this is on relating various analytical approaches to the problem of capsule movement to the experimental data.

Other work on slurry technologies is being carried out in a number of Canadian Universities on a laboratory scale.

D. Shipbuilding Research

Canada has facilities for ship model testing at the National Research Council in Ottawa. Elsewhere in Canada design work is conducted to a great extent by consultants, and to a lesser degree by the larger yards.

Research into Arctic operations for ships is in its early stages, several agencies in the Ministry of Transport, private consultants and private consortiums are active.

Government regulations to help protect the Arctic environment from the effects of oil spills have been drafted. Off shore drilling is also occurring in temperate waters off the Province of Nova Scotia on the east coast. Regulations will probably call for double hull construction and other safety devices to prevent casualty and/or spills.

E. Port Facilities

Major bulk terminals exist on both Canadian coasts handling commodities such as coal, iron ores, potash and sulphur. Container facilities exist at a number of Canadian ports including Vancouver, Halifax, Saint John and Montreal. Consideration is likely to be given in the future, particularly on the West Coast to alternative methods of bulk handling such as slurry systems.

Although not directly related to port facilities, of primary interest to marine transportation is a project of National Research Council in which a very large model of the Saint Lawrence river is being examined with a view to improving navigation conditions in both winter and summer.

F. Aerospace Electronics Technology

Canadian capability is concentrated mostly in airborne navigation equipment including dead reckoning devices, moving map displays, inertial navigation systems. In addition there is a capability for the manufacture of various sensors, cockpit instruments, downed aircraft indicators and aircraft maintenance recorders. Total industry sales amount to about $100M per annum of which about 75% is exported.

G. Aircraft R & D

The National Aeronautical Establishment has Sections dealing with Low Speed, High Speed and Unsteady Aerodynamics, and operates all the large wind tunnels which are available in Canada for research and testing. Examples are a 30 foot tunnel used in studies of V/STOL aircraft performance, and an 11 inch hypersonic helium tunnel with many other tunnels of intermediate characteristics. Speeds range from a few feet per second to Mach 18. In addition there are an Aircraft Structures and Materials Section with, among other equipment, a bird impact simulator, and a Flight Research Section which has been studying the handling characteristics of VTOL and STOL aircraft using helicopters whose flight characteristics are modified by on-board computers. Other studies in NAE include the effects of atmospheric turbulence, and cosmic radiation, and automobile structural safety. The air transportation activities of the Mechanical Engineering Division have been related to research and development work and certification pertaining to new engines. The research and novel investigational work has been mostly concentrated on various aspects of engines appropriate to VTOL aircraft.

Industrial research in Canada concentrates primarily on small STOL aircraft and their associated technical problems. Extensive work is also underway to improve the performance of small gas turbine engines.

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Prepared by the Ministry of
State – Urban Affairs

THE FUNCTION OF THE MINISTRY OF STATE FOR URBAN AFFAIRS

SECTOR VII – URBAN DEVELOPMENT

The Ministry of State for Urban Affairs was established by Proclamation of June 30, 1971. It exists to conduct research, to develop and evaluate policies and to coordinate activities within the Federal Government and other levels of government, in matters of urban concern.

For the purpose of our mission, we have to help our Japanese counterpart familiarize themselves not only with the functioning of this Ministry but with the Canadian urban situation as well. This can be done with relative ease in our case since our Ministry, which is not even one year old, was set up as a result of our most recent assessment of the Canadian urban situation. Possibly, a short history of the Ministry could throw some light on our urban problems.

1. A PERSPECTIVE OF URBAN PROBLEMS IN CANADA

As one of the most highly industrialized countries in the world Canada has experienced a very rapid economic growth accompanied by a rapid rate of urbanization. The problems that we are facing because of the rapid growth of our cities are quite similar to the problems faced by many other industrialized countries: blight and urban decay, overcrowding, fiscal squeeze, poverty, lack of adequate housing, congestion, pollution, ineffective means of transportation, sprawl, land speculation, lack of adequate municipal and public services and many others.

At the heart of many of our problems lies the particular pattern of urbanization that we have undergone: rapid, unplanned expansion, in a land-using, auto-oriented manner.

Throughout the late 1960's it was becoming more and more obvious that the solution to the urban problem was a function of our ability to intervene intelligently in the process of urbanization itself.

One of our first tasks was to provide a direction and the basis for a more complete and rational approach to urban problems.

In 1969 an in-depth expert study was launched to analyze urbanization in Canada. The purpose of the study was to educate the governments and the people and bring them together to a common basis for understanding urban problems and the basic alternatives for dealing with them.

Since then, the study was published under the title or "URBAN CANADA: PROBLEMS AND PROSPECTS". It has moved us in a considerable way to understand urbanization in Canada, its specific manifestations in individual cities and its national consequences.

Because of the interrelatedness and all inclusiveness of "urbanization", we preferred the establishment of a research, policy making and coordinative Ministry of Urban Affairs with no deliver system and no direct program responsibility.

We began to build the new urban Ministry by keeping a strong commitment to maintain the organization as a highly expert, extremely small group, (in terms of other federal departments) whose primary function is research, policy development and coordination within and between governments.

2. OBJECTIVES AND ORGANIZATION

The Ministry's role as a focus and source of policy development for urbanization in Canada has three characteristic features:

1. It is *co-ordinative* in its method of developing comprehensive urban policies, based on continuing research, and primarily oriented to the federal presence and initiative.
2. It is *supportive* to the current and future urban programmes maintained and developed by other federal agencies and having direct urban influence from coast to coast.
3. It is in a *consultative* position in relation to the federal, provincial and local governments' responsibilities in city and municipal matters. The Ministry is committed to develop a broadly-based, highly visible and continuing consultative forum involving the federal government, the Provinces and the Municipalities and urban communities, in order to build the broadest possible understanding for the process of urbanization and, thereby, initiating a consensus in the building of national policies and federal initiatives.

   Canada is a federal system and our constitution reserves municipal affairs to the jurisdiction of the provinces. This remains a major problem for us to solve in terms of urban affairs.

   Although "municipal affairs" is clearly in the jurisdiction of the provinces, the involvement of the provinces, the involvement of the federal government in urban affairs was clearly demonstrated by our studies. The absence of any co-ordinating process between the varied federal programs administered by numerous separate agencies and the equally fragmented activities of other governments was also clearly defined.

   In consequence, the establishment of our Ministry is to serve as a focal point in urban affairs, a point for coordination. We have launched a process with the provincial governments to bring the federal government, the provinces and the representatives of the cities together around the discussion table.

In its organization, the Ministry of State for Urban Affairs has two Branches; one directing Research and Policy, the other for Coordination. Each Branch is headed by an Assistant Secretary who reports to the Secretary of the Ministry.

The Research division seeks to increase understanding of the urban process in Canada. It conducts research and sponsors research conducted elsewhere. One part of the research work consists in the development of a micro-model of a city. Various inputs can be fed into this model which represents the internal structure of a city and then the impact can be established and evaluated. The same thing is done in terms of a macro-model which refers to a system of cities.

Through the research and policy studies which it is now initiating, the division will recommend priorities for further research in urbanization. It is working to coordinate research undertaken elsewhere, in government and other organizations.

The Policy division develops policies for the Federal Government to implement and it studies and evaluates other policies of Government departments and agencies for their true urban impact. In so doing, it is working toward the definition of a national and federal urban policy in Canada, along with other elements of the Ministry and of government and private life.

The Coordination Branch coordinates activities and policies of the Federal Government, where appropriate, with activities and policies of the provinces and their municipalities. It coordinates the policies and activites of the Federal Government that have an urban impact, so as to reduce duplication and conflict of objectives. It acts as a bridge for the Ministry and Federal Government to other governments and to non-government organizations in matters of urban policy and activity. Where appropriate, it participates in projects and activities of the Federal Government that may influence urban life in Canada. These demonstration projects most often have the function of implementing new concepts and ideas, since we believe that the government should encourage and promote innovation.

Although the Ministry is very young, we are hopeful that by achieving these goals, it will improve considerably the Canadian urban environment.

MINISTRY OF STATE FOR URBAN AFFAIRS

Annex A

PRIVY COUNCIL · CONSEIL PRIVÉ
PC 1971 – 1332
June 30, 1971

WHEREAS the implications of increasing urbanization profoundly affect the well-being of Canadians and the future of Canadian society as a whole;

AND WHEREAS the close cooperation of governments is required to ensure that the urban environment evolves in a manner beneficial to all Canadians;

AND WHEREAS many of the activities of the Government of Canada substantially affect, directly or indirectly, the urban environment and it is desirable that the Government of Canada give careful attention to those aspects of its activities that affect the urban environment by formulating and developing comprehensive policies in respect of those federal activities;

AND WHEREAS it appears to the Governor in Council that the requirements for formulating and developing such policies warrant the establishment of a special portion of the public service presided over by a minister charged with that responsibility.

NOW THEREFORE His Excellency, the Governor General in Council, on the recommendation of the Prime Minister, pursuant to sections 14 and 15 of the Ministries and Ministers of State Act, is pleased to direct that a proclamation do issue establishing a Ministry of State for the purpose of formulating and developing policies in relation to the activities of the Government of Canada that affect the urban environment, to be known as the Ministry of State for Urban Affairs and to be presided over by a Minister of State to be known as the Minister of State for Urban Affairs.

HIS EXCELLENCY IN COUNCIL is further pleased to specify that the Minister of State for Urban Affairs shall formulate and develop policies for implementation through measures within fields of federal jurisdiction in respect of

(a) the most appropriate means by which the Government of Canada may have a beneficial influence on the evolution of the process of urbanization in Canada;

(b) the integration of urban policy with other policies and programs of the Government of Canada; and

(c) the fostering of cooperative relationships in respect of urban affairs with the provinces and, through them, their municipalities, and with the public and with private organizations.

HIS EXCELLENCY IN COUNCIL is further pleased to specify that the Minister of State for Urban Affairs shall, in relation to the formulation and development of the aforementioned policies, which are policies for implementation through measures within fields of federal jurisdiction, have assigned to him the following powers, duties and functions:

(a) in respect of policy development he may

  (i) initiate proposals for new policies, projects and activities,

  (ii) evaluate proposals for new policies, projects and activities and seek to ensure their consistency with federal urban policies,

  (iii) evaluate existing policies, projects and activities of the Government of Canada that have an influence on urban affairs and recommend changes therein where required,

  (iv) where appropriate, participate in projects and activities of the Government of Canada that may have an influence on urbanization in Canada, and

  (v) seek, in consultation with other authorities concerned, the cooperative development of urban policy in Canada;

(b) in respect of research, he may

   (i) initiate research and policy studies relating to urbanization,

   (ii) coordinate, in cooperation with other departments and agencies of the Government of Canada, research relating to urbanization that has been undertaken or financed by those departments or agencies, and

   (iii) recommend priorities for research in urbanization; and

(c) he may perform the following coordination functions:

   (i) he may coordinate, promote and recommend national policies in respect of urban affairs among departments and agencies of the Government of Canada,

   (ii) he may coordinate the activities of the Government of Canada in establishing cooperative relationships with the provinces and their municipalities for the enhancement of the urban environment, and

   (iii) he may coordinate the involvement of the Government of Canada with other governments and non-government organizations in urban policy matters.

Establishment of the Ministry

Attached as Annex A is a copy of Privy Council Order PC 1971-1332 dated 30 June 1971 establishing the Ministry of State for Urban Affairs.

SECTOR VII – URBAN DEVELOPMENT

HOUSING CONSTRUCTION IN CANADA

The traditional Canadian residence is the single family detached house, providing a maximum of individuality and flexibility for family living. As in most industrialised countries the large cities of Canada have the fastest rate of growth. High rise apartments of concrete and steel construction provide high density housing in metropolitan core areas. However this is a comparatively recent development and more than 75% of Canadians live in the traditional timber framed house, indicating that aside from high rise developments in metropolitan areas houses built of wood account for about 90% of both old and the new construction.

The essential use of wood is in the structural framework, providing the strength for floors, walls and roofs. The kind of interior or exterior finish applied provides an almost infinite variety of appearance. The amount of insulation and electrical, plumbing and heating services installed is determined by environmental factors and/or the desires of the owners, in accordance with the requirements of the National Building Code of Canada.

More than thirty per cent of current residential construction is produced by the manufactured home industry using wood frame methods in mass production factories. Modular units or components are transported by highway trucks to building sites within four hundred miles (650km) of the factory. This method is effective in producing homes quickly with minimum labour and maximum quality, and independent of adverse weather conditions at the site. A major factor in this efficient operation is the universal availability of Canadian lumber, accurately surfaced on four sides to sizes meeting the needs of the housing industry.

House manufacturing factories in Canada are located outside of widely spaced major urban centers. Ideally they are at the centre of a circle with a radius of about 400 miles (650km) (one day's delivery time) within which there are many small cities and towns. The location of the plant is primarily market oriented rather than oriented to material sources.

Plants have 50,000 to 120,000 sq.ft. (4,500 to 11,000 m^2) of floor space, employ 100 to 300 workers and produce two to ten houses per eight hour working day. The bigger organizations have large outside storage areas and operate their own fleets of specialised delivery vehicles.

Manufactured houses have not given great reductions in cost per unit area of residential accomodation but they have:

- improved and guaranteed the quality of construction;
- speeded up and increased the availability of housing;
- extended the house construction season from eight months to a full twelve month year despite seasonal conditions;
- permitted more rapid turnover of capital;
- permitted greater use of unskilled or semi-skilled labour;
- encouraged and assisted the development of specialized building materials by offering an aggregated market to supply industries.

Home manufacturing is a well established growing industry in Canada, meeting the housing needs and desires of a large segment of the population. It is a wood based timber-frame industry, except for high rise apartments, because this material and this construction system have been found to give the best combination of design flexibility, structural adequacy, transportability and economy.

It is understood that much Japanese housing is also constructed with a wood-based framing system, using a significant proportion of lumber from Canada, and that a high degree of factory prefabrication is utilized in achieving their very large house building program. An exchange of technological information on building systems, and on the compatability of building methods and materials specifications can be mutually beneficial.

In recent years we have participated in inovative housing programs in a number of countries. In 1964 the Canadian and British governments co-operated in a number of projects in Britain to demonstrate techniques new to that country. By 1970, Canadian wood-frame system was used to produce some 10% of British residential construction, especially in medium density single and row housing developments. Similarly, in 1970 Canada and France co-operated in a demonstration project in which 114 Canadian style dwellings were built near Paris. As a result, we understand that in 1972 more than 30 French builders will produce over 1,000 homes using methods based on this demonstration of Canadian housing.

SECTOR VII – URBAN DEVELOPMENT

THE CANADIAN CONSTRUCTION INDUSTRY – CURRENT POSITION

Construction continues to be Canada's largest industry by a wide margin. The value of the construction work carried out is expected to be over the $15 billion mark in both 1971 and 1972.

In physical volume terms, the program executed in 1971 is estimated to be some 4 to 5% over that of 1970. This represents the first year in the past five when more than a token increase in the total construction program has been recorded.

The outlook for 1972 for the construction program as a whole is for another increase in physical volume, although perhaps on a smaller scale than in 1971.

Within these totals there are of course considerable variations in the different sections of the industry and the country.

During 1971, for example, the provinces of British Columbia and Quebec experienced significant increases in total construction activity, whereas Manitoba, Nova Scotia and New Brunswick suffered decreases.

Similarly, taking the country as a whole, residential construction was buoyant, whereas there was a falling off in the volume of work carried out for manufacturers and for schools and universities.

The main factors contributing to the modest gain in volume during 1971 were as follows:

- An above-average carry-over of construction work in progress from the previous year. Some of this was due to major strikes and lockouts which caused delays during 1970. Also, substantial amounts of mortgage funds were released late in 1970 by the Federal Government for residential construction.
- A record number of housing starts.
- Increased outlays on construction for the mining and petroleum industries, utilities and public works.

One of the most significant features of the 1971 construction program was the increased participation of the chartered banks and other private lenders in the residential construction program. This was due to a large degree to the reduced scope for investment by them in industrial and commercial projects.

The "target" at the beginning of the year of 220,000 housing starts was accordingly exceeded by perhaps 15,000 units. Much of this program was comprised of large-scale apartment projects commenced in the summer and latter part of the year so they will constitute another above-average carryover of work into the new year.

This and the relative availability of mortgage funds augur well for another buoyant year for residential construction in 1972.

Governmental measures at all three levels designed to reduce unemployment give rise to expectations that the total volume of public works will rise during 1972.

In addition to the accumulated backlog of deferred public works projects, there is increasing public concern over the protection of the environment. The volume of sewage disposal installations, water treatment plants, industrial pollution abatement work, etc. will likely continue to increase.

Pipeline construction is also on the increase. A decision to transport petroleum from Alaska through Canada to the main U.S.A. market would of course further accentuate this trend.

Most of the major hydro, thermal and nuclear power projects under way in Canada are well advanced. However, they will still mean a high volume of work in 1972 and the James Bay Power Development will be an increasingly important factor in the future.

To date, the outlook for industrial construction in 1972 is discouraging. The response to a survey in October of the 200 largest organizations in Canada indicated a relative decline in spending on construction, compared to 1971.

The comprehensive survey of capital investment intentions carried out by the Federal Government in December will also reveal whether or not the incentives contained in the Federal Budget have provided the desired stimulus to business and economic expansion.

All in all, the prospects are for a modest increase in the physical volume of construction in 1972. Once again, there will likely be widespread variations in the different sectors of the industry and parts of the country.

SECTOR VII – URBAN DEVELOPMENT

HOUSING CONSTRUCTION – WOOD BASED SYSTEMS

During the past decade, Japan has embarked on a very large long term housebuilding program to relieve a chronic housing shortage. The present rate of construction has reached close to 2 million units per year, and is said to be very much lagging behind demand.

The program has greatly stimulated the growth and size of construction firms, and has created a rapid expansion in industrialized timber-frame building. These firms are gradually accounting for a larger proportion of houses erected in Japan, at the expense of the small traditional builders, and the trend is likely to accelerate. The program has also greatly stimulated the country's demand for wood products, particularly since the proportion of wooden structures have been far exceeding initial targets set for them. As these trends progress, they could offer Canadian exporters increased opportunities in the future, particularly in lumber and other wood products.

The very large program for house construction in Japan, where wood framing is a traditional and desired form of building, would indicate that an exchange of technological information on building methods using wood and involving both factory and on-site operations would be useful. A joint-venture is already under negotiation between a Japanese prefabrication company and a Canadian firm, indicating that the Japanese have much to offer in terms of systems. Information on Japanese systems using wood in improved or novel ways would be valuable to the Canadian export industry, and might well make a significant contribution to the Canadian housing industry.

In 1970, Japanese lumber imports rose to some 1.3 billion board feet. More than half of this volume, or approximately 730 million board feet, were supplied by Canadian shippers. The remainder came from the U.S.A., Russia, New Zealand and Southeast Asian countries. Present lumber exports to Japan are mainly in the form of rough squared timber, both in large Japanese squares (from 12" to 24"; 30 to 60 cm) and baby squares (4" x 4"; 10 x 10 cm). Over half of the baby squares (but only a small proportion of the larger square timbers) are used directly, mainly in construction. The remainder are remanufactured by Japanese sawmills into a wide variety of sizes and specifications for the domestic market. We consider this lack of standardization inefficient.

Mission members may wish to examine opportunities that might favourably affect export volumes of more highly processed lumber from Canada to Japan, to service the burgeoning industrialized building sector.

The wide variety of lumber sizes and dimensions presently used in Japan, particularly for house building, have been identified as an important obstacle to increased sales of standard Canadian construction lumber. A Japanese MITI representative has indicated that one problem is that Japanese specifications for houses do not fit the specifications for Canadian lumber. Having already mentioned this difficult area the Japanese may be amenable to further discussion. Mission members could examine this problem and perhaps recommend ways in which greater standization of specifications could be influenced or brought about.

Since the problem of lumber specifications is generally connected to a large extent with Japanese housing standards and codes, a study of these would be of considerable benefit. It would also be helpful to have recommendations on ways in which these might be influenced in favour of Canadian lumber or other construction products.

Any assessment that could be made of existing opportunities for supplying Canadian softwood plywood, cut-to-size dimension lumber and/or prefabricated house components directly to Japanese prefabricated house builders, or for further joint ventures in such activities, would also be of considerable interest to Canadian exporters.

In earlier discussion the MITI representative said that there had been a meeting in Australia last year about the prospects of exporting prefabricated houses to Southeast Asia. MITI and the Ministry of Construction apparently have a proposal for standardization in housing materials, using basic units of 900 mm (35.4") and 2,400 mm (94.5") and multiples of these for standard sizes for factory-built housing. Additional information on either the Australian or Japanese proposals would be appreciated.

Prepared by the National
Research Council of Canada

Housing and Building

The Division of Building Research of the National Research Council of Canada was established in 1947 to serve the construction industry of Canada in a triple role as an information, advisory and research agency. About 5,000 enquiries were answered during the past year from the Building Research Centre in Ottawa and from the regional offices. Some 900,000 copies of publications of all kinds were distributed on request, more than half of these being accounted for by the monthly Canadian Building Digests, which are now becoming widely used in the teaching of building science and technology as well as in the industry generally.

Perhaps the most important function of the Division is the creation of a National Building Code which has been adopted by the vast majority of Canadian municipalities on a voluntary basis. The Code is produced in consultation with representatives of industries, the provinces and the municipalities. It has no legal standing until adopted individualy by municipalities.

The advisory role of the Division, though not clearly separable from information and research, continues to grow, and evidence of this is provided by the committee memberships of all kinds held by the Division, which now total 348. The 1970 edition of the National Building Code has represented a very substantial increase in this kind of activity on the part of the research officers who serve as technical advisers to the various revision committees. This is in addition to the continuing work of the Secretariat of the National Building Code.

SECTOR VII – URBAN DEVELOPMENT

Note 1 – Mission Assessment of Japanese Market

Matters having a bearing on this mission in the context of urban development (Sector VII) are listed below. These relate to housing and other structures and may be considered with particular relevance to urban centres of over 10,000 population.

1) Extent of expenditures on building and urban research by: a) Government; b) Industry, as a proportion of the total value of building construction in Japan.
2) Prevailing architectural styles, architectural treatment, the role and influence of architects in Japanese construction, and the origin of architectural services by countries.
3) Engineering inputs – structure, services, electrical, mechanical, HVAC, extent of services and origin of engineering services by countries.
4) Prevalence of particular materials such as masonry, concrete, wood, steel and related manufacturing and applications technologies indigenous to Japan.
5) Size and importance of the Japanese building industry from an economic point of view.
6) Extent of Japanese Government participation in construction of housing, schools, hospitals, etc.
7) Extent of co-operation on logistics support by the Japanese Government.
8) Quantities of building materials, equipment, components, etc. imported into Japan and volume of exports.
9) Forecast of expenditures within the industry over the next 2 years, 5 years and longer.
10) Classification of building construction – residential, commercial, institutional and engineering – apportioned between the public and private sectors.
11) The structure and character of the Japanese industry, e.g. the dominance of certain firms, certain materials, vertical integration in the manufacturing/contracting sector, the origin of capital for manufacturing and contracting firms, and trends in the industry.
12) Management education and training in the industry.
13) Union structure and influence – craft/industrial power and trends.
14) Availability of finance domestically for plant installation, mortgage funds and other loans.
15) Restrictions or conditions as to the transfer of funds or profits from Canadian companies or prospective companies operating in Japan.
16) Role of the Japanese Government in the foregoing areas with particular reference to specific departments and agencies through which exports of the goods and services of the Canadian construction industry might be expedited.
17) Political aspects and pressures in building construction in urban centres, e.g. priorities determined by politicians, zoning and planning constraints, etc.
18) Technological impediments to trade such as restrictive building codes, regulations and norms.
19) The status of building code development. How codes are promulgated, etc.
20) Economic impediments to Canada/Japanese trade including tariffs and non-tariff barriers such as balance of payments problems, state of Japanese currency, etc.
21) Land acquisition and tenure and developments in urban centres.

Apart from the foregoing, the mission members should concern themselves with the following:

1) Opportunities for export sales of building materials, equipment, components and structures especially prefabricated buildings, houses, schools, hospitals and other structures of Canadian manufacture.
2) Opportunities for marketing Canadian technologies and construction management expertise through construction industry consultants.
3) Possibilities for developing international contractual arrangements in joint projects (joint ventures) in the fields of design, contracting and manufacturing.
4) Promotional activity required (nature and extent) on an industry or individual company basis.
5) Ways and means of increasing Canadian interest in the potential of the Japanese market for Canadian construction industry goods and services.
6) Improving access for Canadian construction goods into Japan.
7) Improving access to other Asian and Pacific Rim countries either through Japan or as a result of experience acquired in the identification and definition of opportunities in Japan.

Note 2 – Summary of the Japanese Housing Market

The intention of this briefing note is to acquaint mission members with the potential influence of the Japanese economy on the housing industry in Canada both as a consumer of Canadian resources and as a possible competitor in the supply of resources.

Japan presently has a population of nearly 100 million people which has been going through a significant period of industrial and social change. This has resulted in substantial increases in the country's standard of living and a reorientation of the population to the major industrial and trading centers. In the past, economic priorities of the government have not favoured the expansion and upgrading of the housing stock which has admittedly been below acceptable standards. However, pressures arising as a consequence of increased incomes and a growing shortage of viable land have fostered a change in government priorities for the immediate future.

The present government target has been to complete 6.7 million dwelling units in the period 1966-70, 10.0 million units in the period 1971-75, and a total of 30.0 million units for the total period 1966-85. In 1969 and 1970 there were 1.5 million and nearly 2.0 million starts respectively. This rate of starts is almost ten times the rate for Canada which has only one quarter of the population. On a per capita basis, the Japanese rate is over twice the Canadian rate. As a consequence, the Japanese housing market is as big as the United States market where the annual level is approximately 1.8 million starts. Such a sized market can undoubtedly present a significant opportunity for Canadians to participate in. As this market is still in the development stage, the present time is most propitious. To participate in even a modest share of this market will be of great significance to Canada.

Traditional housing construction in Japan has favoured small sized single units complete with modest size gardens for privacy. These have had the minimum of services such as sewage, water, heating and insulation. The present government policy will upgrade these services. Of the new program, 40 per cent of the new units will be of the high rise type (4 stories or more) and the rest of a single or two story type.

Housing construction in Japan was, in the past, largely oriented to the efforts of individual contractors who were basically carpenters using imported woods. In recent years, however, the Japanese Government has made concerted efforts to assimilate the latest developments in building technology, with the result that techniques of pre-assembly and mass scale construction are being developed in Japan as in other industrialized countries. These efforts have included:

1. Technical missions to foreign countries including the U.K., U.S., Canada and Europe.
2. Licensing agreements.
3. Joint venture agreements with systems builders in the U.S. and Canada for operation in Japan.
4. Attempts to form joint venture agreements for component manufacture in foreign countries.

Since the third round of liberalization in September 1970, currency controls on prefabricated housing have been lifted and a number of joint ventures established by foreigners in Japan. In the U.S., Levitt Building Systems Inc. have signed an agreement with a large Japanese real estate company for the production of low cost prefabricated homes in Japan. Levitt will provide the system and management, the real estate company the land and financing, and a leading trading company will supply the imported timber. The houses will be built almost entirely of wood and will include the most modern services. Construction costs are expected to be a quarter less than those of local prefabricated housing.

Although there is some question as to what extent Canadians can participate in the Japanese housing market, there is no doubt that there are opportunities to explore. Many factors make the present time opportune. These are:

1. The Japanese market is substantial and will continue to grow.
2. The liberalization of foreign exchange in Japan for the development of prefabricated housing removes a substantial barrier to Canadian participation in the market.
3. The recent decrease in the value of the Canadian dollar on the international market enhances our trading position. This is especially so when compared with the U.S. trading companies who are our potential competition in this market.
4. Canadian housing "know-how" is firmly established and enjoys a world wide reputation as a leader in its field. Japanese "know-how" is antiquated but will not remain so for very long.
5. There are many examples of successful joint ventures in the prefabricated housing field which would suggest the success of a similar joint Canadian Japanese venture.
6. Canadian participation in the Japanese market may offer one of the best defensive controls to Canadian economy when the Japanese decide to enter the international market for housing after they have installed the latest techniques of prefabrication and component production.

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Sector VIII – Food and Agriculture

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Prepared by the
Department of Agriculture

SECTOR VIII – FOOD AND AGRICULTURE

Part A. Background Information

The Research Branch of the Canada Department of Agriculture is one of the largest research organizations in Canada. The Branch has its headquarters at the Central Experimental Farm, Ottawa. The Executive of the Branch is headed by a Director-General, who is responsible for the organization, operational procedures, overall development, and coordination of Branch activities. Three of the Assistant Directors-General are responsible for groups of establishments; one for the research institutes and services, one for the establishments in Western Canada, and one for those in Eastern Canada. A fourth Assistant Director-General is responsible for the administrative services throughout the Branch, and the fifth is responsible for the coordination of programs. The Executive is assisted by a group of Research Coordinators who act as advisers on all programs.

The Branch conducts basic and applied research on soils, plants, animals, pests, diseases, engineering, and food. All programs or activities of the 43 Research Establishments scattered across Canada relate to regional and national goals and objectives, which provide a philosophy of operation and spell out the raison d'être of the Research Branch.

The following are specific areas of interest and importance;

Forages

Forage crops are an important aspect of the Canadian agricultural industry. Research is presently being directed to the curing, storage, and feeding of forage, legumes and grasses. One of the major concerns at present especially in Western Canada is bloat from alfalfa.

Oilseeds

In 1971 about 5.4 million acres were planted to rapeseed and yields are estimated at 105 million bushels, a 33% increase over 1970. The value of the 1971 crop is about 300 million dollars. The crop is concentrated in Alberta, Saskatchewan, and Manitoba. Most of the crop is exported in the seed form. Japan and Europe are the two major markets. The Research Branch of the Canada Department of Agriculture carries the major breeding program, the emphasis being on production of low glucosinalate, low erucic acid varieties. Two new varieties of this type – Span (*Brassica camprestris*) and Zepher (*Brassica napus*) were licensed during the past year. The main Research Branch program is oriented toward production of edible protein fractions for human use. Emphasis is on preparation of meals, flours, and problems related to their preparation and utilization such as tannin, carbohydrate and glucosinalate content.

Horticulture

The vegetable industry in Canada involves 230 thousand acres of production. The most important crops are, potatoes, carrots, corn, cucumbers, onions, peas, rutabagas, and tomatoes. Of the total production 85% is grown in Ontario and Quebec. There are two major phases of the industry, (a) that for fresh market sale, largely grown on organic soils and (b) that for processing, entirely grown on mineral soils.

Potatoes are the most important vegetable crop in Canada and are grown in every province. Canada exports most of its production and it has a competitive advantage in seed production because of pest control combined with effective disease screening and prevention. The Canadian seed potato certification program has entered a new and stricter phase and this will serve to improve seed potato standards.

One of the most important fruit crops is strawberries. Strawberries are grown quite generally throughout the country with the varieties grown in the east and west being different. The market outlet is both for fresh fruit and processing, primarily by freezing. Aphid transmitted viruses have been a problem for the production of strawberries but the general use of certified stocks has largely corrected it. The use of virus-free stocks has significantly increased production, e.g., the average per acre fields in Ontario have increased 17 per cent each year since 1964 when the virus-free Redcoat variety was introduced.

Pest Control

Some 280 scientists in the Canada Department of Agriculture are involved in pest control. The entomologists are aiming at integrated control with studies on insecticides, population dynamics, biological control and the use of bio-agents such as bacteria and viruses in the control of selected pests. The plant pathologists, nematologists and virologists are dealing with biological control, host-parasite relationship and physiology of parasitism.

An important group of pathologists in working on epidemology of diseases and the losses they cause. The Research Branch is involved in the field of remote sensing studies for the determination of disease infection and intensity with aerial infrared photography. The Plant Protection Division is responsible for protecting Canadian agricultural plants from foreign plant pests. Inspectors examine imported plants at their points of entry. Inspectors of the Division also examine and certify plant material for export.

Cereals

More than 90% of Canada's cereals are produced in the provinces of Manitoba, Saskatchewan, and Alberta. Most of the research on cereals, i.e., wheat, barley, and oats is done at CDA Research Station, Winnipeg, Manitoba. World renowned for the development of rust-resistant wheats, this station is Canada's main center of research on cereal breeding, diseases, and pests. It is also the main center for the study of insect pests of stored cereals and their products. Canada is aiming at a better understanding of parasites and interactions with their hosts, as well as developing new improved varieties resistant to parasites.

Corn is a rapidly expanding crop in Ontario and Quebec. It is used for food, feed and distillery purposes. Canadian breeders of corn have emphasized early, low heat unit inbreds, plus stalk rot resistance.

Animals

Canada's dairy cow herd numbered 2.5 million in 1971. Canadians spend 20-25% fo their food dollar on milk and milk products. Dairying is Canada's fifth largest industry and its health and vigor is important to a large segment of agriculture and the processing industry. One-third of Canada's total beef and veal comes from the dairy herd. Canada exports substantial numbers of high quality breeding stock and semen. The chief production problems facing the dairy industry which the Canada Department of Agriculture is devoting its attention to include intensification, larger units, management and waste disposal problems, new feeds and feeding systems for dry lot operation, disease, infertility, mastitus, ketosis, and control development of animals which function efficiently under intensive conditions and produce higher protein milk. In processing and product development there is urgent need for new processes and products to enable this industry to compete.

Meat technology research in Canada is still in its infancy. The meat technologist, biochemist, microbiologist and food engineer, have important roles to play in a balanced research program on beef, pork, poultry, lamb and mutton meat.

Canada Department of Agriculture has been involved in many years of selection with beef breeding which has resulted in a 9% genetic improvement of the selected Shorthorn line. Crossbreds with foreign cattle have been developed and crossbred calves have demonstrated a 10% growth advantage over select line Shorthorns.

Part B. Questions of Special Interest to the Mission

Food

The current surplus of grains in Western Canada has focussed attention on new product development from agricultural products. The majority of product development specialists, in both the university and government sectors are concerned with basic and applied research. Because of the lack of correlation between basic-applied research and marketing research, food research efforts in Canada have had little impact on the food industry. Food research programs in Canada have given priority to horticultural crops and animals over oilseeds and cereals.

The following points should be of interest to us:

1. Japan has been the prime importer of rape seed, they have crushed seeds and use the oil in animal rations. Can we anticipate crushing rapeseeds ourselves, finish our beef, and sell it to Japan?
2. The consumption of red meat is increasing in Japan, what kind of meat products can be developed in Canada for consumption in Japan?
3. What kind of feed grains could be developed in Canada for utilization in Japan?

Canadian delegation should look at the following in Japan:

1. food processing technology and equipment
2. production of plant proteins for human consumption. Japan is producing proteins from soybeans and wheat while Canada utilizes proteins from wheat.

Possibilities for Horticultural Exchange with Japan

Fruit and vegetable production in Japan is a large sector of the agricultural industry there, having an annual value of over $2 billion, representing about 18% of the gross agricultural product. In contrast the value in Canada is about $250 million, some 4% of the agricultural total. Japanese exports of horticultural goods account for nearly one-third of their agricultural export trade, but there is virtually no import of horticultural commodities.

Agriculture in Japan is organized on a much smaller unit base than Canada, 68% of the farms being 1 hectare (2.4 acres) or smaller, and only 8 percent being over 2 hectares (5 acres). For horticulture their industry is extremely intensive and productive, by our standards. For this reason there is much that we can learn from them on the management of horticultural crops to obtain maximum production.

We know very little about their fruit and vegetable breeding programs or about the principal varieties presently being grown commercially in Japan. One of their apples, the variety Mutsu has created a considerable amount of interest in Canada and Europe as a possible alternative to Golden Delicious. We know nothing of their stone fruits, berry crops, etc. Much of the research that they are carrying out would be of interest and real value to us.

In vegetables, considerable publicity has been given to their seedless watermelons, giant radishes, and some of the F_1 hybrids produced there, e.g. Jade Cross broccoli and other cole crops. Since the climate of certain regions in Japan is comparable to that of parts of Canada there is undoubtedly much more that would be of value to vegetable research and production in this country.

On the other hand we have much that could be shared with the Japanese, for example, the new peach varieties from the Harrow Station, the compact sports of apple and cherry varieties developed at Summerland, our expertise in insect pest ecology from studies at Kentville and St. Jean, our knowledge of the technique for controlling codling moth or other insects with radiation-sterilized males, the procedures and equipment developed for controlled atmosphere fruit storage at Kentville, the hardy dwarfing apple rootstocks from the program at Ottawa, improved varieties of strawberries and raspberries from the breeding programs at Agassiz and Kentville, the new processes and products developed in food technology at Summerland, hardy ornamentals from the arboretum at Morden, radiation-induced mutants of greenhouse chrysanthemums from the Plant Research Institute, protein-based foams for frost protection from work at Ottawa, virus-free strains of potato varieties isolated at Vancouver, remote sensing techniques for assessing plant diseases, and many others.

The situation is opportune for a useful exchange of scientists, plant material and scientific knowledge.

Notes on Volcanic Soils in Japan

A major part of Japan is covered by volcanic ash—most of the 200 volcanoes erupted in the Quaternary Period (last million years) and deposited ash over the country. Some is fairly recent.

Soils

The kinds of soils formed from these volcanic deposits under forest are Brown Forest types (like Canadian Brunisols), Podzols (like Canadian Podzols), Podzolic (like our Luvisols), and under grassland conditions the soils are Black types. The latter look like our Black Chernozems but their morphology is different from the Canadian kind. Our Chernozems have a lime carbonate layer under the B horizon which their soils do not. Volcanic ash initially is raw material strongly acid in reaction. The acidity changes to neutral after a period of leaching with rain water. With weathering the bases are released and the ash becomes alkaline. The bases then are washed away and leaching of silicates occurs. The silica and alumina combine to form allophane. (Allophane is an amorphous aluminum-silicate mineral belonging to the kaolinite group). On continued weathering the allophane is recrystallized to hydrated halloysite (aluminum-silicate plus water) and gibbsite ($Al(OH)_3$). These are the soil materials common to Japan. In British Columbia, we have thin deposits (up to 12 inches) occurring in scattered areas; they also occur south of B.C. in the U.S. In Canada we placed these soils in the Brunisolic Order, and the U.S. placed them in the Andept Suborder and Inceptisol Order. In Japan these are called Kuroboku (kuro meaning black and boku meaning friable). In the world system they are called Andosols.

In Japan these volcanic ash materials erode readily by wind and water, because the sediments have a low bulk density (.8 gm/cm) and are fluffy. They respond to fertilization, particularly N, and likely to P and K. Liming is beneficial. The fixing power of these soils for P is high and generally large amounts must be applied to be effective for crop growth. Paddy soils need special care in fertilization; timing and testing appear essential for good yields.

Volcanic soils were considered unproductive at one time but now with improved technology their productivity has been increased significantly. In New Zealand these kinds of soils under 55 inches of precipitation produce up to 500 cubic feet of wood per acre. Trees grown are Douglas fir (imported from Canada) and radiata pine. This yield of wood in New Zealand is more than twice the volume of our best production in Canada.

Land Classification

Land classification is similar to the one used in the U.S. and Canada. That is, classes 1 to 3 are suitable for cropland; class 4 is severely restricted for cropland; classes 5 to 7 are used only for grassland and forest and class 8 for wildlife, recreation, water supply, etc.

Use

Volcanic ash soils are used mainly for upland crops, which in order of importance are grassland, mulberry and orchard. On the agricultural land double cropping is followed; that is, in summer rice and sweet potatoes are grown and in winter, wheat and barley are produced.

Animal Research

The Canadian Mission should make enquiries about the following:

1. Trends in the use of protein concentrates in animal feed as well as the kinds of protein concentrates required in addition to rapeseed meal.

2. The demand for Canadian whey for use in Japanese foods (whey is high in proteins). There have been enquiries from Japan regarding availability of Canadian whey.
3. For what species of livestock would Japan need feed grain. What grains would be favored?
4. What would be the market for high quality beef such as "KOBi" beef (Lethbridge Research Station has a project with Canada Packers to produce "KOBi" beef.

   Are the Japanese interested in setting up beef operations in Canada?
5. What is the demand for poultry products such as dried eggs.
6. What are the demands for pork in Japan? The Japanese do not produce enough pork for their own consumption.

   Enquiries should also be made about 5-6 storey swine production units in Japan including animal waste disposal systems for these units.
7. What are the prospects of demands for dairy and beef cattle stock and semen vs. breeding programs?

Pollution

Major technological activities of mutual interest to Japan and Canada in the area of pollution and which should be discussed are as follows:

1. Work being done on the accumulation, distribution, toxicology, and control of heavy metals through its industrial, water, soil and food chain systems.
2. Chemical, physical and biological reactions in the soil and how they affect the availability of plant nutrients.
3. The disposal of animal wastes.

Protection

The Japanese have had considerable experience in control of plant disease by antibiotics. The Mission should discuss this program with the Japanese. Discussions should also be held regarding their problems with fruit tree viruses especially cherry viruses (little cherry on flowering cherries), Japanese researchers first established that the so-called "yellows viruses" were not viruses but mycoplasma.

CDA is interested in obtaining information on the Japanese mycoplasma research program.

Agricultural Engineering

The main areas in which research and development are being carried out at universities and government agencies in Canada are indicated by the following:

1. Cereal grain harvesting machines and automatic control systems.
2. Forage equipment assessment and evaluation on production systems basis.
3. Tree and small fruit harvesting equipment development.
4. Evaluation of pesticide spray equipment and developments to increase efficacy of application and reduce drift.
5. Environmental studies in livestock structures.
6. Animal waste management and disposal.
7. Cereal grain drying and storage.
8. Some food and feed processing projects.

CDA is interested in obtaining information in areas outlined above, on instrumentation related to equipment controls, and their program on equipment testing and evaluation.

Administartion and Organization of Research

CDA wishes to obtain the following information;

1. How is research organized in Japan. This includes not only government, but also universities and industry.
2. Is there a research organization similar to National Research Council?
3. What is the manpower devoted to agricultural research and development?
4. How is research funded in Japan. What percentage of GNP is devoted to research?
5. What type of research (i.e. applied vs basic) is being done in universities, industry and government. Do government, industry and universities carry out the same type of research programs.
6. How is market research conducted for agricultural products?

CDA will be interested in sending PDF's to Japan in the following areas:

(1) food equipment design technology, e.g. deboning equipment
(2) plant protein utilization
(3) fruit breeding
(4) marketing of agricultural products
(5) floriculture

CDA will be interested in receiving PDF's from Japan in the following areas:

(1) animal nutrition
(2) rapeseed utilization
(3) meat processing technology
(4) insect taxonomy
(5) breeding of apples and peaches
(6) potato research
(7) virus research
(8) organic soil production of vegetables
(9) apple insect entomology
(10) fungal taxonomist

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Sector IX – Fisheries

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SECTOR IX – FISHERIES

FISHERIES IN CANADA

Fisheries management and conservation in Canada is a function of the newly established Department of the Environment of the Federal government, but responsibility for certain aspects of the resource is delegated to Provincial authority upon request. Thus most recreational freshwater fisheries are administered by the respective Provinces but commercial and recreational marine fisheries, except in the province of Quebec, and all inspection and international relations involving the fisheries resource remain a Federal task.

Aquaculture is an increasingly important subject but, as yet, is confronted with problems arising from Federal, Provincial and Municipal legislation.

The administration of commercial and marine sport fisheries involves biological and technological research, management and conservation, inspection, and industrial development. Ancillary activities of the same administration include market research, international liaison and information and consumer services.

Canada's early history was vitally linked with her Atlantic coast marine fisheries; early currency bills even displayed a codfish as a frontispiece. The economic importance of the fishery relative to other industries has since declined, but the resource retains an important place in Canada's economy and in the supply of protein and gourmet foods. Canada borders on three world oceans, Atlantic, Pacific and Arctic, contains a major inland sea, Hudson Bay, has the longest natural coastline in the world and contains or shares 25% of the world's supply of freshwater. The resource potential in these waters is large and, except for those within complete dominion, is shared with nations through treaties, agreements and codes.

The fisheries resource varies regionally. The Atlantic region has a broad continental shelf of nutrient-rich waters and a multi-species resource dominated by demersal species and invertebrates. The Pacific has only a narrow shelf, except in the far north where demersal species are important, and its main fishery is dependent upon pelagic and largely migratory species. The Arctic coast is generally shallow but contains no large populations of fish. Anadromous stocks migrating in and out of freshwater each summer form the major catch and supply the domestic needs; also they provide limited recreational activity. Hudson Bay is a relatively shallow sea with a resource base and productive potential similar to that of the Arctic.

Canada's inland or freshwater fisheries derive largely from those Great Lakes shared with the United States and the large lakes extending north-west into the Arctic along the edge of the Canadian Shield. Productivity is low and annual yields range from over 5 pounds per acre to less than 0.5 pounds per acre.

Aquaculture is becoming increasingly important in Canada. Numerous low-capacity trout culture ponds are scattered throughout the country but recent use of small prairie lakes for rainbow trout culture has proved most effective and provided incentive for further developments. Oyster culture has long been carried on at a relatively low intensity and seed stock in years past was often imported to the Pacific coast from Japan. However, the value of the fish culturing industry is still small in Canada.

Catch of commercial fish in recent years has been about 1.5 million metric tons or about 2.4% of the world total, placing Canada about tenth in order of the world's leading fishing nations. Canada's population is small and about two-thirds of this catch is exported. The industry is valued at about $400,000,000 annually and supports close to 70,000 fishermen. Recreational fishing now attracts about 3,000,000 people who spend an estimated $500,000,000 annually. The multitude of lakes and thousands of miles of rivers and coastline auger well for recreational development and it is estimated the value of the resource will double by 1980.

CANADIAN EYES ONLY

Science and Technology Mission
to Japan, 8-15 March 1972

Prepared by the
Department of the Environment

SECTOR IX – FISHERIES

FISHERIES RESOURCES

Canada borders on three world oceans, the Atlantic, Arctic and Pacific, contains a major inland sea, Hudson Bay, has the longest national coastline in the world and contains or shares 25% of the world's surface supply of freshwater. The resource potential in these waters is large and, except for those within complete dominion, is shared through treaties, agreements and codes with other nations.

The ecological, environmental, economic and social problems differ in each of the major fishing areas. The Atlantic region has a broad continental shelf of nutrient-rich waters and a multi-species resource dominated by demersal fish and invertebrates. Its industry is over-capitalized, has a surplus labour force, and is divided into small operating units spread over an extensive geographical area. The Pacific coast has only a narrow shelf, except in the far North where halibut and other demersal species are important, and its main fishery is dependent upon pelagic and largely migratory species. Its industry is also over-capitalized but is concentrated in a few large well organized companies operating from two principal locations. Its labour force is relatively small but technologically efficient. The Arctic has few fish that are of value beyond local or domestic use. Some fish are caught, processed and marketed through isolated, government-sponsored cooperatives. Both capital and labour are minimal. Marine mammals figure prominently in the arctic fisheries resource but are primarily for the domestic market. Canada's inland waters produce low natural yields of fish, which generally diminish from south to north. Regionally these inland fisheries vary, with the more efficient management and capitalization concentrated in the Great Lakes area. High prices for the desirable products of northern waters support the less efficient industry of the small lakes of remote areas.

Canada's sports fishery now attracts approximately 3,000,000 people who spend an estimated $500,000,000 annually. The multitude of lakes and thousands of miles of rivers and coastline auger well for further recreational development, and it is estimated that over $1 billion will be spend annually on sport fishing by 1980.

Culturally, aquatic resources have been important to Canada and proximity to the supply and processing facilities led to the distribution of many settlements with dependence on a single industry. The 'outports' of Newfoundland, of which there were over 1000 not so long ago, and the shore communities of the Maritime provinces and Quebec are examples of this development. The importance of Canada's commercial fishery is shown in Table 1.

Over or under-exploitation of the resources and alternative priority use of the environment frequently defeat man's attempt to harvest the renewable aquatic resources for the maximum sustainable quantity, quality or value of yield.

Over-exploitation of many species is known and documented. Examples of overfishing include herring on the Pacific and Atlantic coasts, and Atlantic haddock. The slower growing and late maturing species of polar and temperate waters are particularly vulnerable to being overfished by modern highly automated fishing fleets. Increasing demands for protein have resulted in a more aggressive fishery and many species not previously utilized are now actively fished. During the decade ending 1968 world fish catches doubled from over 30 million to over 60 million metric tons. Studies indicate a further increase of about 50% in landings of fish currently in demand are possible but increases beyond this level will require acceptance of animals further down the food chain.

Man has practised aquaculture for centuries and world estimates of cultured aquatic products which are presently close to 4 million metric tons are expected to increase fivefold by 1985. Canada hopes to achieve a production of 100 million pounds annually by 1980.

Many of the deleterious effects of man on his aquatic resources are outgrowths of historical practice, insufficient knowledge, previous and ad hoc policy, multiple uses of water, social and economic conditions and national and international competition. Problems under national control are corrected as conditions warrant but many resources are shared with other nations and must be managed jointly. Canada now cooperates with many nations in obtaining scientific data and formulating management proposals. The rational development and conservation of fisheries of common concern is planned through her membership in nine international fisheries commissions and one international council. These are set out in the 1969-1970 annual report of the Department of Fisheries and Forestry, and a brief summary follows:

The International Council for the Exploration of the Sea, formed in 1902, encourages and coordinates studies of the marine environment with particular reference to its living resources. Canada became a member in 1967 and participates in cooperative oceanographic and biological investigations and in the annual scientific meetings.

The Fur Seal Treaty of 1911, drawn up between Canada, Japan and U.S.A., provides for the conservation of a single marine species. It became inoperative during the early 1940's and a new Convention on Conservation of North Pacific Fur Seals came into force in 1957.

Canada joined with the U.S.A. in 1923 to form the International Pacific Halibut Commission. The convention provides for development and maintenance of the maximum sustainable yield of halibut in the north Pacific Ocean and Bering Sea. The commission maintains a scientific staff to provide data on which regulations are based.

The International Pacific Salmon Fisheries Commission, under a convention between Canada and the United States for protection, preservation and extension of the sockeye salmon, dates back to 1930, and was amended to include pink salmon in 1956. The commission conducts studies of sockeye and pink salmon in the convention area, regulates the fisheries and apportions the catch equally between fishermen of the two nations.

Canada has been a member of the International Whaling Commission since its inception in 1946. The Commission recommends scientific studies, determines the current condition of whale stocks and adopts regulations on open seasons, total catch quotas, closed areas and protected species.

The International Convention for the Northwest Atlantic Fisheries in force since 1950, provides for the investigation, protection and conservation of the fisheries of the northwest Atlantic Ocean to maintain a maximum sustained catch.

In 1968 Canada became a member of the Inter-American Tropical Tuna Commission. It conducts scientific investigations to provide data required to maintain the populations of yellowfin and skipjack tuna and other species of fish taken by tuna fishing vessels in the eastern Pacific Ocean, at levels which permit maximum sustainable catches.

The International North Pacific Fisheries Commission was established in 1953, with responsibility for promoting and coordinating scientific studies to ensure that fisheries of joint interest in the north Pacific Ocean are maintained at the level of maximum sustainable productivity. The convention is unique in that it includes the "abstention principle" whereby a member nation agrees to abstain from fishing stocks which are being fully utilized by another member nation, are subject to extensive scientific study, and are regulated through legal measures for the purpose of maintaining or increasing the maximum sustained productivity.

The Convention on Great Lakes Fisheries between Canada and the United States, established in 1955, is responsible for formulating and coordinating research programs designed to determine measures needed to make best use of the fish stocks of common concern, recommending management measures and implementing a program to control the sea lamprey.

The International Commission for the Conservation of Atlantic Tunas first met in 1969. It studies tuna and tuna-like fishes in the Atlantic Ocean and adjacent seas, and makes recommendations concerning measures required to maintain their populations at levels which will permit the maximum sustainable catch for food and other purposes.

The general principles of conservation as they apply to high continued yield are followed by all nations. But goals differ between nations and within nations depending upon species, region, socio-economic factors, production costs, market demand and competing water uses.

Commercial fishery production in Canada, following the traditional conservation philosophy of obtaining maximum sustainable yield, is valued presently at $400,000,000 annually. Lacking a home market, two thirds of this production is exported. As a consequence exploitation is principally on high value species with ready market demand. Until recently, a policy of unlimited licensed entry into commercial fishing was permitted. This created problems of surplus labour force and overcapitalization of industry which in turn resulted in higher fishing costs. It has been estimated that of the 70,000 Canadian fishermen, 35,000 could be released from the industry, 25,000 from the Atlantic region alone, without a significant decrease in the catch of fish. Through changes in regulations and the promotion of other industries in fishing areas to supply alternate employment, Canada hopes to achieve a reduction in the labour force and an efficient utilization of capital invested in the fishing industry.

Canada's territorial sea was extended to twelve miles from three miles by amendments to the Territorial Sea and Fishing Zones Act approved in June 1970. These amendments also provided for establishment of fisheries closing lines, which came into effect in February 1971, designating major areas on both its east and west coasts as exclusive Canadian fisheries zones. The effect is to assert Canadian jurisdiction over an additional 80,000 miles of coastal waters.

Legislation to control and clean up pollution has already been enacted for home waters, the Northwest Passage and visiting ships. But pollutants respect no national boundaries and international solutions are mandatory for protection of world aquatic resources.

Canada's commercial marine fisheries have distinct inshore and offshore components. Fisheries for cod, herring, lobsters and salmon are the most important in the inshore regions, both in terms of landed weight and dollars. These are usually conducted from small open boats, though on the Atlantic coast there is a growing number of "middle distance" operations from longliners. Most of the offshore fisheries are for various groundfish species taken by trawling although the catch of halibut on the west coast is taken with longliners.

Total Canadian Atlantic catch (all species) in 1970 was almost 1.2 million tons or 37% of the total Northwest Atlantic catch by all countries. In Newfoundland and Labrador fishing areas, over 70% of the total Canadian catch is taken within the 12 mile Territorial Sea; the Gulf of St. Lawrence is reserved for exclusive Canadian fishing. In the Nova Scotia and Bay of Fundy fisheries about 40% of the Canadian catch is taken within the 12 mile Territorial Sea and exclusive fishing zones.

In the Northwest Atlantic fishing area as a whole, it has been estimated that stocks of the familiar groundfish and herring are not capable of producing sustained yields above those presently taken.

Aquaculture in Canada, though still in its early stages, supports: a developing trout fishery; an established and increasing oyster and oyster seed industry on both its east and west coasts; salmon and trout hatcheries and special salmon rearing areas; and pilot plant production studies of sablefish. However, Japan has a large culture industry and we stand to gain much from her expertise.

Canadians consume about 12 pounds of fish per year, the Japanese use over 100. This difference may be related to many factors but is probably also effected by the highly developed techniques of preparation, processing and packaging. This well advanced state of the art in Japan and her need for protein supplies suggests a possible export market for fish such as capelin and sand launce that are presently not utilized in Canada and an import of Japanese processing and packaging techniques.

Table 1. Importance of commercial fisheries in the Canadian economy.

Year	World catch	Canadian catch	Canadian catch as % world catch	Value of all commodity – producing industries in Canada	Market value of all Canadian fisheries products	Market value as % of total industries	Numbers of fishermen employed in primary industry
	1,000's metric tons			millions of dollars			
1954	27,600	1,027	3.72	14,100.8	192.2	1.4	79,600
1959	36,700	1,054	2.87	18,536.6	204.1	1.1	80,100
1964	52,700	1,211	2.30	23,300.9	295.2	1.3	78,100
1967	60,700	1,303	2.15	29,842.0	330.0	1.1	71,200
1968	64,000	1,490	2.33	31,818.9	384.1	1.2	68,400

Source: Annual Statistical Review of Canadian Fisheries.

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Prepared by the
Medical Research Council of Canada

SECTOR X – HEALTH SCIENCES

HEALTH SCIENCE RESEARCH IN CANADA

Introduction

There are in Canada no large central laboratories for health science research such as are found in many other countries. Some research in the area is carried out in government laboratories, both federal and provincial, primarily when such research is relevant to the assigned mission of the departments involved. Some health science research is done by the pharmaceutical and electronics industries but the extent of this has not as yet been great. By far the greatest part of health science research in Canada is carried out in the 16 schools of medicine, the 10 schools of dentistry and the 8 schools of pharmacy in Canadian universities.

The Federal Government

The federal government recognizes a responsibility to support and encourage research in the health sciences across the country and its main instrument for the administration of the funds provided for this purpose is the *Medical Research Council.*

The Medical Research Council is a crown corporation reporting to Parliament through the Minister of National Health and Welfare. The Act setting out the functions of Council is included in the pamphlet entitled "Medical Research Council – Historical Background and Present Programs" which accompanies this brief. The Council mechanism provides, within the apparatus of government, an opportunity for working scientists to participate, in an executive rather than an advisory capacity, in the development and implementation of policy. It is suited to the achievement of medium and long range goals. Council itself is composed of 21 members, drawn chiefly from the health science faculties of the universities, who serve without remuneration for terms of two or three years. In carrying out its function, Council relies heavily on the advice of an additional 121 scientists who serve on numerous working committees which report to it.

The Council operates no laboratories of its own; instead, it uses the funds voted to it by Parliament to promote and support research in universities, hospitals and research institutes. It currently provides to these institutions $35.6 million, or approximately 60% of all support for health science research which reaches them from extramural sources, estimated to be $61.9 million in 1971-72.

The Medical Research Council has three major objectives.

a) to contribute to new knowledge in the health area,
b) by the support of research, to develop and support the scientific and technological back-up to the provision of health care which is necessary if health services are to be of high standard, and
c) to develop and support the research component in the education of health care personnel.

In working towards these goals Council's chief job is to support the research of high quality investigators who among them cover the spectrum of health science research, except public health research (which is the statutory responsibility of the federal Department of National Health and Welfare). Their research programs are in part basic research, in part applied research and in part developmental research, and the investigations undertaken are selected by the researchers themselves. The criteria used by the Medical Research Council in selecting projects for support are almost entirely associated with the scientific merit of the proposal and the responsible investigator, as assessed by committees of his peers in the relevant fields. There are now 17 MRC Grants Committees, each comprised of 8-12 senior investigators, in the following fields:

Biochemistry	Clinical Investigation
Physiology and Pharmacology	Heart and Lung
Pathology and Morphology	Neurological Sciences
Microbiology and Infectious Diseases	Behavioural Sciences
Immunology and Transplantation	Dental Sciences
Genetics	Pharmaceutical Sciences
Cancer	Bio-Medical Engineering
Metabolism	Assessment of Diagnostic and Treatment Procedures

The second job of the Medical Research Council is to see to it that there is a satisfactory level of activity and expertise in the various sectors of science for which it has responsibility. A program of Development Grants has been designed to assist in situations where the level of the research activity is lower than considered adequate, with the main objective of facilitating the recruitment of first-rate investigators to relatively weaker areas.

A mechanism which is used to support research in areas of special interest is that of the MRC Group, which provides for multidisciplinary research in a given area by teams of investigators of complementary interests. There are now four such Groups in Canada:

- MRC Group for Neurosciences at the University of Montreal (Dr. H.H. Jasper, Director)
- MRC Group for Transplant Research at the University of Alberta (Dr. J.B. Dossetor, Director)
- MRC Group for Developmental Neurobiology at McMaster University (Dr. J. Diamond, Director)

and

- MRC Group for Drug Toxicology at the University of Montreal (Dr. G.L. Plaa, Director).

Under the terms of the agreements made with the universities involved, virtually full support for the research program of the Group is provided for an initial period of five years, with continuing support being contingent on re-application and a satisfactory review.

A third job of the Medical Research Council is to give attention to a few special problems. In some areas these problems may be identified by Council itself. Examples of these are the Antilymphocyte Serum Project concerned with the development of a protocol, and production of a single pool of non-toxic immunosuppressive ALS, for a definitive clinical trial of the efficacy of ALS in inhibiting the rejection phenomenon in kidney transplants. Production problems have now been overcome and a clinical trial in 13 centres across Canada, to involve some 200 patients in all, is just underway. An earlier clinical trial, now in part completed, was undertaken to determine the therapeutic effect of human growth hormones in the treatment of certain types of dwarfism.

In some cases, special problems are identified by others and support is given through Council grants and such other mechanisms as may be appropriate in each case. The Council and the Department of National Health and Welfare, for instance, have a combined program for the support of research into the non-medical use of drugs. The Council is also collaborating with the Department in a program related to Family Planning. Both of these collaborative efforts have been described in more detail in another brief.

To develop and maintain an adequate supply of trained scientists funds are provided for trainees at the pre-doctoral and post-doctoral level through Studentships and Fellowships, and for the support of career investigators through Associateships. Intermediate in the personnel support programs is a highly successful Scholarship program designed to provide university salary support for up to five years for a limited number of young investigators who have shown promise of a high potential for independent research.

The funds allotted to the Medical Research Council program for the fiscal year ending March 31, 1972 total $35.6 million. With these funds the Council provides:

- support through its Grants Program for the research of almost 1,400 investigators in Canadian universities and affiliated institutions ($24 million)
- stipends for 680 research trainees receiving prize awards through the Studentship and Fellowships programs ($4.5 million)
- salary support for 120 MRC Scholars and 80 MRC Associates ($3.7 million)
- support for the research programs of 4 MRC Groups ($0.7 million)
- special support through Development Grants to assist in establishing investigators newly recruited to Canadian research ($1.2 million)
- support for symposia, international congresses, Visiting Scientist awards, and other forms of information exchange ($0.2 million)
- a modest grant to each dean of medicine, dentistry and pharmacy to meet urgent local research needs and to provide for summer research training of undergraduates ($1.2 million)
- support for other activities of a general nature related to the overall development of research ($0.1 million)

The Department of National Health and Welfare is another major federal contributor to health research in Canada. The activities of the Department have been described in detail in another brief.

The *Defence Research Board*, under the jurisdiction of the federal Department of National Defence, provides some $500,000 annually for the support of research in its area of interest which is carried out in the universities. It also has an intramural research program carried out in a number of its own laboratories across the country.

The *Department of Veterans Affairs* operates a number of hospitals in Canada, and support for clinical research is provided to medical staff and medical consultants attached to these hospitals. Some $300,000 is available each year for these programs.

The *National Research Council of Canada* also undertakes a certain amount of medically-oriented research in its own laboratories, generally in the field of bio-medical engineering, and supports some research in areas of biological science undertaken in university health science complexes.

The Provincial Governments

The support of health science research by the provincial governments varies greatly both in its nature and in its amount. Some provinces, notably New Brunswick and Prince Edward Island, do not have medical schools and therefore few facilities or personnel for medical research. At the other end of the spectrum, the Provinces of Quebec and Ontario have health science research agencies of some magnitude. The "Conseil de la recherche médicale" of Quebec and the Ontario Council of Health both have substantial programs for the support of research. These agencies have elected to provide support which is complementary to that provided by federal government agencies. In Quebec, for instance, emphasis is placed on "establishment grants" to provide for the basic research requirements, mainly equipment, of newly-recruited staff members during the initial year of their appointments to Quebec universities. In Ontario, applications relating to research into problems of specific provincial concern are given preference.

The Government of Ontario also contributes substantially to research in such areas as cancer, drug and alcoholism addiction, and mental disorders through provincially supported agencies in these fields. The known Provincial funds provided for university-based health science research total $4.6 million in 1971-72.

Voluntary Agencies

There are in Canada some 15 so-called "voluntary" agencies which support research with funds derived in large part from public donation. Their research interests are related to specific disease entities such as cancer, coronary disease, multiple sclerosis, arthritis and rheumatism. They have done a great deal not only in developing research in their specific areas of interest but in increasing public awareness of the value and need for health research.

Most of these agencies, like the Medical Research Council, rely on the peer assessment system in the allocation of their funds. A number of them, notably the National Cancer Institute and the Canadian Heart Foundations, also provide support for trainees and for career investigators.

A list of the major voluntary agencies in Canada is appended. Among them, they provide a total of some $10.5 million for health science research and training in the year 1971-72. There is close liaison, on an informed basis, between these agencies and the federal agencies which support health science research to ensure that investigators of high quality are funded but that duplication of funding is avoided.

The Universities

The universities themselves, in which the bulk of Canadian health science research is conducted, contribute substantially to the total effort. It is the universities which provide the salaries of the majority of those who carry out research, provide the library facilities, the animal facilities and the basic laboratory facilities and other "overhead" costs of research.

The universities are increasingly introducing special mechanisms to encourage research activity, and in particular to remove the barriers to interdisciplinary research.

Major Voluntary Agencies Supporting Health Science Research in Canada

Canadian Arthritis and Rheumatism Society
Canadian Association for Retarded Children
Canadian Cystic Fibrosis Foundation
Canadian Foundation for the Advancement of Therapeutics
Canadian Heart Foundation (a national body with provincial chapters)
Canadian Tuberculosis and Respiratory Disease Association
Multiple Sclerosis Society of Canada
Muscular Dystrophy Association of Canada
National Cancer Institute of Canada

The Atkinson Charitable Foundation
The Banting Research Foundation
The J.P. Bickell Foundation
The Traffic Injury Research Foundation

Prepared by the
Department of National Health and Welfare

SECTOR X – HEALTH SCIENCES

Introduction

The Department of National Health and Welfare is the principal federal agency involved with health matters. The Department has both a direct role in health activities and a supportive role to the provinces. Direct health care activities are concentrated mainly in the Medical Services Branch of the Department which provides health services to Indians and Eskimos, operates quarantine and immigration medical services, administrates the Civil Aviation Program for the Department of Transport, and provides medical counselling and emergency medical service to Federal Public Servants.

The Health Protection Branch is actively involved in health care by maintaining surveillance over the manufacture, advertising, packaging and distribution of foods, drugs, cosmetics and medical devices, as well as performing research in respect to standards for these items and potential health hazards represented by their use. Standards are also set in this Branch for clinical laboratory services, biological products, levels for radiation and environmental pollution as it affects human health.

Financial support to the provinces on a cost-sharing basis for hospital and medical insurance and health resources is provided by the Health Programs Branch. This Branch is also responsible for advisory services, coordination of programs and liaison activities with the provinces in such areas as Child and Maternal Health, Dental Health and Mental Health. A Directorate on the Non-Medical Use of Drugs, including alcohol and tobacco has recently been established.

In addition to the health activities of the Department of National Health and Welfare, treatment programs are also administered by the Departments of Veterans Affairs and National Defence. Statistics Canada is responsible for collection, analysis, and publication of national health statistics. The Medical Research Council administers a Grants-in-Aid Program for basic medical research.

Areas of Special Interest

A. Delivery of Health Care

The delivery of health care is essentially the responsibility of the Provinces of Canada and, as a rule, the primary point of contact by Canadians for entrance to the health care delivery system is through a physician in solo or group practice. Public health nurses in schools and local governments are actively involved in immunization programs, assessment, education of the public, and the delivery of selected home care services. Individuals use the emergency departments and organized clinics of selected hospitals as well as a primary point of service.

Practically all medical and hospital costs are met by universal, comprehensive, prepaid health insurance plans which are administered by each of the ten provinces and by the two territories. Coverage is thus available to the entire population, there are no disease exclusions and there are no limits on the benefits payable or days of care provided subject to medical need on the part of the patient. The central government finances one-half the cost of prepaid personal health services. Care in a tuberculosis hospital, an institution for the mentally ill, or nursing home is not included in the insurance program at this time, however, mental and tuberculosis care are insured by the provinces when rendered in non-acute care institutions. Other levels of care are available through private payment or on the basis of a means test. Dental and pharmacy services are the responsibility of individuals themselves, but voluntary insurance plans are available.

The physician-population ratio is 1 physician for 686 Canadians, and the number of acute and long-term treatment beds is approximately 7 per 1,000. Both physicians and patients have freedom of choice and the predominant method of remunerating physicians is in accordance with the schedule of fees for individual services rendered. Other forms of remuneration, including salary and capitation, do exist also but are not very common among private practitioners.

In spite of the excellence of the health provisions and vastly improved physician and bed ratios, the health care system is faced with problems. There is maldistribution of physicians both by region and specialty. As well, there has been a very rapid increase in costs of health services. Personal health services, including hospitals, physicians, dentists and prescribed drugs, now consume 5.2% of the Gross National Product, while in 1958 it was 3.4%. Much of this can be attributed to the improvement in physician-population ratio, catching up of salaries of hospital employees, technological change, and a period of inflation. Utilization rates for hospital and physician services increased slightly after the introduction of hospital and medical care insurance programs but have plateaued. In 1961 patient days per 1,000 population were 1,952 and 2,039 in 1968. Hospital insurance was introduced in 1958 and Medicare in 1968.

Both the Federal and Provincial Governments are directing their efforts to improving the cost/benefits of the health care system and in particular the efficiency of operations. It is now proposed, in principle, by the Federal Government to limit the growth rate of health services to the rate of increase of the Gross National Product. Health services in Canada are being looked at on an integrated basis rather than hospital services, physician services, etc.

While certain health statistics such as infant mortality, longevity may not compare as favourably as some other countries, the reason for this difference may be due to the wide dispersion of much of the population, the high number of automobile accidents, and a life style that has led to varying degrees of obesity, lack of physical exercise, and anxiety. While trying to improve efficiency and effectiveness of the health care system, governments are trying to make the Canadian public actively aware of the consequences of their own personal life style. There have been recent improvements in the infant mortality rate, longevity and other health indicators.

B. Family Planning and Laws Relating to Abortion

1. *Family Planning*

There have been several motivating forces behind the present family planning movement in Canada. These may be listed briefly as a growing concern for the health and well-being of the mother, the welfare of the child, the stability of the family unit, the rights of women and interest in population problems.

Although birth rates have been declining since 1957, (in 1957, 28.2 per 1,000 population; in 1970, 17.3 per 1,000 population) Canada's population doubled between 1933 and 1969, and forecasters predict that it will double again in about 35 years. Combined with increasing urbanization, this population growth places a tremendous burden on existing facilities and resources, and imposes physical and emotional stresses on the people involved. It therefore becomes increasingly necessary to ensure that family planning services are available to all citizens who desire them.

Child spacing and limitation of family size can help lift families out of the poverty cycle, reduce welfare dependency and child neglect, and increase human health and happiness by helping to ensure that every child is a wanted child. Another factor is the prevention of illegitimacy.

On September 18, 1970, the Minister of National Health and Welfare announced the initiation of a government-sponsored family planning program of public information, training and research. The specific aims of the program are:

(i) To inform Canadians about the purposes and methods of family planning so that the exercise of free individual choice will be based on adequate knowledge.

(ii) To promote the training of health and welfare professional and other staff involved in family planning services.

(iii) To promote relevant research in family planning, including population studies and research in human behaviour and reproductive physiology.

(iv) To support public or private family planning programs through federal grants-in-aid and joint federal-provincial shared cost programs.

(v) To cooperate with provincial health and welfare departments, professional organizations, universities and voluntary agencies in the achievement of the foregoing objectives and in ensuring the availability of family planning services and facilities to those who need and desire them.

Underlying these objectives is the government's growing concern with Canada's high rate of infant mortality and the allegedly high incidence of the unwanted child. The program will stress child-spacing and limitation of family size in an effort to achieve these ends.

The emphasis of the government's program is on making family planning information and services available to all citizens, with no suggestion of coercion. Family planning in Canada remains strictly a matter of choice for every individual and every family.

2. Abortion

Under a 1969 amendment to the Criminal Code, therapeutic abortion became legal in Canada under specific conditions. A qualified medical practitioner may legally terminate a pregnancy when, in the opinion of a therapeutic abortion committee of an accredited or approved hospital "the continuation of the pregnancy of such female person would or would be likely to endanger her life or health".

As the law does not require the board of a hospital to set up a therapeutic abortion committee, a considerable number of hospitals have not done so. According to the most recent information, only 143 out of 1,392 accredited hospitals in the 10 provinces and 2 Territories have therapeutic abortion committees. In the absence of any prescribed grounds for abortion, each therapeutic abortion committee must follow its own judgement in interpreting the meaning of "endangering . . . life or health". As a result, considerable variation is believed to exist among committees in the kind of supporting evidence that is required.

During the first full year following the Criminal Code amendment (i.e., the calendar year 1970), 11,200 therapeutic abortions were reported, representing about 3 per cent of live births. During the period January–June 1971, the latest period for which actual figures are available, 14,188 therapeutic abortions were reported, amounting to 7.6 per cent of live births. There were considerable variations in rates between Provinces.

C. Cancer Research

Cancer research in Canada is supported financially by two major granting agencies. The Medical Research Council whose activities in this area are discussed in another section of this brief, and the National Cancer Institute of Canada. The comments in this section will be devoted to this latter organization.

The National Cancer Institute of Canada is a private organization affiliated with the Canadian Cancer Society and administered by a Board of Directors and a National Office staff. The Executive Director of this Institute is Dr. R. M. Taylor. The work of the Institute is facilitated by a number of committees including the Clinical Advisory Committee, the Advisory Committee on Statistical Studies, the Advisory Committee on the Canadian

Tumour Reference Centre, the Research Advisory Groups and Panels on fellowships and grants.

The expenditures of the Institute in 1971 totalled $3,456,000. Of this $3,360,000 was devoted to cancer research and $96,000 to professional education. The Department of National Health and Welfare provided a grant of $250,000 in support of the Institute. In 1971, 97 grants were awarded to individual grantees for research projects under their direction. In addition, grants for research were awarded to research units at the Universities of Alberta, British Columbia, McGill and Western Ontario, as well as to the Montreal Cancer Institute and the Ontario Cancer Institute. The research supported by the Institute was carried out in all areas of the country from Newfoundland to British Columbia, and embraced most of the disciplines of modern biology.

The statistics in regard to deaths reported from malignant neoplasms in Canada in 1969 are shown in Table I.

D. Public Health Research

The National Health Grants Program established in 1948 was designed to promote a working relationship between the federal and provincial governments for the improvement of the health of all Canadians. Since public health is of concern to various levels of government, cooperation is needed to achieve the necessary balance among financial and administrative responsibilities not only in the delivery of health care, but also in its planning and evaluation. Within this activity, the Public Health Research Grant Program has been established to assist in stimulating and developing public health services in Canada. Under this program, annual grants-in-aid are made available to the provinces and territories of Canada to assist in the development, improvement and extension of health services for the people of Canada. Scientific research oriented to health with special relation to health needs and to provincial and federal health services is generally supported. This may take the form of epidemiologic surveys or deal with administrative problems peculiar to health services, and may be carried out in a university setting or in non-teaching institutions, as well as in various types of agencies. Projects are required to show a direct relationship to any of the following aspects of public health:

1. Prevention of disease, disability or death,
2. Promotion and preservation of health,
3. Epidemiological studies,
4. Community based studies in health services,
5. Operational research (e.g. in systems of delivery of Health Services),
6. Environmental health, including sanitation,
7. Personnel support.

E. Drug and Pharmaceutical Technology

Canadian industry has capabilities and knowledge in the following fields and would be interested in obtaining further related technology by exchange, including licensing:

1. Manufacturing of enzymes and antibiotics by fermentation processes on a large scale.
2. Synthesis of fine chemicals for pharmacological nutritional and animal feed uses.
3. Extraction of animal tissues for medicinal substances, including hormones, growth factors and blood coagulation factors.
4. Preparation of vaccines for prevention and treatment of human and animal diseases.
5. Manufacture of preparations for treatment of allergic and dermatological diseases.

6. Manufacture of diagnostic materials, including culture media and automated systems for analysis of blood, serum and other body materials and functions.
7. Synthesis of organic compounds having isotopic elements in specified molecular positions, for use in medical and physiological research.
8. Manufacture of pharmaceutical preparations in dosage form, human and veterinary, including controlled release types.

Research is proceeding in Canada on the following topics and exchange of knowledge might assist progress and hasten industrial development of medically useful products and processes:

1. Removal of Strontium and Cadmium from the human body by chelation, using alginates.
2. Development of an artificial kidney function unit for treatment of patients with kidney deficiency and for removal from the body of toxic materials such as hallucinogenic drugs.

F. Extraction Technology of Medically Useful Substances from the Sea

While Canada harvests a significant amount of seaweed and other marine materials, development of processes of extraction and of consequent manufactured products is at a very early stage. Technology is needed for extraction and for the further manufacture and use of a variety of substances so obtained which are known to be of value in medicine, in nutrition and in other fields.

Preparation coordinated by the
Department of National Health and Welfare
in collaboration with the
Department of Industry, Trade and Commerce.

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Sector XI – Space Research

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SECTOR XI – SPACE RESEARCH

History

Canadian space activities cover a broad range of scientific disciplines in the fields of basic and applied research and in the applications of space technology. Ballons were first employed in upper atmosphere research early in this century and ground-based research was used in studies of the aurora borealis as early as 1867. The use of sounding rockets as tools for upper atmospheric research in Canada commenced in 1957 in connection with the International Geophysical year. Satellite research was started in 1958 with the planning of Alouette I.

Canada's present reputation as a nation with advanced capabilities in space science technology stems primarily from the success of the Alouette-Isis series of ionospheric research satellites. Also of great importance has been the development of the Black Brant series of sounding rockets. The Churchill Research Range, originally constructed for the IGY program, is now operated under the direction of the NRC and is capable of launching 30 to 35 major sounding rockets per year.

The primary emphasis in Canada's space science programs is now in the fields of communications satellites and Earth resource sensing satellites. Canada's first domestic communication satellite, ANIK I, is scheduled to be launched from Cape Kennedy late in 1972.

Canadian Space Policy

Space science activities have developed primarily as in-house programs of the Federal Government. They have, furthermore, developed on departmental lines without any overall national policy. The various attempts which have been made to establish a national space policy can be summarized as follows: –

i) The Royal Commission on Government Organization (January 1963), which made a recommendation concerning the consolidation into a single agency of all government non-military space research.

ii) The Science Secretariat, which commissioned a technical study, Special Study No. 1, Upper Atmosphere and Space Programs in Canada (February 1967).

iii) The Science Council of Canada, which made specific recommendations to the Prime Minister in its Report No. 1, A Space Program for Canada (July 1967).

iv) Cabinet, which approved the formation of the Interdepartmental Committee on Resource Satellites and Remote Airborne Sensing in July 1969 and of the Interdepartmental Committee on Space in December 1969.

The Interdepartmental Committee on Space has, since its inception in December 1969, been almost entirely concerned with Canada's response to the NASA invitation for participation in the Post-Apollo program. The lack of any basic space science policy and the constitutional weakness of this Committee, particularly its lack of any financial power, have made it virtually impossible for the Committee to organize any significant response. It appeared, towards the end of 1971, that the U.S. itself might back away from the Post-Apollo program but President Nixon's decision to go ahead now makes it important that Canada establish a long-term space science policy. This matter will be a primary concern of the Ministry of State for Science and Technology.

Space Projects

A good general account of Canada's existing space programs is given in the NRC report, "Space and Upper Atmosphere Programs in Canada, Balloons, Rockets and Satellites, 1971" (SRFB 061 January 1972).

Expenditures on Space Science

No formal national space science budget exists since departments and agencies operate individually and space science is not treated as a program heading in the National Estimates. However, the Interdepartmental Committee on Space has prepared a rough approximation of the national space science budget for use in its annual report and this is included with this document.

TABLE I

Number of Deaths Reported from Malignant Neoplasms by Site and Sex, in Canada, 1969

Site	Male	Female
Buccal Cavity and Pharynx	463	148
Esophagus	365	143
Stomach	1,724	863
Intestine, except Rectum	1,576	1,881
Rectum	754	515
Larynx	194	22
Trachea, Bronchus, Lung (Primary)	4,025	682
Breast	19	2,751
Cervix Uteri	–	638
Uterus	–	466
Prostate	1,562	–
Urinary Organs	1,052	429
Skin	202	162
Brain	494	335
Leukemia and Aleukemia	788	536
Lymphatic and Haematopoietic Tissues	926	664
Bone and Connective Tissue	113	80
Other	2,223	2,832
TOTAL	16,480	13,147

Rate per 100,000 population: 140.7 – 156.0 (Male)
125.2 (Female)

Estimated Population of Canada 1969 (including Yukon and Northwest Territories) 21,061,000. All data taken from the annual report of the Dominion Bureau of Statistics.

Statement of Federal Government Expenditures on Space Activities ($ Millions), 1971-72 and 1972-73 (estimated)

Department of Communications	1971-72	1972-73
Spacecraft Technology and Satellite Operations	9.772	15.792
Satellite Communications Systems	1.144[1]	1.569[1]
Scientific Research Utilizing Satellites and Rockets	0.550	0.550
Earth Resource Technology Satellite Ground Station	1.199[2]	0.250[3]
TOTAL	12.665	18.161

[1] 0.270 recoverable from DRB not included

[2] 1.127 capital recoverable from EMR included

[3] 0.214 O&M recoverable from EMR included
0.300 capital to be provided by EMR not included

Department of Energy, Mines and Resources	1971-72	1972-73
Earth Resources Technology[1] Satellite (ERTS) experiments	5.127	2.210

[1] Includes airborne part of the program

Department of Industry, Trade and Commerce	1971-72	1972-73
Ground Stations for Satellite Communications Systems	0.200	0.200
Rocket Development	0.720	0.500
Reproducer for weather satellite pictures	0.070	0.070
Space environment simulator and test equipment	0.082	0.050
TOTAL	1.072	0.820

(All of the above expenditures are under the Defence Industry Productivity (DIP) Program)

Ministry of Transport	1971-72	1972-73
Satellite Communications and Surveillance Systems	0.090	0.500[1]
Space Related Meteorological Activities	0.229	0.468[2]
TOTAL	0.319	0.968

[1] In 1972-73 it is intended, subject to Cabinet approval, that a first payment will be made towards Canadian participation in the "Pre-operational Aeronautical Satellite Development Program".

[2] Although Meteorology is now within the Department of the Environment, it has been included this year under the Ministry of Transport. Th e sum of $240,000 is included in the 1972-73 estimates for the construction of two weather satellite read-out stations to be located at Halifax and Vancouver.

National Research Council	1971-72	1972-73
Intra-mural space oriented programs	3.150[1]	3.450[1]
Extra-mural (University) space oriented programs	0.800	0.800
TOTAL	3.950	4.250

[1] Includes cost of work reported on in pages 51-65 inclusive of SRFB061 with the exception of astronomy.

Department of National Defence/Defence Research Board

Intramural Programs	1971-72	1972-73
Tactical Satellite Communications	0.273[1]	0.370[1]
Studies related to Remote Sensing	0.217	0.282
Other space related research	0.164[2,3]	0.157[2,3]
TOTAL	0.654	0.809
Extramural Programs		
Defence Industrial Research	0.122	0.114[4]
University Grants Program	0.283[5]	Figures not available

1 This work is conducted at the Communications Research Centre of DOC but funded by the Defence Research Board on behalf of the Department of National Defence.

2 Some programs include non-space oriented components. The figures given are for the space oriented components only.

3 Includes $19,000 in 1971-72 and $11,000 in 1972-73 which are recoverable from DOC.

4 DIR programs for 1972-73 are subject to further review and approval. The estimate given here assumes approval at current rate of expenditure.

5 A total of 42 grants to Canadian Universities in 1971-72 under the DRB University Grants Program may be considered as space-related. The applications for grants in the 1972-73 fiscal year are still being processed and it is not possible to estimate the total expenditure at this time.

SECTOR XI – SPACE RESEARCH

The ISIS Satellite Program

The general objective of the ISIS program is to conduct comprehensive studies of the ionosphere. It involves making measurements over a range of heights and latitudes sufficient to determine conditions in the ionosphere and to achieve a full understanding of this region out to the magnetospheric boundary.

For this purpose it was arranged by means of a Memorandum of Understanding between the United States and Canada that Alouette I should be followed by up to four satellites, to be built in Canada and launched by the United States.

Alouette I

This spacecraft was launched from California on 29 September 1962. It was the first satellite to be designed and constructed in Canada and was launched by a U.S. Thor-Agena rocket as part of a joint space program between the U.S.A.'s National Aeronautics and Space Administration (NASA) and Canada's Defence Research Board (DRB). The satellite was designed and constructed by the Defence Research Telecommunications Establishment of the Defence Research Board, now the Communications Research Centre of the Department of Communications.

The satellite is spheroid-shaped, contains 4 experiments and is in a circular orbit at a height of 1,000 kilometers. The experiments are as follows:

Ionospheric Sounder

VLF Receiver

Cosmic Noise Receiver

Energetic Particle Counters

Alouette II

Alouette II was successfully launched on 29 November 1965. Orbital parameters are: inclination 79.8° perigee 502 kilometers, apogee 2,983 kilometers. Although it resembles its predecessor outwardly, Alouette II developed into a substantially different spacecraft because of the change in orbit and because of further information on the ionosphere gathered by Alouette I. The spacecraft contains five experiments, four similar to above plus a Langmuir Probe.

ISIS I

ISIS was launched from the Western Test Range, California, at 0646 GMT, 30 January 1969, into its prescribed orbit. Orbital parameters are: apogee 3,522.54 kilometers, perigee 573.72 kilometers, inclination 88.43 degrees, period 128.3 minutes. This was the third satellite to be designed and constructed in Canada and is the second in the ISIS (International Satellites for Ionospheric Studies) series. This spacecraft contains ten experiments which include a Soft Particle Spectrometer, Ion Mass Spectrometer, Cylindrical Electrostatic Probe, Spherical Electrostatic Analyzer.

ISIS II

ISIS II was launched from the Western Test Range, California, at 0257 GMT, 1 April 1971, into near nominal orbit. Orbital parameters are: apogee 1,423 kilometers, perigee 1,356 kilometers, inclination 88.16 degrees, period 113.55 minutes. This was the fourth satellite to be designed and constructed in Canada and is the third in the ISIS (International Satellites for Ionospheric Studies) series. This spacecraft contains twelve experiments.

In addition to spacecraft design, the ISIS program provides support service in the form of two telemetry stations and a data processing centre. One telemetry station is situated at Resolute Bay on Cornwallis Island and the other, as well as the data centre, at Ottawa. The Ottawa station is also the control station for all Canadian satellites.

SECTOR XI – SPACE RESEARCH (Aiii)

INTERNATIONAL COOPERATION

Churchill Research Range

The National Research Council of Canada operates the Churchill Research Range, which is used for studies of the upper atmosphere in the auroral zone by sounding rockets and balloons as well as by ground based instrumentation. The facilities of the Range have been used primarily by Canadian and American scientists. They have also been used by scientists from other countries. Should the Japanese wish to use these facilities, arrangements could undoubtedly be made. Generally speaking, third country scientists are charged something between incremental and a pro rata share of costs.

SECTOR XI – SPACE RESEARCH (Aiii)

EARTH OBSERVATION SATELLITES

Long-Range Planning:

The objective of the Canadian program of remote sensing from aircraft and satellites is the development of an operational information system that will enable more effective management of the Canadian environment and the optimum development of resources. As far as earth-observation satellites are concerned, several alternative or combinations of alternatives are being considered, which include:

(a) participation in NASA's post-ERTS program depending upon what it consists of (NASA has given no indication yet)

(b) design, development and launch of a Canadian satellite of the ERTS type but smaller in size, complexity and cost. The launch would have to be purchased because Canada is planning no launch facilities.

(c) other bilateral or multilateral cooperation in the design and development of an earth-observation satellite system (negotiations not yet started)

All of these approaches may include development of candidate sensors, ground read-out and data handling facilities and specialized or automated interpretative techniques and equipment.

International Cooperation:

Canada is cooperating with the United States in the ERTS experiment by reading out data about Canadian terrain and by distributing and interpreting such data.

Canada is interested in an international cooperative scheme of earth-observation satellites in which as many nations as possible can have meaningful participation not only in the interpretation of data but also in their acquisition (see attached paper entitled "Planning for a Global Remote Sensing Information System" which was presented at the 1971 Conference of the International Astronautical Federation in Brussels).

The Canadian International Development Agency, which has responsibility for assistance to developing nations, has indicated interest in the potential applications of remote sensing from satellites and aircraft.

Technical:

Canadian Cooperation with the ERTS Experiment:

A receiving station for reading out ERTS data over Canada has been constructed at Prince Albert, Saskatchewan (see report #9, Satellite and Ground Station Engineering) and will be ready for ERTS launch, May 30, 1972.

A Ground Data Handling System for processing data from both ERTS and airborne remote sensors is being established in Ottawa, Ontario.

A sophisticated photo processing unit is also being set up in the same GDHS building.

A unique Canadian contribution to this system is a Colour Laser Beam Image Reproducer/Scanner with built-in geometric correction capability. This particular unit, cost $600,000, is due for completion June 30, 1972. It will have a very large through-put capability with 4 film transports for film 9-1/2 inches wide. It will have the capability of producing 2 sets of false colour images from the 4 bands of multispectral data of ERTS. It will produce precision data at a speed which is as fast as the satellite can produce data.

Interpretation of the RBV and MSS data will be carried out by a large number of user agencies in national and provincial governments, universities and industries. Much of the initial interpretation will be visual, assisted by optical enhancement devices. The development of computer-assisted and automated techniques is being encouraged.

SECTOR XI – SPACE RESEARCH (Bi)

TELESAT

The Canadian domestic satellite communication system is expected to be in operation by the end of 1972. It will be the worlds first domestic satellite communication system using satellites in the geostationary orbit; 22,300 miles above the equator.

The spacecraft programme is proceeding to plan. The programme has advanced into qualification testing at the spacecraft level. During the summer months qualification testing at the unit and electronic equipment shelf level were successfully completed and in September the prototype spacecraft was submitted to vibration tests as a complete entity.

The flight spacecraft assembly is proceeding according to schedule. Both the F-1 and F-2 spacecraft structures built by Spar Aerospace Products Ltd., in Toronto were completed and have been shipped to Hughes Aircraft in California.

The first electronic equipment shelf which will carry the communications equipment of the satellite has been shipped to Northern Electric's new plant at Lucerne, Quebec, near Ottawa, where fabrication of electronic units has been underway since early this summer. Unit testing and installation is proceeding and delivery of the first flight model equipment shelf to Hughes Aircraft for integration with the F-1 structure is expected early in the new year.

The solar arrays for both the F-1 and F-2 spacecraft have been constructed and are awaiting installation at Hughes Aircraft and the hydrazine tanks and reaction control equipment are currently being installed in the F-1 spacecraft.

The launch vehicle chosen for the Telesat project is a modified, thrust-augmented Thor Delta. The vehicle has been renamed the Delta 1913, or the Eight-Foot Delta reflecting the modifications.

Work on the baseline system of some 35 earth stations with which Telesat will begin commercial operations is well underway.

At Allan Park, Ontario the building for the system's master heavy route (HR) station is now enclosed and initial occupancy of the building should take place in December of this year. Construction of the second HR station at Lake Cowichan on Vancouver Island is about six weeks behind Allan Park.

The design and manufacture for the HR, Network Television (NTV), and Northern Telecommunications (NTC) station electronics is proceeding on schedule, and RCA has started construction on all six NTV sites.

Telesat's contractors have completed site preparation and foundation work at all the remote television (RTV) earth station sites in western and northwestern Canada and the installation of antennas and station electronics will begin in the summer of 1972. In eastern Canada engineering and site preparation is progressing at Sept-Iles, Port-au-Port, Goose Bay and the Magdalen Islands.

Even as the initial system of domestic satellite communications with which the corporation will begin commercial operations is nearing completion, studies for possible future expansion of the services offered are underway.

Telesat is currently working with Bell Canada, CN-CP Telecommunications, the CBC and the Department of Communications studying the feasibility of establishing a system of thin-route satellite communications to provide low-density long distance telephone service and radio program service for a number of very small communities in Northern Ontario, Quebec, Labrador and The Territories. Construction of two such thin-route earth stations is expected in early 1973, with the possibility of building an additional 15 within a two year period.

SECTOR XI – SPACE RESEARCH (Bii)

Communications Technology Satellite

The Department of Communications, in cooperation with the U.S. Space Agency has undertaken an experimental project that will carry Canadian technology into the second generation of communications satellites.

The project to launch a high-powered communications satellite into geostationary orbit in 1975 is the subject of a memorandum of understanding signed by officials of the Department of Communications and NASA.

The Communications Technology Satellite (CTS) will be designed and built in Canada.

DOC's Communications Research Centre at Shirley Bay will provide much of the design and management skill for the assembling of the satellite. Canadian industry will supply sub-system expertise and NASA will supply a launch vehicle (a Thor-Delta rocket) and access to some advanced electronic components.

The importance of the new project, is that it will put Canada in the forefront of technology that promises to revolutionize space communications as much as the first generation of geostationary satellites did.

The program offers Canada the following advantages:

– it will keep the Canadian aerospace industry abreast of the latest developments in sub-systems for communications satellites and associated ground installations;
– it will allow Canada to conduct operational experiments with small ground terminals in remote parts of the country.

The most important difference between this experimental satellite project and those that are already operating for Intelsat or those like Anik, that will be operating for Telesat over Canada in two years, is in the power of the signal transmitted by the space segment.

The signal power radiated back to earth from a transponder in the ANIK series will be 6 watts. In the CTS output is 200 watts.

This means that much less expensive ground stations, perhaps no more complicated than those used by CATV systems, will be possible.

Cheaper ground stations mean, in turn, more communities can be served.

At the heart of the experimental high-powered satellite is a new Travelling Wave Tube being developed in the U.S.A. This high-powered tube operates in the 12 gigahertz frequency range (super-high frequency).

Another new feature in the CTS is the experimental ion-thruster which will be used for station-keeping operations. The use of electrically accelerated atoms instead of pressurized propellants reduces fuel load in the satellite and extends the lifetime in orbit.

Private industry will build sub-systems under contract.

The vehicle will be assembled at the Communication Research Centre in a new high-bay facilities. This mixture of government and industry expertise parallels the arrangement that led to the launching of Canada's highly successful Alouette series.

SECTOR XI – SPACE RESEARCH (Biii)

AEROSATELLITE SYSTEM

To ensure that Canada maintains its present position in the control of North Atlantic air traffic which is intimately related to Canadian domestic air space, Canada will participate in the development of the international pre-operational aeronautical satellite system by contributing 10.5 million dollars to the multi-national programme over a period of approximately seven years. In view of Canada's demonstrated expertise in satellite systems it is expected that a major proportion of this will be spent in Canada. Furthermore, the deployment of the system over the Pacific will significantly assist the development of transportation in an area of important and growing interest to Canada.

In the future, satellites are likely also to provide the facility for control of and communications with aircraft over land areas now served by conventional means, and areas such as the Canadian Arctic where service now exists only on a reduced basis. Pressures will undoubtedly arise in time for the introduction of a system of this kind in this continent and it is important that Canada maintain its competence and influence in the technological and operational aspects in order to play its proper part in such a development.

Such an experimental programme is required to investigate the unique problems associated with satellite communications directly to mobile terminals, particularly aircraft, and with the special instrumentation for determining aircraft position. This experience cannot be obtained from existing or planned communications satellites such as INTELSAT or the Canadian Domestic Satellite.

In order to improve oceanic air traffic services, the Aeronautical Pre-Operational Satellite System has the following objectives:

(a) To permit evaluation of technical and operational performance of voice and data communications between the ground and aircraft over the Atlantic and Pacific Oceans.

(b) To provide pre-operational experience in technical, operational and managerial areas, which is required in advance of establishing a fully operational communication and air traffic control system.

(c) To permit experimental evaluation of the use of position data by the air traffic controller as means of reducing separation standards and by the pilot as another means of navigation.

(d) To obtain data necessary for ICAO to develop the necessary standards and recommended practices.

(e) To establish through full scale experimentation the information required for an operational satellite capability.

(f) To permit the carrying out of other experiments that may be required.

SECTOR XI – SPACE RESEARCH

CANADA'S APPROACH TO REMOTE SENSING

By L. W. MORLEY*

ABSTRACT

Canada, like many other nations, is somewhat overwhelmed by the technological explosion in remote sensing. It combines aspects of three other burgeoning technologies: space technology, sensor technology and automatic data processing. Were it not for the fact that remote sensing bears promise of becoming an enormously powerful tool for gathering and sorting vast quantities of information on resources and the environment (two areas of vital concern to all governments), it would be dismissed as a luxury which Canada could not afford.

Rather than assuming a laissez-faire policy towards the development of remote sensing in Canada, attempts are being made at the federal and provincial levels, to coordinate a rational development based on the following principles:

(1) That organizational planning should proceed on the assumption that remote sensing is not a transitory fashion, and that it should therefore be established on an operational basis.
(2) That the potential impact of remote sensing on methods of management of resources and the environment is of such importance that total systems planning from sensor and sensor platform development through to the decision-making stages should be undertaken.
(3) That in such planning, every possible use should be made of available resources and organizational structures to achieve an orderly evolution.
(4) That the high cost of the technology dictates intergovernmental, interdisciplinary and interagency sharing of facilities when and if possible.
(5) And that the overall objective is to provide an economic and effective information system which can respond rapidly to the needs of resource and environment managers and policy makers.

Canada's progress towards accomplishing these ends is the subject of this paper.

The planned United States launching of the world's first resource satellite in March 1972 provides a keystone around which the Canadian program is organized.

*Director, Remote Sensing Centre, Department of Energy, Mines and Resources, Ottawa, Canada.

Introduction

Although well advanced in conventional aerial survey methods and photogrammetry as well as in airborne geophysics, Canada has had little experience in Remote Sensing using multiband techniques and computer enhancement of data. During the last five years a limited amount of IR scanning and multispectral photography has been done. However, we do have a large territory to be covered and we have a large community of resource-oriented and environmental scientists and engineers ready to put the ERTS data to work when it is received.

For the past 18 months we have been involved in a fairly extensive planning operation, so that what is presented here is not what we have done in remote sensing, but what we plan to do.

Organization for Planning

Canadians first became aware of developments in Remote Sensing in 1963 through the medium of the Symposia on Remote Sensing sponsored by the Willow Run Laboratories of the University of Michigan. At that time IR scanners were classified and it was difficult to convince authorities of the usefulness of the method without Canadian examples. Proposals were put in to the government to set up remote sensing facilities in Canada, but they got nowhere because of the expense of the technology involved, failure to prove a favourable cost/benefit ratio and the lack of coordinated proposals by various agencies wanting similar equipment and facilities.

Later when the EROS and ERTS programs were proposed, these helped considerably, because, while it was conceivable that each concerned agency might run its own independent aircraft program, it was quite obvious that they each could not afford to run their own independent resource satellite programs even if the satellite was being supplied by NASA.

This led to the setting up of an interdepartmental Committee on Resource Satellites and Remote Airborne Sensing.

To illustrate the widespread interest in this program in Canada, there are no fewer than 17 federal government agencies represented on this committee which has been in existence since September 1969. The senior policy committee is supported by a full-time secretariat called the Program Planning Office.

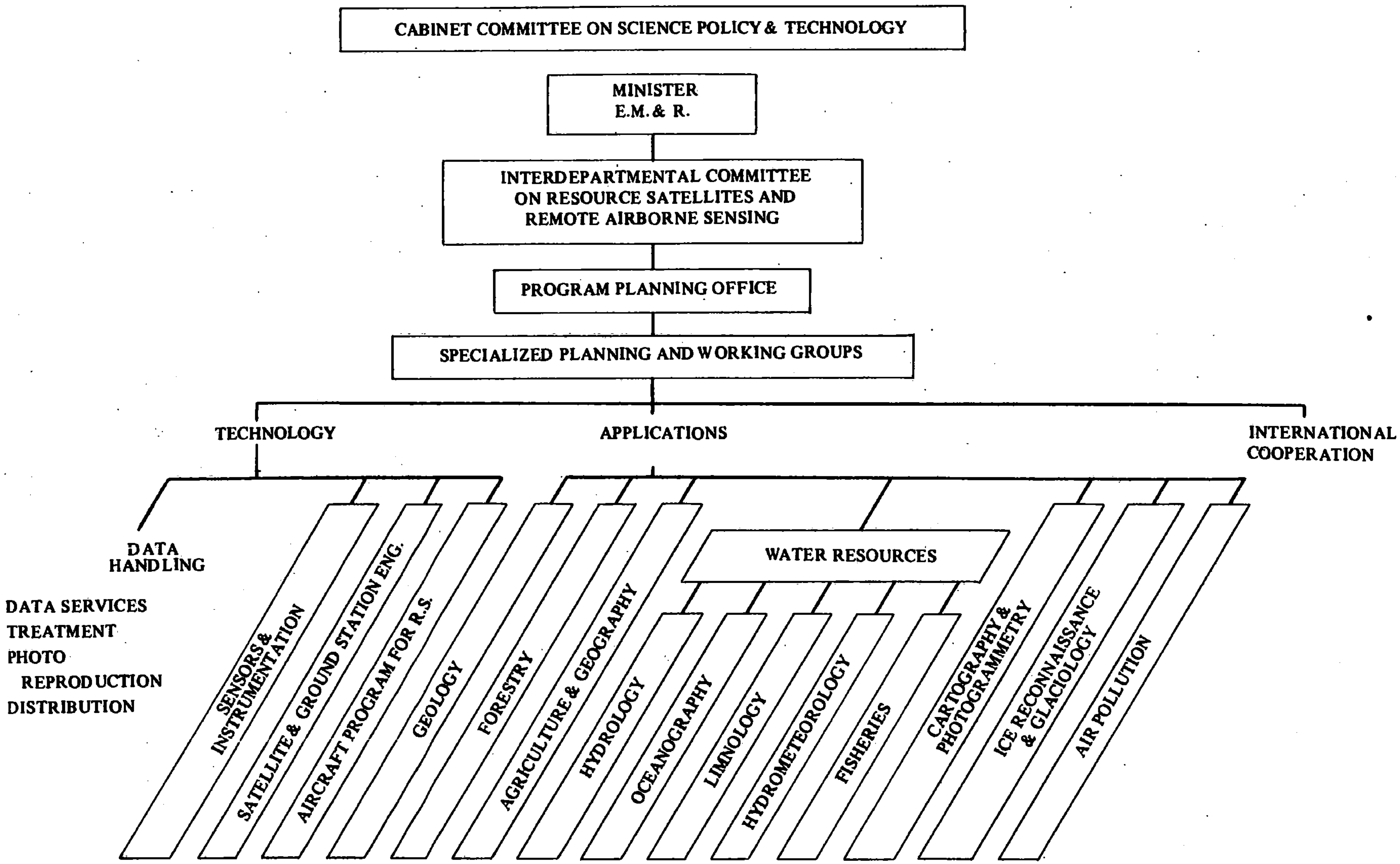
The Program Planning Office proceeded to set up 13 ad hoc working groups in the areas named in Figure 1, consisting of technically experienced advisers from government, university and industry. There were from 10-15 members on each working group so that all-in-all there were nearly 200 scientists and engineers involved. As well as getting advice from these working groups about what to do about Remote Sensing in general and ERTS in particular, they served as an excellent education medium.

The work of all these working groups has been completed and their reports are now being printed for publication.

In a couple of months, it is expected that this whole ad hoc organization will be replaced by a permanent Remote Sensing Centre and a Canadian Committee on Remote Sensing which will have provincial as well as federal representation and which will also have a subcommittee structure similar to that in Figure 1.

Since Canada has no space agency under which this program can be placed, it is necessary to set up what must seem like a rather elaborate committee structure to achieve adequate liaison. While the lead agency in this operation is the Department of Energy, Mines and Resources, a concerted effort is being made to give the organization an interdepartmental image – even to the extent of shared management and funding responsibilities.

Some funds were made available to the Program Planning Office last year for travelling expenses of all these working groups, for engineering studies, for a small aircraft program and for Phase "A" studies on a sensor development program.



INTERIM PLANNING ORGANIZATION

FOR

RESOURCE SATELLITES & REMOTE AIRBORNE SENSING

FIG. 1

Plans for a National Program are now nearly complete and, of course, it is obvious that they centre around the ERTS program as the keystone.

The elements of the proposed program are as follows:

(1) The establishment of a National Facility in Remote Sensing to be known as the Remote Sensing Centre. The lead agency will be the Department of Energy, Mines and Resources.

(2) The conversion of an existing 85-foot diameter parabolic antenna at Prince Albert, Saskatchewan to serve as a dedicated satellite receiving station for ERTS data. This work is being managed by our Department of Communications who have contracted out to the University of Saskatchewan.

(3) A Ground Data Handling Centre capable of photogrammetrically correcting ERTS data as well as line-scan data from aircraft. This centre will be in Ottawa and will be located in the same building as:

(A) An enlarged Air Photo Production Unit (APPU) of the Surveys and Mapping Branch. This unit, for 20 years has been responsible for the reproduction of all aerial photographs in Canada (with the exception of some provincial organizations). It is expected that as a result of the Remote Sensing Program, the throughput of the APPU will be nearly doubled.

(B) An expanded Air Photo Library: This library for 30 years has been the national repository for aerial photographs in Canada and it has been possible for the public to get copies of any aerial photos taken in Canada for the cost of reproduction. It will now distribute remote sensing and ERTS data.

(4) An Aircraft Program: During last year and again this year, a limited aircraft program will be carried out. Multispectral photography, super-wide angle cameras and IR scanners will be used. Areas have been selected by the working groups and ground truth programs will be undertaken by users.

(5) A sensor development program in which industry and university laboratories are being funded to conceive and develop novel sensors to meet specific user needs. (This was in operation last year and is being continued this year).

(6) A research program into methods of enhancing remotely sensed data, automatic methods of extracting information and displaying results. (This has not yet been started).

(7) The establishment of regional interpretation centres for conducting interpretations of available data within the area of their geographical jurisdiction is being considered by some provinces.

(8) The reinforcement of existing specialty centres for photo-interpretation to be enlarged in scope for the interpretation of remote sensing data and ERTS data. For example the interpretation laboratory of the Forest Management Institute will be enlarged. Two specialty centres in water resources – one at the new Canadian Centre for Inland Waters for limnology and another in Ottawa for hydrology. The Canada Department of Agriculture will consolidate and enhance its interpretation capability.

(9) To cooperate internationally in a longer-term look at requirements for future resource satellites and remote airborne sensing.

(10) The designation of ERTS test areas in Canada where interested agencies will undertake ground truth studies in conjunction with airborne and ERTS surveys.

(11) The establishment of a Canadian Committee on Remote Sensing to be responsible, through the Deputy Minister, Energy, Mines and Resources for governing the National Program on Remote Sensing and vetting the activities of the Remote Sensing Centre.

(12) An incipient program on data re-transmission being collectively undertaken by several interested agencies.

Proposal to NASA

Canada has proposed to NASA 75 test areas in Canada where ground truth, and in many cases airborne work, will be done during or before ERTS orbit.

In order to take the load of receiving and handling all this data of NASA, Canada has also proposed adapting an existing ground receiving station in Central Canada (at Prince Albert, Saskatchewan) for ERTS reception, a data handling centre to be located in Ottawa is also proposed.

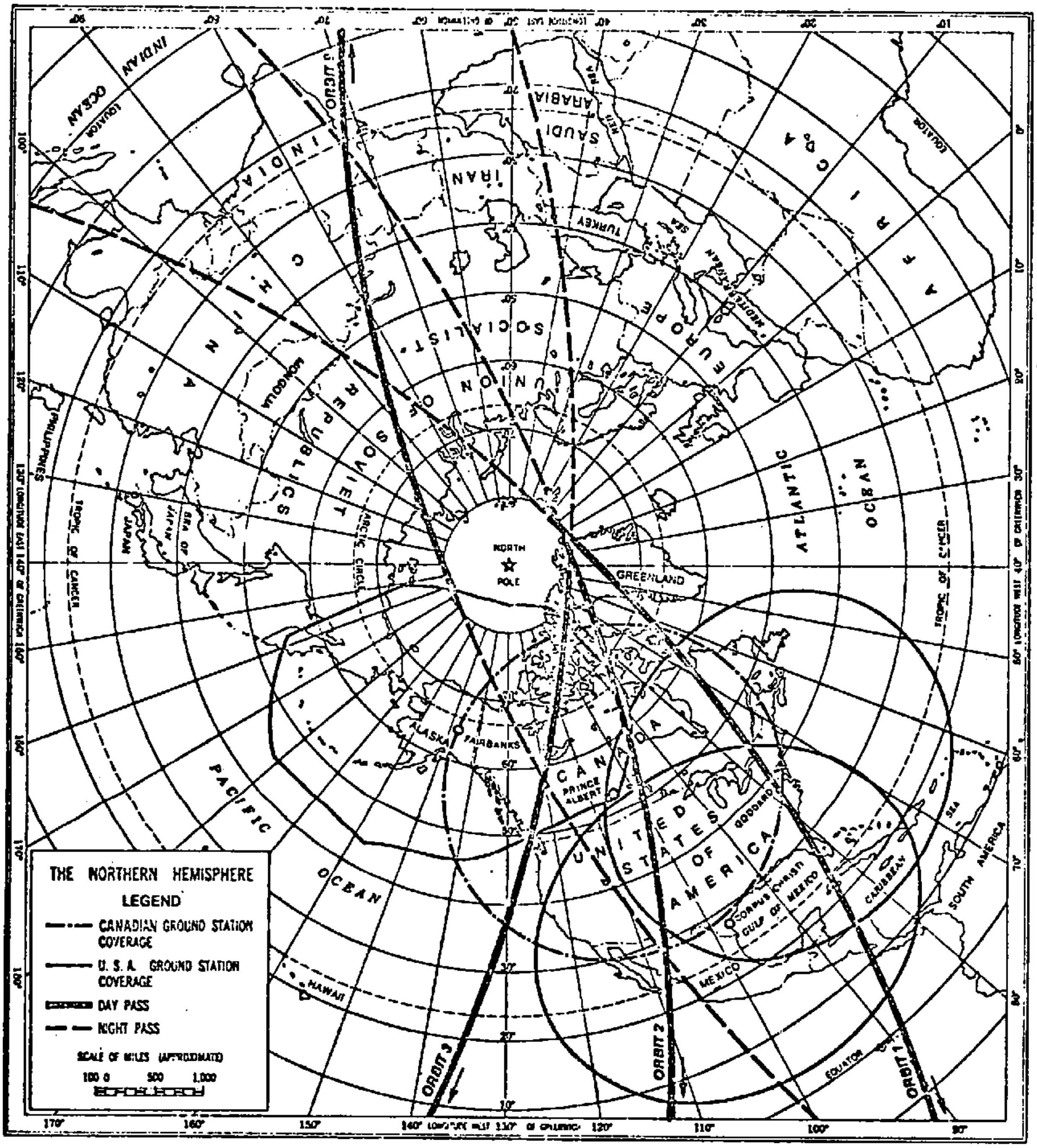


FIG. 2

Figure 2 shows the range circle of the Prince Albert Station in relation to the proposed NASA stations at Goddard, Fairbanks and Corpus Christie.

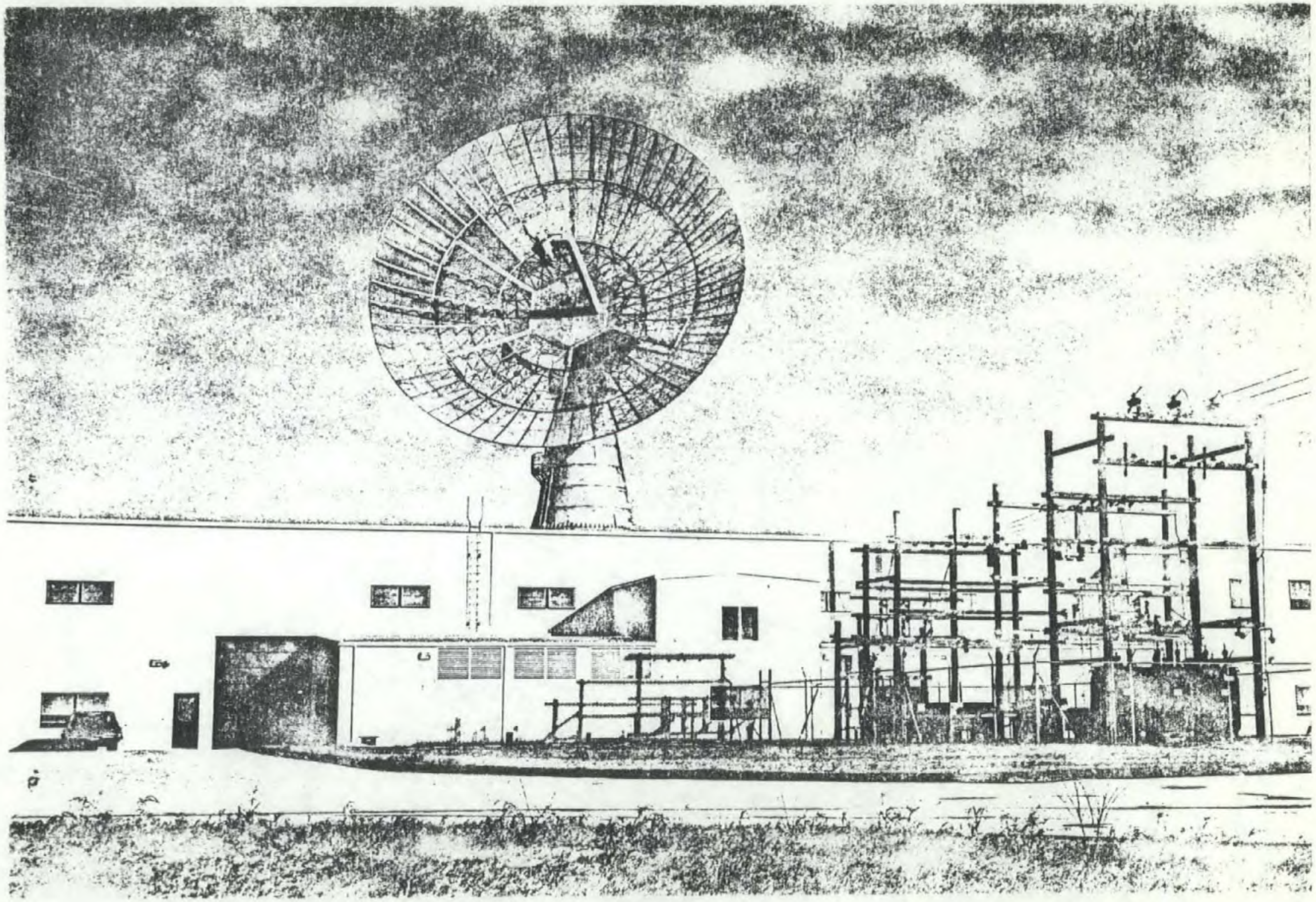


FIG. 3

Tapes from Prince Albert will be air expressed to Ottawa where they will be photogrammetrically corrected by comparison with planimetry from 1:250,000 maps.

The same type of tape recorders will be used at Prince Albert as at Goddard so that tapes can be interchanged between Prince Albert and Goddard.

Since Canada wishes to get as much data as possible of Canada terrain, NASA has been requested to switch to the direct mode over Canada as much as possible. This would of course be subject to power budget problems on the satellite, also to needs to read out taped data from Fairbanks or Goddard while passing over Canadian terrain and finally subject to calibration requirements in the M.S.S. sensor.

Orbital parameters and "predicts" will be requested from NASA so that the Prince Albert Station can acquire the satellite as it appears over the northern horizon. Auto tracking will be employed once the signal is detected. Both the housekeeping and 2.2 GHz data will be recorded.

Although the D.C.P. data from the six Canadian ground data platforms will be received, Canada will not have the capability of unscrambling, and NASA has been requested to do this.

The Communications Research Centre of the Department of Communications which is managing the Prince Albert Radar Station is planning a quick-look facility there using a high resolution C.R.T.

A full study of what is required to be done to convert the Prince Albert Station for ERTS use has been completed and a contract will shortly be let to have the work carried out.

As far as a permanent Resource Satellite Receiving Station for Canada is concerned, Churchill, Manitoba would have been a better location as far as coverage is concerned, but for this experimental program, it was decided to economize by using an existing station. This, incidentally is a surplus dish at Prince Albert which was used up until five years ago for research on radio propagation through the auroral zone. Since proposals for moving earth resources satellite frequencies from 2.2 GHz to 8 GHz and even 22 to provide for wider band width, the Prince Albert dish will probably be rendered obsolete for the Post ERTS resource satellites.

Cloud Cover Studies

R. O. Chipman of the Program Planning Office conducted studies on cloud cover and sun angle and came up with the following probabilities for ERTS coverage with less than 10% cloud cover.

TOTAL PICTURES PER SEASON PER AREA (342,000 KM^2)

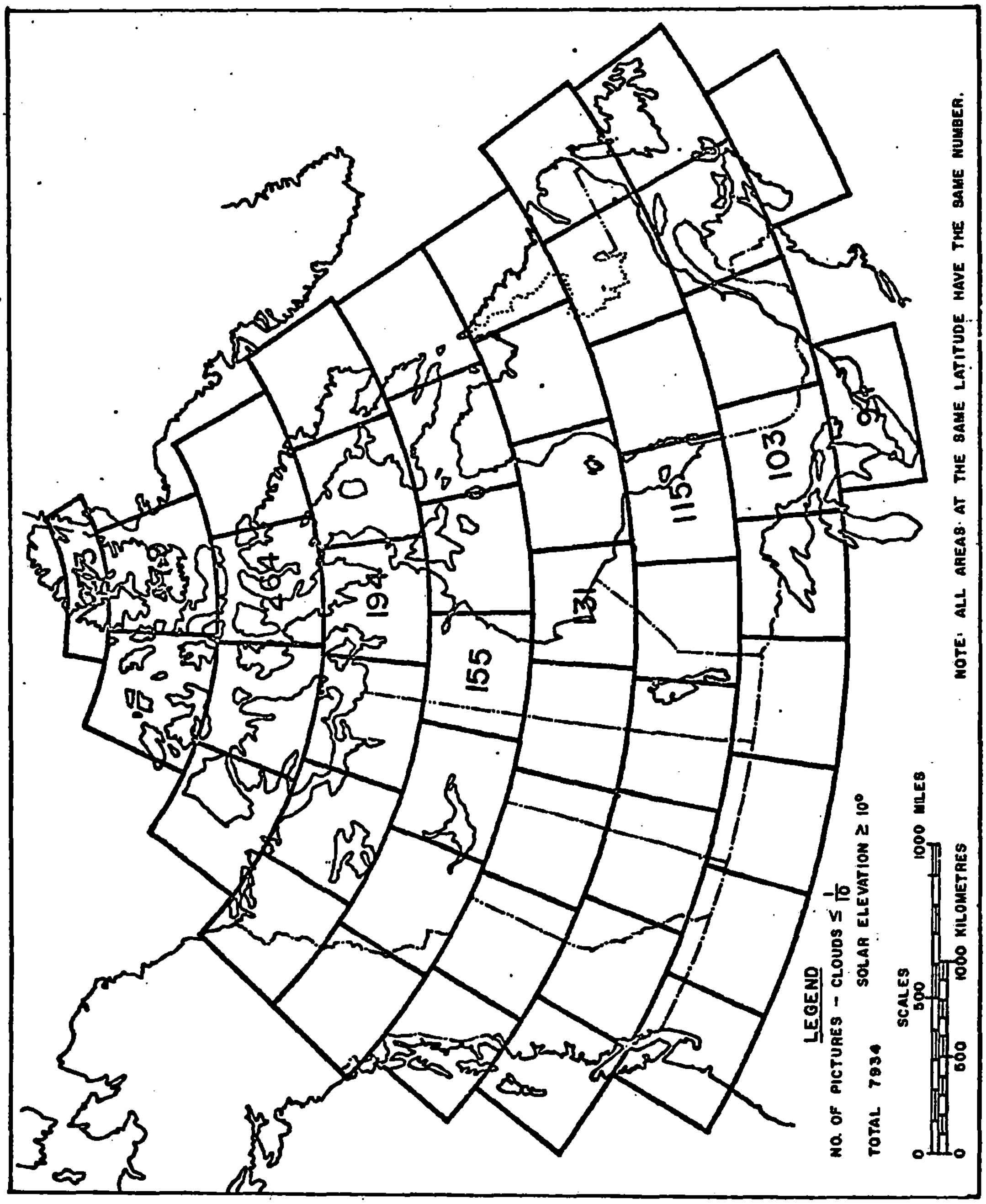


FIG.4

Figure 4 shows the total number of ERTS scenes per season at each latitude. Notice how the number sharply increases as you proceed north due to the converging orbits near the pole. However, there is a cap right over the pole of 8°, over which the satellite never passes.

CLOUD FREE PICTURES - SUMMER

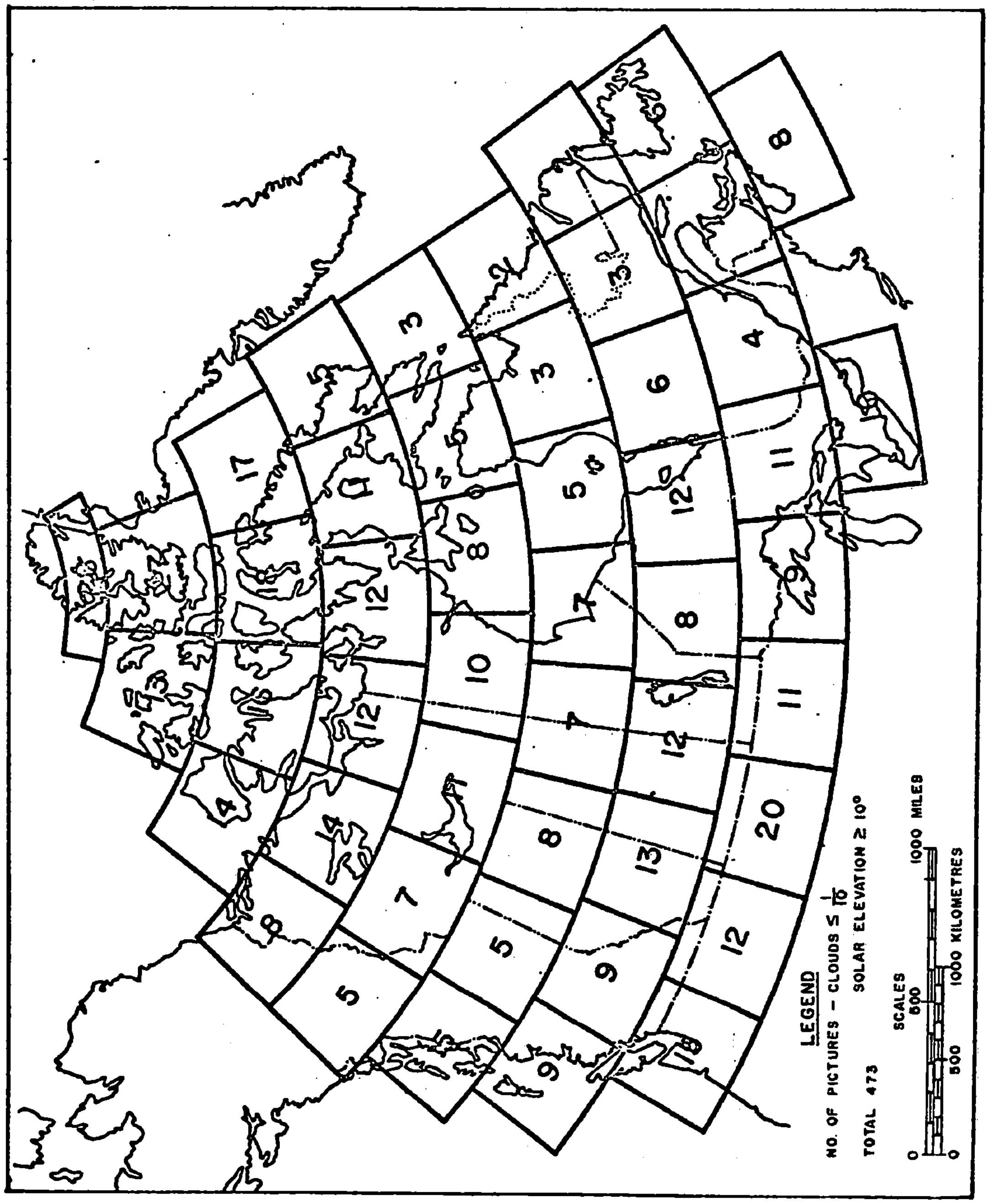


FIG. 5

Figure 5 shows the number of pictures in each 10-scene cell expected in the summer season, taking into effect cloud cover and sun angle. When the sun angle is less than 10° it is assumed that no imagery could be obtained.

There is concern that the combination of snow cover and a reasonably high sun angle will saturate the sensor systems allowing no usable imagery at these times.

The Ground Data Handling System

This is by far the biggest problem – how to convert the taped data into geometrically accurate imagery. It is also the most expensive.

There are, essentially, two types of tapes to deal with: (1) the pulse code modulated tapes from the multi-spectral line scanner and (2) the video tapes from the R.B.V. The data rates are fantastically high and there are four bands from the M.S.S. and 3 from the R.B.V.'s to deal with. Custom tape recorders developed by Ampex and RCA respectively are required for the job and they are both major pieces of machinery.

The simplest way to get imagery would be to display it on a C.R.T. as is done with the APT pictures, but this can't be done without a great loss of resolution. Electron beam recorders or laser beam recorders in which the beams play directly on to the film rather than on to the phosphor of a C.R.T. are used. This is relatively new technology and is having to be specially adapted for ERTS.

Before displaying the imagery either on a C.R.T. or on to film, it is necessary, in the case of the scanner data to demultiplex and transform it to analog form from the pulse code modulated form. When it is printed out, it will be in a distorted form. Corrections have to be made to make the imagery conform with proper map coordinates. This is where the complication and expense arises. There is not space here to discuss the Canadian ground data handling system. Suffice it to say that it is very similar to the NASA system with a few exceptions:

(1) It will use an LBIR as its basic recorder rather than an E.B.R. This LBIR is capable of burning colour directly on to a colour film or alternatively it can burn black and white from one spectral band on to a pan film.

(2) The LBIR will have a double film transport which will allow for overlap on the 100 X 100 n.m. scenes and will also provide for annotation.

(3) While the MSS data should be as accurate as NASA's precision data, the same will not be true for the RBV data. Our RBV data will be corrected for obliquity and scale distortion and some of the pin-cushion distortion. We do not expect to be able therefore to make colour composites of the RBV data.

(4) The GDHC will be designed to handle airborne data as well as ERTS.

Air Photo Production Unit

Rather than setting up separate facilities for photographic processing, it is planned to use the facilities of the Air Photo Production Unit of our Surveys and Mapping branch. For 20 years they have been responsible for reproducing aerial photos of Canada to meet customer needs.

With ERTS it is expected that their through-put will double.

It is planned to move this unit into the same building as the Ground Data Handling Centre, as it is obvious the two must work very closely together. New automatic processors, step and repeat printers and composite printers are on order. This unit will handle all the airborne remote sensing data as well as the ERTS data and of course the normal air photo requirements. It will build up to a total staff of about 60 in the next two years.

The National Air Photo Library

Closely associated with the APPU is the National Air Photo Library operated also by the Surveys and Mapping Branch.

This library will essentially be the marketing agent for Airborne Remote Sensing Data and for ERTS data as well as for the normal air photography. Copies of all these data will be made available to the public and the cost of reproduction.

The Aircraft Program

On this program last year there was one CF-100 aircraft operated by the Canadian Forces. The CF-100 has a 400 lb. payload, carries the pilot and camera operator/navigator, has a range of 1000 miles and an operating ceiling of 45,000 feet. The Air Force supplies a/c maintenance, flying, airframe engineers, avionics technicians, mission planning, hangerage, etc.

This year there will be one CF-100, one DC-3 and a small single engined aircraft for detailed work.

Next year it is hoped to expand to 3 CF-100's, 2 DC-3's and 2 small aircraft.

The main sensors are super-wide angle 9" x 9" cameras, 70 mm. multispectral pods and IR line-scanners. Multispectral line scanners will be acquired.

A Sensor Development Program

On the basis of parameter studies carried out by the 7 user groups, requests for proposals were put out to industry and university labs for novel sensing devices to measure any of these parameters from aircraft or spacecraft. Fifty-four proposals were received and 11 were funded for phase "A" studies. Nine of these 11 are being re-funded this year for phase "B".

Again, there is not space here to describe them, but there is a publication coming out which will do so. Many of them use laser technology, some imaging tubes, some microwave. Air pollution, water pollution, sea-ice thickness and water vapor content are some of the applications.

The Establishment of Regional Interpretation Centers

There are two main reasons for promoting the establishment of Regional Interpretation Centers:

(1) In Canada, the administration of resources and responsibility for the control of the environment comes under the jurisdiction of the provinces within their respective borders. End users and decision makers are mainly located within provincial administrations. By establishing regional centres of expertise in interpretation, it should be possible to get closer to the decision makers. Experience in photo interpretation shows that interpreters who have local knowledge of an area make the best interpreters.

(2) While initially, it is expected that the bottleneck will move down from data acquisition to data correction and data reproduction, ultimately it will be in interpretation. Decentralization should alleviate this anticipated bottleneck. Such decentralization provides for greater "grass-roots" participation which is obviously an important goal to achieve.

It is expected that these regional centres would be autonomously operated by the provinces or groups of provinces. The provinces are just beginning to get organized on an interdisciplinary basis for the purpose of examining their needs.

Specialty Interpretation Centres

Several of the discipline-oriented federal departments already have air photo and remote sensing interpretation facilities specifically oriented towards their own missions. For example, the Forest Management Institute of the Department of Fisheries and Forestry has for many years been active in airphoto and remote sensing analysis. They are presently expanding and equipping themselves to handle ERTS and new RS data.

The Inland Waters Branch of the Department of Fisheries and Forestry is planning specialty centres for Remote Sensing – one in limnology, to be located at the Canada Centre for Inland Waters, Burlington, Ontario and the other in hydrology to be located in Ottawa.

The Burlington Group together with the Meteorological Branch located in Toronto are the two main Canadian participants in the international Field Year for the Great Lakes, which also starts in 1972.

International Cooperation in Remote Sensing

Up to the present, Canada has participated very little internationally, at least at the official level, in remote sensing activities, for the simple reason that no viable domestic program has existed. As capability and ideas are developed, fuller international participation is expected.

In the abstract it is stated that plans are being made under the assumption that remote sensing is here to stay. It follows that if Canada is going to the expense of putting up a data handling centre and a readout station, she is interested in what follows after ERTS. If for one reason or another the successor to ERTS is not suited to Canadian needs nor to the needs of some other countries, I would guess that we would be in the market for international cooperation in a resource satellite that does meet our needs. Alternatively, if the successor to ERTS looks good for Canada except for some minor modifications, I would also guess that we might like to buy into it in order to influence the design. I should hasten to add that this is only my personal opinion and is not official policy.

ERTS Test Areas

In response to NASA's request for test areas, 75 test areas were proposed in Canada as shown in figures 6, 7, 8, 9 and 10.

In most cases these areas were not put up primarily because of ERTS. They are areas where various agencies are planning to do their normal work during the period of ERTS. ERTS data will simply be auxiliary or complementary to the ground and airborne data they already have and will be getting.

Using these people has several advantages over transitory short-term investigations: Experienced professionals in their fields of endeavour are employed. They will be able to place the Remote Sensing Data in its proper context and they already have contact with the decision makers in their areas. The disadvantage is that some of them may be inclined to be conservative in their approach to these data but this can and must be overcome.

Canadian Committee on Remote Sensing

In order to coordinate this expensive national activity – to try to avoid duplication and to share in research costs, it is planned to establish a Canadian Committee on Remote Sensing which will govern the activities of the Remote Sensing Centre or National Facility. The membership of this Committee will be comprised of representatives of provincial and federal organizations, as well as universities and industry. It will be organized somewhat along the lines of the various working groups of the PPO (Figure 1) with a subcommittee structure to ensure wide representation.

Conclusion

While earth-oriented observations are of considerable scientific interest, the main motivation behind the Canadian program in the next few years is the prospect of an operational information system for resources management and environmental control.

Thus the Canadian Program, rather than considering it as part of a space science program, it is more appropriate to consider it as a very applied R & D effort in resource and environmental management. A concerted attempt will be made to achieve a proper balance between airborne, spaceborne and surface data collection on the one hand and between hardware development and interpretation on the other hand.

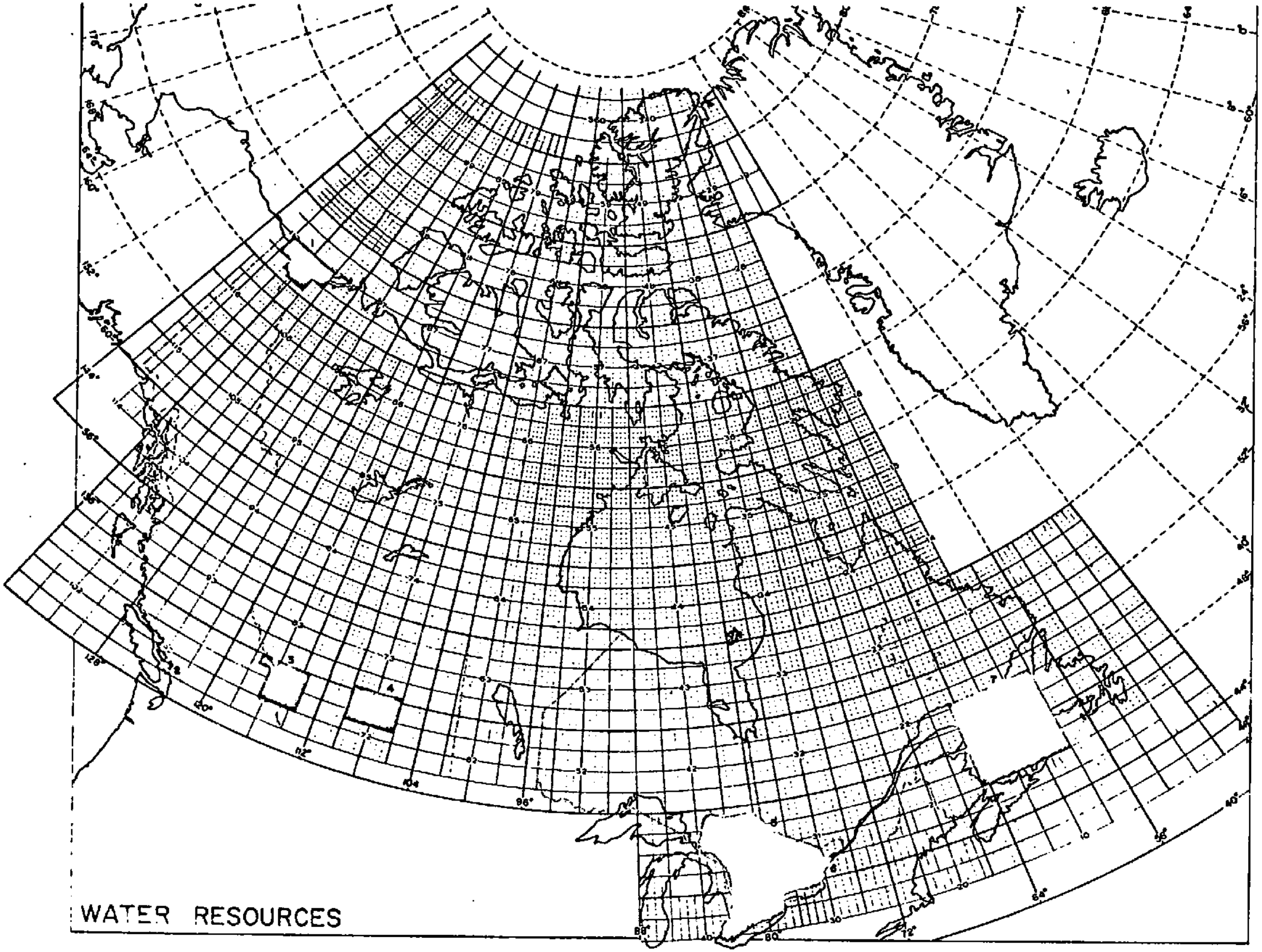


FIG. 6

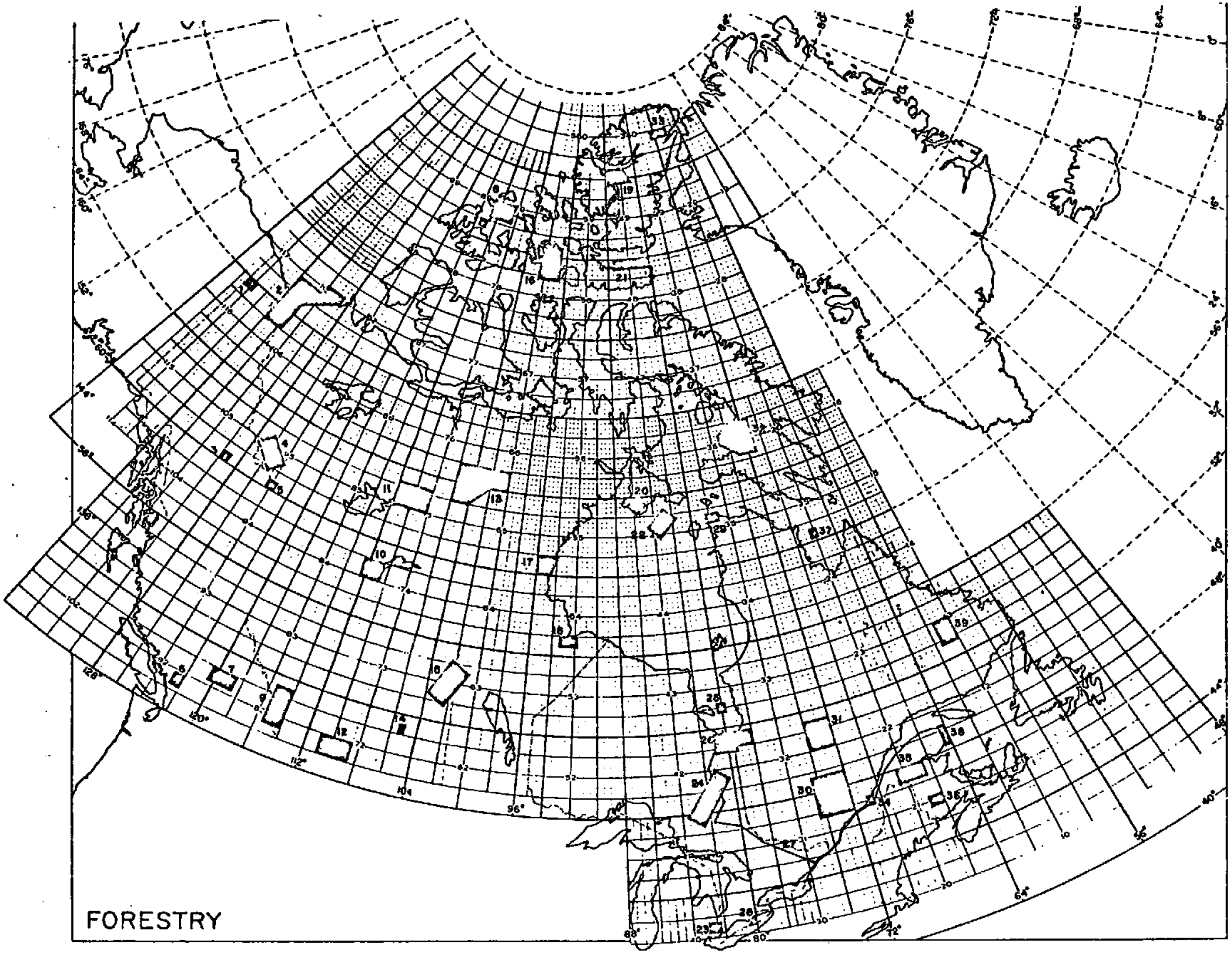


FIG. 7

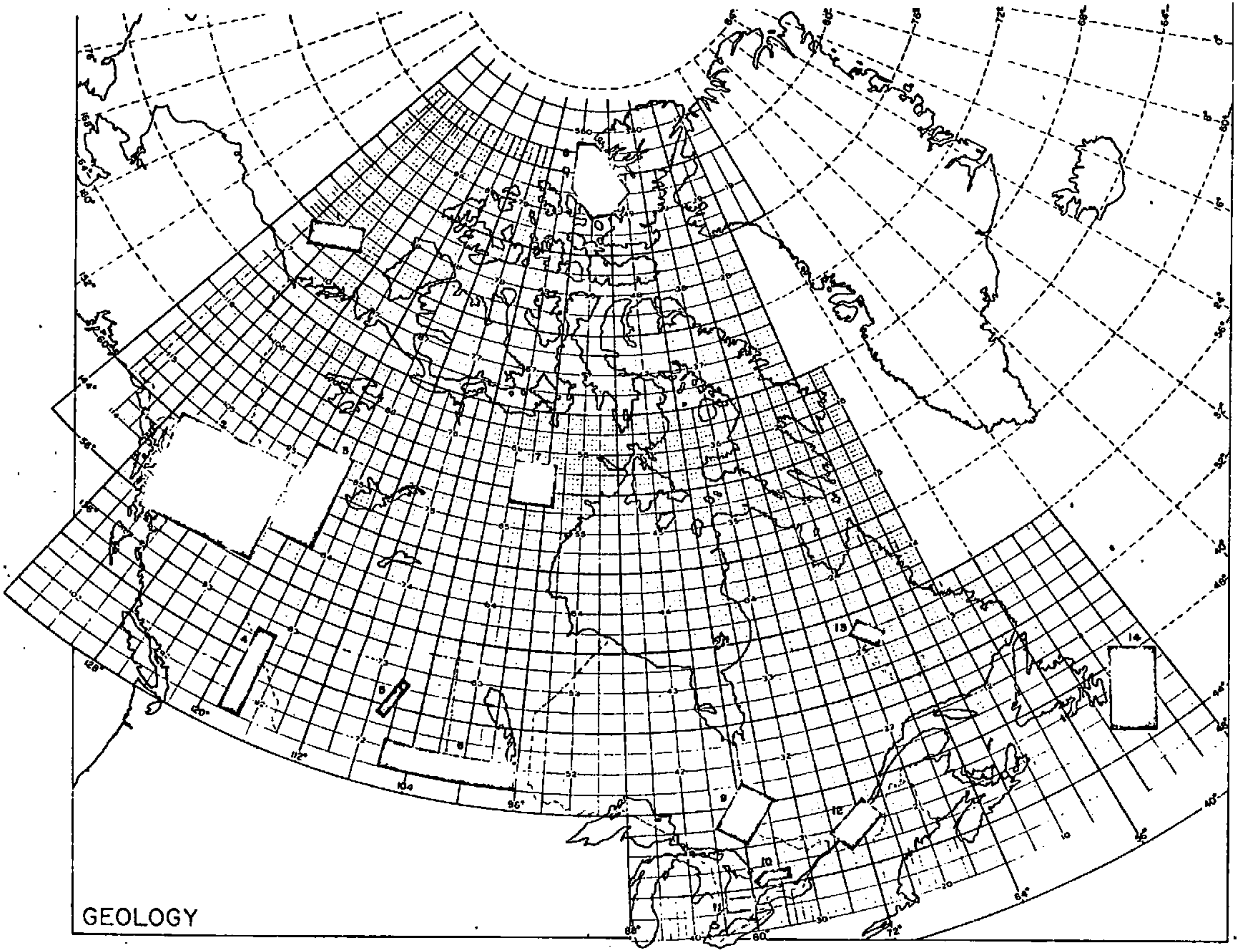


FIG. 8

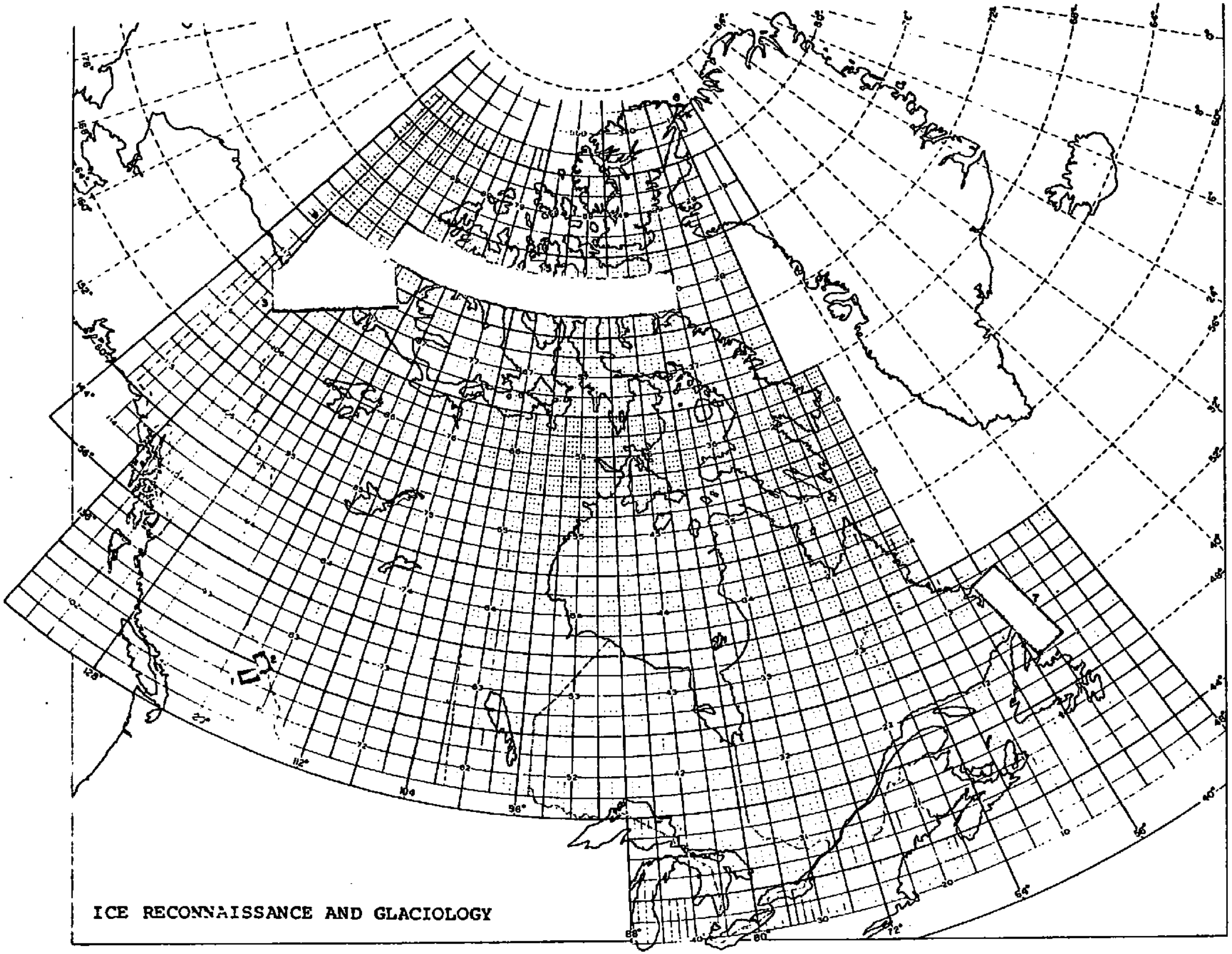


FIG. 9

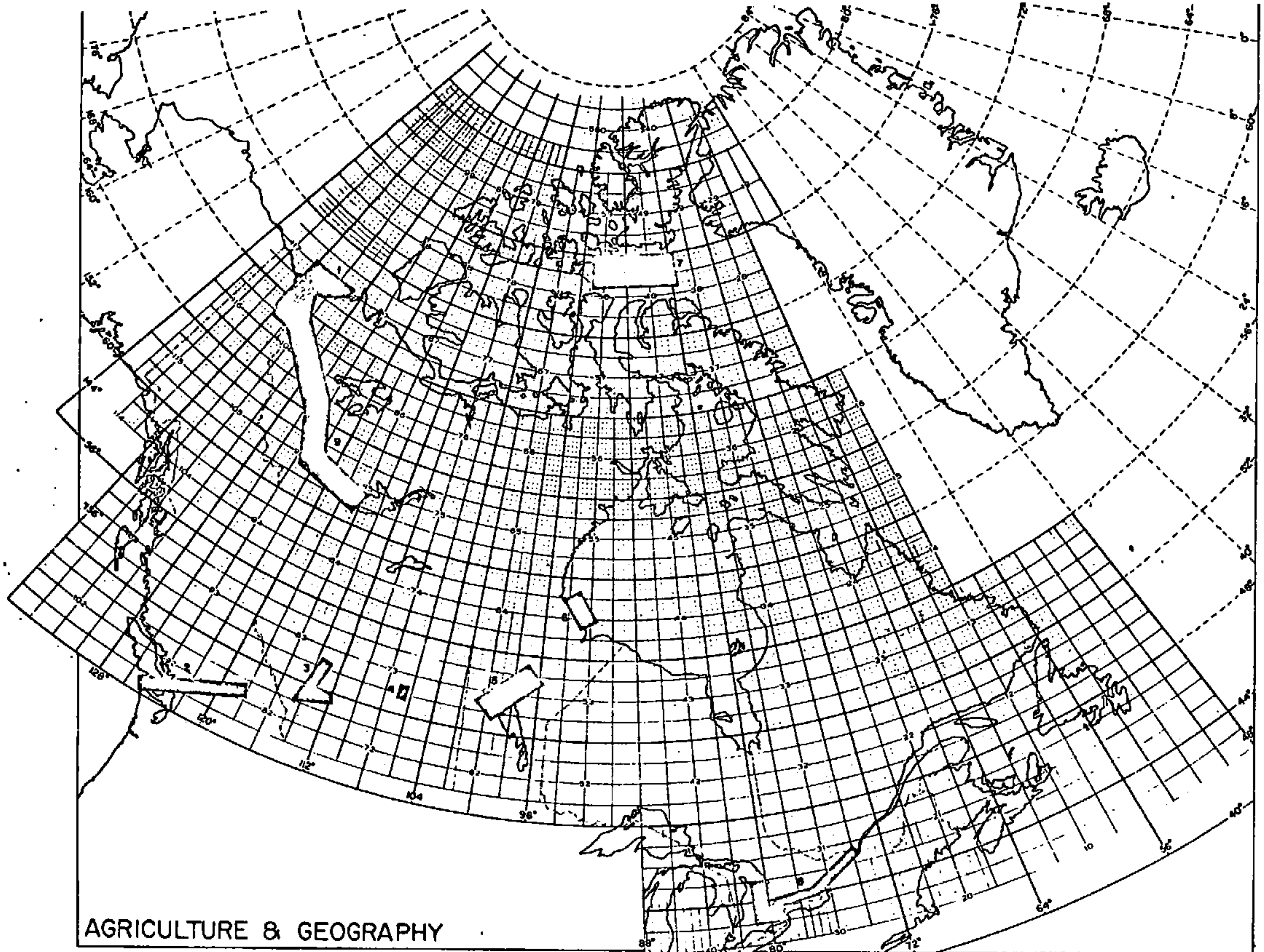


FIG. 10

SECTOR XI – SPACE RESEARCH

DRAFT NOTE FROM THE CANADIAN AMBASSADOR TO THE SECRETARY OF STATE OF THE UNITED STATES OF AMERICA

I have the honour to refer to discussions between representatives of the Canadian Department of Energy, Mines and Resources and the United States National Aeronautics and Space Administration regarding proposals for a joint program in the field of experimental remote sensing from satellites and aircraft. The objectives of the proposed program are to study the application of earth observation satellites to the detection of environmental conditions at and near the surface of the earth.

The proposed program and the details for its implementation have been incorporated in the attached annex. It is understood that implementation and direction of the Canadian participation in the proposed program shall be the responsibility of the Department of Energy, Mines and Resources and that implementation and direction of the United States participation shall be the responsibility of the National Aeronautics and Space Administration. It is further understood that the proposed program shall be without prejudice to any rights and obligations of our governments under international law with respect to remote sensing activities.

If the proposed program meets with the approval of your government, I have the honour to propose that this note together with the annex hereto, which are authentic in English and French, and your reply to that effect, shall constitute an agreement between our two governments for cooperation in a joint program of experimental remote sensing from satellites and aircraft, to be effective from the date of your reply for a period of four years unless terminated earlier by either government upon six months' notice, or extended by the mutual agreement of the two governments.

(A) The Canadian Department of Energy, Mines and Resources (EMAR) and the U.S. National Aeronautics and Space Administration (NASA) desire to collaborate on a four-year joint experimental program in the field of experimental remote sensing from satellites and aircraft of environmental conditions at and near the surface of the earth.

(B) The objectives of this cooperative program are:

(1) to advance the technology of remote sensing from spacecraft and aircraft as applied to the monitoring of environmental conditions (air, water, land and vegetation), the detection and delineation of areas of stress in crops and forests, and the mapping of the movements of ice and ocean currents in the waters contiguous to Canada and the United States; and,

(2) to carry out thematic mapping of such phenomena as geology, hydrology, vegetation and soils.

(C) Accordingly, to carry out this joint experimental program, EMAR will receive data from NASA's Earth Resources Technology Satellite (ERTS) from ground stations located within Canada and will handle and analyze such data at data handling and analysis centers in Canada. It is understood that the data acquired by the U.S.A. Earth Resources Experimental Package (EREP) on the Skylab mission will also be made available. It is further understood that ERTS data acquired by EMAR and NASA will be made available as soon as practicable to the international community.

(D) EMAR and NASA will bear the capital and operational costs of the ground readout stations and data handling and analysis centers to be used to support the program in their respective countries. There will be no exchange of funds between EMAR and NASA.

(E) As in the United States, test areas will be designated within Canada and EMAR agrees to exchange with NASA ground truth and aircraft data, and any reports on Canadian and U.S. test areas, as mutually agreed. Coordination and/or exchange of airborne test flights within designated test areas in the U.S. and Canada may be arranged as mutually agreed.

(F) It is intended that this program be implemented under the general direction of a senior official designated by EMAR and of a senior official designated by NASA.

(G) In addition, EMAR and NASA will each designate a program manager who will be responsible for coordinating the agreed functions and responsibilities of each agency with respect to the other. The program managers will be co-chairman of a joint working group whose members will be designated by EMAR and NASA. This group will be the principal mechanism for assuring that execution of the program and for keeping both sides informed of the program's status at each stage.

(H) Exchange of technical personnel will take place as mutually agreed.

(I) EMAR and NASA will freely share and exchange, upon request, all data and technical information mutually agreed to be necessary for the conduct of the joint program of data acquisition and processing.

(J) Results of investigations in this joint program will be made available in general through distribution centers and through publication in appropriate journals.

(K) EMAR and NASA may release general information to the public regarding the conduct of their own portions of the program as desired.

(L) EMAR and NASA will assure that the program is appropriately recorded in still and motion picture photography and that the photography is made available to the other agency on request for public information purposes.

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(M) It is understood that this program is experimental in character and subject to change in accordance with changing technical requirements and opportunities. Therefore, the details of this program for experimental remote sensing from satellites and aircraft may be modified by the mutual agreement of EMAR and NASA.

(N) EMAR and NASA will use their best efforts to arrange for free customs clearance for equipment required in this program.

(O) It is understood that the ability of EMAR and NASA to carry out the measures assigned to them is subject to the availability of appropriated funds.