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Communications Canada  
and Development (Ca)

1972-73

research and development

COMMUNICATIONS CANADA

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*Dr. J.H. Chapman*  
Assistant Deputy Minister (Research)

## THE RESEARCH BRANCH

The Research Branch of the Department of Communications (DOC) has two main commitments:

- to carry out research and development on behalf of the Department, in both civil and military communications, and
- to provide scientific advice for the development of Departmental policies and plans.

The Research Branch was created in 1969 at the time of the formation of the Department of Communications. The need for a Research Branch in the Department was recognized from

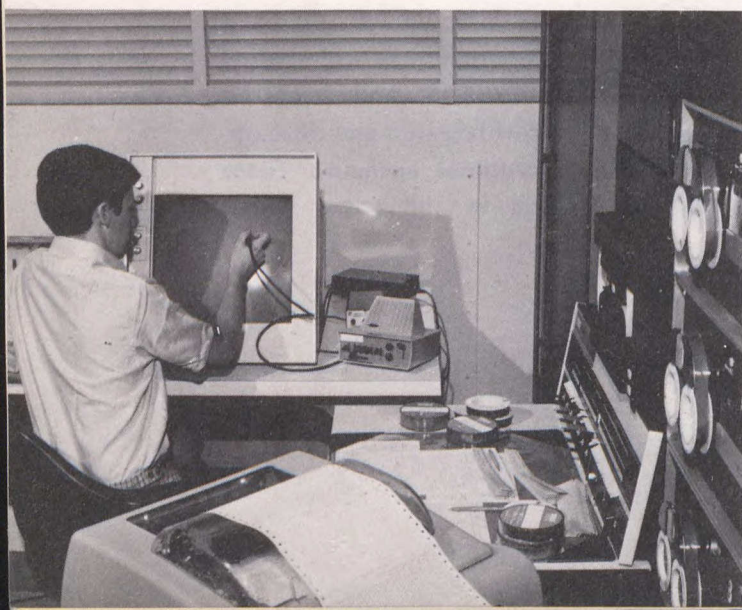
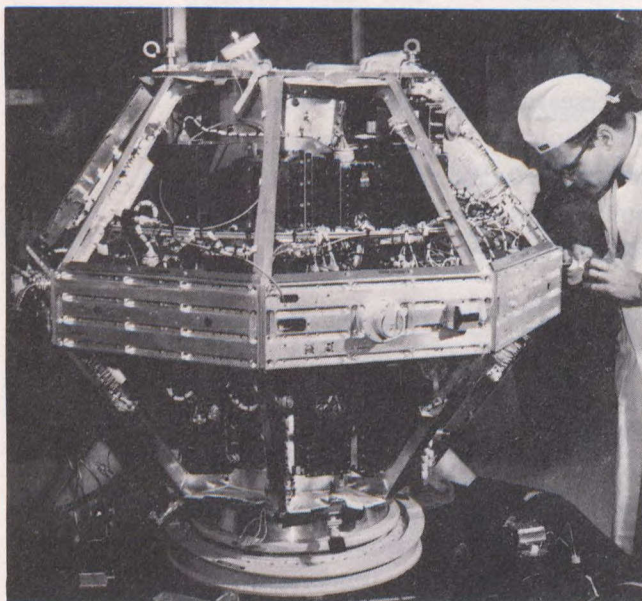
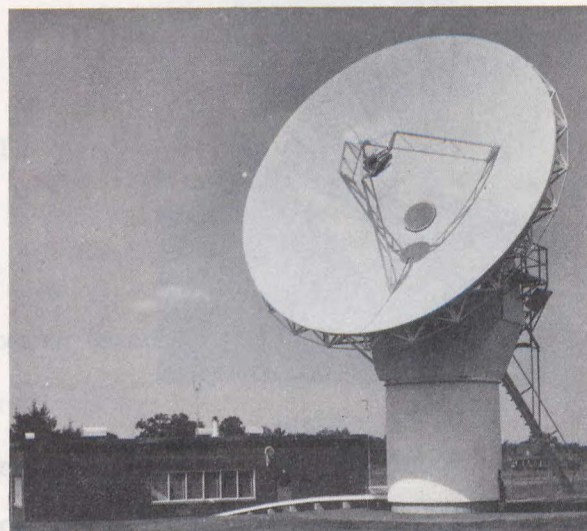
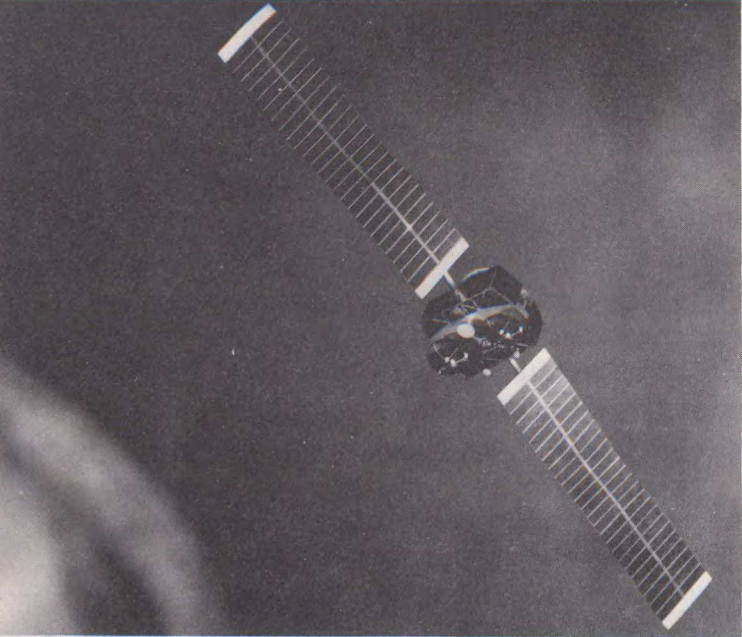
the outset because the rapid advance of technology was introducing many new systems such as communication satellites which were having an increasing impact on communications in Canada.

The Communications Research Centre became the main research facility of the Department of Communications in 1969. The Communications Research Centre (CRC) was reorganized in 1971 into four main divisions which are: communication systems, information sciences, satellite communications and radio research. The programme of the Research Centre has two main elements, namely, a general programme on research in communications technology and a number of special programmes and projects carried out for the Department of Communications and other Departments and Agencies of the Government of Canada.

The organization of the Research Branch is such that the Director-General of the Communications Research Centre reports to the Assistant Deputy Minister for Research. ADMR is assisted by the Director-General of Research and Development in the Headquarters of the Department of Communications, and by a Director-General of Telecommunications Systems Planning.

The main objectives of the Research Branch are: research and development of new communication systems, oriented basic and applied research, provision of advice and scientific support, performance of research and development for other government agencies. These functions are defined in the pages which follow.





## **THE FUNCTIONS OF THE RESEARCH BRANCH**

### **FUNCTION A**

#### **Research and Development for New Communications Systems**

To demonstrate or verify the potential of new communications systems and systems concepts in meeting changing national needs; to examine and promote the use of new methods for systems analysis and systems synthesis in a complex communications environment; to develop and maintain technological competence in the industry so it can better respond to national and international requirements for cost-effective systems, subsystems, and components.

### **FUNCTION B**

#### **Oriented Basic and Applied Research**

To create a store of knowledge and expertise derived from research into topics related to communications; to lay the basis for future development of complex high-reliability components, subsystems, and techniques; to serve as the national centre for research into radio propagation, telecommunications, and space applications.

### **FUNCTION C**

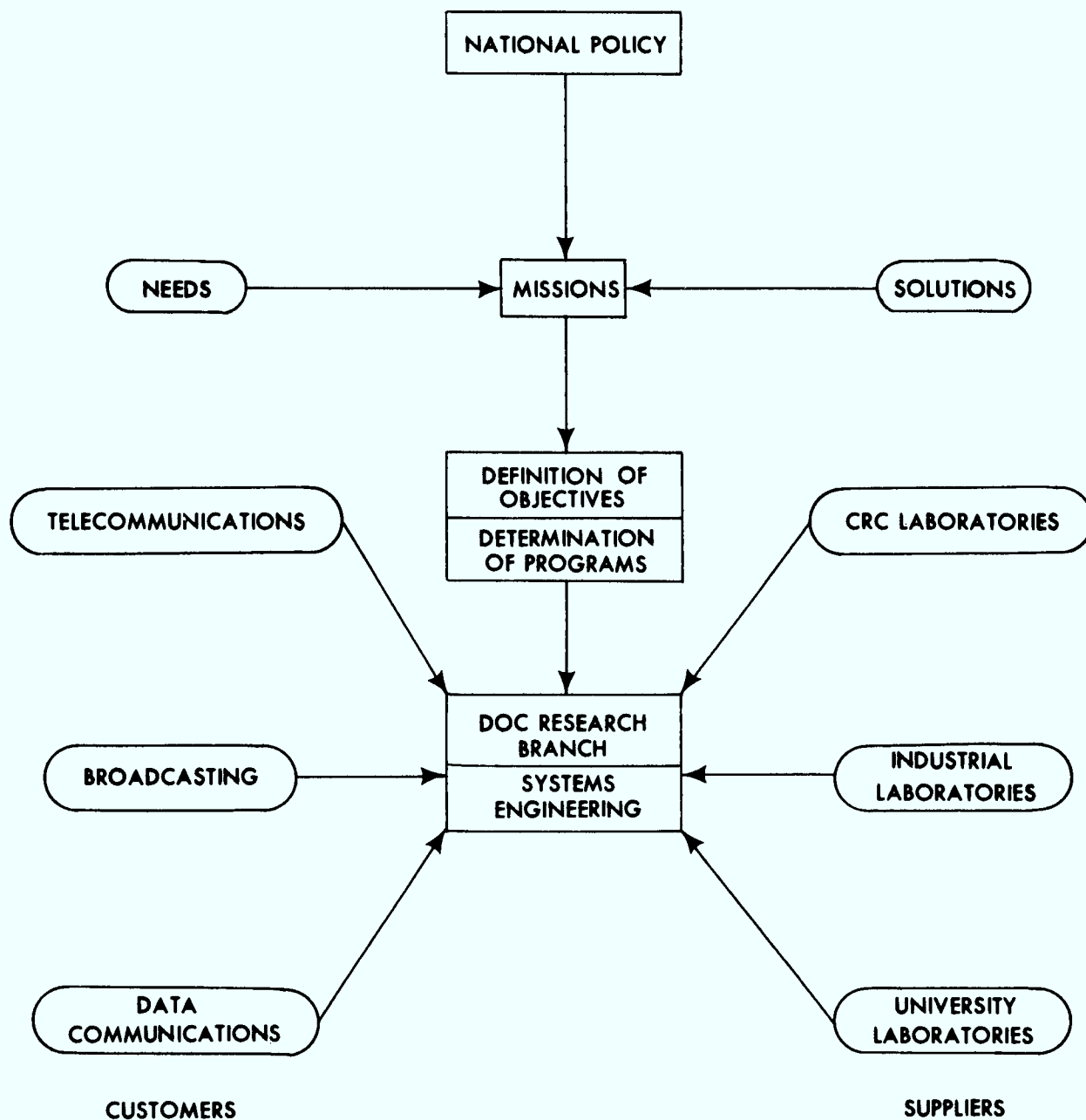
#### **Advice and Scientific Support**

To provide scientific expertise and advice to other branches of the Department; to contribute to policy and planning activities of the Department; to provide advice and scientific support to other Departments and Agencies.

### **FUNCTION D**

#### **Research and Development for other Departments and Agencies**

To perform research and development for other Departments and Agencies in fields such as satellite applications and radar in which the DOC has particular expertise; to manage research and development projects for other government Departments and Agencies.



## THE CUSTOMERS FOR RESEARCH

The Government develops national policy which in turn determines the missions and major programmes of the Department. The main functions of the DOC Research Branch and the supporting role of CRC have already been outlined. While the major programmes and the main research functions are defined for a period of some years, the research projects by their very nature are subject to change and modification as they proceed. The detailed interpretation of the research programme is carried out for the most part in the Communications Research Centre.

The chart shown on the page opposite places in context the implementation of national policy through the definition of Departmental missions, objectives and programmes, and takes into account the needs for communications on the one hand and the solutions on the other. Planning studies give direction to the Research Branch for its analysis of communications systems. These studies benefit from information on the problems of the various users of communications in the three main areas: telecommunications, broadcasting, and data communications. The search for solutions to

the problems is conducted in the laboratories of the Department, in other Government laboratories, in industrial laboratories and in universities.

In general, communications in Canada are conducted by private enterprise and the principal motivation is commercial. However, some communications, particularly overseas communications and broadcasting, have an element of public ownership. Furthermore, TELESAT Canada, which provides communication by satellite within Canada, is a mixed Corporation, with both Government and private ownership.

The eventual customers for systems analysis and research then, are the groups of operators of communication systems from these main fields. In addition, the Government itself, through the Department of National Defence, the Department of Indian Affairs and Northern Development, and other Departments, are customers for communications, and have their own special requirements which must be satisfied in some cases by special developments. These are carried out as part of the mission of the Research Branch.



# COMMUNICATIONS IN CANADA

## TELECOMMUNICATION SYSTEMS

### Trans-Canada Telephone System

The Newfoundland Telephone Company Limited  
 Bell Canada  
 British Columbia Telephone Company  
 Maritime Telegraph & Telephone Company Limited  
 The New Brunswick Telephone Company Limited  
 Alberta Government Telephones  
 Manitoba Telephone System  
 Saskatchewan Telecommunications

### CN/CP Telecommunications

### TELESAT Canada (Proposed Earth Stations)

- Heavy Route Stations
- ▲ Network Quality TV
- Northern Telecommunications Stations
- ◆ Regional Telecommunications Stations
- Remote Television

### BROADCASTING SYSTEMS

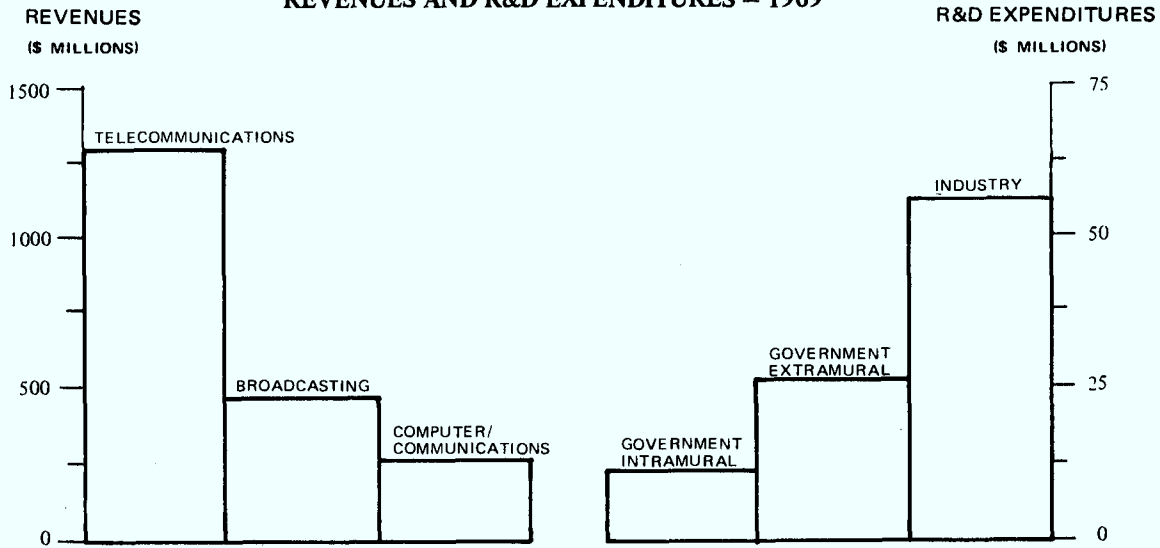
Canadian Broadcasting Corporation (CBC)  
 Canadian Television (CTV)



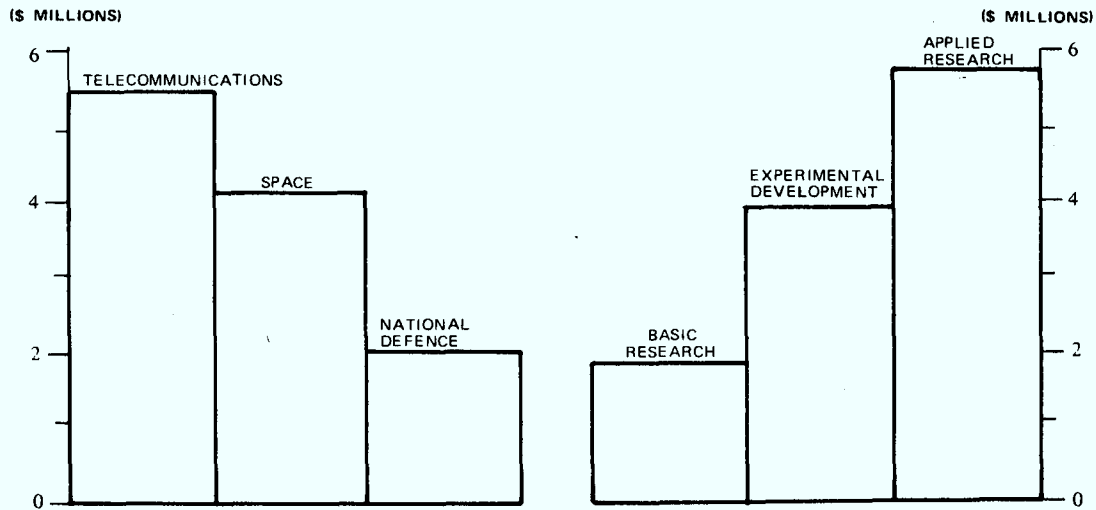


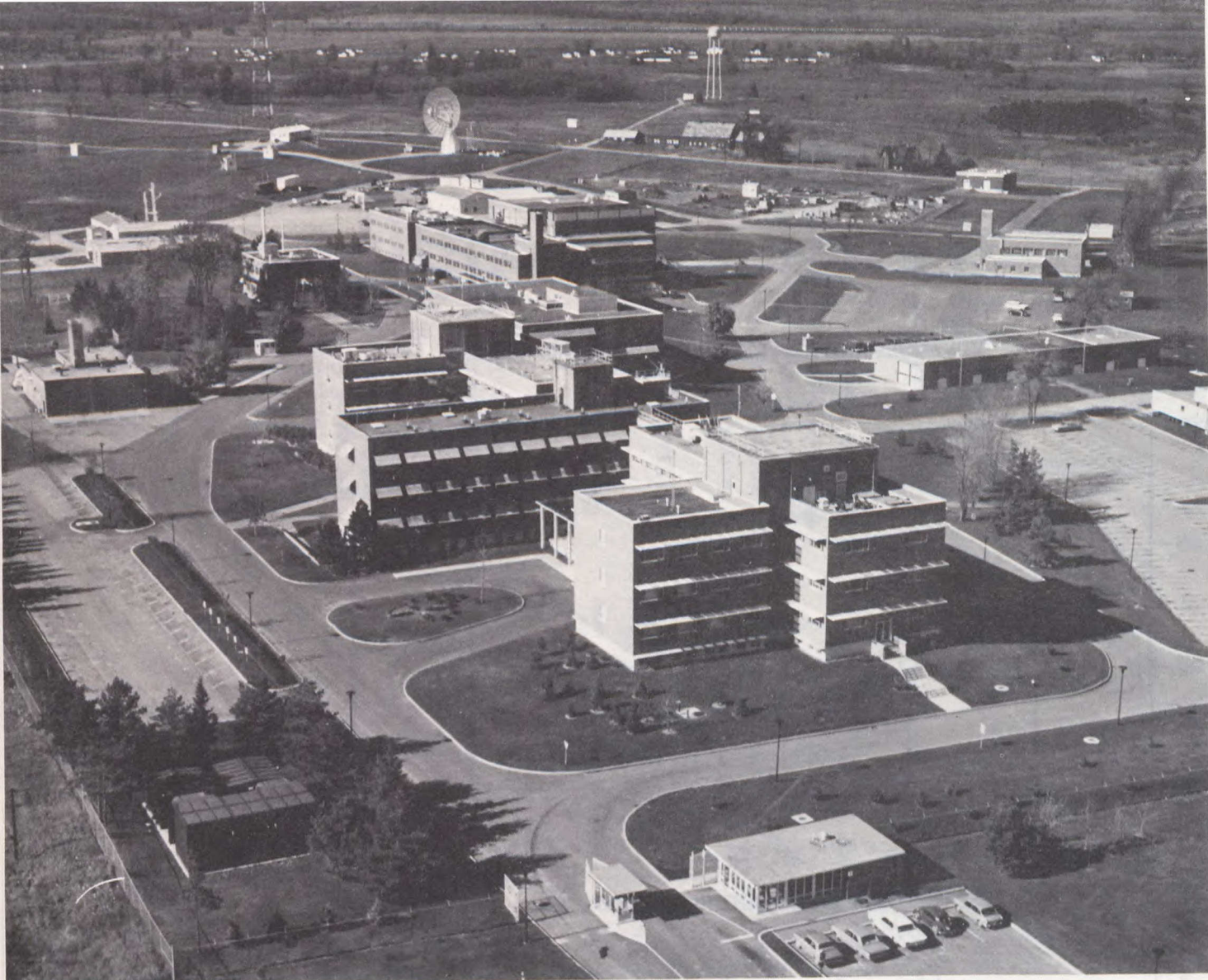
## FINANCIAL STATISTICS

### REVENUES AND R&D EXPENDITURES – 1969

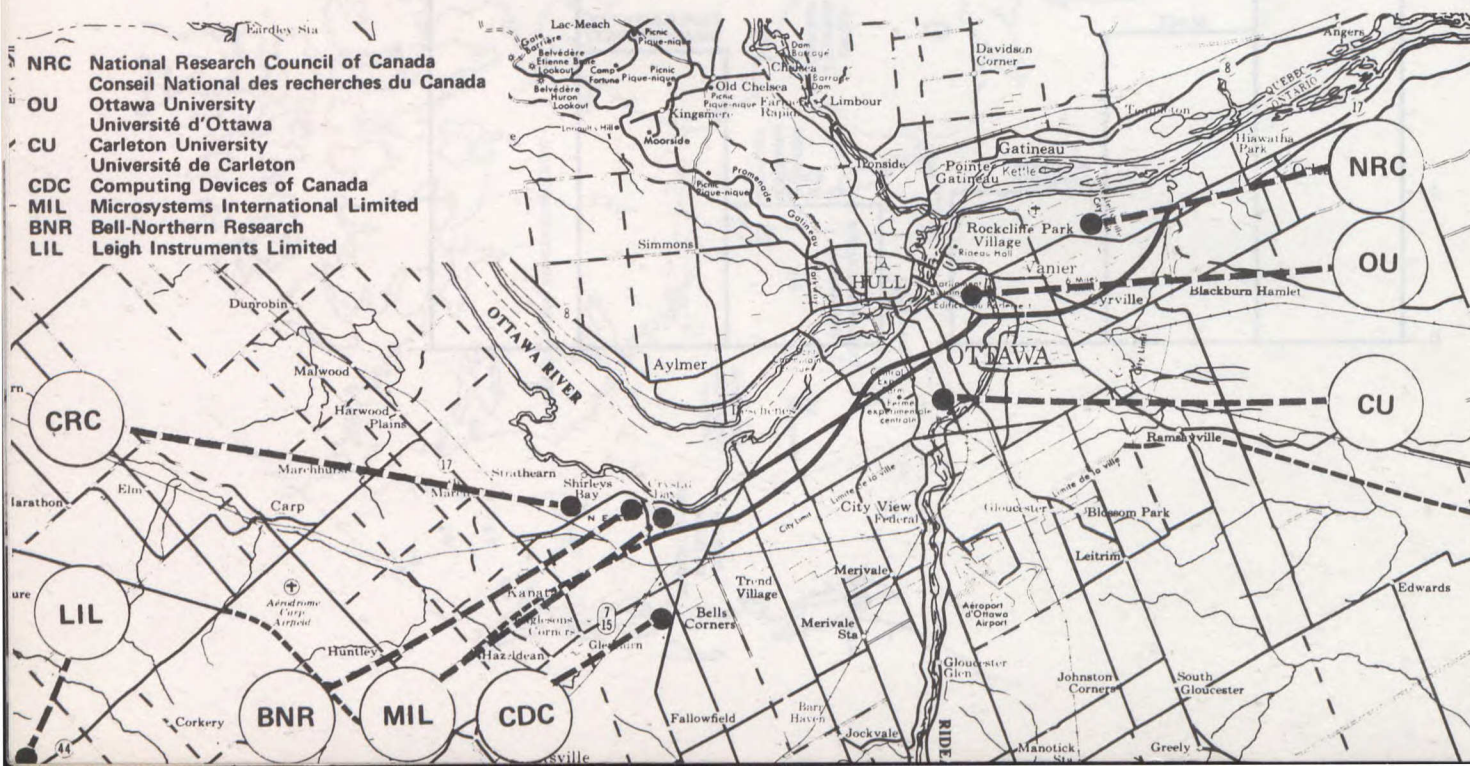


### RESEARCH & DEVELOPMENT IN THE DOC – 1969



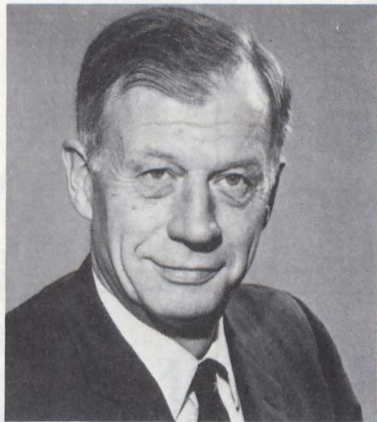


**COMMUNICATIONS RESEARCH CENTRE      CENTRE DE RECHERCHE SUR LES COMMUNICATIONS**  
**SHIRLEY BAY – OTTAWA**





## THE COMMUNICATIONS RESEARCH CENTRE



*Dr. G.W. Holbrook*  
Director-General

The laboratories were originally established as part of the Defence Research Board in 1947 and became known as the Defence Research Telecommunications Establishment. The original mission was to undertake research and development in telecommunications and electronics for the Armed Forces. In April 1969, on the establishment of the new Department of Communications, the laboratories became the principal research facility of the Depart-

ment and were re-named the Communications Research Centre. Concurrent with this change in name, the mandate of the centre was broadened to include civilian as well as military communications and radar.

The original location, some twelve miles from downtown Ottawa, was chosen in what was an electronically quiet rural site. Over the ensuing period a number of industrial organizations working in the fields of electronics and communications have now been established in the vicinity of Shirleys Bay. Consequently, the 120 scientists and engineers who represent the professional staff of CRC now live within a community of about 1000 professional colleagues. Two universities, Carleton University and the Université d'Ottawa, are located within a few miles of the Centre. Thus, an excellent opportunity exists for the ready exchange of research information between the industrial, university and government laboratories. Every effort is made to ensure that this liaison is maintained and strengthened and many of the research projects undertaken by the Research Branch involve contracts with either or both of the industrial and university sectors.

While the laboratories and supporting facilities occupy a total of 250,000 square feet in the main buildings; transmitting, receiving and special radar sites are located in 690 acres of property in the immediate vicinity. The facilities of the Centre include such major features as a Sigma 7 computer, a 60 foot parabolic antenna and an integration and test building for satellites, as well as laboratories, model shops, etc. The staff of the Centre now totals about 500.



# DEPARTMENT OF COMMUNICATIONS — RESEARCH BRANCH

## ASSISTANT DEPUTY MINISTER (RESEARCH)

J.H. CHAPMAN

### COMMUNICATIONS RESEARCH CENTRE

DGRD — R.C. LANGILLE  
DRP — J.N. BARRY

DGCR — G.W. HOLBROOK  
DSCR — I. PAGHIS  
DCCR — R.M. DOHOO  
DRCR —  
DICR —  
DACR — J.P. LANDRY

DGTS — B.A. WALKER  
DSP — M.L. CARD  
DCP — N.D. BREWER  
DTP — J.B. deMERCADO

ADMINISTRATION DACR — J.P. LANDRY	RADIO RESEARCH DRCR — Consultant T.R. HARTZ	COMMUNICATION SYSTEMS DCCR — R.M. DOHOO Consultant F.E. SMITH	INFORMATIQUE DICR Consultant J.N. BLOOM	SATELLITE COMMUNICATION SYSTEMS DSCR — I. PAGHIS	EXTERNAL PROGRAMS
RESEARCH INFORMATION AND PUBLICATION SERVICES E. ATKINS	RADIO COMMUNICATIONS E.S. WARREN	SPACE SYSTEMS B.C. BLEVIS	INFORMATION SCIENCES G.W. JULL	COMMUNICATIONS TECHNOLOGY SATELLITE C.A. FRANKLIN	MILITARY PROGRAMS F.W. SIMPSON
TECHNICAL SERVICES D.P. HOYT	AERONOMY J.S. BELROSE	COMMUNICATION SYSTEMS ENGINEERING W.L. HATTON	SIGNAL PROCESSING A.W. GILCHRIST	SPACECRAFT ELECTRONICS A.R. MOLOZZI	E.M. & R. ERTS PROJECT R.E. BARRINGTON
ADMINISTRATIVE SERVICES H.E. CHECKLEY		RADAR SYSTEMS ENGINEERING D.F. PAGE	INFORMATION SYSTEMS ENGINEERING G.E.K. LOCKWOOD	SPACECRAFT MECHANICS F.R. VIGNERON	M.O.T. AEROSAT B.C. BLEVIS
CONSTRUCTION ENG. AND MAINT. SERVICES H.F. PRAGNELL					

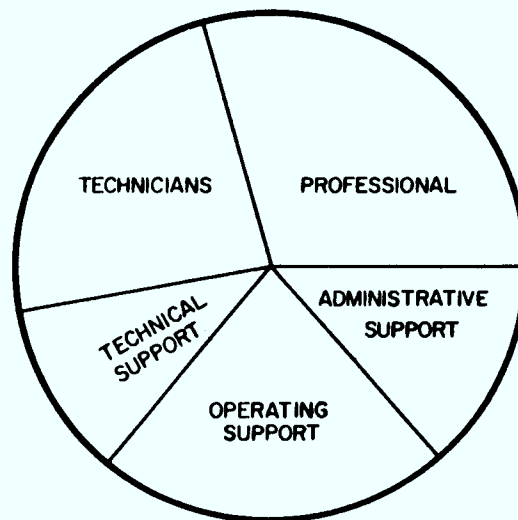
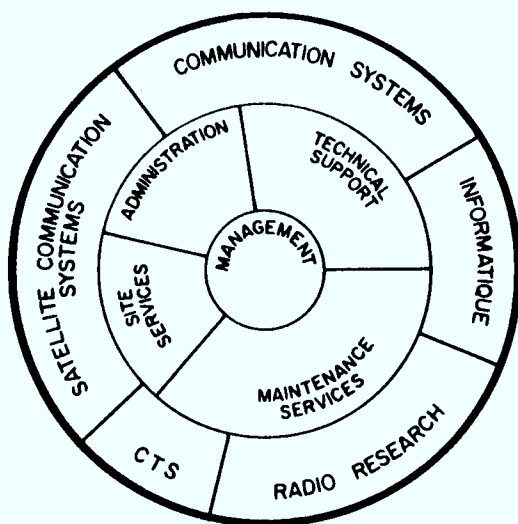
### EXPLANATION

ADMR	Assistant Deputy Minister Research
DGRD	Director-General Research and Development
DGTS	Director-General Technological Systems Planning
DRP	Director Research Policy and Programs
DGCR	Director-General Communications Research Centre
DCCR	Director Communication Systems
DSCR	Director Satellite Communication Systems
DRCR	Director Radio Research
DICR	Director Informatique
DACR	Director Administration
DCP	Director Computer Planning
DSP	Director Space Systems Planning
DTP	Director Terrestrial and Systems Planning

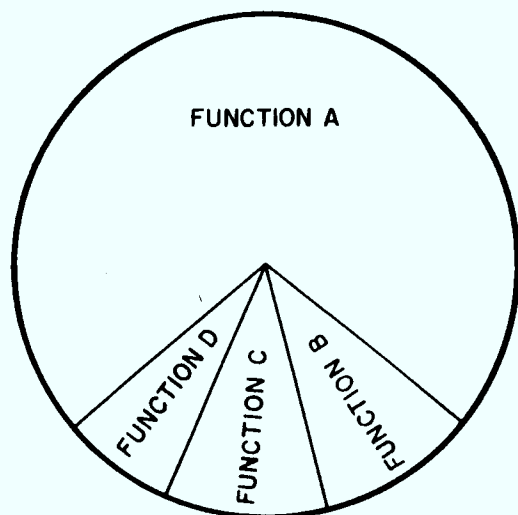
# COMMUNICATIONS RESEARCH CENTRE – RESOURCES STATISTICS

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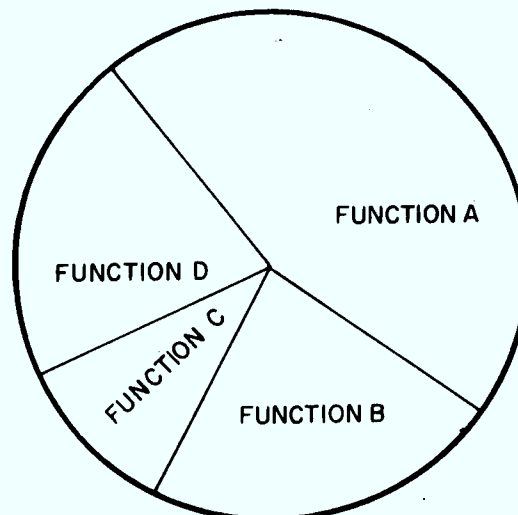
## DIVISION OF CRC PERSONNEL



## DIVISION OF PROGRAMME EXPENDITURES AND RESEARCH PERSONNEL – BY FUNCTION

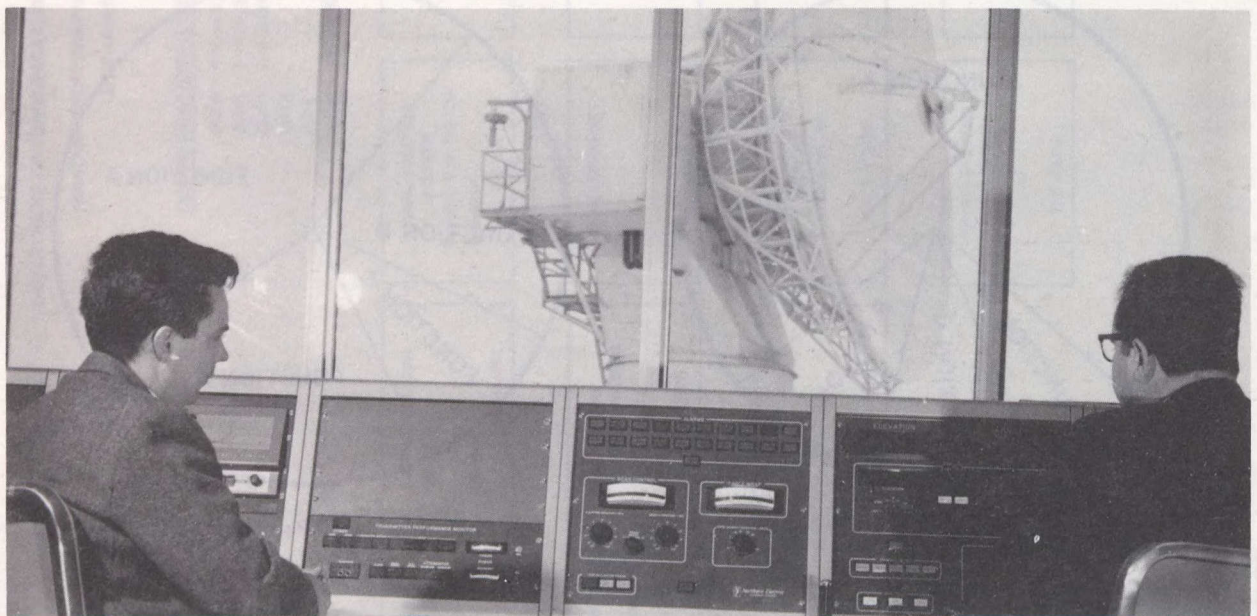


Expenditures



Research Personnel

Numbers in proportion to the areas shown on the chart.





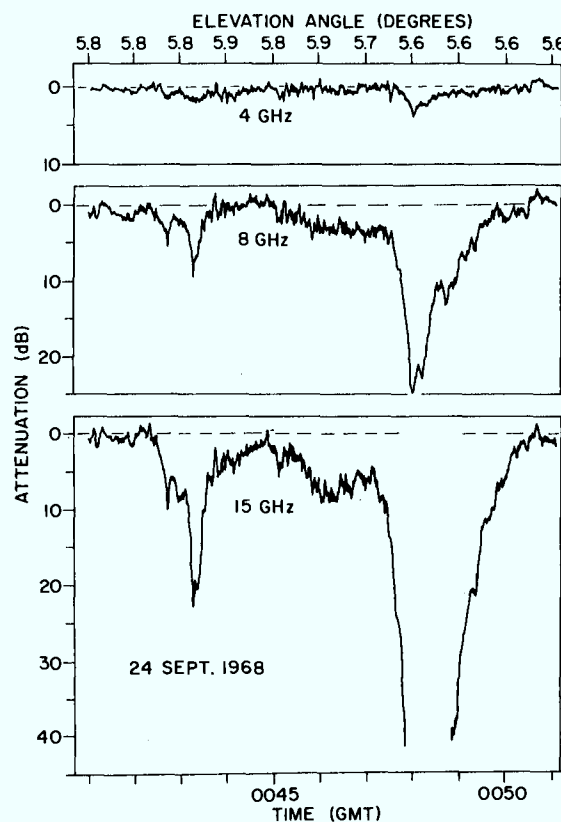
## COMMUNICATION SYSTEMS DIRECTORATE

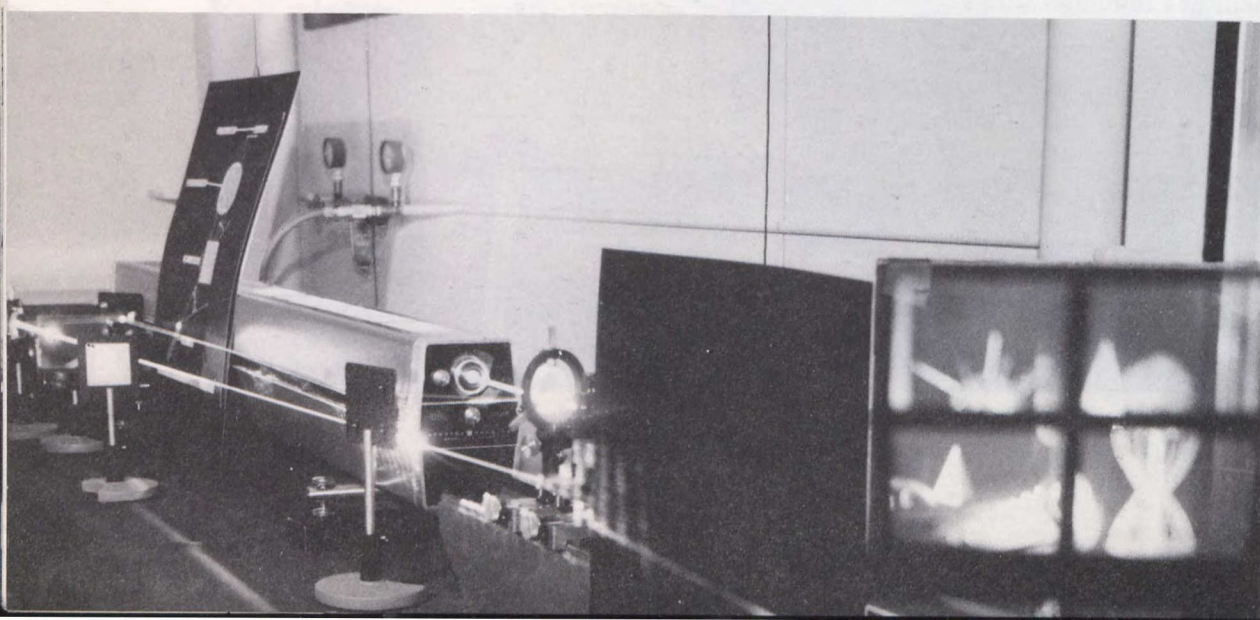
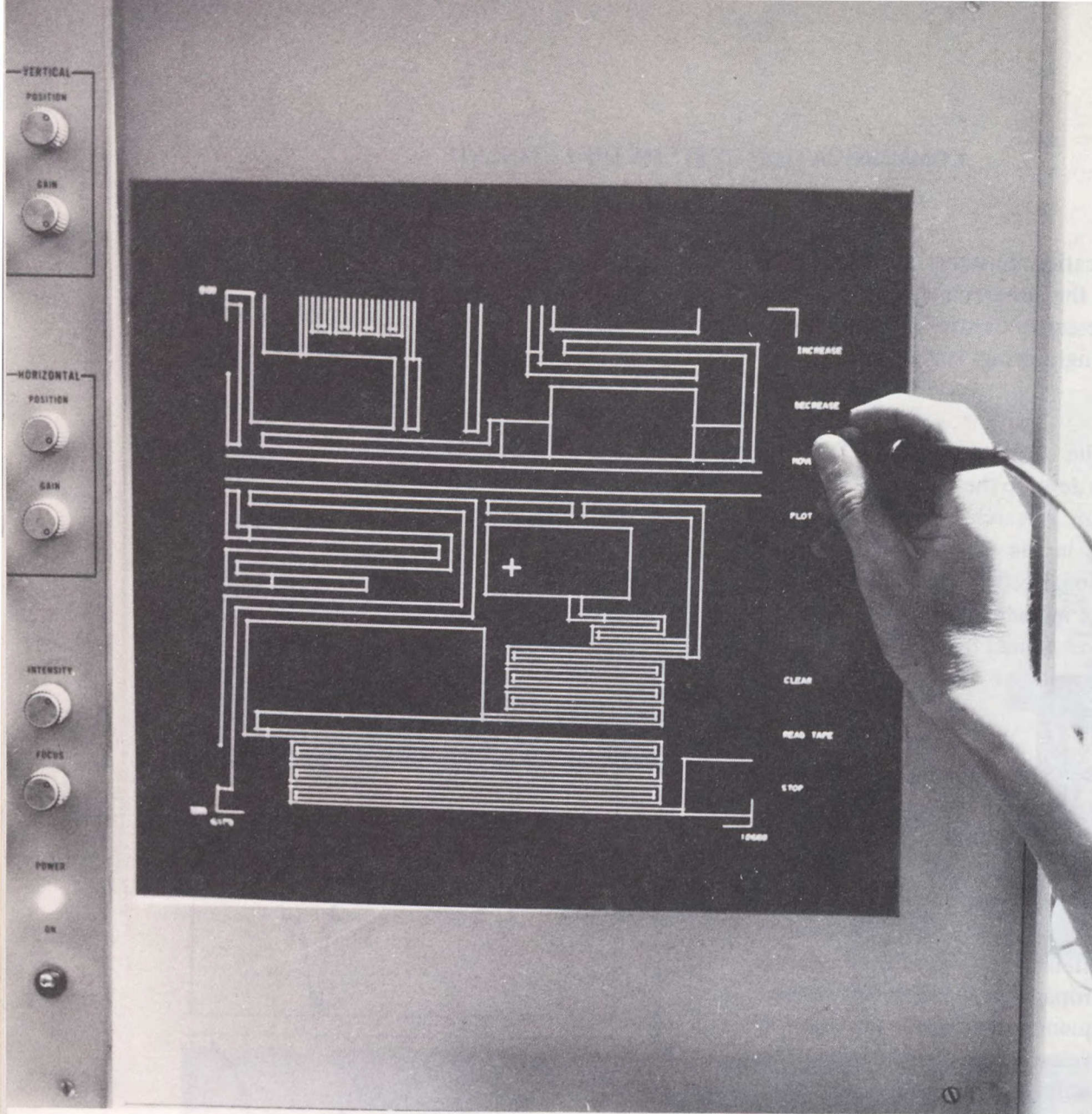
The Communication Systems Directorate is responsible for the programmes of the Communications Research Centre in communications systems engineering, space systems and radar systems.

The aim of the Communications Systems Programme is to develop the tools and methodology of system research and to carry out research studies in the fields of network and systems evaluation, synthesis and optimization. Current projects include studies for data communications development in Canada and of the trends of the costs of future trunk transmission systems.

The aim of the Space Systems Programme includes a series of communication experiments using the SHF transponder on the CTS satellite; studies to support the development of small satellite communication terminals; studies of various aspects of the design of aeronautical satellite systems operating at UHF; studies of microwave propagation in relation to systems design and frequency sharing; the provision of research and development, consultative services and terminal facilities in support of the DRB and Canadian Forces in the field of military satellite communications. This programme also provides extensive support and advice to the management of the radio frequency spectrum in the Department of Communications.

The Radar Systems Engineering Programme includes systems studies aimed at improving the operation of radar systems in difficult clutter environments; radar research and studies in support of the Armed Forces, including special studies and projects to solve immediate practical radar problems; research and technology studies in the use of computers for radar detection and identification.





## INFORMATIQUE DIRECTORATE

The research projects in the Informatique Directorate are principally concerned with improvements in machine-to-machine communications, man-to-machine interactions and man-to-man telecommunications services. These projects are carried out both within CRC and in cooperation with research groups in Canadian universities and industry.

In the area of machine-to-machine communications, particular emphasis is placed on joint CRC/University feasibility studies of a computer communications network. Research in the areas of man-to-machine interactions and man-to-man telecommunications includes stud-

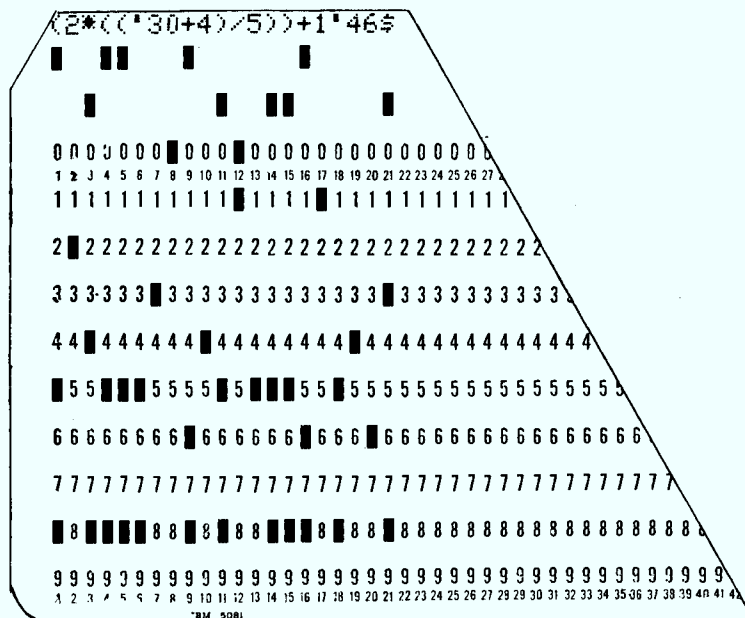
ies of computer graphics systems; studies and evaluation of the effectiveness and impact of two-way video, audio and graphics telecommunications services for institutional user groups; supporting research and studies in the fields of computer image processing, optical data storage and processing, and optical propagation in glass fibres.

In addition, the Directorate undertakes studies in computer signal processing for the Department of National Defence and operates a time-shared computer system for the Communications Research Centre.

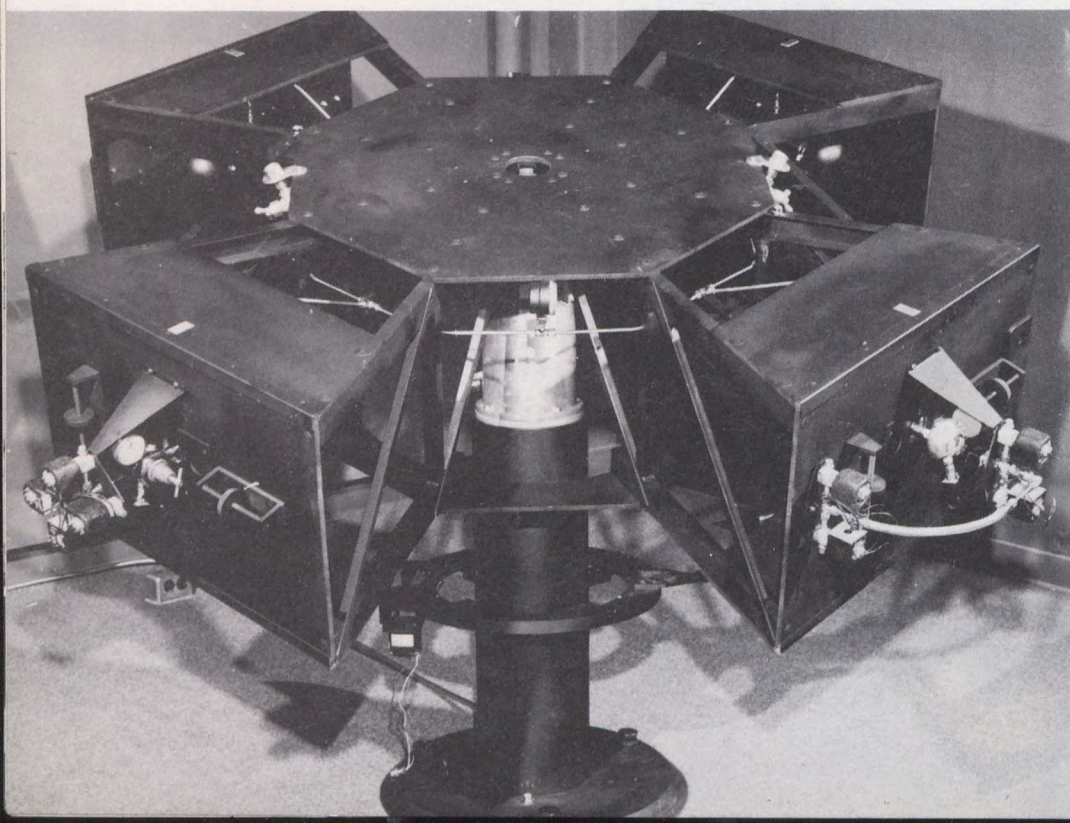
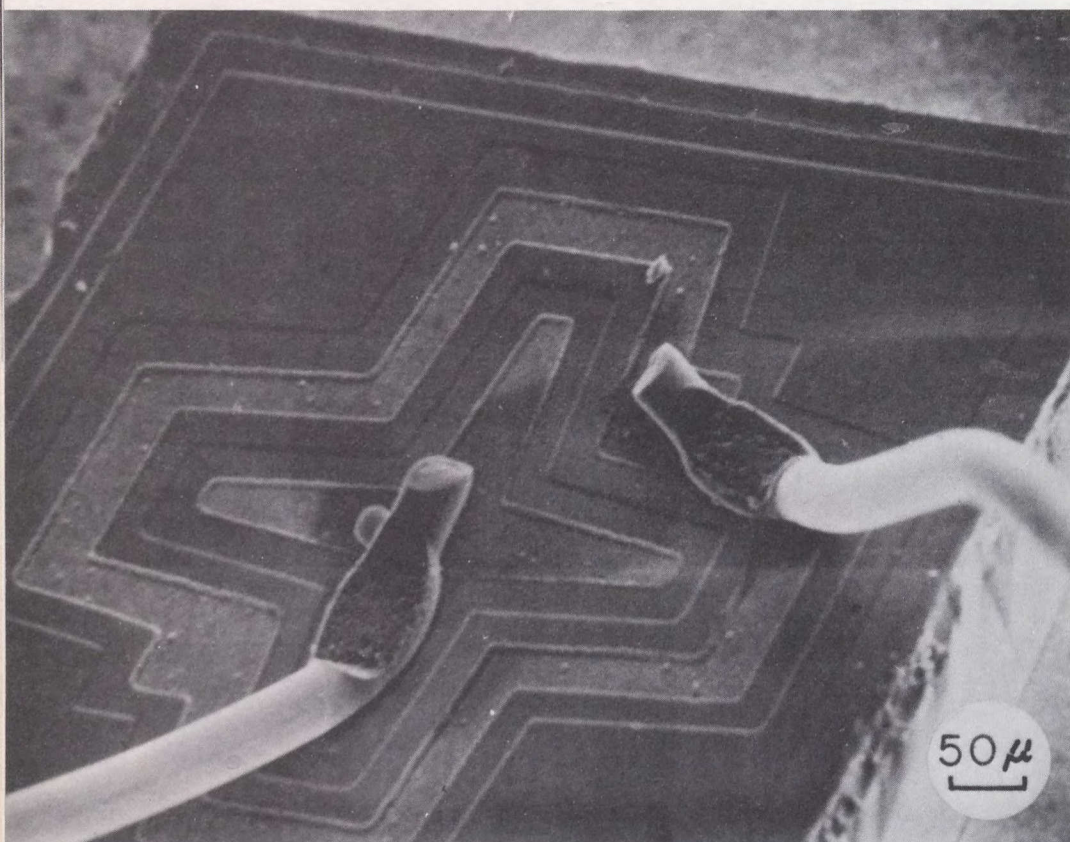
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BRES #(#),#
IF #'10 NEQ 0 SKIP 2$
# '10 EQ 4$
'F0$
(2*(('30+4)/5))+1'46$
'44'46$
'10=. 'F1$
# '10 EQ 3$
IF '20 IS 1 SKIP 2$
- '20 'F1$
'40+1'F1$
'20'F7$
'30'F1$
.BLOCK '40'F1$
'F3$
$
>

```







## SATELLITE COMMUNICATION SYSTEMS DIRECTORATE

The Directorate of Satellite Communication Systems is the national centre for Canadian communications satellite programmes. This Directorate is also responsible for the spacecraft mechanics and spacecraft electronics programmes, both of which are intimately related to the Communications Technology Satellite (CTS) project.

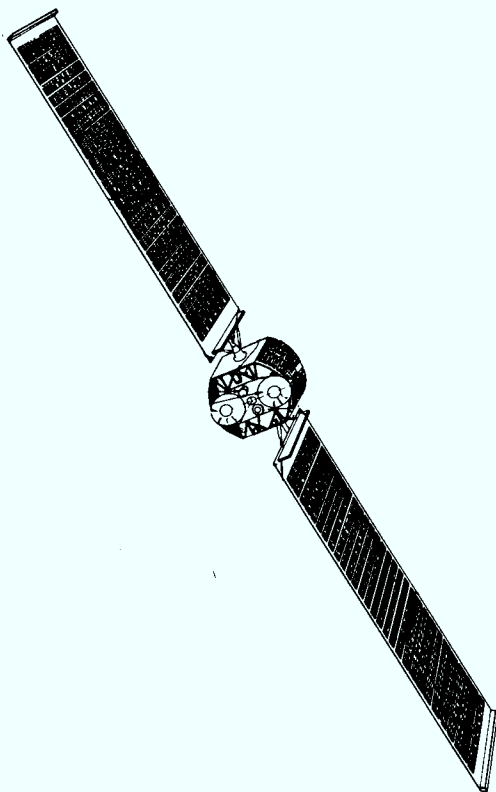
The Spacecraft Electronics programme is divided into the following major areas; processing,

fabrication and encapsulation of high reliability monolithic and hybrid integrated circuits; study of failure mechanisms in integrated circuits, provision of a consulting service to industry; microwave studies of antennas, oscillators, amplifiers and integrated circuits. The provision of two microwave experiments, namely, an SHF Beacon and a Microwave Attitude Sensor, has been undertaken for CTS.

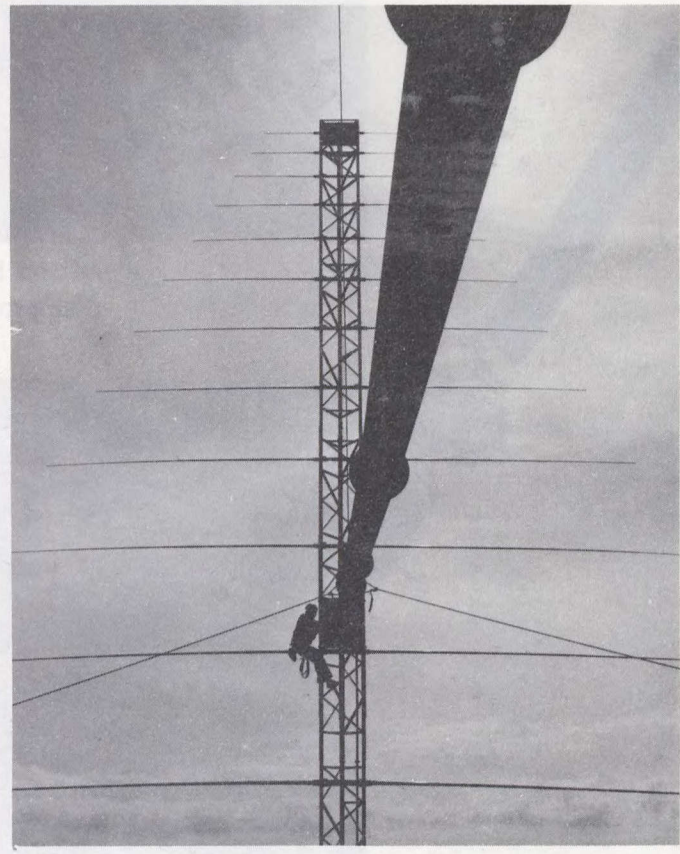
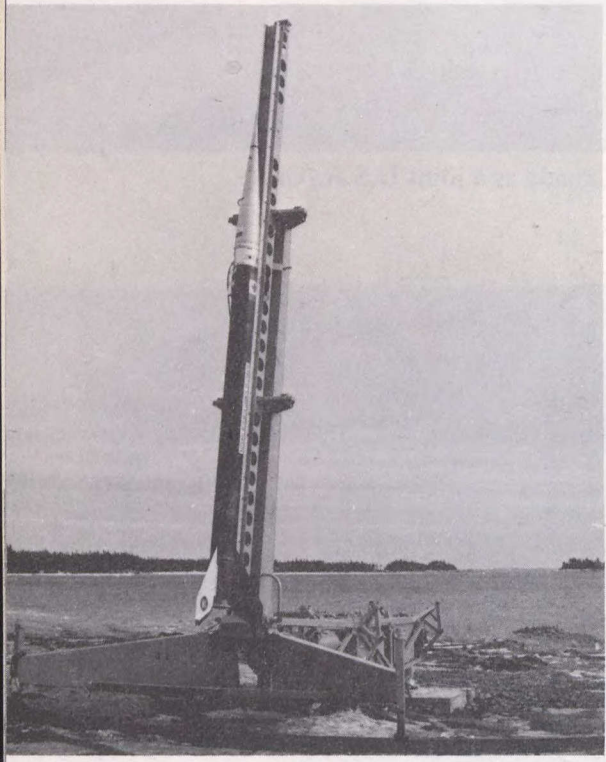
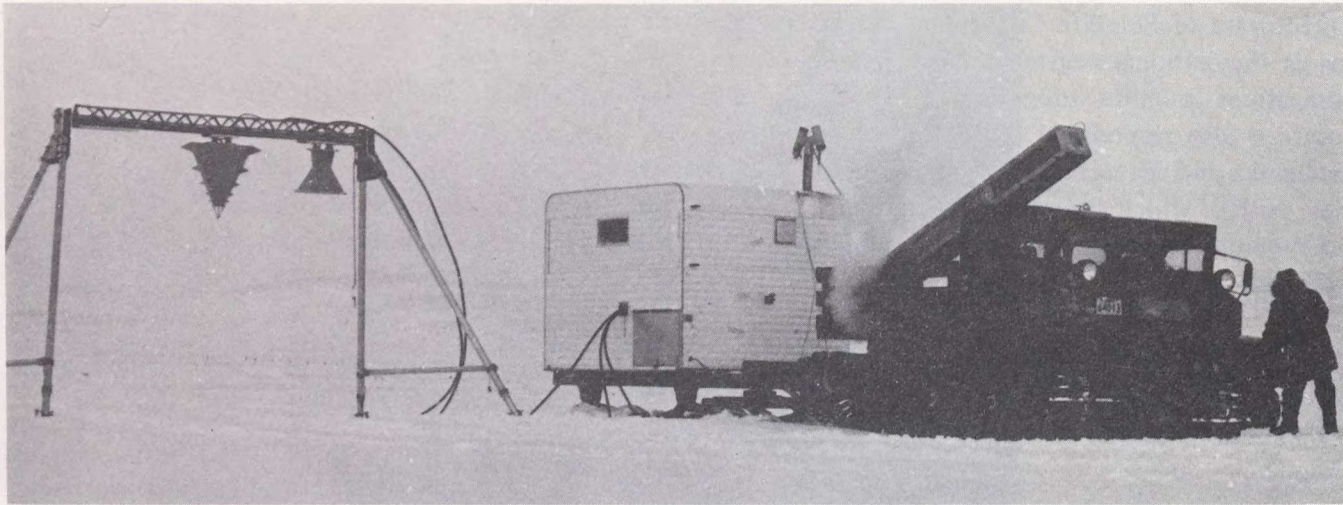
The Spacecraft Mechanics programme includes the development of stabilization and control systems for large flexible satellites; the development of spacecraft thermal control devices; planning and development of experiments proposed for the CTS in ion engine technology; microwave attitude sensors and flexible solar arrays.

The Communications Technology Satellite (CTS) is an experimental high-power communications satellite, scheduled for launch into synchronous orbit in 1975. It is being developed and built in Canada as a joint U.S.A./Canadian project.

The primary purpose of the CTS is to test the feasibility of using a high-power spacecraft, in conjunction with low-cost ground stations, to provide communications to remote and dispersed communities. Additional objectives are to develop and flight test a super-efficiency 12 GHz output tube having an efficiency of more than 50 per cent and an output power of more than 200 watts; one kilowatt solar power arrays that are unfurlable; liquid metal slip rings; an ion engine for station-keeping; and an accurate 3-axis stabilization system for a spacecraft with flexible appendages.







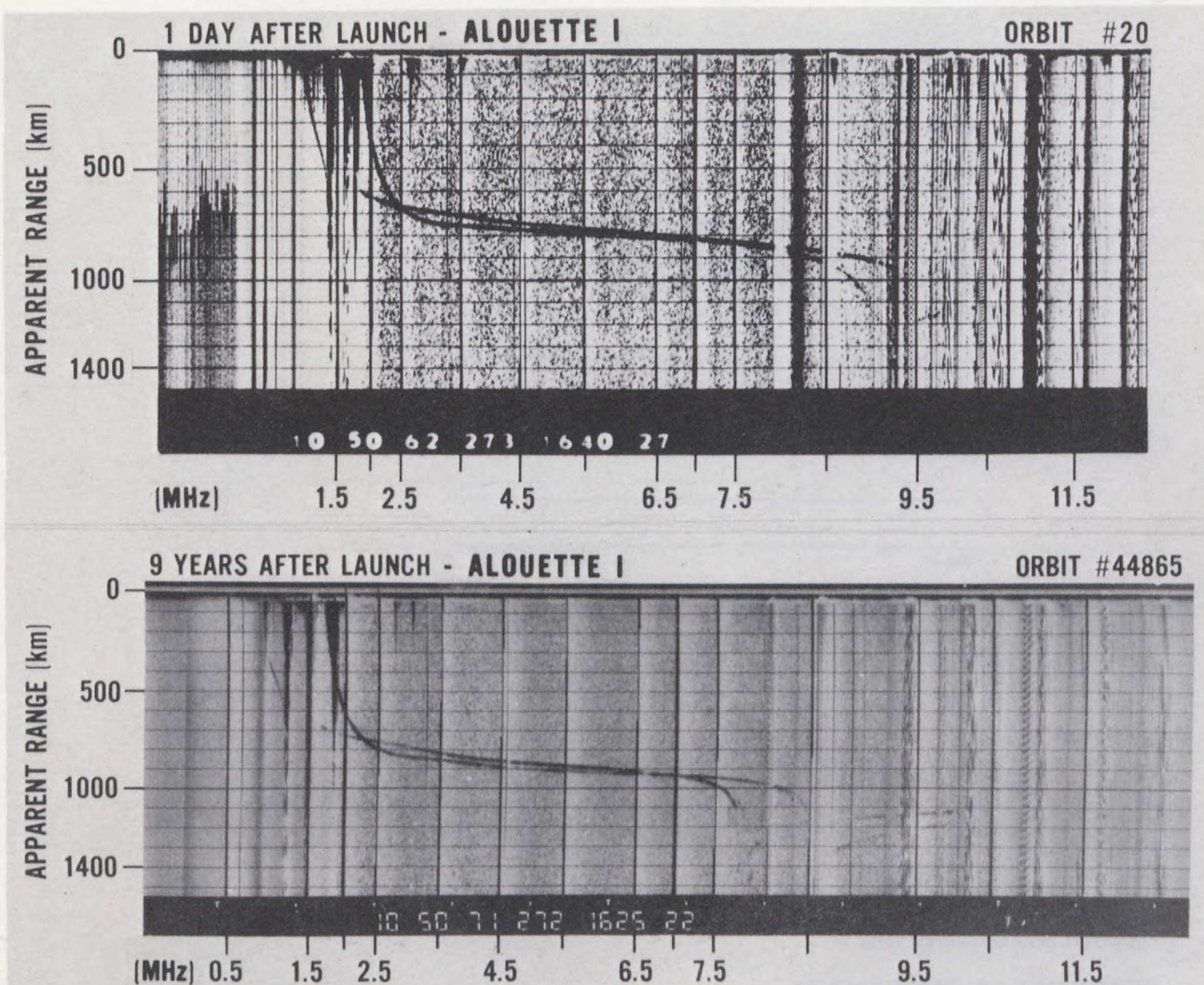


## RADIO RESEARCH DIRECTORATE

The Radio Research Directorate is engaged in studies of the radio environment peculiar to Canadian latitudes, with the view to applying the results to current and future communication systems. Much of the work pertains to systems that depend on the ionosphere, and involves studies of the limitations imposed on radio communications and navigation caused by variations in ionization that result from natural or man-made conditions. For this purpose, a varied observational program is pursued that includes ground-based experiments at a number of locations, rocket-borne

experiments, and measurements on the Alouette and ISIS satellites.

Other related studies deal with the direct effects of ionospheric conditions on spacecraft structures, the monitoring of noise and interference studies in various systems, and the investigations into the use of various portions of the radio spectrum for purposes such as remote sensing. A radio prediction, forecasting and consulting service to Canadian communications users is also provided.



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