

**Survey of Clients of DOC and Comparison Research Labs
Program Profile and Methodology Report**

**Program Evaluation Division
Department of Communications**

Prepared By Peat Marwick Consulting Group

April 1988

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I - Introduction

This report contains a descriptive profile and a summary of the Methodological approach associated with Study #4: Survey of Lab Clients, one of several studies being conducted as part of the overall evaluation of the Department of Communications Research Labs Program.

Study #4 will involve a survey of the clients of the five Department of Communications Research Labs, as well as a survey of the clients of selected foreign comparison labs. The evaluation issues addressed by this study were presented in the Study Overview report prepared in March 1988.

Chapter II of this report profiles each of the five research labs, and provides a list of the clients of each lab.

Chapter III identifies the potential comparison labs in Canada and in other countries, i.e., other labs which undertake research activities which are similar to the activities carried out within Department of Communications.

Finally, Chapter IV presents the interview guide to be used in the survey of Department of Communications clients and clients of the comparison labs.

II - Description of DOC Research Branches

This section provides an overview of the research activities and clients of the five research branches covered by the overall evaluation study, namely the:

- Broadcast Technologies Research Branch
- Communications Technologies Research Branch
- Communications Devices and Components Research Branch
- Communications Applications Branch
- Office Automation Research Branch.

This overview was prepared for three main reasons:

- The evaluation team needed to become familiar with the basic organization, activities, types of client interactions, and research objectives of each branch.
- We needed to identify the major research activities of each branch, so that the criteria for selecting appropriate comparison labs could be established.
- Interviews were required in each branch and division to obtain suggestions regarding suitable comparison labs.

For each of the five branches, we provide a description of the major research concerns, an outline of the divisions within each branch and the current research programs. A list of clients of each branch is presented at the end of this chapter.

The information presented in this chapter was obtained through some twenty interviews in the various branches and divisions, at the director-general, director and chief levels. We also reviewed relevant documentation pertaining to the activities of each branch, including the 1988-1992 Business Plans, the 1988-89 operational plans, and the MOSST Decision Framework. Representatives of each branch provided us with a list of client names, which were supplemented by the client lists contained in some of the branch business plans.

An outline of branch resources and activities is provided in **Exhibit II-1, overleaf**. The table indicates the resource allocation for each branch in terms of person years, total resources used, and the research orientation of each branch. There is a wide variation in resource allocation among the branches, with the Communications Technologies Research Branch allocated more than twice the number of person years and expenditures than any of the other four branches.

Differences also exist in the orientation of each branch's research activities. This orientation is primarily determined by each branch's mandate. There are three main categories of research undertaken by the labs, each with different goals:

- **Mission-Oriented:** to support research and development, and related scientific activities, that are relevant to departmental missions and government priorities, and that maximize benefits that are secondary to departmental missions.
- **Industry-Support Driven:** to assist industries in becoming more productive and internationally competitive, increase private sector investment in research and development and innovation, and to build on regional strengths.
- **Knowledge-Driven Research:** to ensure an adequate supply of highly qualified scientific and engineering personnel, and a stream of new knowledge to lay the basis for future economic and social development.

Exhibit II-1

Branch Resources (1987-88) and Orientation of Research Activities

Branch	Resources		Research Orientation			
	Person Years	Total Resources Used	Mission- Oriented Research	Industry- Support Driven Research	Knowledge- Driven Research	
		(\$ Thousands)	(%)	(%)	(%)	
Broadcast Technologies Research	49	3,869	19	50	40	10
Communications Technologies Research	126	8,221	41	75	15	10
Communications Devices and Components Research	41	3,029	15	50	30	20
Communications Applications	13	883	4	50	50	0
Office Automation Research	41	4,031	20	45	45	10
TOTALS	270	\$20,033	100			

Broadcast Technologies Research Branch

Overview

The Broadcast Technologies Research Branch is primarily concerned with carrying out research activities into the technical aspects and related human and cultural issues of television, sound, and data broadcasting; interactive video services; video programs and cable generation; and interconnection of information systems. It is particularly interested in developing concept-proving technology and then transferring the technology to industry, for further development.

Branch Divisions

The branch consists of four divisions. A description of each division's current research activities and a list of clients follows.

(i) Behavioural Research Division

The Behavioural Research Division is responsible for research on human and cultural issues related to advanced broadcasting technologies. Concentration is placed on the design of technology for use by human users and its social impacts.

The major programs currently being conducted are as follows:

- **Applied Behavioural Models.** Work in this area is aimed at the creation of specialized databases to improve the access to information by human users. This includes studies of the use of neural network technology for image data compression and the dubbing of translated video productions.
- **Advanced Broadcasting Technologies.** Research is currently underway on human visual communication to provide empirical evidence on which to base methods and conditions for testing viewer based evaluations of the new technologies.
- **Impact of Information Technology on Music.** Research activities are pursuing the possibility of developing new software for education and for musical expression which will allow non-trained users to interact with technology and create music. This includes

examination of the socio-economic impacts of developments in electronics that affect the creation of music.

(ii) Information Processing Division

This division is responsible for developing and generating technical knowledge and expertise of new technologies related to broadcast systems. A gradual movement is underway towards increasing concentration of research into the quality of sound and image processing.

The two main research interests are video and sound image processing:

- **Video Processing.** This project will investigate processing techniques and methods for bandwidth reduction of high resolution video signals by using redundancy-reduction algorithms. A major interest is on the completion of a video systems facility. Studies are also being conducted towards:
 - simulating different televisions proposals, evaluating and standardizing them
 - determining the behaviour of new systems on transmission; and cable, satellite and antenna
 - developing processing capability
 - examining motion detection and compensation methods.
- **Sound and Image Processing.** Research activities in sound and image processing are focussed on techniques required by future high quality digital sound applied to television and radio broadcast. The work in image processing will concentrate on the development of signal processing algorithms to permit significant reduction in digitally encoded image data.

(iii) Systems and Networks Division

This division's research and development activities concentrate on the networks and systems integration and optimization for television, sound and data broadcasts, and new two-way interactive services. Research interests are also in the power of micro-computers and network transmission capacities. Their work is towards increasing the number of spin-offs of research activities.

The major programs currently underway focus on two areas: broadcast systems and the cultural industry, with the majority of research conducted in the former area.

- **Broadcast Systems.** The work in broadcast systems is subdivided into two areas: Television, Sound and Data Broadcast Systems, and Networks and Interactive Data/Video Services. The major research interest in the former area is Advanced Television Broadcast (ATV) in particular, the harmonization of new broadcast and cable TV systems elements and standards, and the compatibility and evolution with regard to existing NTSC television systems. Research will be undertaken of system parameters and spectrum requirements in relation to present broadcast bonds and channel allotments including satellite broadcasting in the 12 GHz and 23 GHz frequency.

The work in networks and interactive data/video systems concentrates on all network issues that relate to future broadcast, video and cable services, and examines future interactive systems. Investigation will be made of the future evolution of interactive data/video services, based on the merging of the technologies of high resolution video systems, video disk storage, high capacity transmission networks, and the powers of the micro-computer.

- **Cultural Industry.** At present, very little work is being conducted for the cultural industry; however, activity in this area is expected to rise. The current project is the provision of information centres for the new Museum of Civilization.

(iv) Open Systems Interconnection Division

Research activities in this division concentrate on all aspects of inter-connectivity such as protocol design, conformance, performance, and the Open Systems Interconnection (OSI) implementation environment. The work focuses on proving fundamental concepts, demonstrating technical feasibility, and engaging in interworking experiments with the major issue being the communication protocols which facilitate the actual information exchange.

The major programs in progress are as follows:

- **Conformance Testing.** This project concentrates on developing testing methodologies suitable for multi-layer OSI testing, and conducting basic research on test suite structures and implementation techniques.

- **Performance Issues.** Work in this area is concentrating on the performance issues of Open Systems Interconnection which will include evaluation of OSI implementation sizes, efficiency, and impact of host computer architectures and operating systems on OSI implementation strategies.
- **Upper Layer Architecture.** The research in upper layer architecture is focused on the development and enhancement of OSI upper layer standards. Concentration will be placed on new applications, common application service element groupings, management, and the impact of related developments.
- **Implementation Environment.** Work in this area is aimed at examining the feasibility of using the properties of formal descriptions to computerize protocol implementation directly from its formal specification.

Communications Technologies Research Branch

Research activities in the communications technologies branch are performed on the transportation of information by satellites, radar and optical fibres. Of the 126 person-years (PYs) in this branch, approximately 50 PYs are devoted to research on behalf of the Department of National Defence.

The branch consists of four divisions, following the transfer of the Radar Research Division to the Department of National Defence in April, 1988. For the purpose of this study, we have thus omitted this division. An overview of the research activities of the other four divisions follows.

(i) Radio Propagation Division

Research activities focus on the propagation of radio waves and their interaction with various media. They are presently conducting research into determining the characteristics of regions of the radio spectrum that are currently not in use and in the carrying capacity of radio spectrums that are in high demand.

The main programs being carried out in the Radio Propagation laboratories are as follows:

- **Urban Mobile Radio.** Research activity is concentrated on receivers in local areas larger than cells associated with cellular phones.
- **Wireless Local Area Networks.** Research is conducted within buildings which are not suited for hardwiring.
- **Microwave Propagation.** The focus is on collecting, analyzing and disseminating information relating to the propagation of radio waves in the SHF and EHF bands. Research is also undertaken on improving the design and management of terrestrial and satellite communications systems. Current research activities include up to the 30 GHz range in support of the ESA Olympus satellite. Work is also being conducted for the Canadian International Development Agency (CIDA) with respect to radio measurements of noise from the galaxy at commercial frequencies.

(ii) Optical Communications and Electrophotories Division

Research and development in this division is currently focussed on developing and communicating the research results of novel electrophotonic devices and component technology in support of the Information Technology strategy.

A major program is also underway with the Canadian Centre for Remote Sensing within the Department of Energy, Mines and Resources to develop mass optical storage.

(iii) Satellite Communications Division

Research undertaken by the Satellite Communications Division is concerned with the development of advanced communications satellite technology. Much of the research is of a long-term and high-risk nature in terms of investment and therefore deters private industry from entering this market.

The major research programs are as follows:

- **Mobile Satellite Applications.** This program is concerned with the provision of mobile communications services by satellite and addresses the base technology required for terrestrial, aeronautical, and marine satcom applications. The program deliverables are applied to the MSAT program, the international mobile satcom system and the military applications of the spectrum and power efficient communications schemes.
- **Military Satellite Communications.** This program provides support to the Department of National Defence in the area of satellite communications systems and technology research and development. A significant element of the program is the support for the D6470 EHF program.
- **Advanced Satellite Communications.** Research and development activities focus on system concepts and technologies applicable to future generations of communications satellites. New technologies are evaluated for their potential to reduce costs or to provide major improvements in the level of service. Research is also conducted for the development of satellite systems for distress alerting and other potential spectrum monitoring applications.
- **Communications Satellite Systems.** This is primarily a group which provides support to major satellite projects and acts as a centre of expertise on communications satellite systems.

- **MSAT Program Support.** Support is provided for the MSAT program through activities such as technical support for communications trials, and technical analyses to support planning policy and co-ordination activities. This program will also conduct and manage research and development on space and ground segment technology, as well as participate in national and international coordination for the MSAT Program.

(iv) Radio Communications Technologies Division

Research and development in this division focuses on three activities: communications processing, terrestrial military communications, and SHARP.

The Communications Processing research has concentrated on advances in digital voice coding and the application of Expert Systems to particular problem areas. Research activities in the terrestrial military communications are carried out for the DND Recoverable Program. Work is related to both tactical and strategic communications for voice and data systems, and the development of techniques and systems with civilian applications. The SHARP project is the development of a new delivery system for radio communications in the form of a high altitude microwave powered aeroplane which serves as a communications relay platform or a platform for surveillance or remote sensing.

Communications Devices and Components Research Branch

Overview

The Communications Devices and Components Research Branch is concerned with the electronic technologies needed to process, structure and manipulate signals in civil and military communications and information technology systems. It carries out research and development activities on devices, circuits and components for applications in spectrum-effective communications, high-speed data processing and radar systems. The branch has a particular interest in gallium arsenide technology.

The research undertaken by this branch is positioned mid-way between the long term (10 year plus) research carried out by university labs, and relatively short term product development (1 - 3 years) required by industrial firms. The benefits of the work are available to all Canadian companies, to assist them to minimize risk and entry costs into new technical areas.

The R & D programs undertaken by this Branch contribute to the departmental themes by providing the technological base upon which high-capacity and high-speed communications systems can be developed and incorporated into a Canadian information network. They also support initiatives concerned with the development of more effective lower rate communications systems such as MSAT and cellular radio, bandwidth reduction and sharing techniques such as those required in HDTV, and subsystems components for the Stationary High Altitude Relay Platform (SHARP). The research divisions in this branch are (1) Components and Sub-systems Technology and (2) Advanced Devices and Reliability Technology.

Branch Divisions

(i) Components and Sub-systems Division

The Components and Sub-systems Technology Division conducts research and development on microwave/millimeter circuits, digital circuits and sub-systems; and on antenna design for applications in communications and radar. Their major programs are as follows:

- **Monolithic Microwave Integrated Circuits (MMIC).** The emergence of gallium arsenide MMIC technology is intended to provide significant advantages in terms of size, weight, reliability, cost and performance. There are a variety of potential applications, including active phased array antennas, mobile receivers/transmitters, satellite transponders, optical communications and radar transmit/receive modules.

Compound semiconductor devices based on gallium arsenide technology are expected to provide numerous business opportunities over the next ten years. The Branch is attempting to develop a Canadian industrial capability in this area, since the cost of importing communications devices and components technologies is very high.

- **High-Speed Digital Integrated Circuit Components.** A variety of communications components are being developed which incorporate silicon-based very high-speed integrated circuits (VLSI). High-speed VLSI promises substantial improvements in signal processing and routing rates.

The use of compound semiconductors such as gallium arsenide in the fabrication of digital circuits can result in components with even higher switching speeds. These circuits can be very useful in large systems where incoming data must be very rapidly sorted and routed prior to further processing. In some cases, they are preferable to silicon-based circuits in that the higher speed reduces the total number of chips, and the associated power requirements and thermal problems.

- **Phased Array Antenna Technology.** Antenna technology has become very sophisticated, particularly for communications satellite applications. Offset parabolic antennas have most commonly been used. MMIC's, with their potential for small size, low-cost, and reproducibility, now permits the consideration of active phased array antennas capable of providing very complex beam patterns as well as agility in beam pointing and shaping. These capabilities are expected to provide solutions to many antenna requirements for mobile land, sea and air communications system. Considerable attention is also being given to development of active phased array antennas for military radars and for airport microwave landing systems.

This is a long-term development activity, as significant non-military deployment of active phased arrays is not anticipated before 1995.

- **EHF Components.** Future satellite communications systems will make use of the 20/30/44 GHz frequency band for civil and military applications. Such systems are presently being developed in Europe, Japan and the U.S. for use in applications such as transmission of business data between metropolitan centres in the civil arena, and

secure military communications where a high anti-jam capability is important.

The use of these frequency bands for civil communications systems in Canada may not be required until the mid-1990's or later, but their use in military and foreign systems has already been approved. The Branch is attempting to develop a Canadian capability in the manufacture of subsystem components so as to avoid dependence on foreign suppliers.

(ii) Advanced Devices and Reliability Technology Division

The Advanced Devices and Reliability Technology Division carries out research activities on advanced micro-electronic and opto-electronic devices for incorporation into prototype high-frequency communications hardware. The major projects that are currently underway in this Division are described below:

- **Opto-electronics.** Optical communications systems are expected to play an expanding role in Canadian telecommunications networks because of advantages offered in terms of low loss rate, broad bandwidth, potential reduction of system weight and immunity to electromagnetic interference and eavesdropping. However, commercialization of such systems is still in the early stages.

DOC research laboratories have already carried out R & D to provide a foundation for the development of advanced hybrid opto-electronic circuits, but much work is required to optimize the performance of components. Future work includes the growth and characterization of alternate semiconductor materials such as gallium arsenide.

- **New Compound Semiconductor Devices.** Currently, almost all of the integrated circuit development involving compound semiconductor materials is concentrated on gallium arsenide substrates. The possibilities offered by this technology have not been fully realized. The Branch intends to pursue longer-term R&D in those areas which will achieve the transition into actual applications.

The R&D activities will be carried out using an advanced active layer deposition system, in conjunction with the NRCC Microstructural Sciences Laboratory.

- **Reliability Studies.** Reliability studies are being conducted on the semiconductor based devices and integrated circuits. The studies consist of investigating the long-term reliability of these technology and the materials and processes used in their fabrication.

Comprehensive testing is undertaken to ensure continuous operation in a wide variety of environmental conditions.

Communications Applications Research Branch

Overview

The main focus of the Communication Applications Branch is to stimulate and increase the rate of adoption of emerging communications and information technology and to meet identified user needs through the introduction of improved telecommunications services and products. In addition, the branch concentrates on user oriented application projects that are concerned with the development of new systems and services.

Branch Divisions

The Communications Applications Branch comprise five divisions. A description of each division's projects and clients follows.

(i) Informatics Applications Division

This division focuses on the application of informatics to effectively meet identified user needs. The key element of the informatics program is to meet the need for better interconnection of machines, systems networks and information sources, and for improved information-management of new informatics technology. Towards this development, concentration will be placed on planning, coordinating, and implementing trials and demonstration of the new technology.

The major projects of the Informatics Applications Division are as follows:

- **Electronic Publishing.** This project is concerned with keeping up-to-date with current research and development activities and with facilitating the coordination of electronic publishing activities in the Department of Communications.
- **Teletex.** Activity in this area is currently focused on the development and sales of teletext services and products in Canada, particularly for commercial applications. Government departments will then be requested to participate in service trials and the procurement of teletext services to foster its development and lower operational telecommunication costs.

- **Speech Impaired Project.** This project is concerned with the development of an international standard and software for the communication and representations of Blissymbol telephone, a communication device for the speech impaired.
- **Canadian Museum of Civilization Project.** The primary activity is to provide coordination and support in the installation of an integrated informatics system. This system will enhance the experience of the CMC's visiting public and will allow the Museum to share its information resources on a national scale.
- **Sourcing Database.** Activity is based on the development of a coordinated sourcing database for the management and use in the federal government. This project is currently being coordinated with the Department of Supply and Services with respect to the development of a standard form of collecting data for tombstone databases.

(ii) MSAT Program Division

The MSAT program was initiated in 1979 and is managed by an interdepartmental committee. It is primarily concerned with supporting the establishment of a commercial domestic satellite-based system to deliver a family of new mobile services to users in rural and remote areas in Canada. The mobile services include a variety of telephone, radio, and data services.

(iii) Socio-Cultural Applications Division

The Socio-Cultural Applications Division reports administratively to the Communications Applications Branch; however, the principal technical contacts are with the Office Automation Research Branch. This Division is currently focusing on three projects which are described below:

- **Presence.** This project provides medical and social information to the physically handicapped, sexual abuse victims, and elderly through a telephone and computer terminal. It allows for the possibility of computer conferencing anonymously with others that have similar medically related problems.
- **SIDAIDs.** Activity in this project is focused on providing a computerized information service to individuals suffering from, or at risk of, AIDs. An experimental public electronic information system for AIDs victims is being developed in conjunction with the Royal Victoria Hospital in Victoria.

- **Telemedicine.** This project is the development of health care training in the third world by use of telematics and a computer-assisted health care system.

(iv) Communications Applications Division

The Communication Applications division acts as a facilitator between technology and the user. The applications development of new technology proceeds based on a balance between technology, policy, market, and benefits studies. An example of the division's major programs are outlined below:

- **Olympus Program.** The Olympus experiments and trials using the 30/20 GHz band are expected to begin in 1989 and end in 1994. Research is currently being conducted towards this development. The Olympus program will provide an opportunity for DOC to explore and investigate appropriate applications in 30/20 GHz band, as well as providing a vehicle to perform experimental distance and tele-health projects on an international basis.
- **Radio Applications.** This project will be evaluating the recent developments in HV, VHF, and UHF technologies and subsequently designing appropriate applications for remote telephone services, shipping communications, and very low bit-rate data services for off-shore services.
- **Tele-education and Tele-health.** Distance education and training, tele-health and other public services development will continue to be major domestic activities at 14/12 GHz. Activities in this area are expected to increase, in particular the development of provincial networks in tele-education, tele-health and information transfer.

(v) Applications and Policy Development Division

Work in the Applications and Policy Development division focuses on the development of applications policy, the technology needs, the design and assessment of new program initiatives, and redefining organizational structures and processes. The major project in this division is the design and development of models, principles criteria, and policy requirements for a series of cross Canada Communications/Information technology applications based R&D centres directed at using this technology to assist in local problems; for example, economic development, and will be followed by an assessment of the technology.

Office Automation Research Branch

The Office Automation Research Branch is part of the Canadian Workplace Automation Research Centre (CWARC) and is responsible for research and development in all aspects of workplace automation. A major objective of the branch is to provide leadership in applied research into computerized systems and utilize the related potential for enhanced productivity for both the public and private sectors. It also works towards becoming the focal point of information exchange in the field of workplace automation and fostering cooperation between the experts and different client groups.

The Office Automation Research Branch has five divisions. A brief outline of the research carried out in each division and an example of their clients has been provided below.

Branch Divisions

(i) Organization Research Division

The Organization Research division carries out research activities on the organizational needs of users of integrated office systems and is concerned with the management of change caused by new techniques in organizations and the workplace. An example of the division's research projects that are currently underway are as follows:

- Tools and methods for integrated office system planning.
- Tools and methods in support of training, development, and ongoing learning related to computerized office systems.
- Interfaces between official systems users and computer communications networks.
- Interfaces between people and software environments, especially translated and adapted software environments.

(ii) Integrated Systems Division

Research activities in this division are primarily aimed at improving integration of multiple functions in the same workstation through better interaction mechanisms and the development of

systems designs and applications based on established techniques and the use of new techniques. The division focuses on three research areas:

- **Integrated Workstations.** Research is focused on the integration of workstations of speech processing based on recent techniques of control and voice synthesis and their applications.
- **Open System Interconnection (OSI).** Research is concentrated on improving the levels of technology transfer through the development with industry of trial installation of standardized protocols. The development of test environments and tools for use by industry are also being examined.
- **Experimental Systems.** The research aim of the experimental systems project is to make available the Office Automation Branch specialists and facilities to industry for experimental projects on systems under development, in particular, interconnection by local and area wide networks. The aim of this project is to assist Canadian industry to develop systems.

(iii) Advanced Technology Division

The two main areas of activity in the Advanced Technology Division are computer-assisted translation and expert systems and knowledge management:

- **Computer-Assisted Translation.** The research activity in computer-assisted translation is working towards contributing to the development of a specialized workstation which will offer a variety of tools to the translator. It also seeks to promote the automation of translation in limited areas and to assist in producing increasingly intelligent translation systems.
- **Expert Systems and Knowledge Management.** Research in this area is concentrated on the development of knowledge-based systems (expert systems) and on the various phases of this methodology to produce these systems for use in industry. The main research objective is the development of special software in support of management, professional, and office work.

(iv) External Cooperation Division

The External Cooperation Division facilitates liaison between CWARC's various client groups for the transfer of information and knowledge and serves as a channel between the client group and experts in the field.

The primary research interest is the establishment of a scientific and strategic information network. Towards this end, CWARC has established an integrated information service offering documentation, archival, and tele-reference services; and data banks to compile information on various concerns in workplace automation.

(v) National Exchange Program Division

This program is a recruitment of experts from public, private, or university organizations or institutions for a specified period of time, to participate in research into the technological applications of office automation. This process enhances the results of applied research and facilitates the ongoing efficient transfer of technology.

Clients

The lists of clients for the five branches are contained in **Exhibits II-2 (i) to (v)**, overleaf. Both public and private sector clients are provided for each of the divisions within each branch.

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
Private Sector				
H.B.O.	X			
Roger's Cable	X		X	
Institute for Research on Public Policy	X			
Decoustics Ltd.	X			
Ultimateast		X		
RACE Technologies		X		
IDON Corporation		X		
Ottawa Civic Hospital		X		
Videotron		X		
Crawley Research Ltd.		X		
National Association of Broadcasting			X	
Society of Motion Pictures and Television Engineers			X	

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch (Cont'd)

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
Canadian Interest Groups on OSI				X
Wescom Communications Studies and Research Ltd.	X			
Acquired Intelligence, Inc.	X			
Intellitech Ltd.	X			
Acart Graphic Services Inc.	X			
Talamark Ltd.	X			
Northern Telecom	X			
Bell Northern Research	X	X		
Canadian Advanced Broadcast Systems Committee	X		X	
Advanced Television Systems Committee	X			
Advanced Television Standards Committee			X	
Society for Canadian Office	X			
Automation Practioners	X			

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch (Cont'd)

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
PMO/PCO	X			
AEL Microtel	X			
Consultive Committee of International Radio (CCIR)	X		X	
GTA			X	
Delft University of Technology	X			
University of British Columbia	X			X
York University	X			
Carleton University	X			X
University of Waterloo	X			X
University of Western Ontario	X			
University of Moncton	X			
Memorial University	X			
University of Victoria	X			

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch (Cont'd)

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
University of Alberta	X			
University of Montreal	X			X
Queen's University	X			
University of Lethbridge	X			
University of Guelph	X			
University of Ottawa		X		X
Massachusetts Institute of Technology	X			
Concordia University				X
Public Sector				
CBC	X		X	
- Sound Processing		X		X
NRC	X			X
DSS				
- Bureau of Management Consulting	X			

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch (Cont'd)

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
National Film Board	X			
EMR	X	X		
National Library	X			X
External Affairs	X			X
Museum of Civilization	X			
Social Sciences and Humanities Research Committee	X			
DND				X
CIDA				X
DOC				
- Division of Information Processing	X	X		
- Policy Branch				X
- Industry Development Branch				X
- Cultural Policy and Program				X

Exhibit II-2

List of Clients

(i) Broadcast Technologies Research Branch (Cont'd)

	Behavioural Research	Information Processing	Systems and Networks	Opens Systems Interconnection
- Committee on HDTV Demonstration and Survey	X			
Labour Canada				
- Technology Impact Research Committee	X			

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
Private Sector				
Petrie Telecommunications	X			
Daniel Electronics	X			
Spillsberg Communication	X			
Baron Communication	X			
Diversitel	X			X
Bell Northern Research	X	X		
Maritime Telegraph	X			
NovAtel Communications Ltd.			X	
National Optics Institute		X		
Opti Electronics		X		
Norstar		X		

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch (Cont'd)

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
Canadian Instrument Research		X		
Microtel Pacific Research		X		
Telesat			X	
Teleglobe Canada			X	
Inmarsat			X	
Skywave			X	X
Glenayre			X	
Nexus			X	
Canadian Marconi			X	
Lindsay			X	
Miller Communications			X	X
Spar Aerospace			X	

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch (Cont'd)

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
SED Systems				X
Chan Technologies				X
Northwest Telecom				X
Canadian Astronautics Ltd.			X	X
ICI		X		
University of Western Ontario	X			
Concordia University	X			
McMaster University Communications Research Centre		X	X	
Simon Fraser University		X	X	
École Polytechnique		X		
Université du Québec à Trois Rivières		X		
University of Toronto		X		

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch (Cont'd)

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
Université Laval		X		
Carleton University			X	
University of Ottawa			X	
Queen's University			X	
University of Toronto Institute of Aerospace Studies				X
Consultive Committee of International Radio (CCIR)	X			
Electrical Propagational Panel (EPP)	X			
Inventions Committee		X		

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch (Cont'd)

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
Public Sector				
DND	X		X	X
- Director of Frequency Spectrum Management	X			
- Defense Research Establishment Ottawa	X			
- SAPHIR §	X			
DOC				
- Management of the Radio Frequency Spectrum	X			
- MSAT Program			X	
- Policy Branch			X	
EMR	X			
- Radarsat Program			X	

Exhibit II-2

List of Clients

(ii) Communications Technologies Research Branch (Cont'd)

	Radio Propagation	Optical Communications and Electrophotories	Radio Satellite Communications	Communications Technologies
NRC				
- Space Station			X	
Ontario Ministry of Health			X	
Ontario Communications and Culture			X	
DOT			X	

Exhibit II-2

List of Clients

(iii) Communications Devices and Components Research Branch

	Components and Subsystems	Advanced Devices and Reliability
Private Sector		
M.A. Electronics Canada Ltd.	X	
Bolriet	X	
B.E.L.-Tronics Ltd.	X	
ComDev Ltd.	X	
Varian Canada	X	
SR Telecom	X	
MPB Technologies Inc.	X	X
Canadian Marconi Company	X	
Canadian Astronautics Ltd.	X	
National Public Radio	X	
NovAtel Communications Ltd.		X
IOTEK Incorporated		X

Exhibit II-2

List of Clients

(iii) Communications Devices and Components Research Branch (Cont'd)

	Components and Subsystems	Advanced Devices and Reliability
Alberta Telecommunications Research Centre		X
Les Technologies OMVPE Inc.		X
Precision Photomask Inc.		X
University of Waterloo		X
McMaster University Communications Research Centre		X
Carleton University		X
École Polytechnique		X
Public Sector		
DND	X	
Defense Research Establishment Ottawa	X	X
Defense Research Establishment Atlantic - Advanced Digital Systems		X
Transport Canada	X	
Ministry of Science and Technology		X

Exhibit II-2

List of Clients

(iii) Communications Devices and Components Research Branch (Cont'd)

Components and Subsystems	Advanced Devices and Reliability
NRC - Micro-Structured and Sciences Laboratory	X

Exhibit II-2

List of Clients

(iv) Communications Applications Research Branch

	Informatics Application	Socio-Cultural Applications	Communications Applications	MSAT Program
Private Sector				
IDON Corporation	X			
Bliss Communications	X			
Norpak	X		X	
Electronic Publishing Institute	X			
Le Matin	X			
Royal Victoria Hospital		X		
Centre hospitalier de l'universite Laval		X		
Telesat Canada			X	X
Knowledge Network			X	
Access Alberta			X	
CANCOM			X	
TV Ontario			X	

Exhibit II-2

List of Clients

(iv) Communications Applications Research Branch (Cont'd)

	Informatics Application	Socio-Cultural Applications	Communications Applications	MSAT Program
CFCN	X			
CTV	X			
B.E.L. Tronics Ltd.			X	
COMDEV			X	
Varian Canada			X	
Microtel			X	
Andrew Antenna Company Ltd.			X	
Ontario Hydro			X	
Ultimateast			X	
Newfoundland & Labrador Computer Services Ltd.			X	
Royal College of Physicians and Surgeons			X	
Ontario Educational Communications Authority			X	
Newfoundland Telephone			X	

Exhibit II-2

List of Clients

(iv) Communications Applications Research Branch (Cont'd)

	Informatics Application	Socio-Cultural Applications	Communications Applications	MSAT Program
AGT Network			X	
Canadian Astronautics Ltd.			X	
COMTEL			X	
Gandalf Data Ltd.			X	
INTELSAT			X	
Apollo Microwaves Ltd.			X	
Lapp-Hancock Associates Ltd.			X	
British Columbia Television Broadcasting Systems Ltd.			X	
SPAR Aerospace Ltd.			X	
Kingston General Hospital			X	
Holland College, School of Technology			X	
Laurentian University			X	

Exhibit II-2

List of Clients

(iv) Communications Applications Research Branch (Cont'd)

	Informatics Application	Socio-Cultural Applications	Communications Applications	MSAT Program
University of British Columbia			X	
Ryerson Institute of Technology			X	
University of McGill	X	X		
Université Québec			X	
Simon Fraser University	X			
Memorial University			X	
University of Western Ontario			X	
University of Saskatchewan			X	
Public Sector				
Statistics Canada	X			
Energy, Mines and Resources	X			
Department of National Defence	X			
Department of Regional Industrial Expansion	X			

Exhibit II-2

List of Clients

(iv) Communications Applications Research Branch (Cont'd)

	Informatics Application	Socio-Cultural Applications	Communications Applications	MSAT Program
Canadian Broadcasting Corporation			X	
Ministry of Culture and Communications			X	
Department of Consumer Affairs and Communications			X	
Alberta, Public Works, Supply & Services Telecommunications Division			X	

Exhibit II-2

List of Clients

(v) Office Automation Research Branch

	Organizational Research	Integrated Systems	Advanced Technology	External Cooperation	National Exchange Program
Private Sector					
Canadian Communications Group for Research and Consulting Inc.	X				
Télémediatique	X				
Fédération des Caisses Populaires Desjardins de Montréal et de l'Ouest de Québec	X				
Maneau-Noiseaux, Hôpital Ste-Jeanne d'Arc	X				
EGA	X				
Software Kinetics		X			
Voice & Data Systems		X			
Cerbo Informatique Inc.		X			
Idacom Electronics Ltd.		X			
Loto Québec		X			
AES Data		X			

Exhibit II-2

List of Clients

(v) Office Automation Research Branch (Cont'd)

Organizational Research	Integrated Systems	Advanced Technology	External Cooperation	National Exchange Program
Philips	X			
Québec Téléphone	X			
DTI Inc.		X	X	X
GEAC Inc.		X		
Office Smiths Inc.		X		
Prelect		X		
Hannover House Software Inc.		X		
Computer Time		X		
Continium Inc.		X		
Q'Nail Systems Ltd.		X		
Gestinfo			X	
Centre de Documentation Sur le Sport			X	

Exhibit II-2

List of Clients

(v) Office Automation Research Branch (Cont'd)

	Organizational Research	Integrated Systems	Advanced Technology	External Cooperation	National Exchange Program
CD-ROM Publishing Services				X	
YYIATTS				X	
Université de Montréal	X		X	X	
Université de Moncton	X				X
Université du Québec à Chicoutimi	X				
Université Laval	X				
École Nationale d'Administration Publique	X		X		
École des Hautes Études Commerciales	X				
Télé-Université	X				X
Institut Gamma	X				
Université de Sherbrooke		X			
Institut Nazareth		X			
Concordia University			X		

Exhibit II-2

List of Clients

(v) Office Automation Research Branch (Cont'd)

Organizational Research	Integrated Systems	Advanced Technology	External Cooperation	National Exchange Program
McGill University		X		
University of Western Ontario				X
Memorial University of Newfoundland				X
Public Sector				
Communauté régionale de l'Outaouais - Ministère des Affaires Municipales				

III - Identification of Comparison Research Laboratories

This section provides a list of research laboratories that are "potentially" comparable to the Department of Communication's (DOC) research laboratories. We obtained this information through interview sessions with the director-general's and directors of each of the five branches included in this evaluation. During the interviews we requested each director and director-general to identify laboratories in the public and private sector, which undertook research activities similar to activities undertaken in their research laboratories. Many of them suggested that research laboratories directly comparable to those at DOC do not exist due to such differences as financial resources, size and research interests. We also asked the directors to indicate the research activities of the comparable laboratories, and their "openness" to providing Peat Marwick with an understanding of their research interests and a list of their clients. In total, some thirty-three comparison research laboratories were identified.

Each director-general and director was requested to identify at least three comparison research laboratories, in particular, one private laboratory in Canada and two public sector laboratories in foreign countries. **Exhibit III-1, overleaf**, provides a complete list of all comparison research laboratories mentioned. A glossary of the acronyms for the research laboratories can be found in the appendix. With respect to private laboratories in Canada, the general belief was that there was not one that conducted similar research activities to research undertaken at the DOC laboratories, as DOC's laboratory research was often of a long-term, high-risk nature that precluded private sector interest. Of the private sector laboratories in Canada, Bell Northern Research (BNR) was the laboratory most often mentioned. However, the prevailing opinion was that the personnel of the BNR laboratories would not be 'open' to discussing their research activities or clientele. In addition, BNR only has one major client, Northern Telecom, thereby making a survey of clients impossible.

There were several mentions of public sector laboratories in foreign countries undertaking similar research activities. Based on the information provided in Exhibit III-1, the public sector laboratories with the most research activities similar to those conducted in the Department of Communications Research Laboratories are NASA in the United States, and Centre National d'Etudes des Télécommunications in France.

DOC RESEARCH AREAS COVERED BY POTENTIAL COMPARISON RESEARCH LABORATORIES

[illegible]

DOC RESEARCH AREAS COVERED BY POTENTIAL COMPARISON RESEARCH LABORATORIES

Canadian

Japan

Germany

[illegible]

Exhibit IV-1
Interview Guide
Survey of Clients

Client Identification

The list of clients may at times identify the name of the organization only. In these instances, phone a chief-executive officer or senior member of the organization and try to identify the person most likely to be involved with the Research Laboratories of the Department of Communications (use CRC and CWARC if necessary) or the selected comparable laboratory.

Introduction

Explain that Peat Marwick Consulting Group has been commissioned to carry out a survey of the clients and potential clients of the DOC Research Labs and selected comparable labs.

Briefly outline the topics you would cover e.g., types of interactions with the lab(s), the benefits, satisfaction of clients and suggestions for changes and improvements.

IV - Draft Interview Guide - Survey of Clients

In this section we present the first draft of the interview guide to be used for the survey of Department of Communications' clients and the clients of the comparison labs.

This interview guide is intended to facilitate senior interviewers on the study team to cover the relevant issues of the overall evaluation study. Given the variety of clients and the different types of client interactions with one or more Research Branches of the Department of Communications, it was felt that interviews should follow an open-ended and free-flowing format. This decision is also influenced by the fact that we will typically be interviewing senior-level officials of the client organization. However, the interviewer will use the probes as effectively and efficiently as possible to obtain a comprehensive coverage of relevant issues.

The interview guide addresses the following topics:

- Overview of involvement with the Research Lab(s) or comparable lab.
- The purposes for which the client used the services of the Research Lab(s) or comparable lab.
- The ways in which the Research Lab(s) or comparable lab proved helpful.
- The results of interactions with the Research Lab(s) or comparable lab.
- The impacts of interactions on:
 - The organization
 - Canadian Society
 - Other Societies.
- The incrementality of the lab(s) i.e., what would happen if the lab(s) did not exist.
- Client satisfaction with respect to:
 - Accessibility
 - Time for responses
 - Research competence
 - Quality of staff
 - Quality of facilities
 - Market orientation
 - Communications.

- Client perception of strengths and weaknesses.
- Suggestions for changes:
 - Type of research
 - Management
 - Areas of research
 - Marketing and communications
 - Types of interactions.
- Overall need for the communications laboratories.

The interview guide is presented in **Exhibit IV-1, overleaf.**

Overview of Involvement With Research Lab

1. Could you describe how you (or your organization) were involved with the _____ lab(s).

Probe

- Which lab(s) were used? (Contact persons, groups, etc.)

- What purpose, e.g., obtain:

- Advice
- Ideas/Knowledge
- Contract
- Funds

or carry out a:

- Collaborative effort
- Cost-sharing partnership

or:

- Transfer technology
- Apply technology for a specific purpose
- Carry out technology trials and testing

- How often is (are) the lab(s) used?

- Year(s) of contact.

2. What resulted from your interaction with the Research Lab(s) of the Department of Communications?

Obtain Details On

- New knowledge

- Publications and papers
- Report
- Further research (details on what and who were involved)
- Presentations in seminars, etc.
- Awards and honors.

- **Pre-competitive product or services**
 - Product design
 - Service design
 - Invention
 - Prototypes
 - Bench model
 - Licenses (types of arrangements)
 - Patents (number of years).
- **Technology transfer** (from where to when e.g., obtain technology from government or transfer background technology to the government).
- **New products/services (commercialization).**
- **New process/technique.**
- **Application spinoff** (may also include new companies and staff spinoff).

3. Could you elaborate on the benefits obtained from:

(a) New knowledge (if applicable)

- sold to the private sector
- made public in a press release
- made available in a publication
- transferred background technology to the government for further R&D
- covered by a patent
- more follow-on-research (contracts?).

(b) Technology transfer

- companies formed
- products/services
- process or techniques
- application spinoff
- further research within government
- further research outside government.

(c) Pre-competitive product or service and new product or service

- integrated into product or service mix of the parent organization
- new organization
- increased sales through sale of new product/service
- increased sales of other products/services
- increased staff
- increased competitiveness of firm

(d) New process or technique (if applicable)

- improved the sales of product or service
- improved the quality of product or service
- reduced cost of product or service
- increased productivity
- shortened the time for production or service delivery
- increased the availability (access/reach) of product or service
- follow-up-research.

(e) Application spinoff

- beneficiaries (professionals, industry, consumer)
- economic benefits
- social benefits.

4. Do you think that the results of your interaction (work) with the Lab(s) have benefitted society? How?

Probe

- New breakthrough knowledge to society.
- New technology resulting in increased national competitiveness.
- Increased export sales.
- Decreased imports.
- Increased national employment.
- New ventures.
- Increased national investment in R&D.
- Increased prestige for the nation.
- Reduction of cost to industry.
- Benefits to consumers.

5. How would you rate your satisfaction with the various aspects of the service provided by the _____ Lab(s)?

Probe

- Are services well known? How is this information obtained?
 - Is it possible to easily identify the appropriate person?
 - Is the _____ lab(s) responsive to client needs?
 - What sorts of planning and implementation support is given?
 - What help is provided with respect to obtaining funds?
 - Does the _____ lab(s) communicate with clients?
 - Are there undue delays?
 - Is there adequate staff?
 - What is the quality of the research performed?
 - How about facilities?
 - Where applications are involved, does the _____ lab provide adequate interface between stakeholders?
 - Is the _____ lab(s) more technology oriented than market oriented to the disadvantage of clients? How?
6. Overall, to what extent do you feel the _____ lab exists to serve the needs of clients?
7. How does the quality of research carried out by this lab compare to that of other similar labs in _____ or other countries?
8. If the _____ lab had not existed, how would your work have been affected?

Probe

- Parts of work which could not have been carried out.
- Time delays.
- Quality of results.
- Scope of results.
- Loss of funds.

9. Suppose, hypothetically, that the _____ lab were closed tomorrow. How would this affect you?
- Parts of work which could not have been carried out.
 - Time delays.
 - Quality of results.
 - Scope of results.
 - Loss of funds.
10. (a) If the _____ lab were to close tomorrow, could you obtain similar services from another lab? If yes, obtain:
- Name of labs.
 - Type of help obtained in the past?
- (b) Would the services of the labs mentioned in 10(a) be different from those of the _____ lab(s)? How? Compare where possible.

Probe

- Are services well known? How is this information obtained?
- Would it be possible to easily identify the appropriate person?
- Would the lab(s) be responsive to client needs?
- What sorts of planning and implementation support would be available?
- What help could be obtained with respect to securing funds?
- Does the lab(s) communicate with clients?
- Is there adequate staff?
- What is the quality of the research performed?
- How about facilities?
- Where applications are involved, does the lab provide adequate interface between stakeholders?

- Are labs pursuing technology for its own sake or are they more applications oriented? How?

11. Do you have any suggestions to improve the performance of the _____ lab(s)?

- Areas of research.
- Management (private sector?).
- Reorganization (what basis?).
- Short term R&D versus long-term R&D.
- Pure versus pre-competitive versus commercial research.
- More regional approach.
- More cost-sharing with industry.
- Promote university research.
- More consumer application oriented.
- More industry oriented.
- More pooling of ideas in a systematic way.
- More transfer of technology orientation.
- Better selection criteria for projects selection (what criteria).
- More public procurement contracts.
- Start up support for initiatives aimed at facilitating access to patents and licensing markets.
- Seed money/start-up financing.
- Acceleration of market introduction for new products.
- Support for management of innovative companies.

12. (a) If the lab were to receive more resources which research do you think it should focus on.

(b) How should it conduct the research?

- Collaborative
- Cost-sharing partnership

(c) What type of staff should be increased?

13. If the lab were to receive less resources which research areas do you think it should drop?

To Department of Communications Research Lab clients only.

14. Do you think that there is a need for the _____ lab in Canada?

Probe

- Needs (types).
- Beneficiaries (types).

Appendix

Glossary of Acronyms

RSRE	-	Royal Signals and Radar Establishment
BBC	-	British Broadcasting Corporation
NCC	-	National Computing Centre
CCETT	-	Comité Conjoint sur les Etudes de Télévision et de Télécommunications
CNET	-	Centre National d'Etudes des Télécommunications
PTT	-	Postal Telecommunications and Telegraphs
AGARD	-	Advisory Group on Aerospace and Research Development
ESPRIT	-	European Strategic Programme for Research in Information Technology
CESTA	-	Centre d'Etudes sur la Science et la Technologie Avancée
ESA	-	European Space Agency into Information Technology
NASA	-	National Aeronautics in Space Agency
NRC	-	National Research Council
DND	-	Department of National Defence
BNR	-	Bell Northern Research Ltd.
CIR	-	Canadian Instrumentation Research
NOI	-	National Optical Institute
NPR	-	National Public Radio
MIT	-	Massachusetts Institute of Technology
NTT	-	Nippon Telephone and Telegraph

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Survey of clients of DOC and
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program profile and
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