1990

Communications Canada

GOVERNMENT TELECOMMUNICATIONS PLANNING FRAMEWORK AND REVIEW

Canada

Queen
JL
86
C6
A55
1990
c.2

1990

Industry Canada
Library Queen
JUL 07 1998
Industrie Canada
Bibliothèque Queen

Government Telecommunications Planning Framework and Review

COMMUNICATIONS CANADA
AUG 9 1991
LIBRARY – BIBLIOTHÈQUE

DD 1062 7406
DL 10721722

JL
86
C6
A55
1990
C.2

Printed on recycled paper.

© Minister of Supply and Services 1991
Cat. No. CO35-17/1990
ISBN 0-662-57997-6

Contents

Preface

Readers of previous editions of the *Annual Review and Planning Framework for Telecommunications in the Government of Canada* will note that the title of this edition has changed. Now known as the *Government Telecommunications Planning Framework and Review*, the title reflects the renewed emphasis on telecommunications planning, which is conducted to varying degrees at many levels within the government.

This year, the *Government Telecommunications Planning Framework and Review* focuses on the theme of productivity, or doing more with less. During the period of restraint under which the Government of Canada currently operates, sound management of all aspects of telecommunications provides the government with the opportunity to increase service to its clients, while using fewer resources. This apparently contradictory dictum goes beyond simply applying telecommunications and information technologies to yield incremental increases in productivity: the effective integrated management of these technologies can enable departments to increase service while, in some cases, freeing limited resources to be applied to the pursuit of additional government priorities.

The previous edition of this document, the *Annual Review and Planning Framework for Telecommunications in the Government of Canada 1986/1987*, focused on the theme of management for change. It discussed the requirement for the reorientation of government telecommunications management within the new environment created by the convergence of telecommunications, data processing and office technologies. The complexity of this environment, it was stated, was further compounded by deregulation and competition.

While recognizing the opportunities which this new environment presented, the challenges of telecommunications management were seen to be "... particularly significant in the government, where the complexity stems not only from size but also from the dissimilar organizational structures that support the wide range of government programs." Improved management and control over the introduction and use of technology were considered the paramount challenges to the government telecommunications community, since technology itself had been the dominant force of change. Management and regulation -- the controlling elements -- were seen to be weak, creating "... an imbalance in the three-way relationship of management, regulation, and technology."

The previous edition of this document presented the management challenges posed by this new era of rapid technological advance and deregulation. It is the goal of the *1990 Government Telecommunications Planning Framework and Review* to chart the progress that the Government of Canada has made toward meeting these challenges through the implementation of a coordinated telecommunications management infrastructure designed to ensure that telecommunications is effectively managed as a corporate resource.

While the appropriate use and management of telecommunications and information technologies as a means of increasing productivity has gained near axiomatic acceptance, it must be pointed out that the institution of the new telecommunications management infrastructure is an act in pursuit of increased efficiency and productivity within the management function itself. This infrastructure gives substance to the pooling of telecommunications requirements, facilities, resources and expertise from all federal government departments and agencies. Synergistic efficiencies will result from this cooperative management infrastructure, which addresses many of the management challenges put forth in previous editions of this document.

As in the past, an overall planning framework provides some insight into the factors which are shaping the environment in which telecommunications will be managed. Part I, "Government Telecommunications Planning Framework", includes an environmental analysis of technology, national telecommunications policy and regulatory developments.

Discussions focusing more specifically on the government environment follow: these include sections on new government Information Management Policy, and other policy initiatives and organizational changes which are significantly affecting telecommunications management in the government.

Common telecommunications networks and services developments and plans are briefly discussed, and a complementary section describes the networks of a variety of departments.

Part II, "Government Telecommunications Expenditures Review", summarizes telecommunications resource expenditures in the Government of Canada for fiscal years 1986/87 through 1989/90, and projects them to 1993/94. The expenditures review is maintained as a core component of this document, since the analysis of expenditures indicates to what extent telecommunications is used to support government program delivery, as well as the extent to which telecommunications services are managed from a corporate point of view.

Government Telecommunications Agency recoveries from departments are also reviewed in some detail, to place common services usage in the context of overall government expenditures for telecommunications.

As in previous editions, the target audience of the *Government Telecommunications Planning Framework and Review* encompasses more than telecommunications professionals: it includes senior management, personnel working in related disciplines and users of telecommunications services, for it is their collective needs which must be served.

Executive Summary

Technology and Related Developments

Electronic Data Interchange (EDI)

Electronic Data Interchange offers new ways of doing business, through computer-to-computer exchanges of business documents in standard formats, between different organizations. Improved service, cost reduction and greater effectiveness can be achieved by implementing EDI.

The Treasury Board Secretariat recognizes EDI as a key strategy for improving government procurement procedures. Moreover, the EDI Council of Canada has suggested that an EDI Office be established within the Department of Communications (DOC) to act as a focal point for industry-government liaison. It will also assist in EDI implementation, act as secretariat to the federal government EDI Users Group, and work with DOC's Canadian Workplace Automation Research Centre to develop an EDI conformance-testing facility.

Electronic Data Interchange trials are planned by Public Works Canada, Supply and Services Canada, and the Government Telecommunications Agency.

Fibre Optics

Long-Haul Transmission: Near Term. Telecom Canada's digital fibre optics light guide transmission system has been completed from the Maritimes to British Columbia.

The Synchronous Optical Network standard, based on multiples of T3, continues to gain acceptance.

Long-Haul Transmission: Long Term. Using optical amplification and optical pulses of a specific shape, width and power level, distortionless light-pulse propagation over 6,000 kilometres has been demonstrated in the laboratory.

Local Loop: Long Term. It appears likely that prototype deployment of combined fibre for residential integrated voice, data, and video will occur.

The Canadian Consortel consortium was launched in 1987 to integrate different transmission technologies within a single medium, and will develop a network carrying services presently distributed on separate networks.

Data Networks and Local Area Networks (LANs). The Fibre Distributed Data Interface (FDDI) fibre optic LAN standard will provide transmission at 100 Mbps. Canstar Communications is developing a higher-speed version of its SuperNetwork LAN, which will operate at over 300 Mbps.

Integrated Services Digital Network (ISDN)

Based on international standards, ISDN will permit integrated local access to all telecommunications services and ensure compatibility between networks and terminals.

In 1988, the Private Sector Advisory Committee on ISDN was formed to advise the Minister of Communications on ISDN implementation in Canada. Through a public consultation process, seven major discussion areas were identified for review by the Committee.

Network Termination 1 Ownership. The NT1 is the group of network functions which provide standard basic and primary rate access to ISDN exchanges or switching nodes from customer premises. It was recommended that the customer have the option of owning the NT1 or obtaining it from the carrier. Since ISDN trials are underway, and several carriers have indicated that they will file ISDN tariffs, network interface standards are urgently required. The Canadian Standards Association Steering Committee on Telecommunications was mandated to serve as the

standards-writing body for ISDN in Canada.

The Government Telecommunications Agency and Telecom Canada are collaborating on a national ISDN trial. Most Telecom Canada member companies are also conducting internal trials; moreover, Telecom Canada is working toward conducting overseas and Canada-U.S. trials.

Network Interconnection. The Committee believed that ISDN will enable present levels of competitive network and services interconnection to be maintained and allow for further interconnection, if permitted by regulation.

Enhanced Services. Redefinition of basic and enhanced services may be required. Regulatory bodies will have to ensure that enhanced service providers are able to offer services fully competitive with those of the carriers.

Private Line Services. The Committee determined that carriers will continue providing dedicated facilities as long as market demand exists.

Tariffs. Regulatory authorities must strike a balance between the requirement to ensure maximum competition where it has been introduced, and the need to ensure universal access to basic, affordable telecommunications services.

National Standards. Four national standards issues were considered:

- voluntary national standards;
- conformance testing;
- disclosure of carriers' network plans; and
- the institution of a body to oversee the development of technical network interconnection standards.

Three CSA standards for ISDN basic rate access were published in 1990; a standard for primary rate access should be available in early 1991. The Terminal Attachment Program Advisory Committee issued ISDN network protection standards in 1990.

National Policy. Committee members believed that ISDN should be implemented on a national basis, and that it should be considered as part of a national economic strategy to enhance the efficiency and competitiveness of Canadian industry. It was recommended that mechanisms be established to permit ISDN implementation on a national basis, while ensuring affordable universal basic telecommunications for all Canadians.

The Canadian ISDN Interest Group was established in June 1990 to provide ISDN users with the opportunity to contribute to technology and standards development.

Stationary High Altitude Relay Platform (SHARP)

The Stationary High Altitude Relay Platform is a light, pilotless aircraft powered by microwaves beamed from the ground, allowing it to fly for up to one year. It will relay radio signals over an area of up to 600 kilometres in diameter.

When commercialized, SHARP will provide services such as direct broadcast television and radio, mobile telephone and radio, wide-area paging, broadband data, atmospheric monitoring, radar surveillance and remote sensing. Services could be provided in areas not served by established networks.

A program with industry, government and university participation for research, development and commercialization of SHARP is being pursued, in parallel with regulatory policy development.

Radio Communications: Technology and Market Trends

In the short term (5 years), demand for mobile radio communications services will increase by 10 to 20 percent per year, but the point-to-point and point-to-multipoint telecommunications market will be flat. Regulatory constraints will limit the application of radio.

The most significant growth has occurred in cellular mobile telephony and paging, with total cellular subscribers in Canada expected to be about 500,000 by 1991. Short-term paging services growth is expected to be 15 to 20 percent per year.

Mobile Radio Products and Services. Radio communication can support mobile facsimile machines and portable computers. Dedicated networks are offering public data transmission services. Underwater mobile communications products and wireless local area networks are under development.

By 1990, paging services will include optional information and text messaging. In-house paging services will be integrated with building and process control systems.

Cellular mobile telephony now includes features such as call forwarding, call waiting and three-way conferencing.

Mobile Data Communication Products and Services. Canadian service suppliers, such as Cantel and BCE Mobile, are establishing public radio data networks, but the market for mobile data will be less than five percent of the cellular voice customers by 1992.

Other Market Segments. Radio can be a viable alternative to wire or cable. B.C. Tel, for example, provides telephone service to remote subscribers via radio, while radio may replace wires in plant, office, residential and public applications.

Personal Communications and the Consumer Market. Lower terminal and service costs will probably be required before personal communications reaches the consumer market.

Diminishing Differences Between Distinct Industry Segments. The versatility of emerging technologies will give service and product suppliers the opportunity to integrate services. By the mid-1990s, portable telephones may also provide paging.

Satellite Communications: Mobile Satellite (MSAT)

MSAT is a satellite communications system for the provision of two-way voice and data services to terrestrial, marine and aeronautical mobile stations. It will provide all areas of Canada with direct satellite links to public and private mobile radio systems and the public switched telephone network.

The federal government has allocated $126 million for services to the government and $50 million for technology development, trials and management. The Government Telecommunications Agency will manage MSAT services for the federal government.

MSAT will be launched in late 1993 or early 1994.

Satellite Communications: Long-Term Strategy

The Department of Communication is developing a Long-Term Satellite Communications Strategic Policy. A study was therefore initiated to develop strategic elements, recommend strategies for enhancing Canada's position in the international satellite communications market and identify technology trends, uses and requirements of satellite communications markets to year 2010.

The study concluded that future telecommunications development will be market-driven, based on clearly-identified applications. It also concluded that government and universities must conduct applied research for future technological development.

The satellite communications market will develop primarily in the following general applications areas:

- distribution of television and audio signals in point-to-point, point-to-multipoint and broadcast modes;
- point-to-multipoint one-way (from hub) and two-way distribution of data, analog and digital voice, and analog and digital video;
- mobile satellite services, aeronautical satellite services, voice and data terrestrial satellite services and worldwide personal mobile communications;
- point-to-point, light-to-heavy trunk telecommunications services, interconnected to public-switched voice and data networks;
- inter-satellite links providing service to the remote sensing industry and for international point-to-point, heavy-route video, voice and data.

Eleven key strategy elements were recommended to maintain and improve Canada's competitive international position.

It was recommended that a long-term strategic research program be implemented with appropriate funding and that the federal government sponsor projects related to satellite communications. Four alternative programs were suggested for a government-sponsored payload, ranked below in decreasing order of preference:

- personal communications satellite service payload;
- a ku-band (12 to 14 GHz) hubless Very Small Aperture Terminal (VSAT) payload with at least T1 capability operating with earth stations of 1.2 metre maximum diameter;
- an inter-satellite data relay payload, in a joint venture with either NASA or the European Space Agency;
- an inter-orbit link between two geo-stationary satellites approximately 180° distant in orbital arc.

Teletext

Teletext provides one-way, point-to-multipoint broadcast transmission of graphics and text to low-cost terminals. The data stream is carried in the Vertical Blanking Interval (VBI) of television signals.

The Department of Communications is now cooperating with the Ontario Ministry of Culture and Communications and the CBC in the distribution via teletext of a Road/Weather database. Other pilot trials could be established.

National Telecommunications Policy

Telecommunications Policy Framework

In 1984, DOC began a comprehensive review of the telecommunications industry, which concluded that efficient, innovative telecommunications services would enhance Canadian productivity and competitiveness and which recognized the need for a telecommunications policy that applies across existing jurisdictional boundaries.

In July 1987, the Minister of Communications announced the Telecommunications Policy Framework for Canada. It established two classes of telecommunications carriers: Type I, that own and operate transmission facilities; and Type II, that lease facilities from Type I carriers to provide services to the public. The policy framework established the competitive basis for the evolution of a telecommunications system for Canada.

Local Distribution Telecommunications Networks

Within the Telecommunications Policy Framework, DOC identified the need to establish new rules governing the operation of the common carrier and cable television industries. DOC therefore initiated a review of the regulatory environment and public policies in order to foster the development of state-of-the-art local networks. Public comment was solicited on regulatory, technical and socio-economic issues pertaining to local broadband communications for residential voice, video and data services.

The Department supports local duopolies for competitive locally-distributed service. Two rules should apply in the short term:

- first, cross-subsidization between broadcasting and telecommunications services will not be permitted;
- second, broadcasters will have to allow telecommunications service suppliers to access their infrastructure on a non-discriminatory basis, unless the cable operator does not wish to enter the telecommunications market.

Review of Policies related to Transborder Satellite Services

Transborder satellite-based private business communications, occasional point-to-point video services and reception of television programming

signals are regulated under domestic arrangements established in 1982. In accordance with these arrangements, Telesat Canada continues to be recognized as the sole owner and operator of earth stations involved in transborder operations.

The Minister of Communications initiated a related policy review in 1989. In particular, private business communications and occasional point-to-point video transmission were examined. DOC solicited comments on these licensing arrangements, and should be able to announce the new policy in late 1990.

Radio Licensing: Policy Review for a Restricted Type of Local Public Commercial Service

Private commercial service licences for fixed radio systems permit systems to be used for specified private communications: no charges can be levied for business transacted, services supplied or messages exchanged with a third party.

The Department of Communications has received a number of applications requesting licences to construct fixed radio systems which provide specialized local services or innovative distribution facilities.

The Department initiated a public review to consider whether it is in the public interest to permit local multipoint communications systems (MCS) and other radio system applications which provide restricted types of public commercial service.

This policy review does not affect the status of eligible public commercial licensees.

Regulatory Developments

A major restructuring of the Canadian telecommunications industry is underway, involving changes in technology, rates, regulatory policy, jurisdiction and competition.

Telephone Rate Changes

As a result of rapid revenue growth, Bell Canada and B.C. Tel exceeded their revenue requirements. The Canadian Radio-television and Telecommunications Commission (CRTC) ordered both carriers to reduce long-distance telephone service rates in successive stages.

Long-distance rates have declined by an average of about 40 percent since 1987. Additional rate changes may result from continuing revenue growth and from the recent Supreme Court decision and the Unitel application currently before the CRTC. The implications of these decisions are described below.

The Supreme Court Decision: Alberta Government Telephones (AGT) versus CRTC and CNCP Telecommunications

The Supreme Court ruled that the federal government has jurisdiction over AGT and, by extension, over all other provincially-regulated members of Telecom Canada. Legislation to establish a uniform national telecommunications policy is expected in 1991.

As a result of this decision, the level of terminal and service competition has become more uniform across the country.

Message Toll Service Competition

Unitel made a submission to the CRTC for entry into the long-distance telephone service market in May 1990. No direct effects are likely before fall of 1991.

If approved, Unitel could begin providing service between major cities in Bell Canada and B.C. Tel territories within months of the approval date.

Rate Rebalancing

Rate rebalancing could affect the price of both long-distance and local telecommunications services over

the next 12 to 24 months. Rebalancing will not likely occur before the CRTC decision on the Unitel application, after which local rates may gradually increase through to 1995.

Resale and Sharing of Leased Private-Line Facilities

In 1989, the CRTC liberalized rules regarding resale and sharing of leased private-line facilities connected to the local exchange area, which may stimulate new market growth.

Services for the Hearing-Impaired

The CRTC formally requested that the Terminal Attachment Program Advisory Committee (TAPAC) voluntarily revise its technical requirements such that telephones must be hearing-aid compatible in order to receive DOC certification. TAPAC complied, and all handset telephones certified by DOC must now be hearing aid-compatible.

Other Regulatory Proceedings

Bell Canada has applied to the CRTC for approval to reduce rates by up to 20 percent for high-capacity leased private-line facilities (T1 and T3).

Government Information Management Policy

In 1988 the Treasury Board Secretariat (TBS) developed an Information Management Strategic Planning Process for the government which emphasized three basic requirements: coordinated planning of information management in related common service organizations, formal involvement of departments in common service organization planning, and a strategic "top-down" approach for information management.

An Occupational Analysis revealed that "telecommunications personnel" in the federal government were no longer easily distinguishable. In consultation with the Advisory Committee on Information Management (ACIM), the Telecommunications Advisory Committee concluded that the category known as "telecommunications personnel" needed to be more extensively examined within the framework of information technology.

In June 1990, TBS released the new information technology management policy to replace several chapters of the *Administrative Policy Manual (APM)* and several related Treasury Board Circulars.

The directives require that information technology be used for the improvement of program delivery, where appropriate, with due regard to economic benefits. A business-case approach must be taken in the management of information-based resources.

Each common service agency will be responsible for the development and issuance of administrative practices pertaining to its own area of expertise. Such information will no longer be distributed by TBS.

Government Organizational Issues and Structures

Significant initiatives since 1988 affect the way the government manages itself.

Increased Ministerial Authority and Accountability (IMAA)

Increased Ministerial Authority and Accountability is designed to change the management culture of the Public Service by giving ministers and senior managers increased authority and flexibility and by increasing their accountability.

PS 2000

The goals of Public Service (PS) 2000 are to foster a public service that is professional, highly-qualified, non-partisan and imbued with a mission of service to the public; that recognizes its employees as assets; that places as much authority as possible in the hands of front-line employees and managers; and that provides

scope for different organizational forms, such as Special Operating Agencies.

Special Operating Agencies

Special Operating Agencies (SOAs) were conceived to improve the management and delivery of government services. They are service units that are given more direct responsibility for results and increased management flexibility, within existing legislative limits. The SOA remains within its parent department. However, the deputy minister assigns authority for running the agency to its head, who undertakes to meet specific performance requirements. Each agency must present a business case justifying proposed flexibilities.

Report of the Auditor General of Canada (1989)

The 1989 report of the Auditor General, which expressed concerns which contributed to the creation of PS 2000 and thus SOAs, also examined the management and use of telecommunications.

The report noted that savings from economies of scale are not being adequately pursued. It recommended that a central focus be established for government-wide administration of voice and data communications.

Advisory Committee on Information Management (ACIM)

The Advisory Committee on Information Management established the Working Group on Core Systems and Supporting Infrastructures to address strategic issues related to the management of common systems and supporting infrastructures. The final report of the Working Group, entitled *Strategy for the Management of Integrated Telecommunications Networks and Services for the Federal Government*, concluded that there is a need for a common integrated telecommunications architecture and a telecommunications management infrastructure keyed to government-wide business requirements. The report recommended the following:

- the establishment of an integrated telecommunications infrastructure for the federal government;
- the establishment of a Telecommunications Architect Program within DOC;
- the formation of a task force to steer the implementation of the Working Group's recommendations; and
- the establishment of a telecommunications advisory panel to replace the existing Telecommunications Advisory Committee.

The Department of Communications accepted the recommended strategy, agreed to develop the Telecommunications Architect Program, developed operating principles for both the Telecommunications Common Service Management Program and the Telecommunications Architect Program, and advocated a new telecommunications management infrastructure.

Telecommunications Architect Program Implementation Task Force. The purpose of this task force was to implement the recommendations of the ACIM Working Group, addressing such issues as funding and resource implications, establishment of a telecommunications management board and the Telecommunications Advisory Panel, and follow-up to the Telecommunications Occupational Analysis.

The New Telecommunications Management Structure and the Government Telecommunications Agency (GTA)

The Government Telecommunications Agency's aim is to provide high-quality services to its clients in an efficient and effective manner at an economical cost. It will operate on a cost-recovery basis.

The Agency will provide three principal services:

- common telecommunications services, shared by client departments and agencies;
- customized services -- telecommunications services unique to a particular department or agency; and

- a planning, design and development service -- the telecommunications architect function.

Each year (after 1990/91), GTA will prepare a multi-year business plan, against which its performance will be judged. GTA will also submit annual management reports to DOC.

Telecommunications Personnel: Occupational Analysis

In 1987, TBS established an Occupational Analysis (OA) study to collect data as the basis for an objective review of the telecommunications function. Information was gathered to define the jobs being performed and determine associated requirements. Four functional groups were identified: management, general services, technical services and administration.

It was recommended that a model structure of the telecommunications community be developed, which would be used to create an occupational structure and act as a training framework. The Telecommunications Advisory Panel is reviewing the recommendations.

Common Telecommunications Networks and Services

GTA Services and Plans

Government Telecommunications Network (GTN) Development. The first trial of T1 facilities was held on the Toronto-Ottawa cross-section of the intercity network in 1989 using "compressed" digital facilities.

Pending resolution of transmission problems associated with Group 3 facsimile traffic, GTA is offering the Government Digital Channel Service (GDCS) for data applications. It provides economical T1-based dedicated services between Ottawa and several major centres.

The GDCS will support data, voice and image applications at transmission rates of 2.4 kbps to 56 kbps, 1 DS-0 and over, and 1 DS-1 and over.

The modernization and upgrade of several consolidations were completed, and analog telephone service to the U.S.A. was replaced with digital facilities in 1988/89.

Government Packet Network (GPN). The GPN customer base now exceeds 50 federal departments and agencies, representing an estimated user base of 20,000 employees.

Local dedicated access to GPN is now provided in 130 locations across Canada, with local dial access in 25 Canadian centres. Network switching nodes and traffic capacity continue to be upgraded.

Plans are in place to implement additional dial-up services (e.g. X.32), improve the appointment plan and develop virtual networking for clients.

Government Satellite Network (GSN). The Government Telecommunications Agency signed a contract with Telesat Canada in February 1989 for a government thin-route satellite service. It is expected that 20 GSN sites will be installed during 1990/91. GTA intends to extend coverage to the Arctic.

Shared Messaging Services. Sixty-five federal departments and agencies now use the Government Electronic Messaging and Document Exchange Service (GEMDES), which replaced all GTA messaging and text communications services in 1989/90. GEMDES offers such enhancements such as French character support, binary file transfer capability, X.400 gateways, autodelivery to facsimile, enhanced directory, blind courtesy copy and document conversion.

Reduced rates are offered over competitive services, as well as optional rate structures based on kilocharacters sent/received or connect-time.

Government Voice Messaging Service (GVMS). The Government Telecommunications Agency signed a three-year contract with Time Communications Ltd. for the provision of GVMS in Vancouver, Toronto, Ottawa, Hull and Montréal. Approximately 5,000 mailboxes were activated during the first year of operation.

Government Facsimile Communications Service (GFACS). The Agency is currently planning the development of a shared facsimile communications service, conforming to Canadian Standards Association (CSA) and CCITT standards. GFACS will provide facsimile store-and-forward and store-and-retrieve functions.

Electronic Data Interchange (EDI). The Government Telecommunications Agency initiated the EDI Applications Project as its portion of a joint project with Supply and Services Canada (SSC) to study the potential use of EDI for government procurement. GTA is conducting a related pilot trial, and plans to offer EDI services to its clients.

Mobile Satellite (MSAT) Service. The Government Telecommunications Agency will be the government service provider of MSAT, offering full discounted service in 1994.

GTA Performance Measurement. Average annual growth of GTA revenues between 1984/85 and 1990/91 is projected to be 8.2%. Revenues are projected to increase from $177 million in 1988/89 to $212 million by 1990/91.

The government intercity network carried 48 million calls in 1988/89, up 14% over the previous year. The number of calls increased to 53 million in 1989/90.

Between 1985/86 and 1988/89, GTA's share of total annual government expenditures for voice and data services averaged 40.8%, increasing to 42.7% in 1988/89. It is expected to increase to 47.2% over the period of 1989/90 to 1990/91.

Government Telecommunications Network: GTN-2000

GTN-2000 is a network architecture plan for evolving the existing GTN into a digital, intelligent network infrastructure designed to

- improve the cost and performance of the existing GTN and departmental dedicated networks;
- introduce new common data-oriented network services;
- provide new network-wide enhanced voice communication services;
- serve as the network platform to provide access to, and network connectivity for, common enhanced services and departmental systems;
- extend network coverage to remote and under-served locations;
- promote competitive procurement.

The GTN-2000 network architecture has two major functionally-layered components: the intercity network, and the intracity and access network.

The intercity network will be a digital intelligent network, consisting of a digital high-bandwidth backbone transport network, a set of interconnected Intelligent Communications Nodes, and a network intelligence infrastructure serving the nodes for access signalling, network signalling, queries to network databases, and interfacing to applications processors and databases.

Current GTN services are Centrex-based voice communication, analog and digital private lines, and packet-switched data. GTN-2000 will build on this base and offer the following new services:

- digital channel services for data and voice applications;
- basic switched services;
- intelligent network services.

The ACIM Telecommunications Architect Program Implementation Task Force agreed with the functional layering approach taken in defining GTN-2000's principal layers.

The task force was presented with a three-phase development plan for the intercity network, and recommended that GTA proceed with the first phase. The following activities have been initiated:

- development of a Request for Proposal for the competitive procurement of the Phase I services for late 1991 availability;
- offering the Government Digital Channel Service (GDCS) as soon as possible in 1990;
- planning a national Government Intelligent Networking Pilot for implementation by early 1991.

The Government Telecommunications Agency and Bell Canada collaborated in the Bell Canada and Federal Government Integrated Services Digital Network (ISDN) Technology Trial from November 1987 to November 1989. A joint committee was subsequently formed to develop plans for the National ISDN Trial/Government Intelligent Networking Pilot. A one-year trial will begin in the fall of 1990.

Departmental Telecommunications Initiatives

Several government departments were solicited to describe their departmental networks and how they have enabled them to improve program delivery.

Atmospheric Environment Service: National Communications System

In 1982, the Atmospheric Environment Service approved a major project to replace its communications networks with more efficient network services, resulting in the National Communications System. This system consists of two components:

- the New Computer Communications System, an interactive system for collection and dissemination of low-volume alphanumeric weather data; and
- the Meteorological Satellite Information System, a high-speed satellite communications system which distributes meteorological charts and weather satellite imagery.

The National Communications System will increase the reliability of weather information distribution, providing full redundancy. More information will be available to weather offices. The new network, including graphics workstations, costs the same in 1988 dollars as the replaced system did in 1981 dollars. The capacity to deliver more products more quickly has been achieved at an effective lower annual cost.

Senior Executive Network

The Senior Executive Network links Deputy and Assistant Deputy Ministers across the Government of Canada and provides them with access to information of common interest. GEMDES is the service vehicle. Facsimile is also used to deliver certain types of information.

In addition to messaging services, a range of government information is provided. Customized access to external and commercialized government databases will be provided, and new electronic government databases may be developed.

The long-range goal is to develop a network that includes all federal government senior managers (approximately 4,500).

Correctional Service Canada (CSC): Offender Management System

The purpose of the Offender Management System is to automate CSC's offender-related activities, from the admission of individuals into the federal penal system, to their release. It is based on a distributed architecture, in which databases are highly decentralized.

Networks link over 200 geographically distinct sites. The long-term information technology plan includes migration of the application systems to a distributed processing environment, following the OMS example.

The communications network consists of 10 Mbps Ethernet local area networks, which link local users to hosts, and X.25 Wide Area Network (WAN) facilities. Using the X.25 facilities, users access other hosts, CSC's corporate computing centre or the computing

resources of other government departments or agencies.

Correctional Service Canada approached GTA for assistance with the implementation of this network under the umbrella of GTA's GPN service. CSC signed a Memorandum of Understanding with GTA for the provision of a Corporate Infrastructure/WAN service within the GPN. Implementation was completed in 1990.

Industry, Science and Technology Canada (ISTC): 3270 Network

The 3270 Network provides access to a mainframe computer system which houses ISTC's national applications.

The 3270 Network provides services to Headquarters in Ottawa and ISTC Regional Offices located in each province and territory. The network also serves other government departments and agencies nationally in 31 cities.

Public access is provided to the Business Opportunities Sourcing System application. Companies throughout Canada, the United States and in some European countries use this system.

Headquarters personnel are linked to the ISTC mainframe in Ottawa by local lines, while regional offices use packet-switched services. File transfers from the mainframe to microcomputers are extensively used.

The 3270 network serves a dynamic environment where user requirements are constantly changing and increasing. The network is therefore continually modified. The network is constantly monitored to ensure efficient use and adequate throughput.

National Research Council (NRC): CA*net

Based on strong consensus in the research community and subsequent studies, NRC committed funding to establish CA*net, a backbone network designed to integrate domestic research networks and provide international communications. Network requirements were developed by NRC, ISTC, DOC and the user community. CA*net became operational in 1990.

Researchers in universities, government and the private sector will be able to share information and facilities such as supercomputers, databases and software.

CA*net initially will use 56 kbps leased lines, but will use T1 (1.5 Mbps) and higher-speed facilities as they become affordable. Protocols will conform to international standards.

CA*net and the regional networks are cornerstones for future development of Canadian research networks. CA*net is also part of an ISTC feasibility study on very high speed networks.

Revenue Canada Taxation (RCT): Tax Information Phone Service

To automate enquiry responses, RCT introduced a national voice-data network called Tax Information Phone Service (T.I.P.S). It is a computer-based voice-response system that provides information to taxpayers through digitally-recorded human speech, capable of handling over one million calls annually.

Each T.I.P.S. node consists of a personal computer-based Voice Response System (VRS) which answers calls, and a network interface machine which connects the VRS to RCT's data network.

With GTA's assistance, a separate network on the GPN was established for monitoring the nodes and for telemaintenance and application support.

The basic objective of T.I.P.S. is to maintain or improve service levels. Taxpayers receive some responses in less than one minute, versus an average time of over four minutes for telephone conversations. T.I.P.S. adequately responds to most simple enquiries, freeing RCT personnel to resolve other problems.

Supply and Services Canada: Software Exchange Service

The Software Exchange Service (SES) reduces government expenditures by promoting the sharing of

government-owned applications software, information, documentation and related systems development between government departments.

The SES stores information about available and required client software. A catalogue of sharable software is available on diskette or in printed form. Efforts are in progress to make all of the database information available through an electronic bulletin board.

Government Telecommunications Expenditures Review

Telecommunications Resource Expenditures

Total government facility-based telecommunications expenditures declined in 1989/90 to just under $836 million, a drop of 8.5% from 1988/89. This drop is due to a 25% reduction in capital expenditures. Telecommunications facility-based expenditures break down into operating expenditures (approximately 60%) and capital expenditures (approximately 40%).

Operating expenditures measured more than $500 million in 1989/90, an increase of 6% over 1988/89. Capital expenditures accounted for $325 million, a decline of 25% from the previous year, largely the result of a major reduction in capital spending by Transport Canada.

GTA Financial Activities

The Government Telecommunications Agency recovered 46% of total government telecommunications service expenditures in 1989/90.

The growth in cost recoveries for telecommunications services significantly exceeded total government expenditure growth for the same category.

Approximately 8.6% of the $202 million recovered by GTA in 1989/90 was allocated to administration and overhead. Net profit amounted to $2.6 million.

Expenditure Forecast

Operating expenditures are forecast to grow by between 6 and 7% annually over the next few years, while capital expenditures are projected to grow by 10.7% in 1990/91 followed by growth rates of 5.5% for the subsequent three years. Total expenditures are estimated to grow at between 6.3% and 8.3% over the next four years.

Part I

Government Telecommunications Planning Framework

Introduction to Part I: Government Telecommunications Planning Framework

The "Government Telecommunications Planning Framework" provides a broad analysis of the external and internal environments in which the government manages telecommunications.

Chapters 1, 2 and 3 provide a review and analysis of technology, national telecommunications policy and regulatory developments, as reported by the Department of Communications. These environmental factors are not limited to telecommunications management within the government: technological developments, increased competition and deregulation are factors which affect the telecommunications management and planning functions in all institutions. The government must establish a corporate approach to managing within this dynamic and often volatile external environment.

In the *Annual Review and Planning Framework for Telecommunications in the Government of Canada 1986/1987*, it was reported that the Treasury Board Secretariat, in conjunction with the Advisory Committee on Information Management (ACIM), had initiated a review of administrative policies related to the new information technology environment. Chapter 4 discusses the resulting Information Management Policy, released by Treasury Board in June 1990, and briefly describes the substantive differences between new and superseded policies.

Chapter 5, "Government Organizational Issues and Structures", includes discussions of major policy initiatives which are profoundly affecting the management function within the government, and which form the framework within which the new telecommunications management infrastructure will function. These initiatives include Increased Ministerial Authority and Accountability, Public Service 2000 and the Special Operating Agency model.

Mutually reinforcing reports from the Auditor General of Canada and ACIM, both of which addressed the requirements for changes to the telecommunications management process within the government, are discussed. The ACIM report specifically recommended a new "collegial" telecommunications management infrastructure. This proposed infrastructure, which subsequently was endorsed by the Treasury Board Secretariat, also addresses many of the concerns independently raised in the Auditor General's report. The progress to date in implementing the new management infrastructure is reviewed, and the dual role of the Government Telecommunications Agency (GTA) within it as the Telecommunications Architect and as common telecommunications services manager for the Government of Canada are discussed in the context of GTA's new status as a Special Operating Agency.

To complement the discussions of developments at the organizational and corporate levels, an update and review of the Treasury Board-sponsored telecommunications personnel occupational analysis is included.

Chapter 6 briefly describes GTA common networks and services developments and plans, and includes selected performance measurement statistics. GTA's Government Telecommunications Network (GTN)-2000 telecommunications network architecture plan for the evolution of the common Government Telecommunications Network is also discussed. The GTN-2000 plan, which has been endorsed by ACIM, will form the basis for the systematic evolution of the common government network. With guidance from the ACIM-sanctioned Telecommunications Advisory Panel, this common network will be designed to accommodate a variety of departmental applications.

Consistent with the overall theme of the *1990 Government Telecommunications Planning Framework and Review*, several departments describe how their networks have enabled them to improve their program delivery, in Chapter 7, "Departmental Telecommunications Initiatives".

1. Technology and Related Developments

1.1 Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) offers new ways of doing business, through computer-to-computer exchanges of business documents (for example, invoices, bills of lading, purchase orders) in standard formats, between different organizations.

Strategic advantages, such as improved service and greater competitiveness, can be achieved by restructuring business operations with EDI.

The basic difference between EDI and most automated approaches is that EDI permits the exchange of messages between computers, without the need to know what equipment or software is used by each partner in the transaction. This approach results in the following benefits:

Improved Service:	faster, more accurate flow of information between business partners through improved efficiency, leading to new ways of working together
Cost Reduction:	less paper, reduced inventories, less time consumed communicating, more accurate input, accelerated transaction processing, and "just-in-time" inventory approaches
Greater Effectiveness:	realignment of functions and resources within an organization to maximize the benefits of reduced administrative overhead.

Electronic Data Interchange is designed specifically to exchange "semi-structured" information, such as business forms. In conventional operations, paper forms are processed by various support staff, mail handlers and managers. In an EDI environment, however, forms are handled by software. People start the process and input some of the information, but their "logging and tracking" role is significantly reduced, allowing companies to assign personnel to more productive roles. The direct computer-to-computer exchange of information minimizes data re-entry errors and document delivery time.

Implementing EDI requires three basic technical components:

- electronic communications facilities;
- standardized EDI messages;
- translation software to convert EDI messages to and from internal database formats.

While the problems associated with EDI implementation appear to be primarily technical and simply a matter of obtaining agreement on standard messages, the major problems, in fact, are business-oriented. For example, agreement within industry sectors on standards for essential information elements presents a difficult challenge, as does the restructuring of business functions at the corporate level.

Electronic Data Interchange will cause fundamental changes in how business is conducted, using computers, software, databases, and communications technologies to exchange business messages. It will offer significant cost savings when fully implemented and it will change the nature of organizations.

Canadian Government Initiative

Government leadership and participation in EDI development is actively encouraged by a number of public- and private-sector organizations. These organizations are concerned that the Canadian private sector will be negatively affected without active government participation. Common concerns are that

diverse approaches to EDI implementation have been undertaken and that neither EDI public policy nor industrial development issues are being adequately addressed.

The EDI Council of Canada has suggested that an EDI Office be established within the Department of Communications (DOC) to act as a complementary federal government counterpart to the Council. The EDI Office would act as a focal point for liaison between industry and government, and would assume a role within the government that is similar to that of the Council: to promote greater understanding of EDI, including its benefits, potential applications, its impacts on business operations and structures, and its economic impact.

The Department of Communications' mandate includes fostering the efficient development, use and diffusion of communications technology. In broad policy terms, EDI is a key element in several of the strategic thrusts outlined in DOC's Green Paper entitled *Communications for the 21st Century*, since EDI represents a true integration of computers and telecommunications.

Other government organizations have expressed interest in participating:

- Treasury Board Secretariat (TBS) would assume a leadership role, guiding the use of EDI within government and establishing an infrastructure to assist in formulating and promoting policies and procedures and in defining the standards to be used in government;
- Supply and Services Canada (SSC) and other operational departments would share the role of future users of EDI;
- The Government Telecommunications Agency (GTA) would fulfil the role of the carrier of EDI, since government EDI systems would efficiently use GTA's new digital networks.

The EDI Office

The EDI Office (EDIO) will assist government and industry users to implement EDI across many fields of application. Thus, EDIO will act as the government coordinating agent for industry pilot projects.
By working with national and international standards bodies and by monitoring international activities to assess different approaches, EDIO will be able to assess and develop Canadian strategies and policies for EDI.

It will also work with DOC's Canadian Workplace Automation Research Centre in the development of an EDI conformance-testing facility.
The EDIO will promote the use of EDI by the government and by industry. Its role will complement that of GTA, which is the main carrier of government information. EDIO's promotional and industrial development objectives would include bringing potential partners together.

The EDI Office would also undertake a variety of activities to facilitate the exchange of information between industry and government in support of the adoption of EDI, including the following:

- coordination of government information sessions at public forums discussing EDI;
- development of EDI strategies and policies;
- attendance at international meetings;
- funding of seminars, policy papers, strategy papers and reports to develop sharable EDI implementation information;
- creation of an electronic information exchange to provide access to information using EDI techniques; for example, the National Library of Canada's EDI System could be used as a distribution mechanism for DOC data summaries;
- promoting EDI as a business tool.

The EDIO would also act as the secretariat to the federal government EDI Users Group.

Establishment of an EDI initiative within the federal government which is responsive to industry is similar to approaches in the European Economic Community and Great Britain. A strong federal presence in EDI is required if Canada is to be at the forefront of this

communications technology.

Coordination in Government

Departments interested in using EDI must develop solutions that meet their own needs and those of their partners. Coordination, therefore, is essential, since it is to the benefit of the government to develop EDI message systems which can be shared by all agencies.

Business messages exchanged by government and industry are numerous and range from income tax forms to invoices, reports, and cheques. For example, Canadian businesses currently send the government one million forms a month to pay their contributions to income tax, the Canada Pension Plan, and Unemployment Insurance. Use of EDI would reduce government overhead and improve service to business.

Within the government, TBS has recognized EDI as a key strategy for improving government purchasing and internal administrative and financial procedures. To prepare for an EDI environment, TBS has established and provides secretariat services for the senior level Advisory Group on EDI (AGEDI), which reviews and recommends EDI approaches for the government. The AGEDI includes representatives from several key user departments, such as SSC and Transport Canada. Under AGEDI are three EDI working groups: Finance, Standards, and Users. The Finance Working Group is chaired by the Office of the Comptroller General, the Standards Working Group is chaired by TBS, while Public Works Canada (PWC) chairs the Users Working Group.

Pilot trials to test EDI messaging systems are planned by PWC, SSC, and GTA, with some involvement from industry.

1.2 Fibre Optics

Long-Haul Transmission: Near-Term Outlook

Telecom Canada's trans-Canada digital fibre optics light guide transmission system has been completed from the Maritimes to British Columbia. The system was inaugurated by the Prime Minister of Canada on March 13, 1990.

Unitel Communications Inc. has submitted an application to the Canadian Radio-television and Telecommunications Commission (CRTC) to enter the long-distance communications market, which its expanding fibre optics would allow.

The Synchronous Optical Network standard for fibre optic transmission equipment has continued to gain acceptance with vendors. The standard is based on multiples of the T3 bandwidth (equivalent to 672 DS0 digital voice channels of 64 kbps each, yielding a total throughput of 44 Mbps): Optical Carrier OC-1, 51.84 Mbps; OC-3, 155.2 Mbps; OC-12, 622.08 Mbps; and OC-48, 2.49 Gbps.

Undersea fibre optic systems are currently the fastest-growing communications market in the world. Six trans-Atlantic networks, three trans-Pacific networks and two major systems linking Australia to Hawaii and Guam will be commissioned by 1996.

Fibre optic systems do not experience the inherent delay that occurs in satellite communications. Moreover, undersea fibre optics facilities deliver the type of security that governments and large corporations require, and which satellite communications systems and coaxial cable cannot provide.

Teleglobe Canada is participating in two trans-Atlantic systems: Trans-Atlantic Telecommunications (TAT)-8, which is currently installed, and TAT-9, which includes an undersea active branching multiplexer being built by MPB Technologies Inc. of Montréal. TAT-9 will provide five landing points (in Canada, the U.S.A., France and Spain) using only two active fibre pairs in the undersea cable.

Long-Haul Transmission: Long-Term Outlook

In a typical fibre optic system the signal is regenerated every 40 to 100 kilometres. This regeneration process includes several steps: detection of the relatively weak light signal, conversion of this signal into an electronic signal, amplification of the electronic signal and finally, reconversion of the electronic signal to a light

signal. The development of optical amplifiers, however, allows the direct amplification of light signals, without the need to convert the signal to electronic form. Using optical amplification and optical pulses of a specific shape, width and power level (solitons), distortionless light-pulse propagation over 6,000 kilometres with electronic regeneration has been demonstrated in the laboratory. Since a soliton light pulse can propagate in fibre without changing its shape, long-haul systems are feasible, operating at very high rates up to 100 Gbps.

Local Loop: Long-Term Outlook

In 1990, it appears likely that there will be significant prototype deployment of combined fibre for residential integrated voice, data, and video. The leading network architecture for these subscriber networks uses a passive distribution system with wavelength multiplexing.

An ambitious project to integrate different transmission technologies within a single medium was launched in 1987 with the creation of the Consortel consortium, which consists of Canadian Voice Data Systems Inc. of Pointe Claire (an electronics manufacturer), Cogico Cable Television Company of Montréal, and Québec-Téléphone. The purpose of this association is to develop and test a wideband network carrying a range of services presently distributed on separate networks. Two experimental systems are planned, for residential and business subscribers respectively. Funding for the three-year project is $9 million. Half of the funding will be provided in equal shares by the provincial and federal governments, while the other half will be contributed by the three private-sector partners.

Community Antenna Television (CATV) Fibre Optic Systems

Advances in laser light sources and optical amplifiers have considerably increased the practicality of using optical fibres in CATV distribution systems. Microwave subcarrier multiplexing has been used to transmit 60 to 120 FM video channels over a single-mode fibre. Single-mode fibre has considerably more information-carrying capacity than multimode fibre because there is only one path available through which light may travel. Several companies are developing Amplitude Modulated - Vestigial Side Band (AM-VSB) fibre optic links that will provide an even more cost-effective means of cable television delivery. AM-VSB signals are used by broadcasters and cable system operators for transmitting television programs over the air or through cable. In Canada, Rogers Cablesystems Inc. plans to install a backbone fibre optic network in Toronto. The application of optical fibre technology to CATV distribution will improve reliability and picture clarity. It will also provide cable television companies with the capability of delivering High Definition Television (HDTV) to residential subscribers in the future.

Data Networks and Local Area Networks (LANs)

CA*Net, a planned Canadian national data network, will operate at 56 kbps initially, and increase to 1.5 Mbps. (See 7.5 for details.)

In the U.S.A, the development of a supercomputer network operating at 3 Gbps is planned.

The Fibre Distributed Data Interface (FDDI) fibre optic LAN standard will provide data communications at 100 Mbps. Canstar Communications has developed a 100 Mbps fibre optic network called SuperNetwork, which uses the proprietary HUBNET protocol originally conceived at the University of Toronto. SuperNetwork will also provide FDDI and Ethernet connections. Canstar Communications is developing a higher-speed version of the SuperNetwork LAN, which will operate at speeds in excess of 300 Mbps.

Optical Storage

A growing number of government and private-sector organizations have an increasing need for terabyte (trillion byte) data storage systems. Terabyte optical storage "jukeboxes" are available commercially. These systems use 150 14-inch WORM (write once, read many)-based optical disks. Vancouver-based CREO Electronics has developed an optical tape recorder which can store one terabyte of data on a single reel of tape. Optical tapes have the potential to be a lower-cost storage medium than optical disks, with a faster

access time.

For smaller storage requirements, erasable optical-disk systems have been developed. Rewritable optical storage costs promise to be 100 times less than magnetic disk storage.

1.3 Integrated Services Digital Network (ISDN)

Introduction

In 1988, the Minister of Communications released terms of reference for the Private Sector Advisory Committee on ISDN. This committee was formed to advise the Minister of Communications about the issues, options and recommended courses of action related to the implementation of ISDN in Canada.

Public submissions were solicited. In turn, DOC invited written comments on the submissions. As a result of these activities, seven major areas of discussion were identified, all of which relate to narrowband ISDN.

ISDN Implementation in Canada

Based on international standards developed by the *Comité consultatif international télégraphique et téléphonique (CCITT)*, ISDN will permit integrated local access to all telecommunications services and ensure compatibility between networks and terminals. The CCITT, however, permits flexibility in the development of national ISDNs.

The Private Sector Advisory Committee on ISDN concluded that, in Canada, ISDN will evolve from the public telecommunications networks of the Canadian telephone companies, and from other carriers' networks and private networks.

Integrated access permitting simultaneous, two-way transmission of voice, data and image will generally be obtained through telephone companies' copper local loops. Two access arrangements comprising "B" and "D" channels will be provided: basic rate (2B+1D) and primary rate (23B+1D). The B channels will carry the voice, data and image transmissions; the D channels will be used primarily for signalling. Basic and primary access will be provided by a group of network functions known as Network Termination 1 (NT1), located on the customer premises. Canadian interface standards for connecting ISDN- and non ISDN-compatible terminals to the NT1, and in turn, connecting the NT1 to the ISDN, will have to be developed.

The establishment of a minimal set of "bearer" services is fundamental to the evolution of ISDN. These bearer services provide underlying transport connections for digital end-to-end transmission between ISDN connections. They will initially be limited to 64 kbps.

As ISDN evolves, interconnection between ISDNs and other public and specialized networks will be necessary to ensure continued provision of existing services.

Major Areas Identified in DOC's Public Consultation Process for Review by the Private Sector Advisory Committee on ISDN

i. *Network Termination 1 Ownership.* The NT1 is the group of network functions which provide standard basic and primary rate access to ISDN exchanges or switching nodes from customer premises. It was recommended that the customer have the option of owning the NT1 or obtaining it directly from the carrier.

   Since ISDN trials are underway and several carriers have indicated that they will file ISDN tariffs in 1990, network interface standards are urgently required. These standards must incorporate Canadian, North American and international requirements.

   The Canadian Standards Association (CSA) Steering Committee on Telecommunications (SCOT) was mandated to serve as the standards-writing body for ISDN in Canada. The report recommended that SCOT proceed on an urgent basis to develop interface standards for the basic-

rate and primary-rate accesses, with consideration given to delaying commercial introduction of ISDN services until the standards are adopted.

Currently, GTA and Telecom Canada are collaborating on a national ISDN field trial (see "ISDN Evaluation" section under 6.2). In addition, all Telecom Canada member companies (with the exception of Island Telephone Company) are conducting internal trials. Telecom Canada is also working with Teleglobe Canada to secure an overseas trial partner, and is currently in the discussion stage with American Telephone and Telegraph (AT&T) to develop a Canada-U.S. service trial.

Bell Canada plans to file tariffs with the CRTC in the last quarter of 1990 for ISDN basic rate access. This service, which will likely offer a leased package for interfaces, will permit customers to own the NT1 network terminating device. All other Telecom Canada members plan to file ISDN tariffs in 1991 for commercial service in 1992.

ii. *Network Interconnection*. The Private Sector Advisory Committee believed that ISDN will permit the maintenance of present levels of competitive network and services interconnection and enable further interconnection, if permitted by regulation.

ISDN will provide integrated multi-purpose connection to competing public ISDNs using a single access. Non-discriminatory access availability and pricing will be necessary to ensure that no carriers compete at a disadvantage. Service function identifiers and carrier identification codes will therefore be necessary to differentiate services and facilities on the single access.

iii. *Enhanced Services*. Current regulations have been developed by the CRTC and apply to the federally-regulated common carriers. With the intelligence of ISDN, the demarcation between basic and enhanced services may be more difficult to determine, requiring redefinition of basic and enhanced services. Moreover, regulatory bodies may have to determine how enhanced service providers are permitted to use network intelligence to ensure that they can provide services fully competitive with those of the carriers. Possible solutions could include requiring carriers to unbundle network services and facilities tariffs and disclose more information about their network plans.

iv. *Private Line Services*. During the development of ISDN standards by the CCITT, the concern was expressed that some administrations may use ISDN implementation as justification to discontinue dedicated private line services. CCITT therefore recognized in its standards the need to provide these services. Business users have continued to insist that carriers continue to provide dedicated separate local loops and intercity circuits, believing that virtual private line services may be imposed on users, compromising requirements for highly reliable, secure fully-dedicated private line facilities.

The advisory committee determined that carriers will continue providing dedicated facilities as long as market demand exists. Virtual private line services, however, may provide cost-effective alternatives in some cases.

v. *Tariffs*. Regulatory authorities must strike a balance between the requirement to ensure maximum competition where it has been introduced, and the need to ensure universal access to basic, affordable telecommunications services.

A number of key considerations must be taken into account in determining rating principles and tariffs relating to the introduction of ISDN:

- ISDN should not result in a change from value-of-service to cost-based pricing for basic telephone service.
- ISDN rates should be cost-based and unbundled.
- ISDN rates should not discriminate on the basis of type of information transmitted, except where provisioning costs differ.

- Migration of business customers to ISDN integrated access should not be allowed to adversely affect the residential subscriber costs.

vi. *National Standards*. Four standards issues with national dimensions were considered:

a. voluntary national standards which are needed immediately;

It was agreed that interface standards for connecting ISDN-and non ISDN-compatible terminals to the NT1, and in turn, connecting the NT1 to the ISDN fall into this category. This was discussed in conjunction with NT1 ownership.

b. conformance testing;

It was recommended that a national voluntary conformance testing capability be established -- with reciprocal international agreements -- to assist Canadian equipment suppliers and manufacturers to develop and produce ISDN equipment that is competitive domestically and internationally.

The Canadian Interest Group on Open Systems (CIGOS), in conjunction with DOC, has produced a comprehensive report on the scope of the facilities required for conformance testing in Canada. CIGOS has approved a private sector project proposed by IDACOM Electronics Ltd. of Edmonton for the establishment in Vancouver and Montréal of facilities for conformance testing of Canadian open systems. These facilities have been implemented in collaboration with the Universities of British Columbia and Montréal respectively, with funding from the federal government, as well as the provinces of British Columbia and Québec.

c. disclosure of carriers' network plans;

d. the institution of a body to oversee the development of technical network interconnection standards.

It was determined that the last two of these would best be dealt with in the regulatory process.

Three CSA standards were published in June 1990 for ISDN basic rate access based on CCITT and American National Standards Institute (ANSI) standards. A national standard for primary rate access should be available in early 1991.

The Terminal Attachment Program Advisory Committee (TAPAC) issued ISDN network protection standards in 1990. As a result, common carriers wishing to introduce ISDN network services which require new terminal-to-network interfaces must now provide sufficient information to TAPAC to enable terminal providers to build compatible equipment.

vii. *National Policy*. The majority of committee members believed that ISDN should be implemented on a national basis, and that it should be considered as part of a national economic strategy to enhance the efficiency and competitiveness of Canadian industry domestically and internationally. Accordingly, the committee urged that measures be instituted to ensure the following:

- comparable levels of network interconnection in all jurisdictions of Canada;
- national standards for provision of basic- and primary-rate access and ownership of NT1;
- implementation of a minimal set of ISDN capabilities nationally.

To achieve objectives relative to competition for the implementation of ISDN as established in the committee's terms of reference, it was recommended that mechanisms be established at the federal and provincial levels to permit ISDN implementation on a national basis, while ensuring affordable universal basic telecommunications for all Canadians.

Canadian ISDN Interest Group

The Canadian ISDN Interest Group (CIIG) was established in June 1990 to provide existing and potential Canadian ISDN users with the opportunity to contribute to the development of ISDN technology and standards. A general membership meeting was held in Toronto in November 1990.

1.4 Radio Communications: Stationary High Altitude Relay Platform

The Stationary High Altitude Relay Platform (SHARP) is a light microwave-powered, pilotless aircraft. SHARP is powered by microwaves beamed from the ground, having no internal power source, fuel or pilot.

The entire underside of the aircraft is covered with thousands of printed circuit antennas (rectennas). They capture the microwave signal and convert it into direct current for powering the platform's electric motor and payload. With this effectively limitless supply of energy, SHARP can stay aloft for six months to a year, landing only for scheduled maintenance.

Researchers at DOC's Communications Research Centre and their industry and university partners have been developing the SHARP concept and technology since the early 1980s. In September 1987, a lightweight 1:8 scale prototype achieved the world's first sustained flight by a microwave-powered aircraft.

When commercialized, SHARP will provide new and expanded services, such as direct broadcast television, mobile telephone services, broadband data services, atmospheric monitoring, radar surveillance and remote sensing. Many of these services will be available in areas not served by satellite or terrestrial networks.

The commercial version of SHARP will have a wing span of 40 metres, but will weigh only 1,000 kilograms, as it will be built of composite materials such as kevlar, carbon fibre and foam.

SHARP will circle at an altitude of 21 kilometres -- about twice as high as commercial aircraft now fly -- and relay radio signals over a terrestrial area of up to 600 kilometres in diameter.

On the ground, generators will supply electricity to dish-shaped antennas arranged in a field approximately 100 metres in diameter. Power will be beamed up to the platform as microwave energy.

The underside of the aircraft itself will be covered with 140 square metres of rectenna surface. Fifty-thousand rectennas will produce 50 kilowatts (kW) of available power. To fly at its maximum speed, SHARP will require only 30 kW, the balance of power being available for the payload's electronic systems. SHARP thus will have more power than a communications satellite, and, unlike current satellites, it can be refitted with new payloads to serve changing needs.

SHARP will cost about $20 million, while the average communications satellite costs more than $100 million. Regularly maintained, the platform will last ten years, operating at a cost of about $2 million a year (including ground stations). SHARP will complement terrestrial and satellite networks in Canada, leading to new Canadian business opportunities and new and expanded services for consumers.

Applications

SHARP will function similarly to a communications satellite, overcoming both the range limitations of ground-based systems and the transmission delay and power limitations of satellite systems.
It will allow efficient use of the radio spectrum: several platforms will be able to use the same communications channel without interfering with each other.

Telephone and Radio. SHARP will broaden the range and scope of mobile telephone and radio services, particularly to rural and remote areas where these services are not currently available. Researchers also envision extending cellular services (now available only in and around major urban centres) to less populated areas. Rural telephone subscribers could benefit from an expanded range of more affordable services, such as instant availability and private lines.

With its extended range capability, SHARP can provide reliable high-quality radio communications services to such offshore users as fishing and exploration vessels, as well as commercial shipping.

Paging. Wide-area paging will be possible: messages will be transmitted from a central office to subscribers located anywhere within SHARP's 600 kilometre footprint.

Data Services. Affordable broadband services such as computer communications, video teleconferencing and Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) data transmission could be offered.

Broadcasting. SHARP could become a "superstation", broadcasting high-quality regional FM-stereo and television programs.

Subscribers will be able to use small residential antennas to receive up to 24 low-cost direct-to-home television channels. SHARP will also offer a commercially-viable HDTV delivery system for subscribers with appropriate equipment in both urban and rural areas.

Other possible applications include surveillance, environmental monitoring, remote sensing and navigation.

Development and Commercialization

The Communications Research Centre is planning a half-scale model that will be able to fly at an altitude of five kilometres. It will demonstrate SHARP, validating the concept of providing broadcasting, telecommunications and atmospheric monitoring services from a platform circling at high altitude for sustained periods. Research and development will continue in parallel with the development of regulatory policy.

A cooperative program with industry, government and university participation is being pursued for further development and commercialization of SHARP.

1.5 Radio Communications: Technology and Market Trends

The Department of Communications prepared a report entitled *Market and Technology Trends in Radio Communications*. The report was prepared using existing literature and two contract studies in which a number of interviews were carried out with representatives of the radio manufacturing and services industries, related associations and industry observers.

Developments in the electronics industry over the last two decades have resulted in a number of significant enhancements to basic radio communication: miniaturization, price reduction, cellular services, software-enhanced calling services and the integration of data transmission with data processing. These enhancements, in turn, have created new demand for products and services that rely on radio communication links.

The domestic market for radio communication products and services, such as cellular telephony and paging, has experienced significant growth. In the short term (5 years), the following developments are expected:

- The overall demand for mobile radio communications services, including paging, mobile radio, cellular telephony and mobile data communication, will continue to increase by 10 to 20 percent per year. The demand for radio communications products will continue to be strong, but product demand will be lower than services demand. Much of the growth in demand for products and services will be concentrated in the cellular mobile and paging segments, with business accounting for most of the demand.

- The point-to-point and point-to-multipoint telecommunications market will be flat. While radio will maintain its present share of this segment, wire and cable will continue to satisfy most requirements.

- Two-way radio will continue to be an important communication medium for industry users, with applications in commercial transportation, military

and frontier industries, but opportunities for growth are limited to economic expansion and the adoption of incremental improvements in technology.

- Regulatory constraints will control the application of radio to existing and new communications requirements.

Adoption of Mobile Communication Products and Services

Awareness of the benefits of mobile communication has been stimulated by publicity surrounding the cellular mobile industry. This increased awareness, coupled with new spectrum availability and declining prices for mobile communications products, has resulted in increased demand for mobile communication services. While both business and personal users value mobile communication, the products and services are still priced generally within reach of business only.

The most significant growth in demand has occurred in cellular mobile telephony (which has the highest demand rate) and paging. There were an estimated 375,000 cellular subscribers in Canada in the first quarter of 1989. This total is expected to increase to almost 500,000 by the end of 1990. By the year 2000, one industry forecast estimates that there will be over 3.5 million cellular subscribers in Canada, representing over 10 percent of the population.

Subscriptions for paging services in the United States have been increasing at an average annual rate of 26 percent since 1972, totalling approximately 6.5 million in 1989. Canada lags slightly behind the United States; the Canadian 1989 subscriber base for pagers was approximately 500,000. Growth in Canada is expected to remain strong, ranging between 15 and 20 percent per year over the short term.

Mobile Radio Products and Services

The range of products, services and features for mobile radio, paging and cellular telephony continues to expand.

Radio communication can already support mobile facsimile machines and portable computers. Dedicated networks are offering public data transmission services. One Canadian company is pioneering underwater mobile communications products, while other Canadian and international companies are developing wireless local area voice and data networks.

The paging industry saw the introduction of the alphanumeric display in the mid 1980s. By 1990, paging service suppliers will offer optional information and text messaging services, such as current stock-market data or sports scores. The range of in-house paging services is expanding to include integration with building or process control systems.

Cellular mobile telephony now includes features such as call forwarding, call waiting and three-way conferencing.

Mobile Data Communication Products and Services

The use of radio for data transmission has generally been confined to fixed-location installations, such as private data networks and industrial radio telemetry. Mobile data transmission has penetrated only a small number of market segments, such as the taxi and police vehicle segments.

Among the barriers to growth in mobile data communications have been the lack of a public data communications network and the shortage of terminals tailored to user needs. The mobile data communications industry has experienced some growth in European markets where these barriers have been reduced. Canadian service suppliers, such as Cantel and BCE Mobile, are taking steps to remove these barriers in Canada by establishing public radio data networks.

Compared to mobile voice communications, the market for mobile data is fairly small. The most noteworthy development in this area is the recent emergence of two public networks: MobiData and Mobitex. Their combined customer base is expected to grow from 6,000 in 1990 to as many as 30,000 by 1992. This will represent less than five percent of cellular voice customers.

Other Market Segments

In addition to serving mobile users, radio can be a reliable, low-cost alternative to wire or cable in some fixed applications. To the extent that technology and regulations permit, radio has made inroads into telecommunications markets traditionally served by wire and cable. B.C. Tel, for example, is using radio to provide telephone service to remote subscribers, replacing rural telephone lines. Similarly, Bell Canada uses radio equipment to provide wireless feeder loops. AGT uses the IMM/Microtel digital radio telephone for provision of basic telephone service to subscribers in Etzikom, Alberta.

Some industry estimates are that up to five percent of Canadian subscribers could be economically served by radio telephony. Fixed-point to multipoint radio technology, rather than cellular technology, is more economical for wireless telephone links, since the former uses directed signals and does not require cell-to-cell hand-off capabilities. Fixed-point to multipoint technology will therefore likely be dominant in providing wireless communication to stationary subscribers.

The use of radio to replace wires is also being considered for plant, office, residential and public applications, such as wireless LANs and wireless private telephone switches. The elimination of wires results in greater convenience and flexibility: radio links for industrial and commercial in-house voice and data communication could eliminate costly, time-consuming rewiring required by frequent moves and changes.

One Canadian company, Telesystems SLW, is pioneering the use of spread-spectrum technology for wireless LANs. In 1988, Telesystems became the first company to be authorized by the American Federal Communications Commission to market a local area transceiver using this technology for connecting terminals within buildings. Several companies are actively developing such products as a result of the FCC's having opened parts of the radio spectrum to spread-spectrum devices in 1985, without requiring user licences.

Although some industry participants remain skeptical about spread-spectrum technology, there appears to be a strong demand for cost-effective, wireless local voice and data networks. Opportunities for this type of network, however, appear to be very limited in Canada, due to the inability of this technology to provide truly mobile two-way access, and the acceptance of cellular telephony among mobile users.

More Spectrum-Efficient Products and Services

Equipment and service suppliers are attempting to develop products and services that use the limited spectrum more efficiently. The introduction of digital technology in cellular mobile voice telephony in 1991 will likely increase the number of subscribers per channel, increasing efficiency in the longer term. Similarly, digitally-trunked voice radio systems have more capacity per channel than conventional, non-trunked radio systems.

Data communication can contribute to spectrum efficiency by reducing the need for voice communication; it can also improve operational efficiency. For example, data communication typically allows taxi companies to service five times as many vehicles per channel as voice communication.

Industry Roles

Improvements in product quality and reliability, increased automation in manufacturing, the introduction of surface-mount technology and miniaturization are reducing the role of service and repair in the radio communications industry. At least one major Canadian manufacturer of terminal products no longer operates repair facilities, suggesting that these products have become "throw-away" technology. If wireless communications are accepted in building applications, wiring and systems installation could also decline.

In the longer term, market and technology forces will likely expand the penetration of radio communications to the extent that spectrum availability allows.

Advanced Mobile Communications

Customer service has emerged as a significant means of differentiation in the business marketplace. Communication is essential to improved service and efficiency. Many electronic communication and data processing tools found in the office may therefore become available to travelling employees.

Personal Communications and the Consumer Market

Advances in technology will continue to reduce the size and price of portable communications equipment, eventually bringing personal communication to the consumer market. Some industry participants believe that terminal costs of $300 and service costs within 30 percent of current telephone charges are required before this can occur. Personal communication service will be commercially introduced in England in 1992 by three operators who have already been licensed for the service.

Diminishing Differences Between Distinct Segments of the Communications Industry

The versatility of emerging radio communications technologies will give service and product suppliers the opportunity to integrate previously distinct services. By the mid 1990s, portable telephones will likely be small and easily carried. One communications device will probably provide both paging and telephony. It may ultimately be used to access the wire lines through radio base stations located in the home and office.

One multi-purpose terminal and one access number could then support basic telephony, paging and cellular service. This will require the development of industry standards and regulations and the emergence of a "systems approach" to harmonize services.

Niche Markets and Specialty Applications

Opportunities in niche markets such as radios approved for hazardous environments, underwater communications units and combined very high frequency/high frequency (VHF/HF) systems for shipboard applications will continue to be terminal-driven. Since these markets will be less sensitive to economies of production, they will continue to offer market opportunities.

Canadian companies are established internationally in a variety of radio communications markets, including cellular telephony, radio telephony, mobile data terminal production and systems engineering. Canadian companies also appear to be in the forefront of the emerging field of wireless LANs.

1.6 Satellite Communications: Mobile Satellite (MSAT)

Mobile Satellite (MSAT) was conceived by DOC to satisfy national requirements for improved public and government mobile communications, particularly in rural and remote areas. MSAT is a satellite communications system for the provision of two-way voice and data services to domestic terrestrial, marine and aeronautical mobile stations. It will provide all areas of Canada with direct satellite links to public and private mobile radio systems and the public switched telephone network (PSTN), improving public safety and creating a more hospitable environment for economic development in rural and remote areas.

The Department of Communications has been planning MSAT for more than ten years in cooperation with Telesat Canada, Telesat Mobile Incorporated (TMI), the telecommunications industry, provincial and federal departments, communications equipment suppliers and prospective users.

The MSAT space component will be owned and operated commercially by TMI, following the planned satellite launch in late 1993 or early 1994.

The Satellite System

The initial system will use one Canadian satellite to provide service to all of Canada. Canada's MSAT system and a similar American system serving the United States will provide mutual system back-up.

Telesat Mobile Inc. will manage the satellite system from a terrestrial central control station. TMI will provide several gateway stations for interconnection to the PSTN, as well as several hundred base stations to connect headquarters locations of MSAT users.

As many as 150,000 voice and data mobile earth terminals will be able to use the first-generation system. These terminals will be about the size of current mobile units, using small roof-mounted antennas. Smaller, lighter terminals will be carried on foot. Mobile units will communicate in the L-Band (1500-1700 MHz), while up and down links between the satellite and gateway stations will use 12 and 14 GHz respectively.

MSAT Services

MSAT will provide two major categories of service:

i. data communications services such as two-way messaging, position reporting and text transfer:

   Subscribers with mobile data units will be able to exchange and process information with remote computers via portable video terminals. Moreover, MSAT will be able to collect data transmitted from remote monitoring and alarm devices and send commands to automated control stations. It will also be able to transmit broadcast weather forecasts and agricultural information to any location in Canada.

   Transport operations could be enhanced by an auto-locating feature, providing continuous, automatic updates to dispatch centres. MSAT could also provide nation-wide paging services.

ii. interconnected and non-interconnected mobile radio for voice communications:

   Voice and data could be used in conjunction to provide additional service enhancements.

MSAT Service in the Government of Canada

The federal government has allocated $176 million to support MSAT. Of this amount, $126 million is reserved for the purchase of MSAT services to satisfy urgent government needs. These costs will be recovered from departments who subscribe to the service. TBS has reserved $50 million for technology development, communications trials and management.

The Government Telecommunications Agency will manage MSAT services for the federal government as the sole service provider for federal departments and agencies.

Development and Commercialization

The Department of Communications continues to provide support for the development, testing and implementation of the MSAT system for commercial operation by TMI, through the following activities:

- continued development of antennas, modulation and voice-coding techniques;
- implementation of an industrial strategy for ground-terminal development and spacecraft subsystems;
- planning, coordination and implementation of a program of pre-and post-launch voice and data demonstrations and trials;
- definition and development with industry of service offerings to meet a variety of MSAT applications;
- development of policies and initiatives including equipment standards, type-approval procedures, the licensing of ground and space equipment and licensing fee structures;
- management of cooperative arrangements including government funding and the development of program submissions to TBS;
- dissemination of information to the public.

1.7 Satellite Communications: Long-Term Strategy

During the last several years, significant events have affected the satellite communications industry and the telecommunications and broadcast industries which use satellite services. These events include the large-scale adoption of fibre-optic distribution technology by most public-switched networks in the developed world; significant delays in satellite communications development caused by the American Space Shuttle Challenger disaster and a number of other American and European launch failures; and the evolution of three well-defined and competitive telecommunications trading blocks:

- Canada and the United States
- Europe
- Japan and the Pacific Rim.

To ensure that Canada is well-served domestically and that it expands its position in the international satellite communications market, DOC is developing a Long-Term Satellite Communications Strategic Policy.

A study co-sponsored by DOC, the Canadian Space Agency, Spar Aerospace Limited and Telesat Canada was commissioned to develop strategic elements and to formulate recommendations for strategic approaches to meeting the objective of enhancing Canada's position in the international satellite communications market. The study also identified technology trends, uses and requirements of Canadian and international satellite communications markets, up to the year 2010.

Future Technology and Market Assessment and Analysis

All manufacturing and service sources surveyed concurred that new development for terrestrial- and satellite-based telecommunications would be market-driven, based on clearly-identified applications which fully exploit new technologies. In addition, Canadian and international regulatory environments were expected to have major impacts on the viability of satellite communications.

These sources also agreed that government and universities must conduct applied research which will provide source knowledge for the future technological developments necessary for Canada to remain competitive.

Nine applications were classified in identifying future telecommunications satellite markets and technologies. The following conclusions were drawn from the analyses of those technologies which will most likely be used in satellite networks and in terrestrial and satellite distribution systems.

One-Way Video Networks. Television distribution to terrestrial transmitters and direct to home will remain the dominant applications in all three trading blocks.

Public-Switched Point-to-Point Voice, Data and ISDN Networks. Internationally, terrestrial fibre optics will be the main distribution medium of public-switched point-to-point voice, data and ISDN networks. However, some use of satellite technology is envisioned in all three trading blocks for the purposes of, for example, service restoration in North America, and network back-up and light-route servicing in Japan and Europe.

Private Point-to-Point Voice and Data Networks. Deregulatory thrusts in Canada, Europe and Japan will likely encourage the development of private networks and the use of satellites to overcome rights-of-way and other problems. On-board switching requirements of private networks will likely be less sophisticated than those of common carrier networks. Private systems will probably be the catalyst for development of point-to-point satellite networks.

Public-Switched Point-to-Multipoint Interactive (Two-Way) Networks. Significant technology development of hubless (switching and processing in satellite), high-capacity (at least 2 Mbps), mesh-network, Very Small Aperture Terminal (VSAT) systems in North America will occur. Satellite-based hub-switching and network-management systems will require innovative technological approaches.

Private Point-to-Multipoint Interactive Networks. The same comments as for public-switched point-to-multipoint interactive networks apply, except that star networks will likely predominate, due to centralized

head offices.

Private Point-to-Multipoint One-Way Data and Audio Distribution Networks. The satellite technology used is essentially mature, thus little development is expected.

Mobile Networks. Cellular systems, dedicated mobile voice and data networks and one-way paging networks can all be considered for terrestrial, maritime and aeronautical services. There will likely be a major technological thrust in satellite-based mobile personal communications.

Only the Maritime Mobile Service uses satellite communications to any great extent. However, lower-cost equipment will be required to meet new International Maritime Satellite Organization (INMARSAT) standards for smaller vessels.

Aeronautical mobile communications has been dominated by terrestrial technology, despite gaps in coverage for air traffic control and private and public communications over the oceans. More of these applications will be carried out by communications satellites, requiring technological advances in the space and airborne segments.

While specific market niches exist for satellite communications such as long-distance data and service to remote areas, there will be considerable terrestrial-based competition in the terrestrial mobile market. The first domestic mobile satellites in the Canadian/American MSAT system are scheduled for launch in 1993. Considerable technology development is required, particularly in ground segment equipment.

Data Collection Networks for Space-based Sensors. Earth stations currently receive data from military and civilian remote-sensing satellites that store data in on-board recording machines. Data can be transmitted only while the satellites are in the earth station's "field of view". Inter-orbit links will likely replace this function, thus providing real-time access to data. New transponders, antenna and tracking technology will likely be required.

Data Collection Networks for Ground-Based Sensors. This application is almost entirely terrestrial-based, except for some meteorological satellite applications. This trend is expected to continue, although satellites will likely be more cost-effective, flexible and adaptable in many cases. Minor modifications to VSAT networks will be required, but no new technology is needed.

Satellite Communications Market

The satellite communications market will probably develop primarily in the following general applications areas, in descending order of potential international marketshare:

- distribution of television (HDTV and Standard Definition) and audio signals in point-to-point, point-to-multipoint and broadcast modes;
- point-to-multipoint one-way (from hub) and two-way distribution of data, analog and digital voice, and analog and digital video serving specialized information services, business video, and voice and audio services markets; included are current VSAT and future hubless VSAT networks, and hybrid space-terrestrial networks for load-sharing, diversity and restoration;
- mobile satellite services including maritime satellite services; aeronautical satellite services for navigation, trans-oceanic communication, private and public messaging; voice and data terrestrial satellite services; and worldwide personal mobile communications in maritime, aeronautical and terrestrial modes;
- point-to-point, light-to-heavy trunk telecommunications services, integrally interconnected to public-switched voice and data networks, for load sharing and trunk restoration;
- inter-satellite links providing service to the remote sensing industry and for international point-to-point, heavy-route video, voice and data traffic.

It was recommended that satellites be developed which can carry multi-purpose payloads and are capable of in-service priority modification.

Key Elements of Long-Term Satellite Communications Strategy

It was clearly established that satellite communications is a future strategic thrust of all three trading blocks. Eleven key strategy elements were therefore recommended in order to maintain and improve Canada's competitive international position. These elements included recommendations for government funding and sponsorship of a series of projects, telecommunications policy and regulatory recommendations, and recommendations for government-sponsored research and acquisition and contracting policies.

Government Sponsorship of Projects Related to Satellite Communications

Among the key elements of a comprehensive Canadian strategy was the recommendation that the government undertake a series of projects aimed specifically at satellite communications.

Four programs were suggested as alternatives for a government-sponsored payload. These programs were subjected to a cost-benefit analysis and evaluated against other policy criteria. Outlined below, they are ranked in decreasing order of preference for inclusion in a long-term satellite communications strategy.

- Personal communications satellite service payload aimed at overcoming some current inhibitions to the use of the Ka-Band (20 to 30 GHz) for this type of application.

- A ku-band (12 to 14 GHz) hubless VSAT payload with at least T1 capability operating with earth stations of 1.2 metre maximum diameter. This payload would be aimed at both private- and public-sector business data and digitized voice markets, with potential capacity for business video and Canadian military applications. Traffic management and switching in the satellite would eliminate the need for an expensive VSAT hub and the double-hop requirement for remote stations communicating with each other.

- An inter-satellite data relay payload, in a joint venture with either NASA or the European Space Agency, to further the competitiveness of international satellite point-to-point trunks by eliminating double hops and associated delay. Such a link would operate either in the millimetre microwave band, for example 60 GHz, or in the optical band.

- An inter-orbit link between two geo-stationary satellites approximately 180° distant in orbital arc to provide continuous, real-time communications between second generation Radarsat and a non-tracking earth station, eliminating the need for on-board recording equipment. The payload could also provide continuous real-time communication with a remote sensing satellite from, for example, Japan or Europe.

Research and Development

It was recommended that a long-term strategic research program be implemented with appropriate long-term funding for feasibility studies, directed basic research, applications-oriented research and technology transfer to Canadian industry. The fields of research could include:

- on-board switching and processing;
- beam-switching, hopping and steering;
- antenna technologies;
- Ka-Band propagation and fade countermeasure research;
- the development of appropriate architectures, coding, modulation, protocols and access schemes to provide maximum efficiency in a satellite environment while interfacing and interconnecting with the public-switched network.

1.8 Teletext

Teletext provides one-way, point-to-multipoint broadcast transmission of graphics and textual information to television or low-cost terminals, using the video portion of a television broadcast to carry data communications. The data stream is carried in

the Vertical Blanking Interval (VBI) of the television signal and has no adverse effect on television reception.

(In North America, the 525-line, 60 fields-per-second television signal includes a VBI of 21 lines to allow the receiver to synchronize and perform vertical retrace before the active video picture begins. The VBI can be viewed on a television if the vertical hold is purposely misadjusted. Under present regulations in Canada, up to 5 VBI lines can be used for teletext transmission.)

Four lines of the VBI are currently used for teletext transmission, yielding a transmission rate of approximately 50 kbps. It is expected that 10 lines of the VBI will be used in the future, which would increase the transmission rate to approximately 125 kbps.

National broadcasters such as the CBC or CTV could provide teletext coverage to most parts of Canada. To put this in perspective, the entire text of the *Globe and Mail* could be sent to over 99 percent of the Canadian population in just under three minutes.

Since the teletext signal is carried on television signals which reach large geographical areas, teletext could provide an economical, reliable alternative to other means of transmitting large amounts of data to large audiences. Typical applications would include electronic publishing, computer communications to branch offices and automatic updating of public-access information terminals.

The use of teletext for commercial purposes is relatively new. Recent interest has been stimulated by the increasing penetration of personal computers into commercial operations, the availability of powerful software packages and the decreasing cost of micro-electronic circuitry. These factors have the combined potential to make teletext an attractive alternative for certain classes of data communications.

The Department of Communications is now cooperating with the Ontario Ministry of Culture and Communications and the CBC in the distribution of a Road/Weather database using teletext signals. Since the teletext signal is on the air now, it is relatively easy to put in place other pilot trials.

2. National Telecommunications Policy

2.1 Telecommunications Policy Framework

As a result of the fundamental technological changes and globalization of markets taking place in telecommunications, DOC began a comprehensive review of the telecommunications industry in 1984. Based on extensive consultation with both the industry and users, the review concluded that efficient and innovative telecommunications services would enhance the productivity and competitiveness of Canadian businesses within the Canadian economy and in world markets. It also recognized the need for a national policy for telecommunications that would apply across existing jurisdictional boundaries.

In July 1987, the Minister of Communications announced the Telecommunications Policy Framework for Canada. This policy framework had three central objectives:

- to maintain a universally accessible and affordable telephone service;
- to foster an efficient telecommunications network infrastructure to allow the delivery of services to Canadians at the lowest possible cost; and
- to create a viable competitive marketplace for telecommunications services and equipment in all regions of Canada.

The Telecommunications Policy Framework established two classes of telecommunications carriers. Type I carriers are those that own and operate transmission facilities. This includes such companies as the member companies of Telecom Canada, Unitel Communications Inc. (formerly CNCP Telecommunications), Telesat Canada and Teleglobe Canada. Type II carriers are service providers that use facilities leased from Type I carriers in order to provide services to the public. This includes resellers of telecommunications services and enhanced or value-added service providers.

The government also established a ceiling of 20 percent on foreign ownership of Type I carriers to guarantee Canadian ownership and control. No ownership restrictions apply to Type II carriers.

This classification of telecommunications carriers is intended to facilitate the development of two types of competition in Canada -- limited entry and strong competition in the provision of essential telecommunications infrastructure, and full unregulated competition in the provision of services offered by Type II service providers in order to promote innovation and enhance the competitiveness of the Canadian telecommunications industry.

The Telecommunications Policy Framework thus established the competitive basis for the evolution of a telecommunications system for Canada which will provide users with greater choice of services and facilities. The most recent major policy initiatives are discussed below.

2.2 Local Distribution Telecommunications Networks

Technological improvements, such as the conversion from analog to digital switching and transmission and the deployment of optical fibre by telecommunications common carriers and cable television operators, are enabling the common carrier and cable television industries to offer increasingly similar services over independent networks.

Moreover, continuous development of international standards for broadband ISDN is accelerating the convergence of narrowband and broadband technologies and services, traditionally offered by common carriers and cable television operators respectively. The introduction of broadband ISDN by Canadian and international common carriers, coupled with the delivery of new, non-broadcast telecommunications services to cable subscribers, will further affect the development of local network

infrastructures. These developments are eroding the existing barriers which prevented these industries from offering the same services. Current trends, therefore, appear to be leading toward local duopolies which offer a range of common services.

It is within the Telecommunications Policy Framework that DOC identified the need to establish new rules governing the operation of the currently distinct common carrier and cable television industries and to encourage the economical development of network infrastructures. DOC therefore initiated an in-depth review of the regulatory environment and public policies which may affect the rapid and efficient introduction of new services.

The objective of the policy review was to foster the development of state-of-the-art local networks for service distribution by examining the roles of the present participants and establishing a regulatory framework within which each would operate. To this end, public comment was solicited on regulatory, technical and socio-economic issues pertaining to the development of local broadband communications for the delivery of voice, video and data services to the home. This request for input represented the first stage of a major policy review of the Canadian cable television and common carrier industries. Input was also solicited concerning the most appropriate next steps in considering public response to DOC's request for input, in proposing policy options and in deriving appropriate conclusions and recommendations.

In addition, DOC requested from the cable television and telecommunications industries forecasts of the major technological and economic forces that would be likely to affect the growth and types of new service during the next ten years.

The Department favours a competitive environment for locally-distributed service and is supportive of local duopolies for this competitive service provisioning, unless it can be shown that such duopolies would result in economic hardship for the service providers or the service users.

However, to the extent that local competition becomes generalized in the short term, two rules should apply:

- first, cross-subsidization between broadcasting and telecommunications services will not be permitted;
- second, broadcasters will have to allow telecommunications service suppliers to access their infrastructure on a non-discriminatory basis (as is currently the case for federally-regulated telephone companies). Status quo operations would be permitted for those cable operators who do not wish to enter the telecommunications market.

2.3 Review of Policies related to Transborder Satellite Services

Current domestic arrangements for transborder satellite telecommunications services were established following an exchange of letters between Canada and the United States in 1982 and joint consultation with Intelsat the same year. The services regulated under these arrangements include private business communications, occasional point-to-point video services and reception of television programming signals.

The Minister of Communications designated Telesat Canada as the operator of transborder fixed satellite services in accordance with these arrangements. Telesat Canada's responsibilities include negotiating agreements with U.S. carriers for the provision of transborder satellite services, as well as ensuring that equitable use of Canadian space facilities and proportionate sharing of revenues occur. Telesat Canada continues to be recognized as the sole owner and operator of earth stations involved in transborder operations.

A number of substantive changes have occurred in satellite telecommunications since the establishment of the domestic arrangements for transborder satellite telecommunications. These changes include DOC's domestic transmit-and-receive earth-station ownership policy announced in April 1984; the CRTC decision in July 1984 on enhanced services, the CRTC decision in November 1986 on interconnection of Telesat Canada's space segment services to federally-regulated common carrier services and facilities; and DOC's telecommunications policy announcement in July 1987.

These changes, in conjunction with technological advances such as the development of VSAT networks and mobile services, changing telecommunications markets, and experience gained under the existing arrangements, as well as the expiry in 1990 of some of the existing international arrangements, made a policy review both timely and necessary.

The Minister of Communications therefore initiated this review in 1989 by inviting public input on the Canadian policies that govern the arrangements for transborder satellite telecommunications services. The aim of this policy review was to establish policies which ensure that Canada benefits from new technologies and continues to benefit from one of the world's most effective domestic telecommunications industries.

The services which are being examined under the policy review are those covered by the agreement with Intelsat -- in particular, private business communications and occasional point-to-point video transmission. The agreement does not apply to trunk telephony services or transborder services covered by the original exchange of letters between Canada and the United States in 1972.

The Department of Communications solicited comments on licensing arrangements for Canadian and U.S. transborder services, with the stipulation that authorization of organizations other than Telesat Canada would have to address requirements for accountability, regulatory responsibility, equitable use of Canadian satellite facilities and proportionate sharing of revenues.

Nineteen submissions were received from interested parties during the period for public comment. A revised policy is now being put forward for approval by senior management. DOC should be in a position to announce the new policy in the fall of 1990.

2.4 Radio Licensing: Policy Review for a Restricted Type of Local Public Commercial Service

Licences for land station (fixed) radio systems issued under the provisions of the General Radio Regulations, Part II are issued for private commercial and public commercial services. Private commercial service licences permit the licensee to use the system for specified private communications; no charges can be levied for any business transacted, services supplied or messages exchanged with a third party. Public commercial service licences permit telecommunications common carriers to carry public correspondence within the terms of their public telecommunications undertakings.

The Department of Communications' existing microwave licensing policy requires that applicants demonstrate that the public interest would be served by the creation of new facilities, and that existing facilities cannot properly satisfy this interest. This policy allows the Minister of Communications to consider such factors as cost, convenience, quality, flexibility and regional concerns in the granting of licences.

The Department considers that the public interest is best served by issuing public commercial licences only to telecommunications common carriers which operate public undertakings, charge for telecommunications services, and meet a reasonable level of public service responsibility and accountability, as required by legislation and regulatory provisions. This policy review does not affect the status of eligible public commercial licensees.

The Department has, however, received a number of requests and applications from entrepreneurs seeking radio licences to construct fixed radio systems providing specialized local radiocommunications services or innovative transmission distribution facilities. In some cases, radio facilities are intended to provide specialized services to select groups of clients or provide a restricted public service. These specialized services include new services which may not be available from the carriers, or which provide an efficient alternative to existing competitive services.

They are not intended to be a substitute for local public telephone service.

The Department recognizes that specialized local radio services cannot be effectively developed within the current definitions of public and private commercial services. It therefore initiated a public review to consider whether it is in the public interest to institute a licensing policy to permit local multipoint communications systems (MCS) and other similar spectrum-efficient radio system applications which provide restricted types of public commercial service.

The following are some of the important issues which must be considered in the development of a balanced policy:

- Would it be in the public interest to consider the licensing of local MCS and similar spectrum-efficient radio systems which provide specialized, innovative services as a restricted public commercial service? What would be the relative benefits to telecommunications users and the telecommunications industry of licensing restricted public commercial services?

- Would the licensing of specialized local public radiocommunications systems for restricted public commercial services adversely affect the availability of universal basic telephone service?

- What would be an appropriate definition for a local radio system? What would be the scope of the licence for this type of restricted public commercial service? What should be the conditions of licence, and what should be the licensing criteria and operating guidelines?

- On what spectrum efficiency principles should the decision be based to licence a restricted public commercial service where several system applications are competing for the same spectrum? Should these local radio systems be restricted to particular frequency spectrum bands, and should they be required to demonstrate certain spectrum efficiency requirements?

3. Regulatory Developments

There are numerous telecommunications carriers in Canada; however, the majority of telecommunications services are provided by 15 major telephone companies, Unitel, Teleglobe Canada and Telesat Canada.

Almost all carriers in Canada are regulated by federal, provincial or municipal authorities. Regulation is exercised on a carrier-by-carrier basis with respect to the services each provides. Following a Supreme Court decision in 1989, all member companies of Telecom Canada have been declared to be subject to federal jurisdiction. However, due to their status as provincial crown corporations, SaskTel and Manitoba Telephone System will remain under provincial regulation until appropriate amendments are made to federal legislation. Telesat Canada and the nine largest telephone companies form an unincorporated association called Telecom Canada to manage primarily the long distance communications industry. (The list of member companies and other major carriers is found in Figure 1).

The greatest regulatory impact on telecommunications services in recent years has resulted from interconnection decisions and terminal attachment policy.

The CRTC decisions, in 1979, to permit CNCP to interconnect its system with the exchange facilities of Bell Canada and, in 1980, to grant the subscribers of federally-regulated carriers the right to attach customer-owned equipment to the public telephone network, have continued a pattern of controlled movement towards a more competitive environment in telecommunications. However, significant differences still exist in provincially-regulated areas as is shown in Figure 2.

A more uniform approach to regulation can be expected to develop over the next few years in light of the national telecommunications policy framework announced by the Minister of Communications on July 22, 1987 and the 1989 Supreme Court decision. (See 2.1).

What these developments portend is a much more competitive telecommunications environment in the years ahead. This in turn accentuates the need for coordinated planning to ensure compatibility, cost-effectiveness and the achievement of maximum benefits.

It is not possible to forecast in great detail the effects or timing of developments in technology, rates, regulatory policy, jurisdiction and competition. Nevertheless, general trends and probable impacts can be identified.

3.1 Telephone Rate Changes

As a result of the rapid growth of telephone service traffic revenues in response to declining long-distance rates during the past two or more years, Bell Canada and B.C. Tel have exceeded their revenue requirements. In response, the CRTC has ordered both carriers to reduce long-distance telephone service rates in a number of successive stages. Since 1987, long-distance rates have declined by an average of about 40 percent.

It is not possible to predict whether or when the CRTC will order further rate reductions in long-distance services, but additional minor reductions are possible due to a continuing growth of revenue. Other changes in long-distance rates can be expected as a result of the Supreme Court decision and, if approved, the Unitel application currently before the CRTC, the implications of which are described below.

Figure 1

MAJOR CANADIAN TELECOMMUNICATIONS CARRIERS AND THEIR REGULATORY AGENCIES

CARRIER	REGULATORY AGENCY
* Bell Canada	CRTC
* British Columbia Telephone Company	
Northwestel	
Teleglobe Canada	
* Telesat Canada	
Unitel Communications	
* Island Telephone Company Limited	CRTC (as of August 1989)
* Maritime Telegraph and Telephone Company Limited	
* New Brunswick Telephone Company Limited	
* Newfoundland Telephone Company Limited	
* AGT	CRTC (as of October 4 1990)
* Sask Tel	Responsible to the Government of Saskatchewan
* Manitoba Telephone System	Manitoba Public Utilities Board
Northern Telephone Limited	Ontario Telephone Service Commission
Thunder Bay Telephone System	Ontario Telephone Service Commission
Québec-Téléphone	Régie des télécommunications du Québec
Télébec Ltée	Régie des télécommunications du Québec
Edtel	City of Edmonton

* Member of Telecom Canada

Figure 2

LEVELS OF COMPETITION

Regulatory Arrangements for Telecom Canada Telephone Companies (Post-AGT Decision)

Telecom Canada Telcos (representing 97% of the Canadian Telco market) / Type Of Competition	B.C. TEL British Columbia	AGT Alberta	SASK TEL Saskat-chewan (Note 1)	MTS Manitoba (Note 1)	BELL CANADA Ontario & Québec	NB TEL New Brunswick	MT&T Nova Scotia	Island Tel Prince Edward Island	New-foundland Tel New-foundland
Terminal Attachment									
First Telephone Set	✔	✔	✔	(Note 2)	✔	✔	✔	✔	✔
Residential Extension	✔	✔	✔	✔	✔	✔	✔	✔	✔
Business Multiline (PBX)	✔	✔	✔	(Note 2)	✔	✔	✔	✔	✔
Coin Telephone	✘	✘	✘	✘	✘	✘	✘	✘	✘
Network Interconnection									
Private Line	✔	✔	✘	(Note 2)	✔	✔	✔	✔	✔
Satellite	✔	✔	✘	(Note 2)	✔	✔	✔	✔	✔
Cellular Telephone	✔	✔	✔	✔	✔	✔	✔	✔	✔
Paging	✔	✔	✔	✔	✔	✔	✔	✔	✔
Resale & Sharing	✔	✔	✘	✘	✔	(Note 3)	(Note 3)	(Note 3)	(Note 3)
Public Data	✔	✘	✘	✘	✔	✔	✔	✔	✔
Services									
Value Added	✔	✔	✘	✘	✔	✘	✘	✘	✘
Public Long Distance, Voice	(Note 3)	✘	✘	✘	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 3)
Basic Local Telephone	✘	✘	✘	✘	✘	✘	✘	✘	✘

Notes:

1. Provincially-regulated telcos. The other seven telcos shown are under federal (CRTC) regulation
2. Expected early in 1991.
3. For CRTC consideration in Spring 1991

✔ - ALLOWED

✘ - NOT ALLOWED

3.2 Effects of the Supreme Court Decision: Alberta Government Telephones (AGT) versus CRTC and CNCP Telecommunications

In the Supreme Court of Canada Decision: Alberta Government Telephones (AGT) versus CRTC and CNCP Telecommunications (now Unitel Communications Inc.), the Court ruled that the federal government has jurisdiction over AGT and, by extension, over all other provincially-regulated members of Telecom Canada. Comprehensive federal legislation establishing a uniform national telecommunications policy is expected to be tabled in 1991.

In the wake of the AGT decision, the CRTC has, to date, assumed regulatory authority over five of the seven affected telephone companies. As a result, the level of terminal and services competition has become much more uniform across the country. In addition, the standards developed by the Terminal Attachment Program Advisory Committee (TAPAC) are now legally binding in the territories covered by these carriers. Heretofore these carriers had required compliance, to the extent that they permitted terminal attachment, on a voluntary basis. Following the Supreme Court Decision, Telecom Canada became a full voting member of TAPAC.

In so far as all members of Telecom Canada have the same cost/price structure, it is likely that the rates for trans-Canada message toll service and for public message and data communications will begin to decline as they have in Bell Canada and B.C. Tel territories during the past two years. These changes, which have already begun, could occur over the next two to three years.

3.3 Message Toll Service Competition

Unitel made a submission to the CRTC for entry into the long-distance telephone service market in May 1990. Since the CRTC hearing is not scheduled to begin until April 1991, no direct effects from competition are likely before fall of 1991 at the earliest.

If the Unitel application receives CRTC approval, it is possible that the company could begin providing service between major cities in Bell Canada and B.C. Tel territories within months of the approval date, since it already has facilities interconnection with Bell Canada and B.C. Tel exchanges for the provision of public data and private line services. There is some likelihood that rates for long-distance telephone services would drop somewhat as a result of competition.

No other applications are expected in the near future for any types of interconnection that will affect telephone rates, at least not until the CRTC rules on the Unitel application.

3.4 Rate Rebalancing

Rate rebalancing is another issue that could affect the price of both long-distance and local telecommunications services over the next 12 to 24 months. Since this is at the discretion of the CRTC, no predictions can be made. It is unlikely, however, that any rate rebalancing will take place before the CRTC decision on the Unitel application is rendered. If it does take place, it is likely that local rates will be increased gradually. Local rates could rise between $.05 and $.40 per year through to 1995 according to estimates contained in a CRTC report.

It is probably impossible to link changes in local telephone service rates to rate rebalancing, since changes to carrier construction plans as a result of network modernization, for example, or changes in depreciation policy, however small, will probably result in steady increases in local rates over the next decade.

3.5 Resale and Sharing of Leased Private-Line Facilities

In 1990, the CRTC substantially liberalized its rules regarding resale and sharing of leased private-line facilities connected to the local exchange area, giving customers and customer groups the same privileges that single businesses have had through a foreign

exchange (FX) facility. This decision is likely to stimulate growth in this new market and bring benefits to small- and medium-size companies. The CRTC also approved the resale and sharing of Teleglobe Canada's international services but not on a joint use basis.

3.6 Services for the Hearing-Impaired

On May 31, 1989, the CRTC issued Telecom Decision CRTC 89-7, formally requesting that TAPAC voluntarily revise its technical requirements such that telephones must be hearing-aid compatible in order to receive certification from DOC for attachment to networks of federally-regulated telephone companies. TAPAC responded favourably to this request and incorporated the requirements for hearing-aid compatibility into its standards document.

In addition, an implementation plan which included effective dates and exemptions was published in a DOC Gazette Notice in July 1989. From the beginning of 1990, all handset telephones certified by DOC have had to be hearing aid-compatible.

3.7 Other Regulatory Proceedings

Bell Canada has applied to the CRTC for approval to reduce rates for high-capacity leased private-line facilities (T1 and T3) by up to 20 percent to bring them more into line with American rates. If approved, this will likely have a significant effect on large customers.

4. Government Information Management Policy

4.1 Environment for Change

Miscellaneous Influences

The explosion of technologies in the eighties swept the government by storm. As offices filled up first with word processors, then PCs and printers, as multi-feature push-button telephones replaced their basic dial-up predecessors and the gateways of networks flew wide open to the world, data processing and telecommunications became no longer just the business of managers, but the interest and concern of everybody in the office.

Overnight, working within increasingly tighter budgets, telecommunications managers had to provide new products and services they could not knowledgeably evaluate. Senior management struggled with the quandary of organizational changes in the wake of decentralization of data processing and its convergence with telecommunications and office systems. Interdepartmental committees were reluctant to release the hold on their particular areas of expertise to the melting pot known as information technology.

Nor was the situation simpler for the central agencies. Procurement became a major issue in the throes of terminal attachment; network planning in advance of technological breakthroughs called for risks proportionately unfamiliar to government strategists; and policy development was a brand new ball game.

As the dust settled, certain facts became obvious.

First, these new tools and services had great potential for increasing productivity, and they were here to stay. Clearly, the government had to take a leadership role in both their use and promotion.

Second, the changes would have to be made with care and foresight so as not to create an environment of constricting isolation at either the departmental or the macro corporate level.

Third, with the budget deficit growing ever fatter, the restraints suffered through the eighties were unlikely to be diminished in the predictable future. All known economic measures must be embraced without jeopardizing program delivery.

Fourth, telecommunications, data processing and office systems were being irresistibly drawn together. Any one of these disciplines could no longer be planned without taking into consideration the impact of the other two.

These were the foundation stones that Treasury Board had to work with as it set about to define a new telecommunications management infrastructure in 1987.

Directional Influences

There were, of course, related changes at play that would influence the shape and form. One significant consideration was the introduction of a revolutionary change in corporate management philosophy. Increased Ministerial Authority and Accountability (IMAA) (see 5.1) gave departments more responsibility in managing their own scope of operations, removing the requirement that they report their activities and plans to a coordinating authority (TBS). Nor were they any longer accountable to anyone for non-use of common services; yet, common services would have to play an even more significant role in achieving the efficiency and economies required.

The Auditor General's Report of 1989 gave focus to this fact. "Departments have given little consideration to achieving government-wide efficiencies in telecommunications," it declared. In terms of data, many costly and inefficient parallel networks had been created, in addition to duplication of capital investments in modems, multiplexers, switches and leasing of high-cost, low-speed circuits. Better development and use of common telecommunications services was recommended.

In the fall of 1989, TBS found itself faced with the task of resolving the policy conflicts that now existed. Besides this untenable situation with respect to policies, the Board had been left with no apparent mechanism for ensuring that departments treat telecommunications issues from a government-wide perspective. A new corporate planning structure was clearly in order.

The groundwork had been laid a year earlier (1988) when the Board developed an Information Management Strategic Planning Process for the Government. In line with theories set out in the 1986/1987 *Annual Review and Planning Framework for Telecommunications in the Government of Canada,* Annex A, "Telecommunications Management Issues", it emphasized three basic requirements: coordinated planning of information management in related common service organizations; formalized involvement of departments in common service organization planning; and a strategic "top-down" approach for information management. This treatise became the framework for the future policy and committee architecture.

In another area, progress on the Occupational Analysis (see 5.7) had brought with it the revelation that "telecommunications personnel" in the federal government were no longer easily distinguishable. Many jobs containing telecommunications tasks were found to be spilling over into other disciplines. In consultation with the Advisory Committee on Information Management (ACIM), the Telecommunications Advisory Committee (TAC) came to the conclusion that the category known as "telecommunications personnel" needed to be more extensively examined within the framework of information technology.

4.2 Policy and Related Changes

Starting with the basics, TBS came up with a policy to replace *Administrative Policy Manual (APM)* Chapters 435, "Telecommunications Administration", 436, "Telecommunications Administrative Practices", 440, "Electronic Data Processing" and 448, "Typing and Word Processing", as well as several related Treasury Board Circulars. Released in June 1990, the policy articulates for the first time the government's position on the management of information technology.

Management of Information Technology Policy

The stated objective of the policy is "...to ensure that information technology is used as a strategic tool to support government priorities and program delivery, to increase productivity, and to enhance service to the public."

In summary, the directives require that information technology be used for the improvement of program delivery (not just to control costs) wherever appropriate and with due regard for human resource objectives; that consultation and communication be considered primary factors in the successful introduction of information technology in the workplace; that approved government standards be used; and that government-wide strategies be enunciated to guide the application of information technology and the evolution of information management.

With the focus on program delivery, human resources and planning, the new policy ushers in a fresh directional approach. Although cost control has always been -- and ever will be -- a major concern in the public sector, the primary emphasis is on program delivery with due regard to economic benefits. At the same time, the policy requires that a business-case approach be taken to the management of information-based resources.

In addressing human resource objectives, training and education are highlighted.

And finally, the requirement to develop government-wide strategies is aimed at bringing about a cohesion in planning and implementation under the coordinated guidance of senior bureaucrats.

Significantly absent are the central agency controls that characterized previous policy -- a reflection of the strategic effects of IMAA. As a matter of fact, one of the basic changes that this policy implements impacts on TBS itself. Each common service agency will be

responsible for the development and issuance of administrative practices pertaining to its own area of expertise. Such information will no longer be distributed through the medium of Treasury Board Circulars.

Other Directives

The above changes in policy offer potential for exciting improvements. But information technology cannot exist in a vacuum. The policy must conform with other directives that impact on information technology, such as those that deal with security, procurement and common services.

Security. The GOC Security Policy, revised in September 1987, "...prescribes a security system that will effectively safeguard classified information and other assets sensitive in the national interest, and protect other sensitive information and sensitive and valuable assets. It also establishes a job-related screening system." It replaces Chapter 435, section .6 of the APM.

Following implementation of the security policy and guidelines in September 1987, GTA staged two headquarters study sessions on information technology security and one in the Atlantic Region. Videotapes of these sessions are available on loan to government agencies, and updates on all aspects of information technology policy and standards are routinely included in the annual government telecommunications study sessions known as "Teleforum".

Procurement. In keeping with the policy changes being brought about by TBS, in 1989 DOC and SSC developed a new Memorandum of Understanding to streamline and clarify the procurement function each of them should follow in procuring information technology goods and services. This agreement is to be interpreted in conjunction with APM Chapter 310, "Contracting", which, itself, was revised in 1990 to harmonize with IMAA.

Common Services. The implementation of IMAA also rendered the existing policy on common services ineffectual. Restructuring began in the second half of 1989 and the revised policy was issued in 1990. The policy objective is to achieve value for money, ensure effective support to departments in realizing their program objectives, and support stated government socio-economic goals.

The basic change in terms of information technology is that telecommunications and integrated office systems are categorized as "optional" rather than "mandatory" types of common services.

This is in keeping with the collegial approach to management of telecommunications introduced with the Telecommunications Architect function explained in section 5.5 of this report.

The services provided by GTA are defined as follows:

- developing the government-wide telecommunications architecture;
- planning and managing the common government telecommunications infrastructure (i.e. common telecommunications facilities and services);
- coordinating the use of shared telecommunications facilities and services;
- identifying opportunities for strategic, operational and economic benefits;
- assisting in the development of departmental systems; and
- identifying requirements for interfaces between the government-wide telecommunications architecture and departmental architecture.

Standards. Information technology per se could not have evolved without a parallel development of standards. In Canada the federal government has taken a leading role in this all-important work and has given priority to establishing standards policy in support of the growth of information technology within its own boundaries.

The Information Technology Standards Policy that was implemented in 1987 was supplemented the following year by a *Guide to the Government Information Technology Program*. While the policy defines the roles and responsibilities of organizations both inside and outside the public sector, the Guide provides an

interpretation of the policy and describes the management mechanisms and procedures necessary to ensure compliance with the policy.

5. Government Organizational Issues and Structures

Significant changes have occurred since 1988 in the way the government manages itself. Several major instruments have been developed to improve Public Service management. Chief among these are IMAA, Public Service 2000, and the new organizational model, the Special Operating Agency.
In this chapter, we will describe each of these initiatives, and show how they are changing the government's telecommunications management infrastructure. In particular, we will trace the development of the new status of GTA as a Special Operating Agency, and of its new role as Telecommunications Architect for the Government of Canada.

5.1 Increased Ministerial Authority and Accountability (IMAA)

The government launched IMAA in 1986. Described as a systematic initiative designed to change the management culture of the Public Service, it has two broad objectives:

- to give ministers and senior managers the increased authority and flexibility they need to deal with changing circumstances and to manage effectively with limited resources; and

- to enhance the accountability of ministers and senior managers for the achievement of results, both in program delivery and in the implementation of Treasury Board policies.

More specifically, it involves

- recruiting and retaining the best people through such measures as new benefits, a better working environment, employment equity, equal pay for work of equal value and new management training initiatives;

- providing managers with the flexibility needed to manage efficiently and effectively by delegating authorities, deregulating and reducing paperburden;

- focusing on results by establishing meaningful accountability to TBS without imposing an unreasonable burden on departmental managers;

- tailoring IMAA to departments by means of Memorandums of Understanding (MOU) negotiated between individual departments and TBS; an MOU outlines the accountabilities and authorities approved for a department for a three-year period; and

- recognizing that the nature of the Public Service requires a core of government-wide policies, and ensuring that essential policies are revised in consultation with managers.

As of December 1989, six departments had signed MOUs, nine more were conducting negotiations with TBS, and several others were discussing specific authority or accountability issues. In addition, a number of small agencies were examining ways to remove administrative and reporting burdens that they feel are either excessive or inappropriate to small organizations.

5.2 Public Service 2000

Public Service (PS) 2000 grew out of the recognition by senior officials and Ministers that there exist structural and attitudinal barriers which must be broken down in order to create a modern public service capable of responding to the needs of a changing Canadian society. The program was announced by the Prime Minister on December 12, 1989. Its goals are to foster a public service that

- is professional, highly qualified, non-partisan and imbued with a mission of service to the public;
- recognizes its employees as assets to be valued and developed;
- places as much authority as possible in the hands of front-line employees and managers; and
- provides scope for different organizational forms (such as Special Operating Agencies) to meet differing needs, but in the context of a single Public Service.

To this end, ten task forces comprising more than 90 Deputy Ministers, Assistant Deputy Ministers and senior regional officials were created. The task forces report to the Clerk of the Privy Council.

In the first phase of the program, the task forces were asked to make recommendations regarding obstacles that could be removed or improvements that could be made independent of legislative change. Several dozen such recommendations emerged covering the areas of increased authority to departments and line managers, reduced paperburden, and improved human and financial resource management. These recommendations have been sent to appropriate departments and agencies for review, comment and implementation where possible.

The second phase involved the study of broader, longer-term issues, including those areas of change requiring amendments to legislation. In addition, departments were asked to begin their own PS 2000 processes involving consultation with employees. Reports from most task forces, comprising a total of nearly 300 recommendations, were completed by August 1990. A policy statement, together with a set of legislative amendments, is expected in the fall.

The third phase will coincide with the introduction of major changes, and will involve training and reorientation for both managers and employees.

5.3 Special Operating Agencies

A third initiative to improve the management and delivery of government services is the creation of Special Operating Agencies (SOAs) announced by the President of the Treasury Board on December 15, 1989.

Special Operating Agencies are service units within departments that are given more direct responsibility for results and increased management flexibility -- within the limits of existing legislation -- in order to improve service delivery. The idea behind the SOA concept is that giving greater authority and scope to individual employees and managers will encourage initiative and lead to improved performance.

The SOA remains within its parent department and is accountable to the deputy minister and minister. However, the deputy minister assigns authority for running the agency to its head who undertakes to meet specific performance levels and results. These performance objectives and the resources initially needed to achieve them, including any special managerial flexibilities, are set out in a framework document approved by Treasury Board ministers. It is expected that initially the flexibilities will occur mainly in the area of personnel administration, thus reflecting the focus of PS 2000. The framework document describes

- the SOA's mission;
- its performance goals;
- how it will be held accountable for those results;
- any special administrative flexibilities needed to achieve the results; and
- the policy environment, the services the agency will provide, and the relationship with the parent department and other departments.

In addition, each agency will be required to present a sound business case justifying how proposed flexibilities will contribute to more efficient or cost-effective operations.

Testing the SOA as an organizational model will allow the government to make adjustments for wider use of such agencies in the future.

5.4 Report of the Auditor General of Canada (1989)

The 1989 report of the Auditor General is relevant to the discussion of organizational issues for two reasons:

i. the concerns expressed in the report were among the factors that led to the creation of Public Service 2000, and thus to the increased flexibility being given to SOAs; and

ii. in 1989, the Auditor General examined the management and use of telecommunications in the federal government.

In his report, the Auditor General noted that savings from economies of scale are not being pursued for data communications to the extent that they are for voice communications, and estimated the potential short-term savings to be between 20 and 30 percent of operating expenditures ($30-45 million in the first year based on current annual expenditures of $150 million). The report went on to estimate that additional savings of at least 15 percent of voice operating expenditures are achievable with the integration of voice and data on government-wide networks.

The report recommended that a central focus be established for government-wide administration of both voice and data communications as a common service. It also warned that without clear leadership, the government is not positioned to take advantage of either the significant existing opportunities or the technological innovations that should soon be available.

The Auditor General's recommendations were echoed in the report of the ACIM Working Group on Core Systems and Supporting Infrastructures.

5.5 Advisory Committee on Information Management (ACIM)

The Advisory Committee on Information Management provides advice to TBS and acts as a government-wide forum for the sharing of information on policy related to such areas as telecommunications, office automation and information technology and systems. To identify and address strategic issues related to the management of common systems and supporting infrastructures, a working group was created. The Working Group on Core Systems and Supporting Infrastructures' task in Phase I was to analyze the core areas of personnel, finance and materiel and present a strategy for managing common information in those areas. The group's findings were adopted by ACIM and approved by TBS, and are currently being implemented under the direction of an ADM-level steering committee.

In Phase II, the Working Group was asked to review the existing approach to government-wide network planning, development, procurement and management; it was to identify the need, the opportunities and, where appropriate, the means to maximize the benefits to departments and the government of a common telecommunications infrastructure, and to specify the policy implications involved. It was also asked to examine the need for fail-safe common telecommunications networks and services to facilitate departmental initiatives to provide effective program-related services, nation-wide and internationally, at significant savings. Work on Phase II began in June 1988.

The final report of the Working Group, entitled *Strategy for the Management of Integrated Telecommunications Networks and Services for the Federal Government* was submitted in December 1989. It concluded that there is a need for a common integrated telecommunications architecture and a telecommunications management infrastructure keyed to government-wide business requirements. Specifically, it pointed to the opportunities for savings and increased cost-effectiveness presented by a government-wide telecommunications architecture function. Further, it identified a need for a new executive-level advisory panel for telecommunications whose primary focus would be on strategic and policy

issues, government-wide common telecommunications architecture management, standards, and shared programs.

In line with these conclusions, the Working Group recommended, among other things,

- the establishment of an integrated telecommunications infrastructure for the federal government;
- the establishment of a Telecommunications Architect Program within DOC;
- the formation of a task force to steer the implementation of the Working Group's recommendations; and
- the establishment of a telecommunications advisory panel to replace the existing TAC.

In response to the Working Group's conclusions and recommendations, DOC presented a proposal in which it

- accepted the recommended strategy for the management of integrated telecommunications networks and services;
- agreed to develop within GTA a new Telecommunications Architect Program;
- developed a set of operating principles for both the Telecommunications Common Service Management Program and the Telecommunications Architect Program; and
- advocated a new telecommunications management infrastructure including an ADM-level telecommunications management board as well as a telecommunications advisory panel.

The Department's proposed implementation plan included the immediate establishment of an ad hoc implementation task force.

Telecommunications Architect Program Implementation Task Force

The purpose of the Telecommunications Architect Program Implementation Task Force was to implement the recommendations of the ACIM Working Group on Core Systems and Supporting Infrastructure. Among the issues it addressed were

- funding and resource implications of the new telecommunications management infrastructure, including the Telecommunications Architect Program;
- creation of a telecommunications management board;
- establishment, in consultation with TBS, of the new Telecommunications Advisory Panel; and
- follow-up action to the Telecommunications Occupational Analysis study completed by the PSC; classification benchmarks for telecommunications personnel; and human resource development programs.

Chaired by the Director General of GTA, the Task Force held its first meeting in December 1989.

The Government Telecommunications Agency raised the issue of funding and resources for the new infrastructure with TBS through the Multi-Year Operational Plan (MYOP) process. The establishment of the Telecommunications Advisory Panel was also discussed. Following the announcement of the creation of SOAs, however, GTA informed the Task Force that the MYOP would be replaced by the business plan for the SOA.

Following a meeting between the Chair of the Task Force and the newly-appointed Chair of ACIM, the proposed telecommunications management board was renamed the Government Telecommunications Council. The Council will evaluate proposals for both the government telecommunications architecture and common services. It will also ensure that plans provide a balance between departmental requirements and overall government needs.

Subject to the structure of the Council, the Task Force, at the conclusion of its mandate, became the Telecommunications Advisory Panel (TAP). The mandate of the TAP is to provide advice and guidance on the strategic and operational issues identified by the ACIM Working Group on Core Systems and Supporting Infrastructures as well as others identified by the Task Force.

5.6 The New Telecommunications Management Structure and GTA

The Government Telecommunications Agency was one of the first five SOAs whose creation was announced by the President of the Treasury Board in December 1989.

As stated in its Framework Document, GTA's aim, in meeting the telecommunications needs of the federal government, is to provide high-quality services to its clients in an efficient and effective manner at an economical cost.

To execute this mandate, GTA will provide three principal services:

- common telecommunications services, shared and used by client departments and agencies;
- customized services -- telecommunications services which are unique to a particular department or agency; and
- a planning, design and development service -- the telecommunications architect function -- which will provide the strategy and take into account the operational need for an integrated system for all users.

The Agency's objectives include offering better value for money than client departments could otherwise achieve; running its operations, as far as practicable, in accordance with best business practices; and recovering the cost of all services as far as possible.

In this connection, the Agency has established as its goals to provide savings to clients of 35 percent on common voice services, 15 percent on common data services, and 15 percent on any new service offered.

It will operate with three financial goals:

- to be completely financially self-sufficient over any three-year period;
- to keep overhead costs below seven percent of revenue; and
- to send all invoices to clients within five weeks of month end.

Each year (subsequent to the initial 1990/91 year), GTA will prepare a multi-year business plan for approval by DOC (its parent department) and submission to TBS. The GTA business plan will be the definitive document against which GTA's performance will be judged. The business plan covering the 1990/91 fiscal year reflects GTA in a year of transition as it adjusts to its SOA status, and to the weight and importance of the strategic role of Telecommunications Architect for the Government of Canada.

In accepting this role, GTA assumes responsibility for:

- ensuring that government telecommunications needs will be met in an integrated, coherent fashion;
- achieving the greatest effectiveness for the government's one billion dollar annual expenditure on telecommunications; and
- ensuring that the maximum savings possible are achieved through effective procurement and efficient operation of the government-wide networks and customized applications.

Consequently, the architect function will not only influence the configuration and design of the networks of today and tomorrow, but will also provide the framework within which common services and customized applications will function.

In addition to the business plan, GTA will submit to DOC an annual management report and will implement financial control and management

accounting systems that enable its performance to be reviewed against agreed objectives.

To achieve its performance goals, GTA has, in its Framework Document, requested flexibilities in the areas of financial, personnel management and administrative authorities.

The close liaison and sharing of information between GTA and other components of DOC with respect to planning, long-term technical requirements and procurement strategies will further the Department's overall objectives for telecommunications, technology and research, including the development of Canadian industry and regional development.

5.7 Telecommunications Personnel: Occupational Analysis

Throughout the '80s, as the new technologies have developed, telecommunications personnel have expressed an increasingly urgent need for training. Indeed, there has been continuing concern about a wide range of human resource activities in a community that accounts for more than 6,000 person-years. Whether the requirements for action are there has never been the issue. Getting a handle on the requirements, on the other hand, has been a conundrum looking for a solution. Just identifying the community means untangling a massive web of jobs and classifications.

With resources at a premium, band-aid solutions to training needs have been sought and applied. These include efforts by the former TAC to identify the training needs of Telecommunications Service Officers; study sessions organized by the TAC and by GTA; and -- in the absence of availability of telecommunications training from the Public Service Commission (PSC) -- the compilation of a course inventory and publication of a training catalogue by GTA.

In 1987, these efforts were supplemented by TBS's formal establishment of an Occupational Analysis (OA) study to be carried out under the sponsorship of TAC by the Staff Development Branch (now known as the Training Programs Branch) of the PSC.

The Project Directive stated the aim of the OA was "...to collect quantifiable data which will accurately describe the jobs being performed within the telecommunications community as the basis for an objective review of the job structure, classification, selection, training and employment of telecommunications personnel...."

Considering the scope of classifications that could arbitrarily be included, certain parameters had to be established. The focus would be on the management and administration of the telecommunications function in the Public Service and would exclude those jobs which are primarily of an operations nature, such as Radio Operators (RO), or technical maintenance, such as Electronics (EL).

Method

The questionnaire that was developed and distributed to departments and agencies was designed to gather information that could be analyzed to give definition to the jobs actually being performed, and, as well, find out what associated knowledge and abilities are required to carry out the identified tasks. In addition, issues and concerns identified during interviews with some 170 telecommunications personnel provided another dimension to the information gathered in the questionnaire.

Once analyzed, the data would become the basis for developing a telecommunications training framework within the broader training framework for the management of information technology. It would also provide a database of information to assist TBS, the PSC, TAC and departments and agencies in their other human resource management activities.

Results

The survey proved successful. The extent of the response (a 64 percent return) reflected the support of the community at large. Moreover, 78 percent of those who responded indicated that half or more of their telecommunications job was captured in the questionnaire.

The resulting analysis identified four major functional groups, i.e. management, general services, technical services and administration. The remainder -- a grouping of 13 job types -- represented personnel whose telecommunications-related duties account for only a portion of their complete jobs.

As the structure began to take shape, a human resource management analysis plan was drawn up to accommodate the objective of the study.

Recommendations

The report to TAC, issued in June 1989, noted that telecommunications means "different things to different people". Before an accurate occupational structure can be designed, a clear consensus of meaning should be sought -- one that rationalizes the telecommunications function in relationship to the management of information technology as a whole in the government. This would facilitate the development of a model structure of the telecommunications community which would be used in the creation of an occupational structure that would address human resource management concerns (e.g. recruiting, selection standards, employment patterns, career planning and pay). In addition, the model would act as the infrastructure for a training framework that would meet the current and future needs of the community.

These recommendations were accepted by TAC and passed on to the emerging Telecommunications Advisory Panel for further action.

6. Common Telecommunications Networks and Services

6.1 GTA Services and Plans

The Government Telecommunications Agency continued to develop common network and enhanced telecommunications services for the Government of Canada during 1988/89 and 1989/90. These years represent a significant period of evolution for GTA: the process of replacing several common services with more efficient ones began; state-of-the-art services, such as the Government Packet Network, continued to be developed to meet user requirements; and new common services such as the Government Voice Messaging Service were launched. These events represent the culmination of several years of planning.

Moreover, the telecommunications management infrastructure, within which GTA fulfils its mandate, experienced significant change and in turn altered the mandate of GTA. (See Chapter 5, "Government Organizational Issues and Structures".)

The following review summarizes GTA's common network and services developments and plans, as well as GTA's performance.

Government Telecommunications Network (GTN) Development

The Agency issued a Request for Proposal (RFP) to CNCP (now Unitel Communications Inc.), Telecom Canada and Telesat Canada in November 1988 for the procurement of T1 digital facilities for selected cross-sections of the government intercity network. Proposals were received from all three carriers.

The first trial of T1 facilities was held from August to September 1989, using digital circuits on the Toronto-Ottawa cross-section. Traffic consisted primarily of voice, voice-band data and Group 3 facsimile carried on "compressed" 32 kilobit-per-second circuits. Results of the tests indicated that compressed facilities are not currently suitable for Group 3 facsimile traffic. A solution to this problem is being developed.

In the meantime, GTA is offering the Government Digital Channel Service (GDCS) for data applications. Based on a combination of Telecom Canada and Unitel digital circuits on selected cross-sections of the GTN, GDCS provides T1-based dedicated transmission services between Ottawa and each of the following locations: Vancouver, Edmonton, Toronto, Montréal and Halifax. GDCS rates are substantially lower than those of Telecom Canada's Dataroute and Unitel's Infodat digital data transmission services.

An interim service rate structure has been established pending CRTC approval of CBN 2 and Mach III digital facility tariffs filed by Telecom Canada and Unitel respectively. Rates will be further reduced after CRTC approval has been obtained.

Services that can be supported on GDCS during the interim service period include GTA customized data, GTA consolidated procurement and new departmental applications for data, voice and image.

The following transmission rates will be offered:

- 2.4 kbps to 56 kbps
- 1 DS-0 and over
- 1 DS-1 and over

Network Consolidation Upgrades

The Agency completed the modernization of the Belleville consolidation, and upgraded the London, Sudbury and Sherbrooke consolidations to Centrex III service. In addition, Direct Access Intercity (DAIX) Service, which provides access to the intercity network from commercial local service, was introduced in several locations in British Columbia.

Telephone Service to the United States

The analog Wide Area Telephone Service (WATS) to the United States was replaced with digital facilities in 1988/89. Quality of service improved significantly.

New service to the U.S. has been installed in the Pacific Region, and is in the process of being installed in Ontario.

Directories

An analysis of the Government of Canada telephone directories was conducted, resulting in a revised directory format.

All federal departments in the National Capital Region (NCR) now use GTA's Automated Directory Production System to produce their portions of the NCR directory. The system is also used to help produce all GTA regional directories.

Government Packet Network (GPN)

The number of GPN packet-switched accesses increased by 482, or 57 percent, to 1,326 between March 1989 and March 1990. This total had further increased to over 1,600 by October 1990. Associated billing in March 1990 exceeded by 47 percent the monthly billing thresholds required to achieve the 20 percent discount under the terms of the contract with Unitel. The GPN customer base now exceeds 50 federal departments and agencies, with an estimated user base of 20,000 federal employees.

Additional network switching nodes in Vancouver, Montréal and Moncton have been added to the original nodes in Ottawa, Toronto and Edmonton. Network expansion continues in Vancouver, Edmonton, Toronto and Ottawa. Traffic capacity has been upgraded in several locations.

Local dedicated access to GPN is now provided in 130 locations across Canada. Local dial access, which can be used to reduce the cost of accessing the Government Electronic Messaging and Document Exchange Service (GEMDES), is now provided in 25 Canadian centres.

The Agency plans to offer X.32 and Synchronous Data Link Control (SDLC) dial-up services, improve the GPN appointment plan, and increase the speeds of digital trunking facilities between nodes. Virtual networking capabilities, which will permit applicable organizations to manage their GPN-based services as if they were private networks, continue to be developed.

Government Satellite Network (GSN)

In April 1987, GTA released an RFP for the procurement of a government thin-route satellite service for voice, data and image transmission, which culminated in the signing of a contract with Telesat Canada in February 1989.

After a lengthy delay, the CRTC has approved the tariffs associated with the GSN. Service implementation has now begun, and it is expected that 20 GSN sites will be installed during the 1990/91 fiscal year.

In 1990, GTA intends to introduce a C band (6/4 GHz) service which will extend GSN coverage into the Canadian Arctic.

Shared Messaging Services

The Government Data Network Service, both versions of the Government Electronic Message Service (GEMS-Dialcom and GEMS-Envoy 100) and the Government Text Communications Service were replaced by the Government Electronic Messaging and Document Exchange Service (GEMDES) during 1989/90.

The competitive process for the provision of GEMDES to the Government of Canada culminated in the signing of a five-year contract by GTA and Bell Canada in November 1988.

In 1989 Telecom Canada introduced new Envoy 100 and iNet software, augmenting the standard Envoy 100 features with GEMDES enhancements such as French character support, binary file transfer capability, X.400 gateways, autodelivery to facsimile, an enhanced directory and blind courtesy copy. The document conversion capability was subsequently added.

The number of GEMDES subscribers increased by 1,315, or 40 percent, to 6,668 between January 1990 and October 1990, representing 65 federal

departments and agencies.

The GEMDES rate structure, implemented in February 1990, offers reduced rates as well as optional rate structures based on either kilocharacters sent/received or connect-time.

The Agency plans to introduce new features such as autodelivery to terminals on GPN and upgraded EDI support.

GEMDES has been adopted as a principal component of the Senior Executive Network (see 7.2).

Government Voice Messaging Service (GVMS)

As a result of an RFP, GTA signed a three-year contract with Time Communications Limited for the provision of GVMS in Vancouver, Toronto, Ottawa, Hull and Montréal. Approximately 5,000 mailboxes were activated during the first year of operation.

Government Facsimile Communications Service (GFACS)

A program was initiated by GTA in 1988/89 to plan the development of a state-of-the-art, shared facsimile communications service, conforming to CSA and CCITT standards. GFACS will offer more than basic facsimile transmission, providing facsimile store-and-forward and store-and-retrieve functions from user "mailboxes".

The Agency issued a Request for Information (RFI) for facsimile communications services to approximately 60 companies in August 1989.

Efforts are now underway to define the user requirement for this service and to develop a technical specification for it.

Electronic Data Interchange (EDI)

The Government Telecommunications Agency initiated the EDI Applications Project as its portion of a joint project with SSC to study the potential use of EDI for the government procurement of telecommunications and other goods and services. GTA is conducting a related pilot EDI trial.
The Agency plans to offer common EDI services to clients to facilitate the implementation of government-wide and departmental EDI applications. It will also be developing EDI applications specifically for the telecommunications procurement function within the federal government.

Mobile Satellite (MSAT) Service

Mobile Satellite service (see 1.6) will provide all areas of Canada with direct links to public and private mobile radio systems, as well as to the public switched telephone network. Data and voice services will be provided.

GTA will be the sole service provider for the federal government, offering discounted, full MSAT service in 1994.

GTA Performance Measurement

Average annual growth of GTA revenues between 1984/85 and 1990/91 is projected to be 8.2%. Revenues are projected to increase from $177 million in 1988/89 to $212 million by 1990/91.

The government intercity network carried six million more calls in 1988/89 than in the previous year, for a total of approximately 48 million calls, representing growth of 14%. This growth occurred during a period in which the number of government personnel actually decreased, indicating the increasing importance of the GTN to government program delivery. Total intercity calls increased again in 1989/90, totalling 53 million.

The trend in lower average cost per call on the intercity network continued, despite a slight increase in 1988/89, due to the 10% federal sales tax and tariff increases. It is expected that the average cost per call will decrease over the period of 1989/90 to 1990/91, due to limited cost increases, and increases in facsimile and data traffic volumes.

Increases in customized and coordinated procurement expenditures averaged 6.8% between 1983/84 and 1989/90.

Between 1985/86 and 1988/89, GTA's share of total annual government expenditures for voice and data services averaged 40.8%. It increased to 42.7% in 1988/89, and is expected to increase to 47.2% over the period of 1989/90 to 1990/91.

Between 1984/85 and 1989/90, GTA clients, by service category, increased as follows:

Service Category	From	To
Intercity Voice and Local Shared Services	130	142
Shared Data Services	57	66
Customized Voice and Data Services	72	100

The revenues per GTA person-year increased from $492,000 to $627,000 per year (1979/80 constant dollars) between 1986/87 and 1989/90.

6.2 Government Telecommunications Network: GTN-2000

The Government Telecommunications Agency initiated the GTN-2000 program in 1988 to address the government's need for a new telecommunications network architecture in response to changing user requirements, new and evolving network technologies, and the restructuring of common carrier tariffs.

GTN-2000 Objectives

Under the GTN-2000 program, GTA has produced a network architecture plan for evolving the existing GTN into a digital, intelligent network infrastructure designed to

- improve the cost and performance of the existing GTN and departmental dedicated networks;
- introduce new common data-oriented network services to satisfy the increasing data communications and information management requirements in the government;
- provide new network-wide enhanced voice communication services in order to improve internal government communications, public access to government services, and network operational efficiency;
- serve as the flexible network platform to provide access to, and network connectivity for, common enhanced services (e.g. messaging) and departmental operational systems;
- extend government network coverage to remote and under-served user locations; and
- promote competitive procurement and multivendor implementation.

The technology strategy to achieve the above objectives rests on

- the establishment of an all-digital transmission backbone network to complement the digital switches already in place in government nodes;
- the deployment of new network technologies, such as Common Channel Signalling (CCS)7 network signalling and ISDN access, to add new network intelligence to the current base of digital switches;
- improved network management systems and practices; and
- adoption of an open, functionally-layered architecture using, where feasible, standard interfaces.

Network Architecture

The GTN-2000 network architecture has two major components: the intercity network, and the intracity and access network. Both networks will be open; all user/network interfaces as well as interfaces between major functional blocks within the network will have to be compliant with standards, to the extent that they are available and cost-effective. The networks will also be functionally layered. Access, transport, basic switching and network intelligence functions have been separately defined for possibly separate implementation.

The intercity network will be a digital intelligent network consisting of three major parts:

- a digital backbone transport network using high-bandwidth facilities (initially at 1.544 Mbps);
- a set of interconnected Intelligent Communications Nodes (ICN); and
- a network intelligence infrastructure serving the ICNs for access signalling, network signalling, queries to network databases, and interfacing to applications processors and databases.

Advanced, single-point network management will be integral to each part.

The intracity and access network will consist of direct digital access links (with or without ISDN access) and, in some nodes such as the NCR, a fibre-based Metropolitan Area Network (MAN) providing variable high-bandwidth access as well as intracity connections.

Services Portfolio

The network services currently provided in the GTN are Centrex-based voice communication, analog and digital private lines, and packet-switched data. GTN-2000 will build on this base and offer the following new common telecommunications services:

- digital channel services for data and voice applications (Systems Network Architecture [SNA], LAN-LAN interconnection, virtual dedicated networks, access and transport of common enhanced services such as messaging);
- basic switched services (circuit-switched voice and voice-band data, circuit-switched digital data, switched packet mode, and switched integrated voice/data); and
- intelligent network services (network-wide call management, 800-type services, enhanced network-wide operator and automatic call distribution services, improved access, exit and routing control) to enhance existing intercity telephony, and offer new value-added network services.

For each new service, the appropriate service management capabilities are required in the network to support the deployment of the service.

Development Plan

Based on industry's responses to GTA's 1988 RFI, GTN-2000's network services and functionally-layered network architecture were confirmed as consistent with industry's trends and will be available in the 1990-95 period. In a later review with the ACIM Telecommunications Architect Program Implementation Task Force, there was consensus on the functional layering approach taken in defining GTN-2000's three principal layers: a) a high-capacity digital backbone transport layer; b) an intelligent networking layer based on ISDN and CCS7 signalling; and c) a fibre-based MAN layer in the NCR.

The task force was presented with a development plan consisting of the following three phases for the intercity network:

- Phase I: Intelligent Digital Backbone Network 1990-92
- Phase II: Full ISDN 1992-95
- Phase III: Broadband ISDN 1995 +

The Phase I services portfolio includes:

a) digital channel services to be provided at a variety of standard data rates;

b) basic switched services including circuit-switched voice, circuit-switched digital data, packet-switched data, and switched integrated services; and

c) intelligent network services based on CCS7 signalling, ISDN access, and network databases (e.g. network-wide call management, Enhanced 800, Network Inward Access Authorization, etc.).

For the NCR's intracity network, a MAN pilot is planned for 1991/92.

Phase II will comprise the expansion of Phase I features and network coverage. Phase III will focus on future broadband connectivity. The task force recommended that GTA should proceed with Phase I.

To implement Phase I, the following parallel activities have been initiated:

- development of an RFP for the competitive procurement of the Phase I services for late 1991 availability;
- the offering as soon as possible of an initial GDCS in 1990 based on tariffed T-1 service; and
- planning with Telecom Canada of a national Government Intelligent Networking Pilot for implementation by early 1991.

ISDN Evaluation

In a related development, GTA initiated the ISDN Applications Development and Assessment Project to assess strategic and technical developments in ISDN. Under this project, GTA is defining the network and service requirements necessary to support government applications. Selected applications will be implemented as common services under GTN-2000.

The Agency and Bell Canada collaborated in the Bell Canada and Federal Government ISDN Technology Trial, the first ISDN trial to be held in Canada, which lasted from November 1987 to November 1989. The scope of this trial included user assessments of the technology, the analysis of user problems, and evaluations of the technology, as well as operational, administrative and maintenance issues, and the development of recommendations for post-trial activities.

A joint GTA-Telecom Canada GTN-2000/ISDN Trial Planning Committee has been formed to develop plans for the National ISDN Trial/Government Intelligent Networking Pilot. An agreement was concluded to begin the trial in the fall of 1990, linking government users in Ottawa with users in both eastern and western Canada. Pilot locations could consist of Ottawa and major cities in most provinces. The trial will last one year.

7. Departmental Telecommunications Initiatives

Consistent with the overall theme of the *1990 Government Telecommunications Planning Framework and Review*, several government departments were solicited to describe their departmental networks and how they have enabled them to improve program delivery through gains in productivity and efficiency.

7.1 Atmospheric Environment Service: National Communications System

In 1982, the management committee of the Atmospheric Environment Service (AES) approved a major project to replace AES communications networks with more efficient network services, resulting in the National Communications System. This system consists of two components, which are currently being implemented:

- the New Computer Communications System
- the Meteorological Satellite Information System

New Computer Communications System (NCCS)

The NCCS is an interactive system for the collection and dissemination of low-volume alphanumeric weather data, such as observations and forecasts. It is supported by a network of eight interconnected Tandem computers located in six regional nodes and two central nodes in Downsview and Dorval. The nodes are interconnected by carrier-supplied X.25 accesses, with full redundancy designed into the network.

The AES-developed Interactive Data Entry and Interactive Data Display applications software is run on each regional computer node. This software provides conversational access between remote weather office terminals and the host computer system. Users can display weather data and send information to the host for storage. Weather data are stored on the regional node and both national nodes.

The NCCS replaces a teletype-based network, and will result in quicker dissemination of weather data. It is, however, backwardly compatible with teletype systems. The new network has permitted upgrades of communication links between the American National Weather Service and the Canadian Meteorological Centre. The Centre is now receiving more data more quickly, as a result. In addition, domestic data are being transmitted more quickly, which may eliminate one operational forecast run, in turn freeing more super-computer time to improve numerical forecasts. The NCCS will also replace interactive systems in some regions, freeing these systems for scientific functions.

Meterological Satellite Information System (METSIS)

The METSIS Network is the high-speed satellite communications component of the AES National Communications System which distributes meteorological charts and weather satellite imagery to AES weather centres and weather offices across Canada, via the ANIK-D communications satellite.

Information is transmitted to the satellite from earth stations located in Downsview and Dorval. Both uplinks carry three data channels for satellite photographs and one for weather charts. A third uplink located in Edmonton transmits Arctic photographs to the Canadian Ice Centre in Ottawa.

Weather centres are located in eight major cities across Canada. Data are delivered to the weather centres through receive stations located at each site, capable of capturing up to three METSIS data channels. Weather charts and photographs are reproduced on laser printers and standard digital facsimile recorders.

Each of 56 weather offices, through which AES disseminates most of its weather information to the Canadian public, has a METSIS receive dish which is interfaced to a multi-purpose display station capable of receiving two data channels. This configuration permits each weather office to receive weather charts on one channel and regional satellite photographs on the other.

In addition to providing weather services to the public, AES provides weather, ice and sea-state services to the Department of National Defence, which has several stations on METSIS. AES also provides services to Transport Canada's Flight Service Stations.

The METSIS network replaces low-speed facsimile networks for the distribution of charts and weather satellite images. Significantly more information is now delivered to weather offices more quickly. Distribution of weather data was previously schedule-driven, using facsimile circuits. Weather station users now access data as and when required and weather forecasters and briefers can decide whether to retain the information and for how long.

Benefits of the National Communications System

The National Communications System will increase the reliability of weather information distribution, providing full redundancy. More information will be available to weather offices, many of which will receive data which were formerly unavailable to them. The increased capacity will provide opportunities for future growth.

The new network is more cost-effective than the one which it replaces. Its projected cost -- including full graphics workstations -- is the same in 1988 dollars as that of the previous system in 1981 dollars. Overall, the capacity to deliver more products more quickly has been achieved at an effective lower annual cost.

The work environment of the weather offices will significantly change as a result of the system: it will move from a paper environment to an electronic one. The new tools will provide the means for productivity improvements both in the operation of the network itself, and, more important, for users in the weather offices, resulting in better service to clients.

7.2 Senior Executive Network

The Senior Executive Network (SEN) links Deputy and Assistant Deputy Ministers across the Government of Canada and provides them with access to information of common interest. The SEN is similar to communications networks established by organizations such as the Canadian Bar Association, whose members benefit from regular new information on the organization's activities and from easy access to information relevant to the profession, as well as from electronic communications with other group members.

The vehicle for the network is GTA's GEMDES service, based on Telecom Canada's Envoy 100 and iNet 2000 services, enhanced to meet GTA's specifications. Facsimile is also considered an integral means of delivering certain types of information.

One key assumption in designing the network service was that clients for the service are not necessarily computer-literate. Moreover, as senior executives, clients require information that is focused and relevant, as well as easily accessible. Clients' needs will be met by a combination of customized user-interface software and customized access to data services.

The challenge of meeting client needs increased by the range of computer platforms in use across the government. SEN has clients in 34 organizations. Approximately 70 percent of the clients have IBM-compatible personal computers, configured in various ways from stand-alone to mainframe-connected. Approximately 20 percent of clients currently use DEC All-in-One or IBM PROFS network systems with dumb terminals. An additional seven percent use Apple computers, while the remainder use other systems.

The network services are being developed in three stages:

i. In addition to messaging services, a range of government information of interest to senior managers is provided, generally through a series of private notice boards located on the iNet 2000 server. Some information, such as graphic material (e.g. Statistics Canada's *The Daily*), is delivered to Deputy Ministers via facsimile.

ii. Customized access to external and government databases that have been commercialized will be provided.

iii. New electronic government databases will be developed, if there is strong demand matched by departmental willingness to contribute.

Following implementation of the first stage, existing services will be assessed with respect to relevance to client needs and ease of use in order to identify the priorities for subsequent stages.

The long-range goal is to develop a network that includes all senior managers in the federal government (approximately 4,500 individuals).

The Network is committed to allowing users to continue using their existing equipment to access the various services offered through the network.

7.3 Correctional Service Canada: Offender Management System

Correctional Service Canada (CSC) received approval from TBS in January 1988 to proceed with the development and implementation of the Offender Management System (OMS). The purpose of OMS is to automate CSC's offender-related activities, from the admission of individuals into the federal penal system, to their release back into the community.

The Offender Management System is a direct result of public enquiries, which recommended increased availability of accurate and up-to-date offender information to allow correctional staff to make timely decisions about offenders. The OMS is integral to the fulfilment of CSC's mandate to protect the public, while meeting the needs of the offender population.

The system is based on the implementation of a distributed database architecture in which computing power and databases are highly decentralized. This is a departure from CSC's existing EDP environment, which is based on a hierarchial network of statistical multiplexers linking users to a corporate mainframe facility in Toronto via dedicated lines. Initial plans are to install Digital Equipment Corporation (DEC) microVAX-class minicomputers in some 70 locations across Canada, including every major correctional institution, District Parole Office, CSC Regional Headquarters and National Parole Board (NPB) office, as well as in the CSC National Headquarters. Each of these microVAX systems in turn provides computing services to a community of smaller sub-offices. The microVAX located in the Montréal District Parole Office, for example, serves a number of parole sub-offices in the Montréal area, as well as local users.

Sixty-four microVAX systems were installed by the end of March 1990. In total, CSC's network links over 200 geographically distinct sites, and provides direct links to the NPB, Royal Canadian Mounted Police, Solicitor General of Alberta and SSC.

The CSC's long-term information technology plan includes migration of its EDP application systems to a distributed processing environment, following the OMS example. With this and other objectives in mind, a decision was made to implement a new networking infrastructure to support this environment into the 1990s. CSC also decided that it would be advantageous to link existing mainframe users to this new network, eliminating the need for dual network operation.

The communications network consists of two components:

i. Local Area Network (LAN)

At each MicroVAX site, a 10 Mbps Ethernet LAN links local users to the host. Local users can access the microVAX using either IBM-compatible microcomputers equipped with Ethernet cards, or VT100-class terminals. LAN installations in CSC/NPB office sites were completed in April 1990. Detailed LAN surveys at selected CSC institutions were scheduled for completion later in the year.

ii. Wide Area Network (WAN)

Using the X.25 networking capability of the microVAX, users can access WAN facilities such as other microVAX nodes, CSC's corporate

computing centre in Toronto or the computing resources of other government departments or agencies. Planning for the WAN began in March 1988. To meet specific OMS requirements, as well as TBS and future CSC requirements, a hybrid X.25 network was proposed, which incorporated both public and private X.25 facilities. In compliance with TBS's approval for OMS, CSC approached GTA for assistance with the implementation of this network under the umbrella of GTA's GPN contract with Unitel. Over the course of several months, CSC and GTA worked closely together to develop the necessary specifications and refine the CSC design. In September 1989, CSC signed a Memorandum of Understanding with GTA for the provision of a Corporate Infrastructure/WAN service within the GPN. Implementation began in December 1989 and was completed in 1990.

Security features have been incorporated into the design of all communications hardware, services, systems and applications software. Adherence to these security measures is constantly monitored and is an integral part of all systems planning. All aspects of the CSC network are operated and managed entirely by CSC personnel. Network operations are based on a three-level support model, consisting of local, regional and nationally-based informatics staff. Because of the critical and sensitive nature of the information residing at each node, most aspects of network operations are highly centralized.

All hardware and software installations, upgrades and enhancements must be extensively planned and carefully implemented to minimize the impact on correctional operations.

To meet end-user needs, CSC's National Support Centre was established to support this highly-technical environment. Network monitoring and trouble call management are provided from 07:00 to 19:00, with staff on call during off-peak times.

To enhance network support operations, extensive use is made of network monitoring tools, including X.25 monitoring equipment, modem management equipment and local area network monitoring software.

7.4 Industry, Science and Technology Canada (ISTC): 3270 Network

The ISTC 3270 Network provides access to a mainframe computer system which houses ISTC's national applications and corporate database. Major mainframe applications include the following:

RAMS - Resource Accounting Management System
PRISM - Program Resource Information System for Management
BOSS - Business Opportunities Sourcing System
PEMD - Program for Export Market Development

The mainframe applications support ISTC's Establishment File and collectively form an integrated corporate database. This corporate database approach allows updates to be made through one application and reflected in the data used by the other applications.

Data entry is usually done interactively, on-line, with an optional on-line enquiry capability.

Printed output can be produced in Ottawa at ISTC Headquarters, or in the regional offices using the same communications lines.

The 3270 Network provides services to ISTC Regional Offices located in each province and territory. The network also serves other government departments and agencies throughout Canada. Altogether, 31 cities are served by the network.

Approximately 50 percent of mainframe users are located in Ottawa, and the remainder are dispersed across the country in regional offices and sub-offices. Of those cities other than Ottawa, 50 percent have a dedicated 3270 cluster controller, while the remainder use dial-up facilities.

Public access is provided for use of the Business Opportunities Sourcing System. Companies that use this system are located throughout Canada, the United States and in some European countries. External users are served by either Datapac or Infonet, depending on location.

Headquarters personnel are linked to the ISTC mainframe in Ottawa by local lines, while regional users connect via Telecom Canada's Datapac packet-switched network. Different types of Datapac access are used in different areas, depending on requirements.

Sixty-eight cluster controllers configured for a total of 550 terminals are located in 15 different cities. Prime-time usage on the mainframe is approximately 130 concurrent on-line sessions.

In offices with smaller volumes, the individual workstations which access the mainframe may be shared by the users of several applications.

Workstations are either IBM 3270-compatible terminals or IBM-compatible microcomputers. The microcomputers access the host mainframe using one of three methods:

- If the microcomputer is close to a cluster controller and high usage is expected, a CXI 3278 emulation board is installed allowing the microcomputer to be connected to a cluster controller via coaxial cable. This provides the same functionality and speed as a terminal connected in a similar manner.

- If the microcomputer is remote, either dial-up or dedicated Datapac 3101 access is used in combination with SIMPC communications software. This software allows microcomputers to emulate a 3278 terminal over asynchronous accesses.

- If there are many microcomputers connected to a LAN, a 3270 gateway is installed on the LAN. This gateway provides all microcomputers connected to the LAN with access to the mainframe via a single access point.

File transfers from the mainframe to the microcomputers are extensively used within the Department. The software allows files to be transferred over the different communications media used within ISTC.

The output from batch jobs and screens dumps can be printed in the regional offices on the existing printers connected to the 3270 clusters. This is made possible by using specialized software on the mainframe. The host is also capable of initiating a Datapac connection to the appropriate printer when a job is ready to be printed.

Other government departments, including External Affairs Canada, the Atlantic Canada Opportunity Agency, Western Economic Diversification Canada and Revenue Canada-Customs and Excise access one or more ISTC mainframe applications. The network services provided to these departments are equivalent to those provided to internal users.

Security has been implemented at the computer log-on stage. Because the network must be flexible enough to provide access to public users in addition to internal users, it was more efficient to implement the required security on the mainframe than within the network itself.

The 3270 network serves a dynamic environment where user requirements are constantly changing and increasing. The network is therefore continually modified. The use of Datapac for the regional offices allows this to take place without incurring large expenses. The network is constantly monitored to ensure efficient use and adequate throughput.

7.5 National Research Council: CA*net

In 1987, the National Research Council (NRC) convened a meeting of representatives of Canada's research communities to discuss Canadian requirements for a national network. Based on the results of this meeting, it was agreed that improved facilities were needed. NRC worked with ISTC, DOC, and the existing NetNorth and CDNet networks to establish a new national network -- CA*net. NRC committed $2 million to establish a start-up fund for CA*net. A consortium made up of the University of Toronto, IBM Canada and Integrated Network Services Inc. (INSINC) won the bid to develop the network.

Today, CA*net is fully operational and will be self-supporting (through member fees paid by regional

networks to interconnect to CA*net) after NRC's initial funding is finished. Policy direction and financial management are controlled by the CA*net board of directors, consisting of representatives of each of the regional networks. The responsibility for daily operations and technical management rests with the University of Toronto.

CA*net, Canada's research network, provides data communication services throughout the country, linking regional/provincial networks across the nation and providing connections to similar networks in the United States and worldwide.

CA*net links ten regional networks across Canada, providing vital computer communication services Canadian researchers need. With high speed communication capabilities, Canada's R&D communities in universities, governments and private industries can collaborate, efficiently and effectively, on multidisciplinary projects. Researchers from coast to coast can share information or cooperate to find solutions to problems. Equally important is the network's ability to stimulate the transfer of technology between public and private sector organizations. Technology developed in the laboratory can reach Canadian industry faster, giving Canadian companies the competitive edge they need.

Facilities and resources provided by CA*net and the regional networks include

- data bases
- software
- supercomputers
- library collections
- electronic mail
- file transfer
- access to international R&D resources.

CA*net is the third tier of a hierarchy of networks that reach across Canada. The first tier, the local area network, exists within a private sector firm, university or government laboratory. These local networks connect to a second tier of regional/provincial networks. Each of the ten Canadian regional networks provides communication links among the universities, governments and industries located within its province. Regional networks are autonomous, locally-managed networks with individual fee structures and policies.

Each regional network in this second tier pays fees to interconnect to CA*net. In return, CA*net provides the regional network with computer communication capabilities across Canada, to the U.S. through NSFNET, and internationally via the Internet.

CA*net and the regional networks currently use transmission control protocol/internet protocol (TCP/IP) on 56 kbps leased lines. The networks will support T1 (1.5 Mbps) and higher speeds as communication lines become affordable. Protocols will evolve towards international standards as these standards become established. CA*net is now participating in the ISTC feasibility study to develop very high speed networks.

7.6 Revenue Canada Taxation: Tax Information Phone Service

Revenue Canada Taxation (RCT) receives millions of telephone enquiries each year. These calls include general enquiries about various topics such as the Child Tax Credit, as well as specific requests for taxpayer information such as the status of personal income tax refunds. Approximately four years ago RCT decided to automate responses to as many enquiries as possible. This effort resulted in the introduction of a nationwide voice-data network called Tax Information Phone Service (T.I.P.S).

The Service is a computer-based voice-response system that provides taxpayers who use Touch-Tone telephones with certain information. Digitally-recorded human speech is used to give the information to the taxpayer.

Depending on the time of year, taxpayers can use the following services:

- Info-Tax, which provides income tax and information about filing income tax returns;
- Telerefund, which provides the latest information on the status of income tax refunds; and

- Advanced Child Tax Credit, which provides information on whether taxpayers are eligible to receive the child tax credit prepayment, and when they can expect to receive the cheque.

Twenty-eight District Taxation Offices are designated as T.I.P.S. nodes. The T.I.P.S. network is capable of handling over one million calls annually on 500 local and "800 Service" lines. Each node consists of a personal computer-based Voice Response System (VRS) which answers taxpayer calls, and a network interface machine which connects the VRS to RCT's data network. To assist in managing incoming phone calls, the VRS is connected to the Public Switched Telephone Network via a Private Automatic Branch Exchange (PABX).

With GTA's assistance, a separate network was established, based on the GPN, for monitoring the nodes and for telemaintenance and application support. An automated monitor was developed to check system functioning 24 hours per day. The monitor makes periodic voice/Dual Tone Multifrequency (DTMF) Signalling and data calls to all nodes, and sends voice messages to a pager in the case of a malfunction.

The basic objective of T.I.P.S. is to maintain or improve service levels during periods of increased service demand. T.I.P.S. is simple to use: the taxpayer need only press a few keys on the telephone in order to obtain the desired information. For added convenience, T.I.P.S. is available outside normal office hours, in some cases on a 24-hour basis. It is very efficient: for example, taxpayers who do not require detailed instructions can receive a response in less than one minute. This contrasts with an average interaction time of over four minutes for telephone conversations with RCT enquiries officers, and the associated higher telecommunications costs.

The Service can adequately respond to most simple enquiries without assistance from enquiries officers, freeing RCT personnel to resolve more complicated problems. It allows the Department to respond to a growing tax-filing population without a corresponding increase in resources. This observation is consistent with results of an evaluation indicating favourable taxpayer response, and an overall decrease in personnel-assisted refund enquiries. It is expected that this trend will continue, and become more significant as taxpayers become familiar with the system and the information provided.

Ensuring taxpayer confidentiality is the responsibility of the Department under the Income Tax Act. Since the T.I.P.S. network provides direct access to taxpayer information contained in RCT databases, security continues to be a prime concern. The security design was developed as part of the Risk Threat Assessment, with very specific guidelines for implementation. Proper taxpayer identification is a key issue for certain T.I.P.S. applications. For example, the Telerefund application requires taxpayers to key in their social insurance number, date of birth and the amount of refund claimed on the income tax return. Only after confirmation of these data are taxpayers advised whether the return is processed and when a refund cheque can be expected. As an additional precaution against unauthorized access, the user is restricted to a limited number of attempts during the service period.

The Department recognizes that voice-response technology is an excellent means of providing up-to-date information to taxpayers. The refund and payment enquiries applications are particularly well suited to this type of service, since the information needs are limited and well-structured. Any future applications of this kind would be prime candidates for T.I.P.S.

The Service currently serves only Touch-Tone telephone users. Rotary-dial telephone users must still be served by RCT personnel. While estimates vary, a large number of taxpayers -- perhaps as many as half -- do not have convenient access to DTMF service. Significant potential savings are therefore possible if the rotary service can be automated. The most promising approach would be to use speaker-independent word recognition. To mimic touch-tone operation, only digits 0 through 9, as well as a few control phrases such as "yes" and "no", must be recognized. It is only in the last few years that this technology has reached the market place.

7.7 Supply and Services Canada: Software Exchange Service

The Software Exchange Service (SES) was initiated by SSC to promote the sharing of government-owned applications software, information, documentation and related systems development investment among departments and agencies. In this way, it hopes to reduce government expenditures by avoiding duplication of effort.

The SES team gathers information on software and documentation within the federal government that has the potential for common use. They use their Software Exchange Support System database to store this information about client software (both needed and available for transfer), as well as system descriptions and technical data. A catalogue of sharable software is currently available on diskette or in printed form.

Efforts are in progress to make all of the database information available through an electronic bulletin board, allowing clients to make requests and suggestions, offer software for sharing, and exchange related information.

In addition, the team sets up interdepartmental conferences and meetings to discuss common needs, and organizes software showcases involving both government and private-sector suppliers. Where no known software is readily available to meet a common need, SES will encourage cooperative development or acquisition.

The service operates on the basis of shared ideas and information. To this end, departments are encouraged to submit to the SES office any information on systems software and documentation with the potential for common use, as well as their plans for future software development.

Among the benefits offered to government organizations by the project are

- quick, cost-effective solutions to users' needs;
- reduced software development costs;
- faster systems development; and
- greater uniformity among government systems, thus facilitating networking and the use of common protocols.

Part II

Government Telecommunications Expenditures Review

8. Government Telecommunications Expenditures Review

8.1 Introduction

This section of the *Government Telecommunications Planning Framework and Review* summarizes telecommunications resource expenditures in the federal government for fiscal years 1986/87 to 1989/90 and forecasts these expenditures up to the end of 1993/94. Public Accounts data are the primary source for identifying facilities-based expenditures (operating and capital). An additional dimension is given to this data by the use of information about Government Telecommunications Agency (GTA) recoveries, generated from GTA's financial system.

Public Accounts data, which originate within the federal government departments' financial systems, are supported by a common expenditure coding system established by the Office of the Comptroller General. This financial coding system distinguishes telecommunications expenditures from other types of expenditures and provides the basis for this review.

Changes to the financial coding structure and definitions for telecommunications were recently implemented (April 1, 1990). The purpose of streamlining the financial expenditure coding system for telecommunications was to reduce the burden on departments of reporting to central agencies, and to improve the government's assessment and forecasting capability. Future editions of this document will reflect these changes.

8.2 Telecommunications Resource Expenditures

Table 1

TELECOMMUNICATIONS EXPENDITURES BY CATEGORY
1986/87 - 1989/90

EXPENDITURE CATEGORY	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIB. OF 1989/90 EXPENDITURES (%)
TOTAL OPERATING	414,667	2.9	433,948	4.7	480,058	10.6	510,486	6.3	61.1
TOTAL CAPITAL	422,219	24.3	442,752	4.9	433,114	-2.2	325,466	-24.9	38.9
TOTAL FACILITY-BASED EXPENDITURES	836,886	12.7	876,700	4.8	913,172	4.2	835,952	-8.5	100.0

Source: Accounting, Banking and Compensation Directorate, Supply and Services Canada

Total government facility-based expenditures surpassed the $900 million mark in 1988/89, increasing by 4.2% from the 1987/88 level, and then declined in 1989/90 to just under $836 million. The 1989/90 expenditure represents a decline of 8.5% from 1988/89. The drop in facility-based expenditures is due to the significant decline in capital expenditures of 24.9%. During the period 1986/87 to 1989/90, facility-based expenditures showed an overall reduction; however, decreasing expenditures was not a trend during this period but rather the result of changes in 1989/90. Both Table 1 and Graph 1 reflect these observations.

Total telecommunications expenditures comprise both operating and capital expenditures. Over the past years, the division between operating and capital has changed from being more or less equal to now being approximately 60% operating and 40% capital. More detailed analysis of operating and capital expenditures is provided in subsequent discussions.

Graph 1

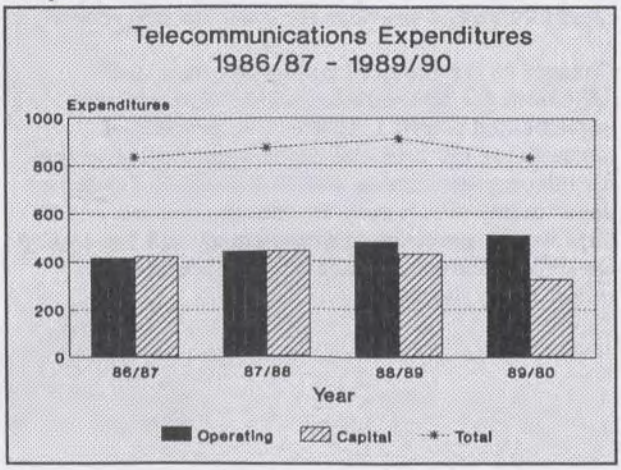


Table 2

OPERATING EXPENDITURES BY CATEGORY
1986/87 - 1989/90

EXPENDITURE CATEGORY	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIB. OF 1989/90 EXPENDITURES (%)
Telephone Service	248,290	4.1	261,110	5.2	283,064	8.4	294,742	4.1	57.7
Message, Data, Other Communication Services	110,792	-1.0	113,977	2.9	132,645	16.4	147,483	11.2	28.9
Repair: Lines, Telecom Equipment	40,600	10.4	42,533	4.8	49,280	15.9	52,392	6.3	10.3
Rentals: Telecom Equipment	14,985	-3.7	16,328	9.0	15,069	-7.7	15,869	5.3	3.1
TOTAL OPERATING	414,667	2.9	433,948	4.7	480,058	10.6	510,486	6.3	100.0

Source: Accounting, Banking and Compensation Directorate, Supply and Services Canada

Operating expenditures grew by 23% over the period from 1986/87 to 1989/90, averaging 7.2% per year for each of the three years. For 1989/90, they measured more than $500 million, an increase of 6.3% from 1988/89. Operating expenditures, which are presented in both Table 2 and Graph 2, are divided into four component parts, namely "telephone service"; "message, data, other communications services"; "repair: lines, telecom equipment"; and "rentals: telecom equipment".

Telecommunications services, which comprise *telephone* and *message, data, other communications services*, account for the major part of operating expenditures. In 1989/90 they represented almost 53% of total telecommunications expenditures and approximately 87% of operating expenditures.

Telephone service remains the largest of the two telecommunications service types, measuring approximately $295 million in 1988/89. *Message, data, other communications services*, although significantly less than *telephone services*, grew by 11.2% in 1989/90 to more than $147 million.

The remaining expenditures under the operating domain are repair and equipment rentals, which together are responsible for only 8.2% of total telecommunications expenditures, or 13.4% of operating expenditures.

Graph 2

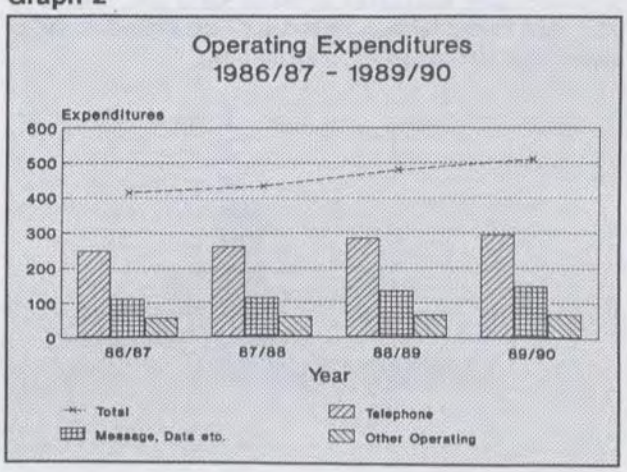


Table 3

CAPITAL EXPENDITURES BY CATEGORY
1986/87 - 1989/90

EXPENDITURE CATEGORY	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIB. OF 1989/90 EXPENDITURES (%)
TOTAL CAPITAL	422,219	24.3	442,752	4.9	433,114	-2.2	325,466	-24.9	100

Source: Accounting, Banking and Compensation Directorate, SSC

Capital expenditures, the second component (38.9%) of total telecommunications expenditures, account for $325 million in 1989/90. This represents a decline of almost 25% from the previous year's expenditures. The significant decline in 1989/90 is not representative of the total government, but rather the result of a major reduction in capital spending by Transport Canada. If 1989/90 total government capital expenditures excluding Transport Canada are compared with similar expenditures for 1988/89, growth is found to measure 1.4%. This reinforces the notion that the 1989/90 sharp decline in capital expenditures is not a common trait throughout the government. Neither is this decline in capital a historical trend. Over the three years since 1986/87, capital expenditures have declined by approximately 23%, dropping on average by 7.4% per year. Individual yearly changes in expenditure levels, however, have fluctuated between 4.9% and -24.9%. Included in capital are outlays for telecommunications equipment, buildings or installations.

Table 3 and Graph 3 provide a view of capital expenditures for the period 1986/87 to 1989/90.

Graph 3

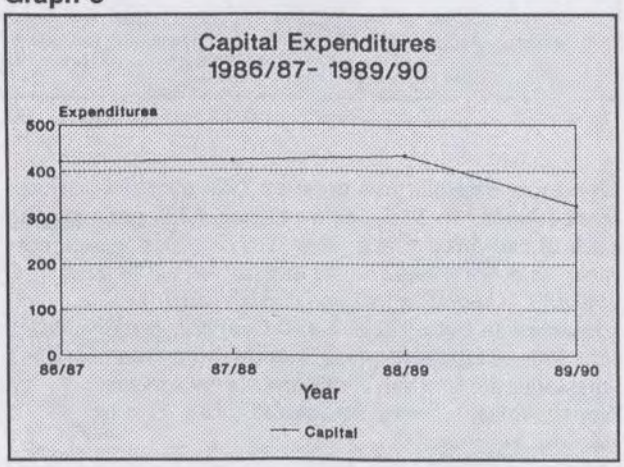


Table 4

TELECOMMUNICATIONS EXPENDITURES BY GROUP
1986/87 - 1989/90

PROGRAM GROUPINGS	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIBUTION OF 1989/90 EXPENDITURES (%)
Defence	327,679	8.6	369,805	12.9	379,715	2.7	399,996	5.3	47.9
General Government Operations	85,596	17.4	83,005	-3.0	93,842	13.1	97,917	4.3	11.7
Transportation	195,843	26.8	176,888	-9.7	187,190	5.8	78,084	-58.3	9.3
Social	63,519	5.7	66,006	3.9	70,811	7.3	70,378	-0.6	8.4
Natural Resource Based	51,961	2.3	66,225	27.5	63,624	-3.9	63,710	0.1	7.6
Justice & Legal	62,467	21.1	61,997	-0.8	59,923	-3.3	61,612	2.8	7.4
External Affairs & Aid	21,832	4.5	24,442	11.9	26,936	10.2	29,246	8.6	3.5
Communications & Culture	13,925	-6.9	13,938	0.0	14,656	5.2	17,570	19.9	2.1
Industrial, Regional & Scientific/Technological	14,064	-7.1	14,394	2.3	16,475	14.5	17,439	5.9	2.1
TOTAL FACILITY-BASED EXPENDITURES	836,886	12.7	876,700	4.8	913,172	4.2	835,952	-8.5	100.0

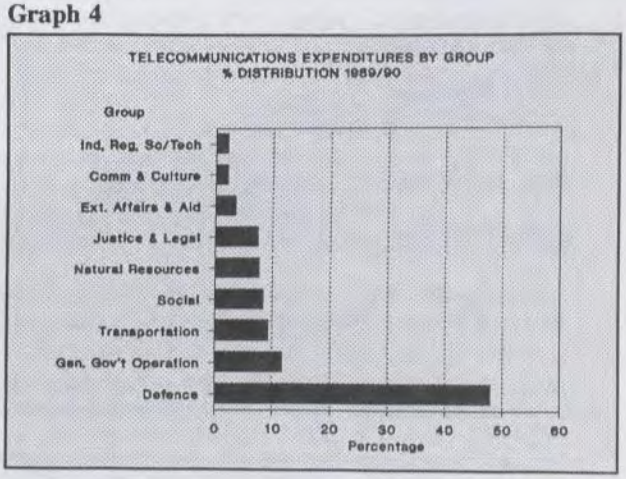
Source: Accounting, Banking and Compensation Directorate, Supply and Services Canada

Total telecommunications expenditures, grouped according to program/department commonality, are shown in Table 4 and Graph 4. Groups identified are similar to those used to analyze government budgetary expenditures in Part I of the *1989-90 Estimates*.

It is worth taking a look at certain groups because of their unusual size or growth rates. For example, Defence is by far the largest group identified, representing approximately 48% of total telecommunications expenditures. In 1989/90, growth of this group's expenditures measured 5.3%, well above the overall average of -8.5%

Telecommunications expenditures for the Transportation group, now the third largest group, declined by 58.3%. From the review of capital expenditures, we know that Transport Canada reported significantly reduced capital expenditures, and therefore contributed greatly to lowering this group's expenditure level. The Transportation group was responsible for 9.3% of total telecommunications expenditures in 1989/90.

Graph 4



Growth in the Communications and Culture group was the largest of all other groups, measuring 19.9%. It is also one of the smallest groups with regard to its telecommunications expenditure level.

8.3 GTA Financial Activities

GTA is the branch of Communications Canada delegated the responsibility of planning and coordinating telecommunications services for departments, branches and agencies of the Government of Canada [Department of Communications Act RSC-1970, c.24-s.5(d)].

In 1989, the Government of Canada proposed that GTA become a Special Operating Agency with increased autonomy and emphasis on commercial operation. The transition from Common Service Organization to Special Operating Agency is now underway.

The Agency operates on a cost-recovery basis financed through a revolving fund.

Table 5

GTA REVOLVING FUND (RF)
1986/87 - 1989/90

OPERATING EXPENDITURES	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIBUTION OF 1989/90 EXPENDITURES (%)
TELEPHONE SERVICE									
Total Government	248,290	4.1	261,110	5.2	283,064	8.4	294,742	4.1	57.7
Provided through GTA RF	117,726	0.4	124,986	6.2	141,426	13.2	162,000	14.5	79.9
Percentage of Total Provided through GTA RF	47.4		47.9		50.0		55.0		
MESSAGE, DATA, OTHER COMMUNICATION SERVICES									
Total Government	110,792	-1.0	113,977	2.9	132,645	16.4	147,483	11.2	28.9
Provided through GTA RF	24,738	4.5	26,920	8.8	35,597	32.2	40,682	14.3	20.1
Percentage of Total Provided through GTA RF	22.3		23.6		26.8		27.6		
OTHER OPERATING - REPAIR, EQUIPMENT RENTALS									
Total Government	55,585	6.2	58,861	5.9	64,349	9.3	68,261	6.1	13.4
Provided through GTA RF	0	0.0	0	0.0	0.0	0.0	0	0.0	0.0
TOTAL OPERATING									
TOTAL GOVERNMENT	414,667	2.9	433,948	4.7	480,058	10.6	510,486	6.3	100.0
PROVIDED THROUGH GTA RF	142,464	1.1	151,906	6.6	177,023	16.5	202,682	14.5	100.0
PERCENTAGE OF TOTAL PROVIDED THROUGH GTA RF	34.4		35.0		36.9		39.7		

Note: GTA is financed by a revolving fund that covers all administrative, operational and capital expenditures. It is managed on a full cost revenue-dependent basis.

Source: Accounting, Banking and Compensation Directorate, Supply and Services Canada
Government Telecommunications Agency (GTA)

Table 6

GTA RECOVERIES BY SERVICE
1986/87 - 1989/90

GTA SERVICES	1986/87 ($K)	CHANGE FROM 1985/86 (%)	1987/88 ($K)	CHANGE FROM 1986/87 (%)	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	DISTRIBUTION OF 1989/90 EXPENDITURES (%)
Intercity - Voice	110,776	-0.6	117,662	6.2	133,397	13.4	152,332	14.2	75.2
- Data	24,738	4.5	26,920	8.8	35,597	32.2	40,682	14.3	20.1
TOTAL INTERCITY	135,514	0.3	144,582	6.7	168,994	16.9	193,014	14.2	95.3
Local - Voice	6,950	19.3	7,324	5.4	8,029	9.6	9,668	20.4	4.7
- Data	0	0.0	0	0.0	0	0.0	0	0.0	0.0
TOTAL LOCAL	6,950	19.3	7,324	5.4	8,029	9.6	9,668	20.4	4.7
TOTAL GTA SERVICES	142,464	1.1	151,906	6.6	177,023	16.5	202,682	14.5	100 0

Source: Government Telecommunications Agency (GTA)

Tables 5 and 6 provide summaries of telecommunications expenditures recovered by GTA. It should be noted that the measurement of *telephone service* and *message, data, other services* expenditures recovered by GTA is based on results from the GTA billing process. The actual purpose for which the service is used may vary. For example, it is known that many clients use the government intercity network for the purpose of transmitting data and facsimile traffic, and yet for the purpose of billing, these charges are considered as expenditures for voice services. Recent studies estimate that for 1989/90, GTA may have recovered over 50% of total government *message, data, other services* expenditures. In the same study it was estimated that GTA recovered approximately 41% of total government *telephone service* expenditures.

With reference to these tables, it is interesting to note the following:

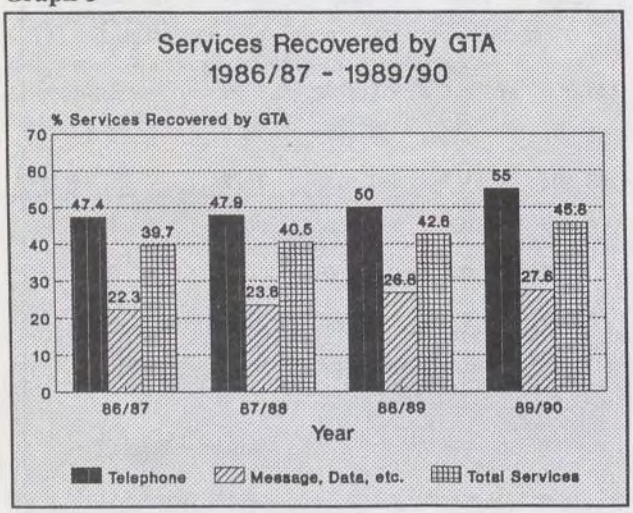
i. The proportion of total operating expenditures provided by GTA has remained relatively stable for the years shown in Table 5, increasing slightly in 1988/89 and more so in 1989/90. This has occurred during a period when carriers were offering long-distance services at reduced rates to the public and small telecommunications users. GTA's success in maintaining its share of total government operating expenditures is, at least in part, a function of its ability to hold down costs and to increase the efficiency of its services.

ii. The operating category includes expenditures for repair and equipment rentals ("Other Operating") which are not areas of GTA cost recovery activity. If these are excluded from total operating expenditures, as shown in Graph 5, and GTA recoveries are compared to the residual operating expenditures (telecommunications services), a more realistic view of GTA's recoveries is revealed. It can be seen that GTA recovered approximately 46% of telecommunications service expenditures in 1989/90.

iii. Local telephone service to GTA-managed consolidations is billed directly by telephone companies to departments. Therefore, it is not included in the amounts recovered by GTA. The relatively low figures for local service recoveries shown in Table 6 reflect this practice of direct billing to departments for local service. Clearly, GTA's principal role, in terms of cost-recovery activities, is on

the intercity side. This fact camouflages the very important role that GTA plays in managing local service installations and, perhaps, the even more important role it plays as a consultant on systems, networks, etc., to other departments.

Graph 5



iv. The growth in cost recovery activities related to both *telephone service* and *message, data, other communications services* significantly exceeds the expenditure growth in these areas.

v. GTA recoveries are used to pay for operating costs (including the cost of acquiring telecommunications services provided to the federal government) and administrative and overhead costs associated with managing these services (salaries, accommodations, materials and supplies etc.). For 1989/90, approximately 8.6% of the $202 million recovered by GTA was allocated to administration and overhead, with the remainder going towards the operating costs and net profit. Net profit in 1989/90 amounted to $2.6 million.

8.4 Expenditures Forecast

Table 7

SUMMARY OF FORECASTS OF FACILITY-BASED EXPENDITURES
1988/89 - 1993/94

	ACTUAL				FORECASTS							
EXPENDITURE CATEGORY	1988/89 ($K)	CHANGE FROM 1987/88 (%)	1989/90 ($K)	CHANGE FROM 1988/89 (%)	1990/91 ($K)	CHANGE FROM 1989/90 (%)	1991/92 ($K)	CHANGE FROM 1990/91 (%)	1992/93 ($K)	CHANGE FROM 1991/92 (%)	1993/94 ($K)	CHANGE FROM 1992/93 (%)
Operating	480,058	10.6	510,486	6.3	544,615	6.7	581,923	6.9	621,787	6.9	664,382	6.9
Capital	433,114	-2.2	325,466	-24.9	360,291	10.7	380,107	5.5	401,013	5.5	423,068	5.5
TOTAL	913,172	4.2	835,952	-8.5	904,906	8.3	962,030	6.3	1,022,800	6.3	1,087,450	6.3

NOTE: Forecasts are based on the use of exponential curve fit techniques applied to historical data.

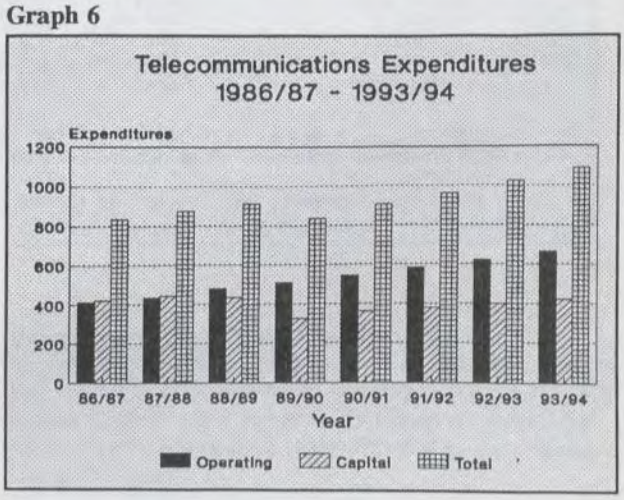
Table 7 presents forecasts of operating and capital expenditures for the years 1990/91 through 1993/94. These forecasts must be treated with a certain amount of caution since they are based solely on extrapolation of limited historical data. Because of the rapid changes in technology, management and the regulatory environment taking place in the field of telecommunications, quantifying future expenditure levels is difficult and uncertain.

In particular, in the recent applications to the CRTC for digital channel services, the major Canadian carriers proposed significant reductions in charges. These tariff changes will undoubtedly affect the validity of the forecast operating expenditures. Reductions in digital channel service costs would have the effect of both reducing overall data communications costs and motivating users to employ digital communications services in place of more expensive or less efficient services. For example, the use of voice grade service for data transmission is likely to decrease with the introduction of less expensive digital channel service.

Nevertheless it is interesting to review the figures in Table 7, which were estimated using exponential curve fit techniques, and to note the following:

i. Operating expenditures are forecast to grow annually by between 6 and 7% over the next few years. This growth rate does not differ significantly from the annual average growth rate of 7.2% during the past three years mentioned previously in this section. Increased competition and resulting price changes, increased use of digital facilities for both voice and data, and the ever increasing demand for

Graph 6



new and improved services, combined with the shortened lead time required for implementation of new and emerging technologies, are likely to affect the size of operating expenditures in the future.

ii. Capital expenditures are projected to grow by 10.7% in 1990/91 followed by growth rates of 5.5% for the subsequent three years.

iii. Total expenditures, which combine the growth rates of both operating and capital, are estimated to grow at between 6.3% and 8.3% over the next four years.

iv. Telecommunications expenditures for the period 1986/87 to 1993/94 are shown in Graph 6. The forecast expenditures identified here can be observed in the presence of past years' figures. Generally speaking, it can be said that total telecommunications expenditures have been growing smoothly and steadily over the period (with the exception of 1989/90), and are predicted to continue doing so.

Table 8

TELECOMMUNICATIONS EXPENDITURES BY DEPARTMENT/AGENCY
(Descending order of total 1989/90 expenditures)

DEPARTMENT/AGENCY	1987/88 TOTAL ($K)	1988/89 TOTAL ($K)	1989/90 OPERATING ($K)	1989/90 CAPITAL ($K)	1989/90 TOTAL ($K)	% CHANGE FROM 1988/89
National Defence	369,804	379,715	151,643	248,353	399,996	5.3
Transport Canada	175,916	185,327	51,349	25,503	76,852	-58.5
Royal Canadian Mounted Police	47,704	47,826	34,402	14,069	48,471	1.3
Employment and Immigration Canada	40,948	44,963	40,784	1,995	42,779	-4.9
Revenue Canada Taxation	21,090	25,373	26,605	2,049	28,654	12.9
External Affairs and Internat'l Trade	22,804	24,974	20,929	6,090	27,019	8.2
Environment Canada	28,201	25,454	21,490	3,748	25,238	-0.8
Supply and Services Canada	15,442	15,335	15,195	584	15,779	2.9
Health and Welfare Canada	12,674	13,024	13,743	54	13,797	5.9
Revenue Canada Customs and Excise	10,017	11,903	12,540	519	13,059	9.7
Fisheries and Oceans	10,192	11,986	9,321	3,685	13,006	8.5
House of Commons	11,512	11,751	11,045	1,002	12,047	2.5
Agriculture Canada	11,469	13,337	10,219	1,124	11,343	-15.0
Energy, Mines and Resources Canada	15,549	11,972	6,088	5,183	11,271	5.8
Public Works Canada	7,149	11,095	8,683	1,645	10,328	-6.9
Communications Canada	6,151	6,561	7,823	1,816	9,639	46.9
Correctional Services Canada	10,673	8,148	5,718	2,788	8,506	4.4
Indian and Northern Affairs Canada	6,736	6,488	6,221	236	6,457	-0.5
National Research Council Canada	5,141	5,784	5,060	994	6,054	4.7
Industry, Science and Technology Canada *	5,876	6,157	4,966	330	5,296	6.6
Statistics Canada	5,274	5,611	5,160	27	5,187	-7.6
Veterans Affairs Canada	3,820	4,168	4,329	114	4,443	6.6
Secretary of State	3,228	3,425	3,053	188	3,241	-5.4
Consumer and Corporate Affairs Canada	2,380	2,483	2,666	116	2,782	12.0
Department of Finance Canada	2,203	2,256	2,596	87	2,683	18.9
Privy Council Office	2,879	2,036	1,887	565	2,452	20.4
Public Service Commission of Canada	2,231	2,303	2,147	161	2,308	0.2
Department of Justice Canada	1,690	1,780	2,096	46	2,142	20.3
Canadian Internat'l Development Agency	1,558	1,863	2,111	0	2,111	13.3
Forestry Canada **	NA	NA	1,476	279	1,755	NA
Atlantic Canada Opportunities Agency	383	994	1,152	124	1,276	28.4
The Senate	1,442	1,221	1,250	0	1,250	2.4
National Film Board	1,497	1,318	1,221	0	1,221	7.4
Labour Canada	995	1,081	1,141	27	1,168	8.0
Immigration Appeal Board	163	459	984	118	1,102	140.1
Other Departments	11,909	15,001	13,441	1,847	15,288	1.9
Total	876,700	913,172	510,486	325,466	835,952	-8.5

Source:Accounting,Banking and Compensation Directorate, Supply and Services Canada
* 1987/88 and 1988/89 expenditures are derived by combining expenditures for Regional Industrial Expansion and Ministry of State for Science and Technology.
** Forestry Canada was reported as part of Agriculture Canada in 1987/88 and 1988/89.

Table 8 looks at telecommunications expenditures for the past few years by department. Capital, operating and total telecommunications expenditures are identified for 1989/90.

A look at the distribution of total expenditures by department shows that the nine largest departments are responsible for over 80% of total expenditures in the government. The distribution of capital expenditures is even more skewed as demonstrated by the largest two departments which are responsible for almost 85% of total capital. As expected, operating expenditures are more evenly distributed throughout the government.

Table 9

Telecommunications Services Usage
Total Government Profile
November 1989

Services	% of Departments Using Service by Source of Billing		
	Government Telecom Agency (%)	Common Carrier (%)	Other Telecom Service Provider (%)
Voice			
Government Intercity Network	100.0	0.0	0.0
Authorization Code , Credit Card Calling	95.2	31.0	2.4
DDD, IDDD, Operator assisted Calling	61.9	38.1	0.0
Intercity Dedicated Circuits	14.3	7.1	0.0
WATS, 800, 900	57.1	11.9	0.0
Zenith	0.0	2.4	0.0
Teleconference	81.0	7.1	2.4
Mobile, Cellular Telephones	0.0	61.9	19.0
Voice Messaging/Mail	4.8	7.1	9.5
Data, Messaging, Image, Video			
Packet Switched Network	57.1	31.0	11.9
Circuit Switched and Dedicated Circuits	59.5	26.2	14.3
Intelligent Network	0.0	7.1	2.4
Telex, TWX	38.1	26.2	2.4
Electronic Mail	64.3	14.3	7.1
Electronic Data Interchange	0.0	2.4	2.4
Facsimile Network	4.8	21.4	7.1
Video Teleconferencing	0.0	7.1	0.0
Other			
Satellite:			
- Voice	0.0	2.4	0.0
- Data	2.4	4.8	0.0
Secure Communications Network:			
- Voice	0.0	0.0	0.0
- Data	0.0	2.4	2.4
Digital Channel Communications	0.0	9.5	0.0
ISDN	0.0	2.4	2.4

Table 9 looks at the percentage of departments in the government using the various telecommunications services supplied by GTA, common carriers, and other telecommunications providers. The information shown in Table 9 was compiled from results of surveying fifty departments (forty-two responded) in

the fall of 1989. This survey requested information from all but the very largest and smallest departments in the government. Most noteworthy of the departments excluded from this survey are National Defence, Royal Canadian Mounted Police, Transport Canada, and External Affairs Canada.

Looking at the percentages in Table 9, all departments report using voice category services. Packet-switched network services, circuit-switched and dedicated circuit services, and electronic mail services are also used by a significant percentage of departments.

The Government Telecommunications Agency is identified as by far the preferred supplier of the popular services. One exception stands out: mobile, cellular telephone services. GTA made a business decision not to provide cellular telephone service. Instead, the Agency negotiated with the common carriers on behalf of departments for a favourable pricing scheme which is now available to all departments directly from the carriers.

List of Abbreviations

ACIM	Advisory Committee on Information Management
CCITT	*Comité consultatif international télégraphique et téléphonique*
CRTC	Canadian Radio-television and Telecommunications Commission
CSA	Canadian Standards Association
DOC	Department of Communications
EDI	Electronic Data Interchange
GEMDES	Government Electronic Messaging and Document Exchange Service
GPN	Government Packet Network
GTA	Government Telecommunications Agency
GTN	Government Telecommunications Network
HDTV	High Definition Television
IMAA	Increased Ministerial Authority and Accountability
ISDN	Integrated Services Digital Network
ISTC	Industry, Science and Technology Canada
LAN	Local Area Network
MSAT	Mobile Satellite
NCR	National Capital Region
RFI	Request for Information
RFP	Request for Proposal
SOA	Special Operating Agency
SSC	Supply and Services Canada
TAC	Telecommunications Advisory Committee
TAPAC	Terminal Attachment Program Advisory Committee
TBS	Treasury Board of Canada Secretariat
VSAT	Very Small Aperture Terminal