COMMUNICATIONS IN CANADA

A SECTOR OVERVIEW

International Trade
Department of
External Affairs

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A SECTOR OVERVIEW

Note
This book is designed to acquaint foreign buyers with Canadian developments and capabilities in the telecommunications field. It is intended as a companion volume to *Telecommunications Products and Services for World Markets,* a directory of Canadian suppliers, which contains profiles of some of the most active manufacturers and exporters of telecommunications equipment and of those firms offering consulting, engineering or training services.

For further information concerning telecommunications products and services, please contact:

Information Technologies and
Electronics Division (TDE)
Department of External Affairs
125 Sussex Drive
Ottawa, Ontario
Canada K1A 0G2

Tel: (613) 996-1893
Telex: 053-3745 TDE
Fax: 613-996-9288 TDE

The Department of External Affairs (DEA) is responsible for and aggressively promotes international trade by providing closely integrated and focused services to Canada's business community and to businesses abroad with an interest in Canada.

New international marketing units based on industry sectors are available to provide business clientele with the total market picture; they offer timely information about markets around the world, and across the spectrum of exportable products and services. Within DEA, the International Trade Development Branch works closely with International Trade Centres across Canada, the DEA geographic divisions and DEA trade missions in major markets abroad.

DEA personnel are available to provide specialized commercial information; co-ordinate and enhance the use of the trade mission planning systems; identify market opportunities; update and utilize the WIN Exports database to identify suppliers; and provide an industry-specific information service.

The department's central aim is to offer exporters and potential exporters easy, co-ordinated access to programs and services.

Canada, 1989

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SPAR AEROSPACE LIMITED, SATELLITE AND COMMUNICATIONS GROUP

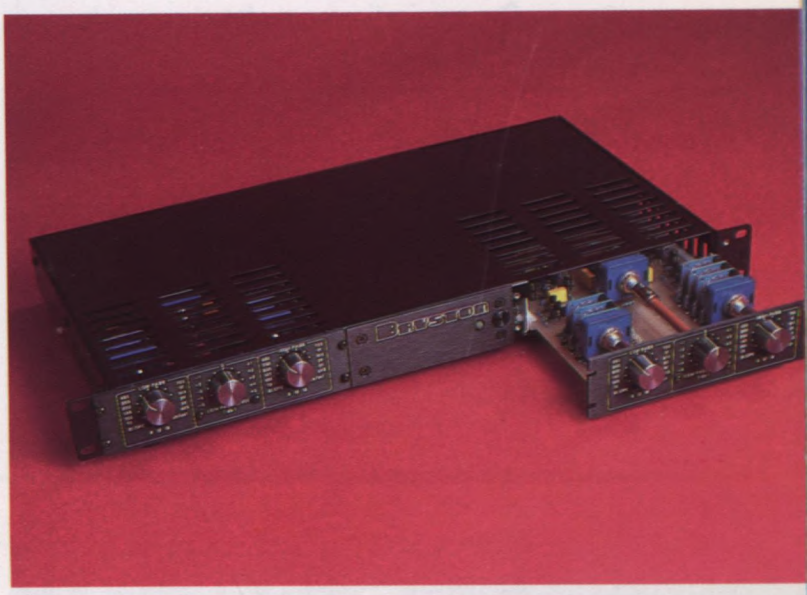
Canada has long been a pioneer in communications and today continues as a world leader in the development and application of new technologies. This standing at the forefront of innovation has its roots in the physical nature of the country.

Canada is vast. The second-largest nation on the globe, it spans the continent from the Atlantic to the Pacific, from the U.S. border to the high Arctic. With a total area of nearly 10 million km^2, it takes in six time zones and is bordered by three oceans.

Yet compared to the country's size, Canada's population is surprisingly small – 25.6 million people, unevenly distributed around the nation, and in many cases isolated by climate and geographical barriers.

One of the primary ways that Canada has met the challenge of geography and a scattered populace is through the development of communications technology. Today, Canada has a sophisticated communications system that is among the most advanced in the world. It includes three coast-to-coast microwave networks, a domestic satellite network, and telephone service to more than 98 per cent of all households in the country. Mobile radio serves both urban and remote areas. Broadcast needs are met by two national television networks, some 1 000 private cable companies, a national radio network and numerous private AM and FM radio stations.

■ *Anik E (45021433) — Spar is currently working on several satellite programs and is prime contractor for Anik E, the next generation of Canadian communications satellites scheduled for delivery to Telesat Canada in 1990.*



BRYSTON LTD.

■ *Bryston 10B electronic crossover*

Canadians derive widespread benefits from the system. From a social standpoint, it provides equitable access to services such as health and education, even in very remote areas. It also plays a key role in helping Canadians to share in their nation's rich culture, which embraces two official languages (French and English), aboriginal peoples and languages, ethnic groups and distinct regional identities.

Communications are also a cornerstone of Canada's economy. Domestic business communications such as video and data networks, as well as mobile radio systems, are just some of the applications that link business and industry, often across great distances. Canada's resource industry, for example, relies on Canadian-developed systems and products for communications with remote mines and forestry operations. Similarly, remote control systems have been designed to monitor the flow of gas and oil through thousands of kilometres of pipelines in Canada's far north.

Internationally, Canadian manufacturers, systems planners and other professionals are retained by governments, international agencies and the private sector for major telecommunications projects. These range from the design and construction of satellite earth stations to switching systems, microwave networks, and pipeline/hydro-electric communications systems. In many instances, these projects are funded by Canada's federal government, as part of its overseas assistance programs. In recent years as well, Canadians have played an important role in the worldwide transition from analog to digital technologies.

Canada is also an international contributor at the planning and advisory level, as an active member in organizations such as the International Telecommunications Union (ITU), International Standards Organization and INTELSAT.

As the technological revolution continues, Canada continues to look to the future. Ongoing conversion to digital technologies in domestic systems is proceeding at a steady pace, along with development of a national fibre-optics network. Canada is also committed to the development of Integrated Services Digital Networks (ISDN) and in space technology is embarked on the development of MSAT, a mobile satellite service for users in rural and remote locations.

■ *Global's thermoelectric-solar PV hybrid system*

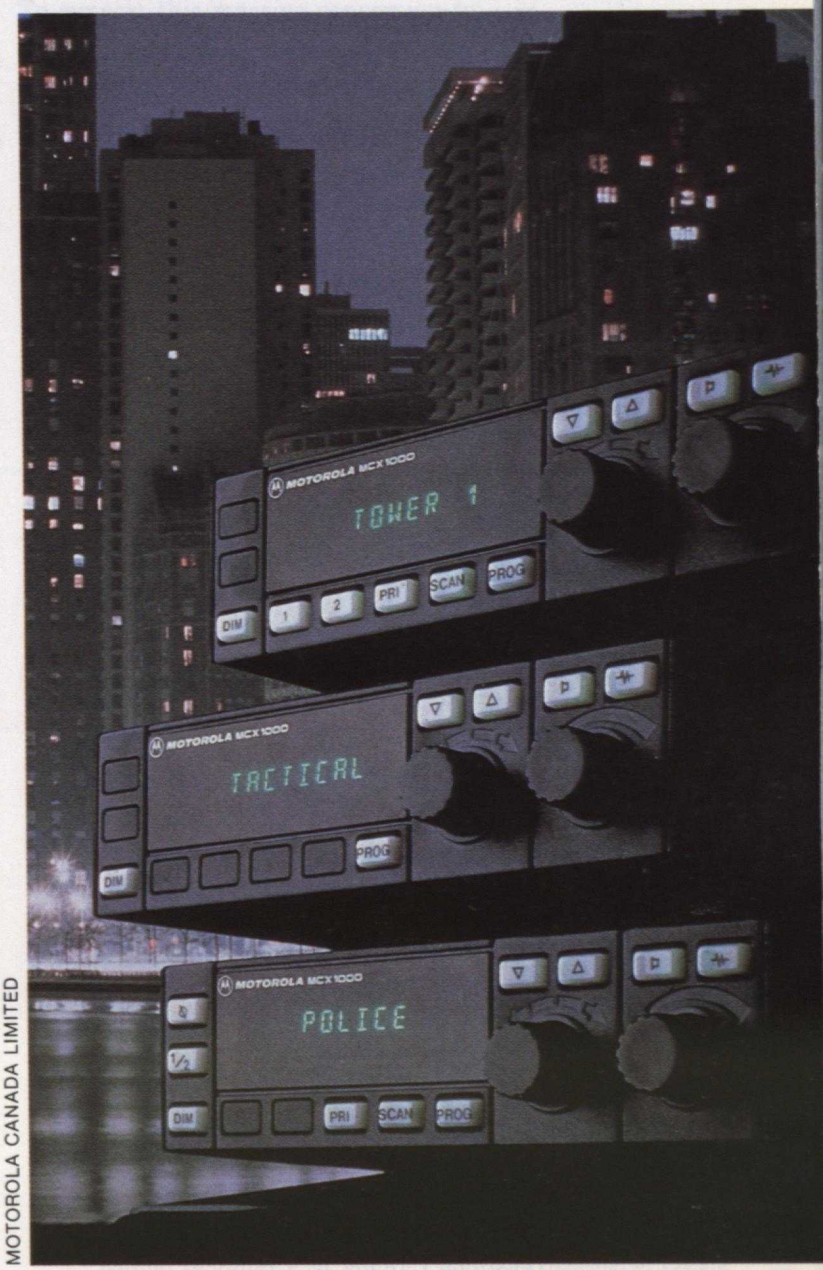
GLOBAL THERMOELECTRIC POWER SYSTEMS LTD.

To support the public's communications needs, an extensive communications network has evolved in Canada, stretching some 6 000 km from east to west and 4 800 km from north to south. The network employs many different technologies to provide individuals in this vast area with equitable access to voice, data, and video communications. These technologies include terrestrial radio, fibre optics and satellite communications.

Because of the network's historical development, different geographic portions are owned and operated by different companies, representing both the private and public sectors. All companies operate as monopolies but are regulated to ensure that Canada's goal of equitable service to all is maintained.

Canada has two data networks, one operated by the major telephone companies and the other by the railways. These networks are completely separate, and each offers unique features and rate structures.

Transmission of video in Canada is via either domestic satellites or the terrestrial microwave systems owned and operated by telephone companies and the railways. Distribution of local video is by television broadcasters or cable television networks.



MOTOROLA CANADA LIMITED

The MCX-1000 family of radios features advanced software that combines options such as single tone signalling, scan, and selectable PL/DPL. Unique digital capable models enable encrypted communications and compatibility with data terminals.

Voice Communications

With a penetration of 80 telephones per 100 people, Canada is ranked among the world's leaders in telephone service. Virtually all Canadians have access to the telephone network, including those in remote areas, where service is via satellite. Now that this high penetration has been achieved, the emphasis is on conversion of the entire network to digital technology, integration of voice and data circuits and enhanced subscriber services, including ISDN.

Most telephone service in Canada is provided by Telecom Canada, an association formed by 10 major telephone companies to provide integrated telephone service across the country. Local service is provided by Telecom members plus many smaller non-member companies. Long distance service is handled by the Telecom companies, with long distance circuits provided by Telesat, a Telecom Canada member that owns and operates Canada's domestic satellites.

Overseas telephone service has been assigned to one carrier, Teleglobe Canada. An INTELSAT signatory, Teleglobe Canada is a publicly owned company that operates satellite gateways in both eastern and western Canada. In addition, Teleglobe is a member of a number of consortiums that own and operate submarine communications cables, including cables from Europe and Asia that terminate in Canada.

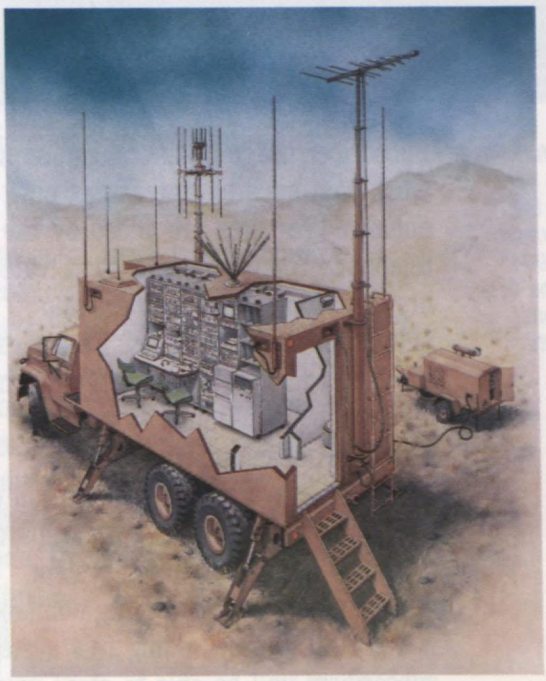
MILLER COMMUNICATIONS SYSTEMS LTD.

Automated satellite carrier monitoring system

Though Canada's telephone system includes many different companies, it operates as a single entity, thanks to establishment of interface specifications, performance standards – either meeting or exceeding those recommended by the International Telegraph and Telephone Consultative Committee (CCITT) and International Radio Consultative Committee (CCIR) – and rate-sharing schedules. This is an enormous advantage for users, giving them direct dial connection to all other subscribers in Canada, and to many other countries in the world.

The conversion of voice communications from analog to digital technology is well under way in Canada. Conversion of the telephone network was started in earnest approximately a decade ago and is proceeding rapidly. Toll switching is now estimated to be 75 per cent converted, with local switching lagging slightly. A 90 Mbit digital radio spanning more than 6 000 km was placed into service in the early 1980s and has been expanded several times since. A 7 000-km buried transcontinental cable, with 12 optical fibres operating at 545 Mbits per fibre pair, will be operational by 1990. The final section of this cable will employ state-of-the-art laser frequencies.

To support this massive conversion to digital, Canada has developed its own product designs, acquired state-of-the-art manufacturing capability and modernized its construction methods. Because of the network's increased complexity, data acquisition systems have been improved and expanded to monitor overall network performance, and to reduce maintenance costs. This in turn has increased the network's ability to handle traffic.



LNS SYSTEMS INC.

■ *RSM-200T, transportable monitoring system*

MICROTEL LIMITED

■ *Successful testing was carried out by the Canadian Armed Forces in 1984 on one of the first Spacetel transportable units.*

Subscriber usage of the telephone network continues to increase as new or enhanced features are added by the telephone companies and by private organizations seeking to develop subscriber-based business. Examples of the latter include systems that permit a subscriber's terminal to access a remote database using the public switched network, and registration of university students using a standard touchtone phone. Another system, which is currently becoming available, is voice messaging. Using this system, subscribers will be able to store voice messages in electronic mail boxes for convenient access by the addressee.

Canadian telephone companies are preparing for the next challenge, the conversion of the network to support ISDN. Many have contributed to the international committees that are setting ISDN standards and are currently either undertaking or planning ISDN field trials. In a similar manner, Canadian equipment manufacturers are preparing their products to meet the new requirements and accommodate the new services.

In step with other advanced areas of the world, Canada introduced cellular radio into its communications system architecture in 1985. The implementation approach has been to permit two separate licensees in each area, the local telephone company and an independent company. The initial installations were in locations with populations of 100 000 or more, but expansion into other areas is now taking place. Subscribers have now surpassed 100 000 and are currently doubling in number every year.

The Advanced Mobile Phone System (AMPS) technology has been chosen as the country's standard for cellular radio. Canadians are already realizing one of the advantages of AMPS: they can use their equipment in the United States.

One of Canada's major goals in the development of its communications network has been to provide equitable service to its remote and geographically isolated rural population. This challenge was initially met by adapting standard products, such as mobile radio. From this modest beginning, Canada has developed a highly specialized industry that designs and manufactures products specifically for rural telecommunications. To support the application of these products, Canadian companies have acquired an expertise in planning, system design, and construction.

In the area of rural telecommunications products, Canadian companies have pioneered the development of subscriber radio systems and single-channel-per-carrier satellite transmission systems. The subscriber radio system, which operates using point-to-multipoint transmission and is a CCIR standard, is typically used to concentrate telephone circuits from remote subscribers into a central location. This system has also proven an advantage in locations without a cable infrastructure, where service needs to be established quickly. It is also used in areas where the service period does not warrant cable installation. Modified mobile base stations have proven successful where point-to-point subscriber service is required.

COMMUNICATIONS TECHNOLOGY (CANADA) LTD.

■ *The CAS 2000 cable-analysis system, multiple purpose test set providing analysis of a specific cable test*

Single-channel-per-carrier subscriber earth stations have proven to be the most economical method of providing communications to locations that are very remote from any other system. In Canada this is particularly true of mountainous areas and in the far north.

To complement rural telecommunications products, Canada has also developed site technology that includes towers, antennas, and power sources. Solar and thermal power systems are now commonplace, as are remote unattended mountain-top repeaters, which can withstand extreme environmental conditions. Canadians have acquired all this technology to support the service needs of Canada's rural population.

Data Communications

Canada has had some form of data communications network since the introduction of the railroad and its open-wire telegraph system in the 1800s. Since then, this network has undergone many transformations, as new technologies have been introduced and emerging needs had to be satisfied.

Today, the Canadian public is served by two data networks which are accessible to virtually everyone. The two public data networks, Infoswitch and Datapac, are owned and operated by the railways and the major telephone companies respectively. Both networks are based on packet switching, using CCITT X.25 protocol standards. Because the systems conform to international standards, both can be used for offshore or border-crossing communications.

Universal data access has led to the development of electronic mail and messaging services. For example, customers can subscribe to an international messaging service that permits them to post electronic messages in mail boxes provided by the operator's central computer. The messages may be retrieved via a private terminal or one of the many public terminals located in areas such as airports, railway stations and hotel lobbies. Similarly, the electronic mail service may be accessed by any individual wishing to deliver a hard-copy message to another location. In this case, the message is either given to a system operator or directly input and then transmitted to the receiving terminal, where it is printed and delivered through the normal mail system. Through international gateway connections, users of electronic mail can access similar systems in many parts of the world.

An additional service provided by Canadian data networks is the accessing of large electronic databases, in Canada and associated countries. These databases include libraries, newspapers, technical journals and government files. Charges for the service are based on access fees, on-line time and the amount of data transferred.

NOVATEL COMMUNICATIONS LTD.

■ *NovAtel's 370 cellular telephone handset*

As Canadian data network suppliers continue to expand, access is being extended in remote areas and tariffs are being reduced. In addition, systems are under development that permit assignment of bandwidth on demand at standard PCM (Pulse Code Modulation) hierarchical levels. This latter development will eventually lead to the integration of voice and data and ultimately ISDN.

Video Communications

In the past three decades, video distribution has been one of the major growth areas in Canada's communications sector. The roots of its development go back to the early 1950s, before Canada had its own television production capability. At that time, the only Canadians with access to television lived in the southern part of the country, where it was possible to receive off-air pickup from the United States. Because signals were weak, a costly antenna was required and members of a community would often pool their resources and share a single installation. The relatively simple technology of sharing subsequently grew into the development of cable television technology.

NORSAT INTERNATIONAL INC.

A 2.048 Mbit digital and audio processor and modulator

With the advent of television production capability in Canada, domestic transmission facilities were required. Video transmission was first introduced in the 1950s, and the first transcontinental circuit was in operation by the end of the decade. Since then, there has been a continuous demand to increase the number of channels and expand the service area of transmission and delivery systems. Terrestrial transmission has increased significantly; satellite technology has evolved; cable systems have reached maturity; and low-power rebroadcast equipment is readily available. Now that virtually every location in the country can receive television, the emphasis is on increasing the number of available channels and improving the technology.

Initially Canada's largest terrestrial transmission facility consisted of a coast-to-coast, 6 000-km backbone route, which carried programming in Canada's two official languages, French and English. In addition, there were many shorter microwave systems operating in a north-south orientation. These carried both Canadian and U.S. programming to areas remote from Canada's southern television infrastructure. In addition, one Canadian province, Saskatchewan, pioneered the distribution of television on fibre optics. In this case, installation of an extensive buried fibre-optic system between all population centres eliminated the need for microwave facilities.

SKYWAVE ELECTRONICS LTD.

■ *Suitcase Satellite Terminal, models KSST-1, KSST-1E*

The most significant technological advance in improving the quality and distribution of television in Canada is the introduction of satellite technology. Canada's domestic satellites carry numerous video channels that include both network distribution and circuits linking remote production areas with the network's central distribution facility. Through the use of Television Receive Only (TVRO) earth stations, television can be readily received in virtually all areas of the country.

Local distribution is provided by two methods – either a low-power rebroadcast transmitter or a cable system. The technology chosen depends on the terrain, the population density and the number of channels to be distributed.

Throughout their history, Canadian Community Antenna Television (CATV) companies have played a vital role in the distribution of television at the local level. These companies deliver television to more than 60 per cent of Canadian television households and generally have a penetration of 85 per cent or higher in their serving areas. They have developed cable headends which combine off-air pickup, microwave feeds, TVROs, video tape recorders and local production facilities. These headends feed cable systems that range from a few subscribers in a building complex to thousands of subscribers in a community. Their local distribution systems are now being expanded to 40 channels on the existing single tube coaxial cable, and plans call for future increase to 80 channels. Other trends include fibre optics, which is beginning to enter the cable plants, and two-way distribution with enhanced subscriber services.

As with any modern industrialized country, Canada has developed a communications infrastructure to support its industrial expansion. Specialized systems that have been developed include private networks for corporate communications, control circuits for power generation and distribution, data and message circuits for transportation, and communications links for distance education.

Private Networks

Private communications networks have evolved in Canada mainly to meet the needs of large national companies whose offices are widely distributed throughout the country. These companies have found a need for data links between their district offices and their central computer to control such items as inventory, payroll, and orders.

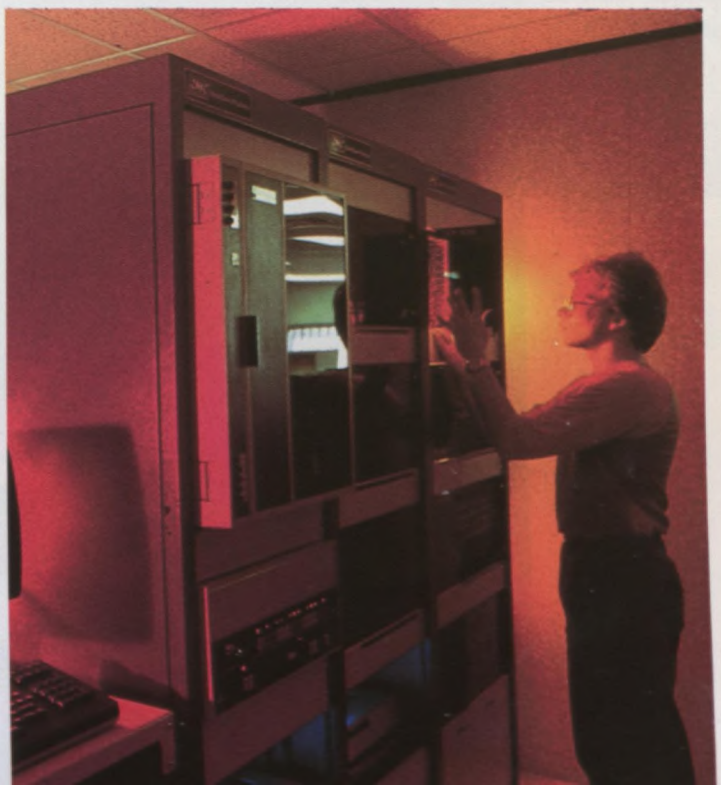
Companies in Canada may acquire and operate a private communications network or may lease the facilities from a service provider such as Telecom Canada, CNCP Telecommunications Limited or Cancom (Canadian Satellite Communications Inc.). In general, the service offered is customized to meet the user's needs and may utilize circuits from several different sources.

The most recent service to be offered is transmission of voice and data on a specialized network that uses VSAT (Very Small Aperture Terminal) satellite technology. The advantage of this service, which is offered by Telesat and Cancom, is that the necessary earth stations are located on the user's premises, eliminating the need for costly and sometimes unreliable local loop wireline circuits.

Electric Power Generation and Control

Electric power generation and distribution systems in Canada were initially very simple: one system would serve one geographical area. But as the country developed and power consumption increased, it often became necessary to have more than one power source. Power generation in remote locations and long distribution lines became a reality, and eventually the need developed to interconnect these networks to form power grids.

■ *The DataComm Products Division is dedicated to the design, development and manufacture of telex switching systems and related equipment. Its CMA-755 telex exchange was selected by British Telecom for BT's new inland telex network, operating from 11 exchanges in 10 major cities in the United Kingdom.*



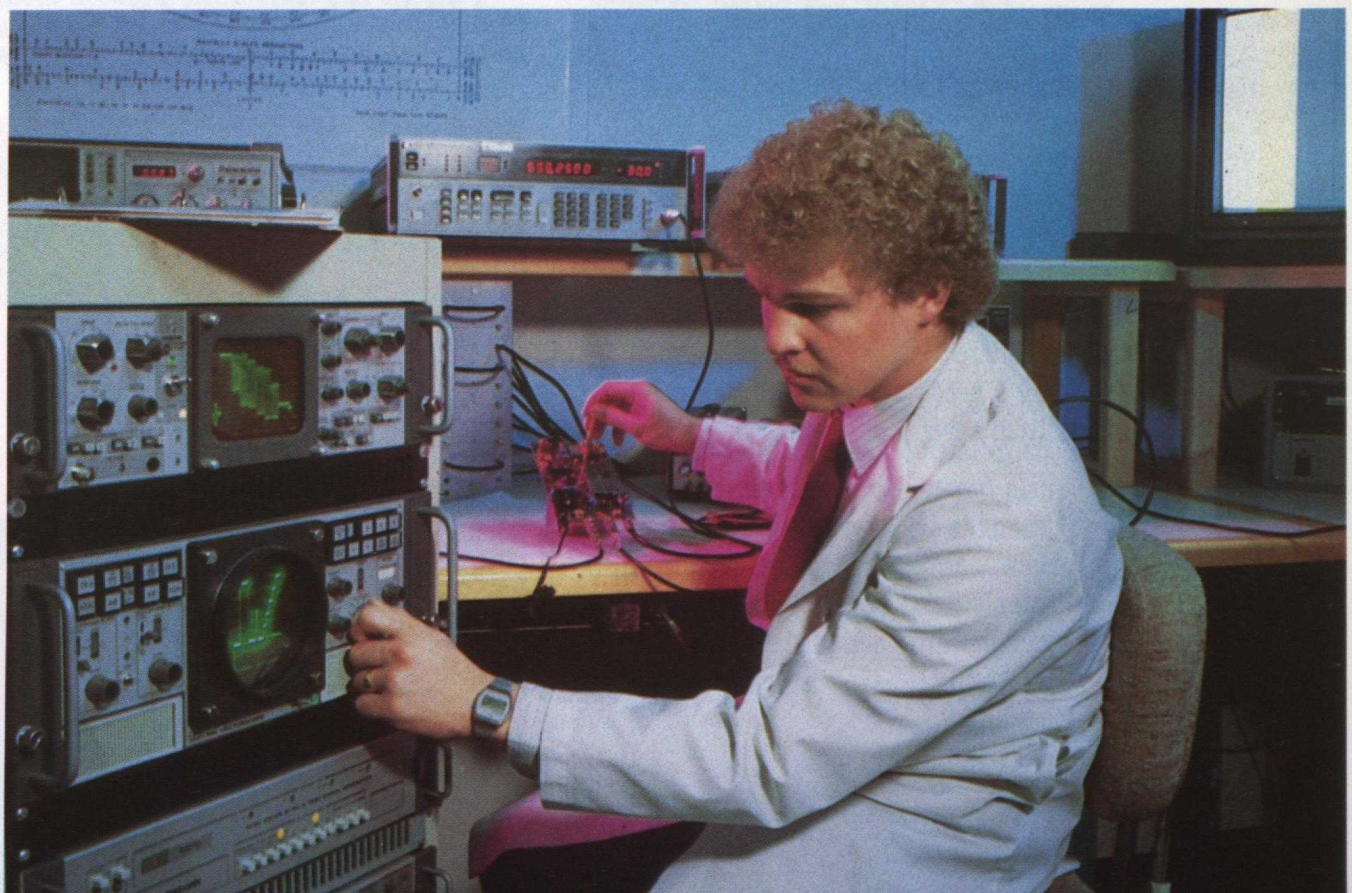
CANADIAN MARCONI COMPANY, DATACOMM PRODUCTS DIVISION

Today it is not unusual to have electrical power generated hundreds of kilometres away from its markets. Distribution networks have been interconnected to form complex power grids that daily exchange power from one company to another, in many cases between Canada and the United States. To control these remote generation plants and power grids, highly reliable national and international communications links have been established.

Within Canada, several hundred microwave communications links have been installed to form communications networks whose sole purpose is controlling the power network. Because ultra-high reliability is a necessity for minimizing signal delays in the transmission of control data, these networks employ design techniques that are unique to the communications industry.

A typical example is the communications system used by Ontario Hydro to control the generation and distribution of its electrical energy. Ontario Hydro has a series of generating plants based on thermal, nuclear, and hydro power sources, and maintains transmission lines to the United States. To control this complex, Ontario Hydro has constructed a communications system made up of numerous microwave sites interconnected to form a ring. All microwave sites within the ring are physically separated, so that the loss of one site will not destroy the integrity of the whole system. Control data are transmitted to the receiver in both directions around the ring. This approach acts as a safeguard; if one transmission path fails, the receiver will automatically switch to the other path.

NEXUS ENGINEERING CORP.



Testing in the R&D lab

Transportation

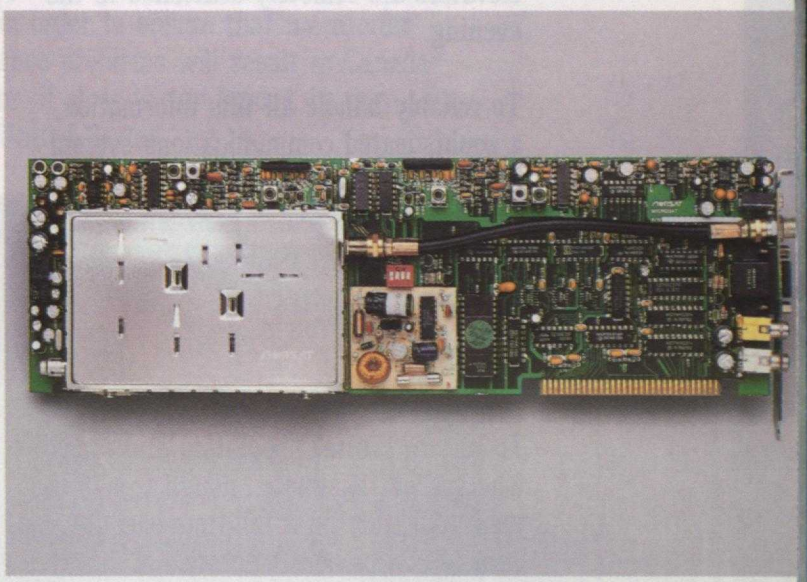
Canada has large transportation systems, carrying people and materials across vast distances. To make effective use of rolling stock and right of ways, it has been necessary to install equipment and communications systems for monitoring the usage of these transportation systems.

Canada's two national railways have always formed an important transportation link in Canada and played a major role in the early development of the country. They established early communications technologies that were not only used to control rail traffic, but also served as a messaging system for the general public. Their contribution continues to this day.

The backbone of the railway's communications network is a terrestrial microwave system, coupled with fibre-optic links, that follows the right of way. In addition to operational communications, the network also carries leased circuits for private networks and a public data network.

For local distribution, the railways operate trackside communications systems. These comprise circuits that permit continuous voice communications with railway locomotives, control of railway switches, location of trains, and systems that monitor the movement of cars and equipment. All these systems have led to a more efficient operation of the rail network.

Another important mode of transportation in Canada is mass transit. This sector is continually expanding its use of communications technology, as a means of improving operating efficiency and maximizing public safety. Buses are now being equipped with communications equipment that automatically informs the dispatcher of the number of passengers on each bus and its location. Two-way communication permits the vehicle operators to contact the dispatcher in an emergency. It also makes it possible for dispatchers to reroute vehicles during peak traffic periods, or provide emergency assistance as required.



NORSAT INTERNATIONAL INC.

■ *MICROSAT, an IBM PC expansion card containing a complete satellite audio-video data receiver*

A major new transit system in Vancouver, British Columbia, depends heavily on communications links for its operation. The advanced light rapid transit system, known as Skytrain, operates over a 28-km track without any on-board operators. All vehicular movement is controlled by a centrally located computer complex. On-board station announcements are generated through synthesis techniques and transmitted to the trains via vehicular radios. Passenger safety radios, which communicate with a central dispatch location, are available in each car. Station video surveillance is transmitted to a centralized monitor station, and all station elevators are remotely controlled in the evening.

To reliably handle all this information, a sophisticated communications system carries voice, data and video. The transmission system, which is installed along the right of way, makes extensive use of fibre optics.

Education

To serve its rural population and those who are not fortunate enough to obtain their education on a full-time basis, Canada has pioneered the use of distance teaching techniques. Several different systems are currently in use, but each depends heavily on the use of communications systems.

AMDAHL COMMUNICATIONS INC.

■ *ACI's line of state-of-the-art multiplexers and data sets leads the way in the world of data communications products.*

In the province of British Columbia, the Knowledge Network broadcasts educational and public interest programs via Canadian domestic satellites. Programs are received on TVROs that are privately owned or on those used as the headend for CATV systems. In some cases, dial-up audio circuits allow program recipients to participate in the lectures.

In another province, Ontario, TVO (Television Ontario) uses a similar method of satellite communications but also uses video subcarriers for delivering software-based courses in a computer-assisted learning environment.

Other provinces have used the public switched network to provide access to lecturers via audio conference facilities. The one factor all the systems have in common is the desire to provide equitable education by using Canada's extensive communications network.

Mobile Communications

Canada has historically had an extensive mobile communications network for those working and travelling in remote areas. Engineers in the mobile communications field are continually exploring innovative ways of providing wide area coverage that is cost efficient and highly reliable. They have developed low-power mountain-top repeaters that can operate unattended for long periods at extremely low temperatures. Another innovation is the creation of radio systems that permit several different user groups to share the same system with complete privacy. But in spite of all the advances, some areas of Canada are still too remote to be served economically.

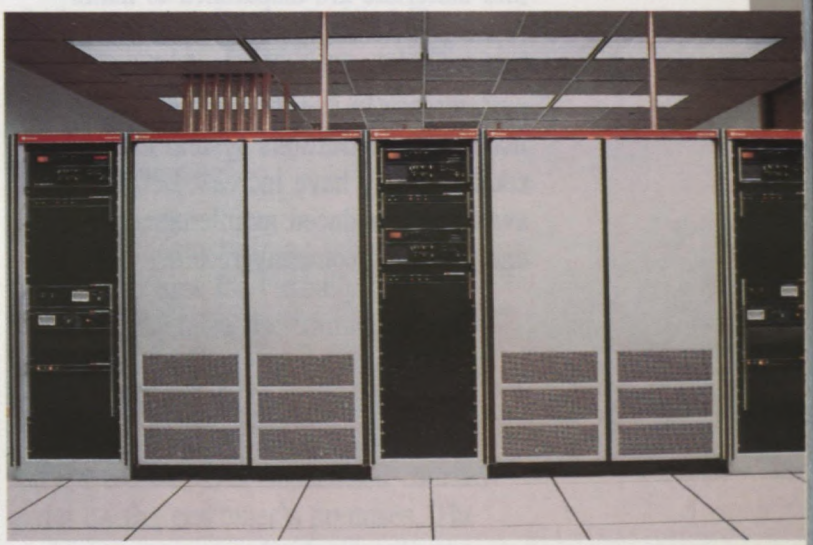
Canada is now undertaking the development of a mobile satellite system which, it is hoped, will provide coverage to all remote areas. The new system, designated MSAT (Mobile Satellite), is based on satellite communications. In this system, each mobile unit will communicate directly with the satellite – an approach that will achieve wide area coverage. After several years of planning, the universal parameters for the system have been established, and technology is now being developed to permit implementation.

Communications Network Support

As the infrastructure of a country's communications system becomes more and more complex, tools must be developed to assist those in regulatory areas, system design, network operation and maintenance. Canada is no exception to this rule and has developed a leadership position in many of these systems.

To regulate the Canadian frequency spectrum, the Canadian government has developed a management system based on computer technology. Prior to issuance of any operating licence, the system is used to check frequencies, in order to ensure that no interference problems will result in Canada or, if close to the border, in the United States.

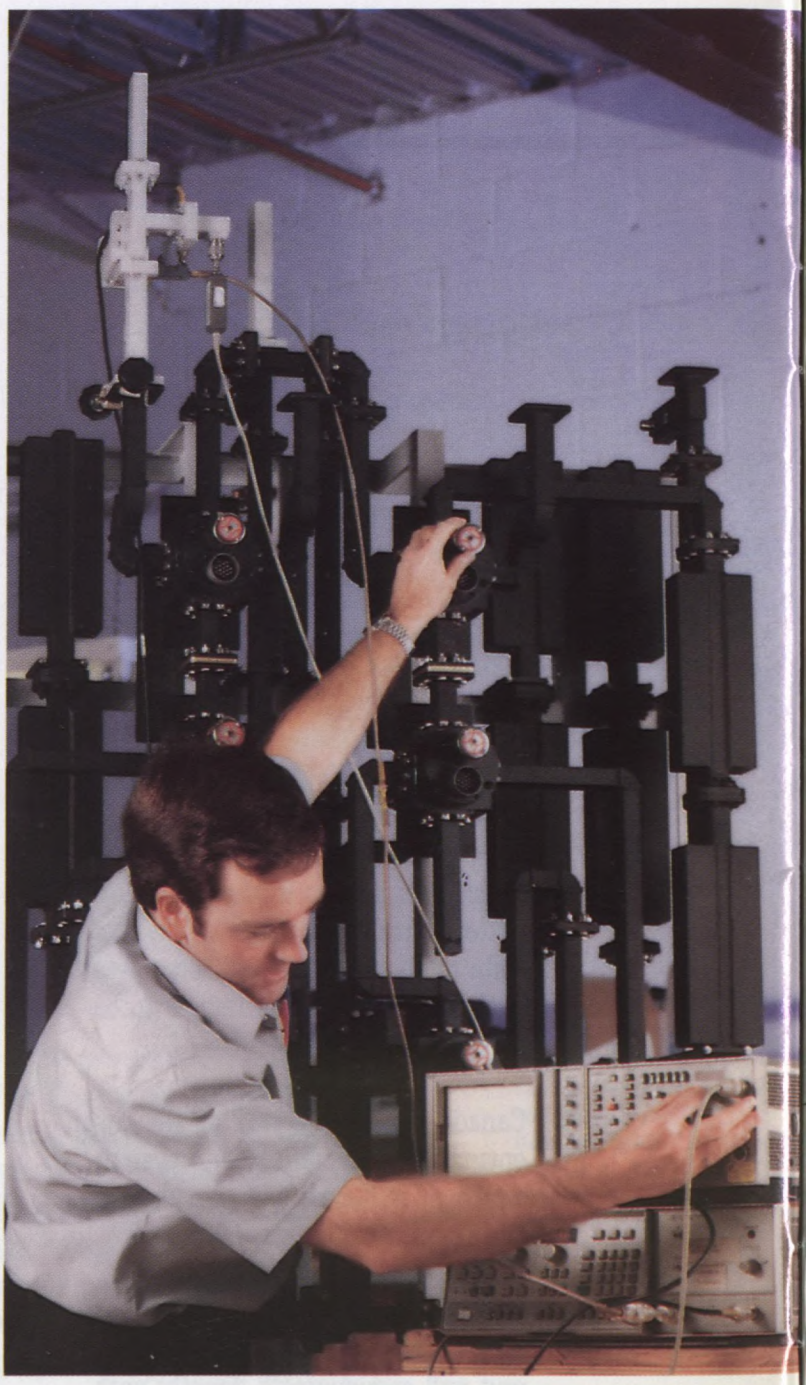
ROCKWELL INTERNATIONAL OF CANADA LTD., COLLINS CANADA DIVISION



Collins HF-80 1 kW systems

Canadian telephone companies have also developed a major database containing all radio communications sites within Canada and adjacent United States areas. This system contains the radiated power levels, frequencies, and radiation patterns for each site. Using this system, subscribing companies can readily determine whether their radio frequency plan is sound.

To provide operational support for large and complex communications networks, Canadian companies have developed computer-based systems that manage the network, control inventory, assign repair staff and maintain plant records. Through network monitoring, companies can now identify circuit degradations and rapidly pinpoint failures. Systems can be efficiently restored when staff with the correct skills and materials are dispatched to make repairs. With accurate inventories, purchasing can be optimized. These systems are in use on virtually every major communications system in the country. They have increased circuit availability, reduced maintenance staff, and improved company records.



MITEC ELECTRONICS LTD.

■ *WR159 switching/combining network*

Canadian companies have very few export restrictions and have proven their ability to compete at the international level. For example, Canadian communications products may be found in China, Saudi Arabia, Mexico, Turkey, Indonesia, Thailand, and many African countries. Based on their excellent performance, many companies are enjoying repeat orders and expanding their international reputation.

Equipment

Canadian communications equipment manufacturers have developed products that are recognized internationally for their excellence. Some of these Canadian companies include Northern Telecom, with its totally digital communications systems and international factories; SR Telecom, a pioneer in modern subscriber radio; Spar Aerospace, with capability to manufacture a complete range of space-related products, including satellites and INTELSAT-class earth stations; Mitel, which originated in Canada and developed a world-class reputation before being acquired by British Telecom; and mobile radio companies such as Motorola, Mobile Data International, NovAtel and Glenayre, to name a few.

MITEL CORPORATION

Headquarters building, Kanata, Ontario

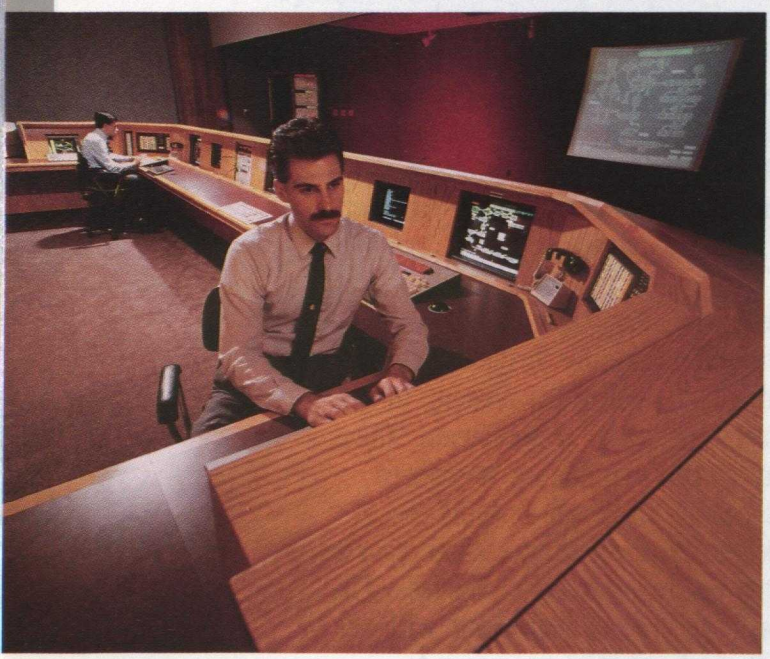
Training

To meet the staffing needs of Canada's many communications networks, companies have been formed which specialize in training – in everything from telephone economics to repairing fibre-optics equipment. In addition, several of the larger manufacturers have formed divisions for training customers on their equipment.

Today, Canadian training schools can develop a course for virtually any need and will customize the training to customers' particular requirements. These may include training on specialized equipment, on-the-job training in foreign countries, or specialized courses given on the customer's premises. The goal is to prepare individuals with the skills and expertise necessary to manage and maintain ever-changing communications systems.

Consulting

Canadian consultants can be found throughout the world, involved in planning, engineering, and supervising communications projects related to transportation, telephone systems, electric power generation, satellites, and a host of other areas. These consultants come from many different areas. They may have private practices, be members of a large firm or even be on loan from a Canadian operating company. Their assignments may last from several weeks to several years. One thing is clear, however. Their reputation is growing as they demonstrate their competency and prove their uncompromising commitment to serving the client's best interests.



DATAP SYSTEMS, A DIVISION OF SANDWELL SWAN WOOSTER INC.

IRIS 7 Remote monitor and control system, designed by DATAP Systems, installed in the U.S. Sprint Western Regional Control Centre

System Integration

The majority of Canadian companies have the capability to engineer, furnish and install their own products, but some companies specialize in the integration of many products and technologies into major communication systems. Such companies have a strong project management capability which is supported by sound system engineering. In addition, they have a wealth of experience in dealing with such issues as overseas shipping, foreign regulations, local construction techniques and offshore living conditions.

Typical projects demonstrating Canadians' ability to construct major communications systems can be found in Saudi Arabia, where a major upgrade to the telephone system was completed and a communications system was constructed across the desert to control a pipeline; Indonesia, where a railway communications system is being constructed to support the movement of coal; Zambia, where an INTELSAT standard A earth station was constructed to increase overseas connectivity; and China, where a domestic satellite network was installed.

CANADA'S ROLE IN INTERNATIONAL ORGANIZATIONS

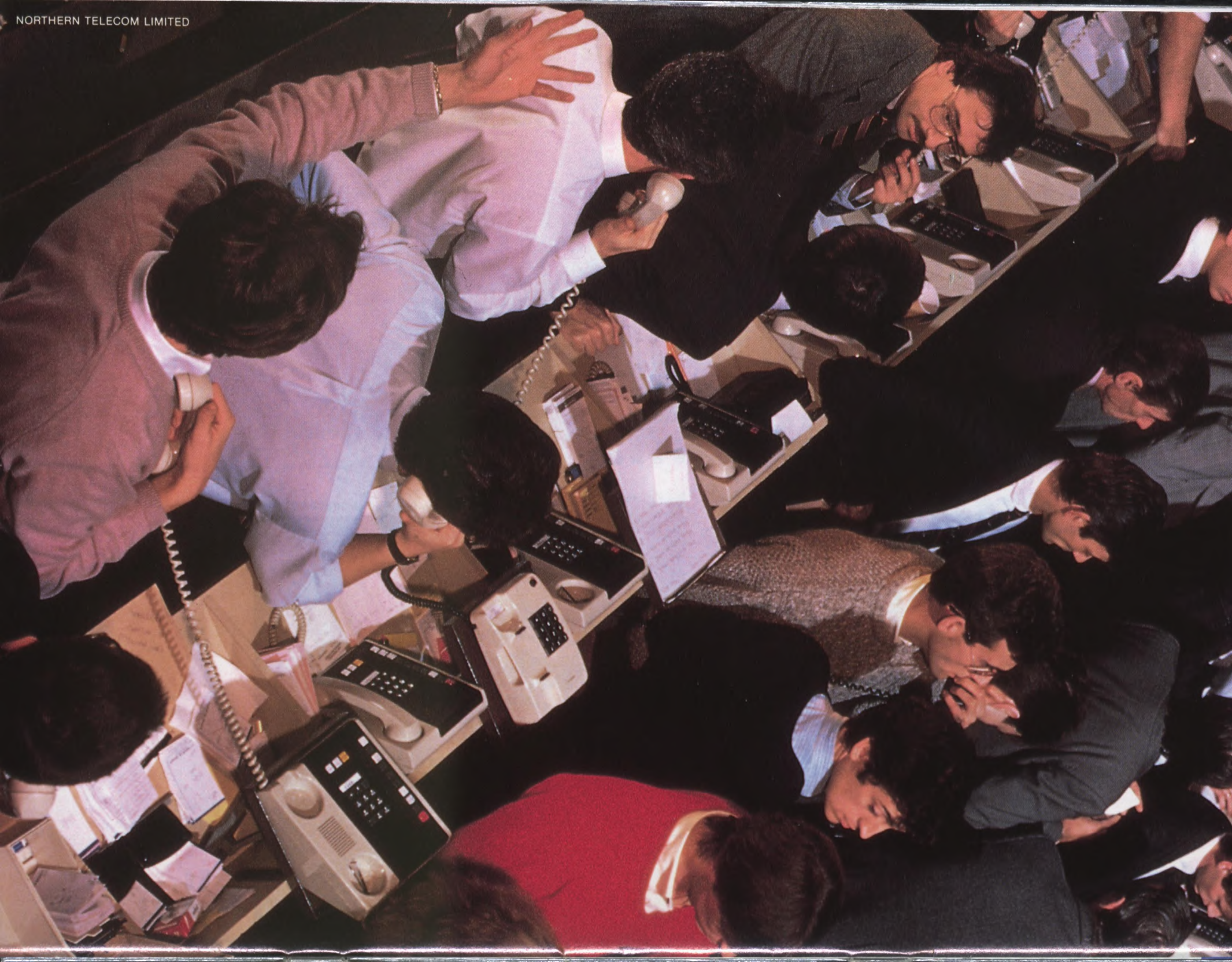
As a developing country, Canada has historically supported international organizations dedicated to improving communications throughout the world. Initially this support was from the public sector because of the need to define interfaces at Canada's gateways. As Canadian companies entered the international marketplace, they realized that to effectively compete they must be prepared to meet international standards and participate in their development.

As a consequence, many companies now serve on the various international committees that are developing the standards. As a result, more international standards are being applied in the development of the Canadian communications networks. As an example, recent notable activity includes the development of ISDN and OSI (Open System Interconnect) standards.

Today Canadians are serving on committees of the International Telecommunications Union (ITU), the Pacific Telecommunications Council (PTC), Commonwealth Telecommunications Organization, INTELSAT and many other organizations dedicated to developing greater uniformity in international communications. In addition, Canadians are regular participants in conferences with counterpart operating organizations, both abroad and in the United States. This participation helps to resolve communications interface problems and to ensure that Canada truly retains a position in the world community.

BMS COMMUNICATIONS SERVICES LTD.

Typical rural microwave radio communications installation — Westmin Mine site, Stewart, B.C.



■ *Northern Telecom's Meridian SL-1 private branch exchange is used to meet the demanding information requirements of the Bourse de Paris in France.* ◀

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