The supply of communications equipment in Canada

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1. INTRODUCTION

This report provides a succinct overview of the Canadian communications equipment industry; it updates the 1981 publication of the Department of Communications entitled The Supply of Communications Equipment in Canada (referred to as The Pink Book in this document). The publication is part of a series which also includes reports dealing with the supply of computer communications and cable television equipment in Canada produced by the department to publicize Canadian manufacturers who, in many instances, have carved out an enviable place for themselves on the international communications equipment market.

Sources of information

The information contained in this report has been gathered from various sources, including:

- the Department of Communications;
- the business opportunity sourcing system of the Department of Regional Industrial Expansion; and
- the members' directory of the Canadian Advanced Technology Association.

To study public sector companies listed on one or more stock exchanges, we thoroughly examined their annual reports and various related documents. We requested the voluntary co-operation of 250 private companies in order to bring our information up to date, and more than 80 agreed to provide information.

Convergence of telecommunications and computer technologies

This report is not intended in any way to be exhaustive; it deals primarily with manufacturers of communications equipment for voice and data. However, in the course of updating our information, we frequently encountered problems related to definitions, which were already evident when The Pink Book was published and have multiplied since. Indeed, it has become difficult to establish a precise distinction between telecommunications and computer technologies. The gradual disappearance of boundaries between the two has resulted from the convergence - mentioned in the preceding document - of both sectors, which has arisen because they are each based on integrated circuits and software.

This technological correlation has ramifications that must be examined, if only briefly, because they are crucial not only to firms engaged in supplying equipment, but also to the entire Canadian economy.

The interdependence of techniques has created a unique information market which, because of its complexity and importance, is difficult to analyze. Our attempt to do so is based upon the Program on Information Resources Policy produced by a task force at Harvard University, which represents the various sectors of the market on vertical and horizontal axes.

From the bottom to the top, the vertical axis encompasses information products and services, while the horizontal axis describes how information is processed. Moving from left to right, it progresses from the simple transmission of information to the creation of content.

The upper lefthand corner of Figure 1 describes the postal service: the delivery of letters and parcels constitutes a service, although it does not alter the content of the information. On the other hand, in the opposite corner are found videocassettes, video discs, books and so forth, all of which are products designed to generate new content. Dictation and document classification equipment, which is only used to convey information, is the opposite of various professional services indicated in the upper righthand corner, which, obviously, create new content.

Figure 1 clearly highlights how hard it is to define exactly what is meant by communications equipment. For example, should Northern Telecom's Displayphone terminal - the first to integrate voice and data - be classified as a communications product or a data processing apparatus? Mitel's PBXs should presumably be included under office automation products. How should we deal with the coaxial transmission equipment marketed by NABU? They are designed to be hooked up to cable television systems and may be considered communications terminals, although they might also be described as microcomputers.

In other sectors of the information market, the situation may, at the outset, seem clearer. We have deliberately excluded the delivery of letters and parcels, and the publishing industry, from the field under study. However, they are facets of the system that are essential to the growth of communications equipment manufacturers and, of course, to Canada's economic growth.

Only a few years ago, it was unimaginable that a service such as the post office could be directly affected, or even threatened, by so many other sectors of the information market. Canadian firms will have to face a daunting challenge; as the distinctions between telecommunications and data processing become increasingly blurred, Canadian manufacturers will increasingly compete with major multinationals, the biggest of which is, unquestionably, IBM. Perhaps only a few Canadian companies have sufficient human and financial resources to bear such competition.

Figure 1

THE INFORMATION MARKET

SERVICES

TRANSMISSION	Delivery of letters and parcels	Basic telephone services	New voice and data transmission services	Cable television and broadcasting	Access to remote data banks	Consulting, financial services, advertising and other professional services
		Printing plants				
	Newsagents	Services not linked to the local system (satellite or radio)		Shared-time data processing services	Back-up data processing services and support software	Directories
	Photocopy and printing equipment		Military communications	Data processing systems PABX private	Software marketing	Specialized periodicals
	Typewriters	Terminal equipment • telephones • printers • facsimile • terminals, sales outlet • word processing	High-volume terminals for data processing and storage		Newspapers	Magazines
	Dictation and document classification equipment				Advertising flyers	Other content • videocassettes • video discs • books, and so on

CONTENT

PRODUCTS

Brief overview and overall context

Communications equipment manufacturers offer a great variety of products. This report deals primarily with category SIC 335, which includes the manufacturers of the following products:

- telephony and telegraphy equipment and parts;
- electrical or electronic signalling devices and electronic control panels;
- radio and television transmitters, radar equipment, closed-circuit television equipment, electronic navigational aids, outdoor public address equipment; and
- repair and testing of electronic equipment.

It is also relevant, however, to examine this category in a broader context, generally defined as the electronics sector which, aside from category 335, includes:

Category	Industry
CAE 318	Manufacturers of office and business machines
CAE 334	Manufacturers of domestic radio and television sets
CAE 3911	Instruments

As Table 1-1 (following) indicates, the apparent domestic market (ADM: shipments plus imports less exports) in the electronics sector was worth $8.8 billion in 1982. The balance of trade deficit reached $3.26 billion, or 59 per cent of overall shipments, which totalled $5.55 billion. The communications equipment and components industry took the lead, with slightly more than 54 per cent of shipments and 38 per cent of the ADM.

Table 1-1

Apparent domestic market, foreign trade and the electronics industry, 1982 in millions of $

SIC	Industry	Shipments	Imports	Exports	ADM	Trade balance*
318	Office machines	1,170	2,863	1,187	2,846	(1,676)
334	Radio and television	398	680	112	966	(568)
335	Communications equipment and components	3,000	1,876	1,542	3,334	(334)
3911	Instruments	985	868	178	1,675	(690)
	TOTAL	5,553	6,287	3,019	8,821	(3,268)

Source : Industry, Trade and Commerce/Regional Economic Expansion, Electronics Industry, Statistical Summary, 1982 edition.
* ( ) = deficit.

Communications equipment industry

Between 1973 and 1982, shipments in the communications equipment industry almost quadrupled from $889 million to $3 billion, an average annual growth rate of 29.7 per cent. Employment gradually declined until 1977, then improved little by little: 44,629 people were employed by the industry in 1982. As Table 1-2 indicates, the number of firms rose from 226 to 443 between 1973 and 1982, an increase of 96 per cent.

Table 1-2

Selected statistics on communications equipment manufacturers (SIC 335), 1973-1982

Year	Number of establishments	Number of employees	Shipments in millions of $
1973	226	43,719	889
1974	260	44,281	1,225
1975	262	42,041	1,368
1976	261	38,467	1,383
1977	250	36,676	1,441
1978	331	37,895	1,532
1979	384	39,326	1,814
1980	411	43,343	2,329
1981	427	46,330	2,786
1982	443	44,629	3,055

Source : Statistics Canada, catalogue no. 43-206.

Table 1-3 shows that the industry is clearly concentrated in Ontario, which accounted for 61.6 per cent of employees and 59.5 per cent of shipments in 1982. It was followed by Quebec, with 27.5 per cent of jobs and 28.9 per cent of shipments. The other provinces combined accounted for only 7.2 per cent of overall employment and 8.6 per cent of shipments.

Table 1-3

Regional breakdown of the communications equipment industry, 1982

Province	Establishments		Employees		Shipments in millions of $	
	Number	%	Number	%	Value	%
Ontario	263	59.4	28,090	61.6	1,819	59.5
Quebec	88	19.9	12,528	27.5	884	28.9
British Columbia	43	9.7	1,689	3.7	91	3.0
Subtotal	394	89.0	42,307	92.8	2,794	91.4
Other provinces	49	11.0	3,322	7.2	261	8.6
TOTAL	443	100.0	45,629	100.0	3,055	100.0

Source : Statistics Canada, catalogue no. 43-206.

Table 1-4 indicates that 84.7 per cent of establishments in the Canadian communications equipment industry employed fewer than 100 people in 1982, and accounted for only 15.6 per cent of all jobs, and 11.8 per cent of shipments. The nine firms employing more than 1,000 people accounted for 44.6 per cent of jobs and 46.9 per cent of shipments. All told, the 37 companies with more than 200 employees accounted for 74 per cent of jobs and 79 per cent of shipments.

The industry is heavily dominated by Northern Telecom, whose sales in Canada in 1982 accounted for slightly more than 45.5 per cent of all Canadian shipments, and essentially the same percentage of all jobs in the industry.

Table 1-4

Selected statistics on the communications equipment industry by number of employees, 1982

Employees	Establishments		Employees		Shipments in millions of $	
	Number	%	Number	%	Value	%
99 or fewer	375	84.7	7,150	15.6	362	11.8
100 - 199	31	7.0	4,742	10.4	281	9.2
200 - 499	18	4.1	5,442	12.0	333	10.9
500 - 999	10	2.2	7,930	17.4	647	21.2
1,000 and more	9	2.0	20,365	44.6	1,432	46.9
TOTAL	443	100.0	45,629	100.0	3,055	100.0

Source : Statistics Canada, catalogue no. 43-206.

Wire and cable

This report also deals with the manufacture of communications wire and cable. As Table 1-5 indicates, shipments of communications wire and cable totalled more than $264.5 million in 1982.

Tableau 1-5

Shipments of communications wire and cable, 1981-1982
in thousands of $

	1981	1982
Telephone wire and cable	313,430	255,786
Coaxial cable, radio and television wire and cable	13,085	8,750
TOTAL	326,515	264,536

Source : Statistics Canada, catalogue no. 43-209.

Structure of the report

In addition to the introduction, the report contains seven chapters. Chapter 2 deals with the demand for communications equipment in Canada, thus rounding out this overview of an increasingly important sector.

Chapter 3 deals with Northern Telecom which, with sales of more than $3 billion in 1982, is by far the biggest Canadian manufacturer.

Entitled "Major Manufacturers," chapter 4 examines the following companies: Microtel Ltd., Mitel Corporation, Electrohome Ltd., Canadian Marconi Company Ltd., Spar Aerospace Ltd. and Gandalf Technologies Inc. All of these firms have revenues in excess of $50 million and, with the exception of Microtel, are listed on the stock exchange. Microtel offers a wide range of communications equipment. The other companies are more specialized ones, that have succeeded in occupying a particular field. During the past five years, they have experienced quite exceptional rates of growth.

Chapter 5, entitled "Medium-sized Manufacturers," deals with private Canadian firms, subsidiaries of foreign companies and certain government-owned corporations with more than 100 employees and communications equipment sales of less than $50 million.[1]

Chapter 6 discusses businesses with fewer than 100 employees, designated as small manufacturers, which offer a wide variety of products, components and assemblies for other manufacturers. This group comprises rapidly expanding, very promising firms.

Chapter 7 ("The world scene"), examines Canadian firms in light of the international situation and briefly describes the importance and origin of the principal multinational manufacturers.

Chapter 8 draws various conclusions about the current situation of communications equipment manufacturers and outlines short- and medium-term trends.

The report includes three appendixes, which present an alphabetical list of manufacturers examined and their addresses.

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1. In the case of certain companies that did not wish to divulge their revenues, the figure is an estimate.

2. DEMAND FOR COMMUNICATIONS EQUIPMENT IN CANADA

Before dealing with the supply of communications equipment, we will examine the principal public and private sector firms that provide communications services and, therefore, require such products. This overview will enable us to study telecommunications and broadcasting, which are the main facets of this sector, as well as satellite communications.

Telephone companies and Teleglobe Canada are the leading telecommunications firms. Because of the important role they play in the Canadian economy, we will examine them in particular detail. The broadcasting and cable television industries are reviewed next, and then Telesat Canada, Canada's sole supplier of satellite communications services.

In each instance, we first describe the sector or firm in question, then examine capital expenditures on communications equipment and acquisitions carried out during the last year for which information is available. The brief analysis concludes with a look at prospects in the realm of communications equipment purchases.

Telephone companies

In 1981, there were 153 publicly- and privately-owned telephone companies in Canada, which were regulated either by federal (Canadian Radio-television and Telecommunications Commission (CRTC)) or provincial authorities.

Fourteen of these companies operated 99 per cent of all plant, and 98 per cent of all telephone sets:

Newfoundland Telephone Company Limited
The Island Telephone Company Limited
Maritime Telegraph and Telephone Company
New Brunswick Telephone Company Inc.
Bell Canada
Manitoba Telephone System
Saskatchewan Telecommunications
Alberta Government Telephones
B.C. Tel
Québec Téléphone
Télébec Inc.
Northern Telephone Limited
Thunder Bay Telephone System
'edmonton telephone'

The first nine companies and Telesat Canada made up the TransCanada Telephone System (TCTS) which became Telecom Canada in the fall of 1983. This organization was established in 1931 in response to the need in Canada for a long distance telephone communication network.

Between 1971 and 1981, at the same time as Alberta was experiencing marked economic growth, 'edmonton telephone', which is not part of Telecom Canada, expanded its services at the expense of those offered by Telecom Canada. At the beginning of the decade, Telecom Canada provided 93.5 per cent of all telephone services in the country, compared with 92.5 per cent ten years later.

During the same period, the number of telephone companies plummeted from 1,490 to 153. As the firms that disappeared were mostly small rural operations, the industry was not seriously affected.

In 1982, the 14 telephone companies mentioned above owned 16.5 million telephone sets, or an average of 67 telephones per 100 inhabitants. Canada ranks fourth among western nations with respect to number of telephone sets per capita. The United States, which ranks first with 83 sets per 100 inhabitants, is followed by Sweden and Switzerland, with 79 and 72 sets respectively.

Capital expenditures

All told, the telephone companies' plant was worth $22.3 billion (at cost) in 1981. Of this amount, $6.4 billion (28.7 per cent) was accounted for by outside plant facilities, such as telephone pole lines, various cables, open wires and underground ducts. Switching equipment (manual, step-by-step, crossbar, circuit, radio and electronic) was valued at $7.77 billion (34.9 per cent), compared with $4.28 billion (19.2 per cent) for station apparatus (telephone sets and related connections).

Telephone companies rank first with respect to the demand for communications equipment in Canada. In 1981, they purchased machinery and equipment worth nearly $853.3 million, in addition to spending $61.8 million for the rental of circuit and transmission equipment.

A 1982 DOC survey of the principal Canadian telecommunications companies reveals that they make extensive equipment purchases from Canadian manufacturers. In 1981, Canadian manufacturers had supplied 91 per cent of their communications equipment requirements; the companies estimated, for purposes of the survey, that the figure would rise to 94 per cent in 1983 and 98 per cent in 1984.

The launching of a new service

In parallel to the traditional telephone, a new telecommunications service is about to be introduced whose promising future can be judged by its rapid expansion when it was introduced in Australia and Sweden. DOC is planning to issue cellular mobile radio licences to service the first of Canada's 23 largest cities in July 1985. The service is designed to remedy the current shortage of frequencies available for mobile telephone service; 50,556 sets were in use in 1982.

As telephone companies can readily gain access to the public switched network to provide this service, they will be allocted half the available frequencies. Cantel, the applicant selected among the other would-be service providers, will be granted the other half.

This type of telephone service will generate a major increase in communications equipment purchases. Market research indicates that about 150,000 cellular mobile telephone units will be in use in Canada five years after the introduction of the service.

Providers of cellular mobile radio services must also purchase switching and transmission equipment. It has been estimated that the equipment required to install a system comprising 16 cells would cost about $7 million.

Terminal attachment and the breakup of AT&T

Two important recent events, the attachment of customer-owned terminal equipment to the public network and the breakup of the AT&T empire have had major impact on the telephone industry and, thus, on the activity of communications equipment manufacturers.

In August 1980, the CRTC tentatively authorized the connection of privately-owned terminals - of which telephones are the best known example - to Bell Canada's network and facilities. Its final decision, brought down in November 1982, confirmed that a policy of greater flexibility in connecting terminal equipment was in the public interest, and extended its application to other terrestrial telecommunications companies regulated by the federal government (B.C. Tel, CNCP Telecommunications, Northwest Tel and Terra Nova Telecommunications Inc.).

This decision was to have numerous ramifications, especially on the development of technical standards and procedures respecting equipment certification, the selection of criteria for assessing the basic telephone service, the shared utilization of equipment, resale agreements, and others. Moreover, the CRTC felt that the participation of telecommunications companies in supplying terminal equipment was desirable for the establishment of a dynamic, competitive market.

Thus, Bell Canada, a fully owned subsidiary of Bell Canada Enterprises Inc., sells terminal equipment and participates in the interconnection market through one of its subsidiaries, Bell Communications Systems. However, this company competes with other interconnection companies, all of which want to serve a virtually brand new market as subscribers in the business sector - the most profitable segment of the market - are starting to purchase terminal equipment. Among Bell's biggest competitors, is the Canadian Telecommunications Group (CTG) which, in less than three years, has achieved annual revenues of more than $40 million.

The advantages of this situation are those inherent in any form of competition; a greater choice for consumers in terms of the equipment available and the sources of supply, lower prices, and more flexible, efficient service, especially for business subscribers.

However, there may be some question as to the wisdom of relaxing regulations governing the connection of terminals, especially in light of possible repercussions on the Canadian communications equipment manufacturing sector. The question is a crucial one, given the amounts at stake; estimates put Canadian sales of telephone sets (ranging from mini-exchanges to telephones) at $300 million and $500 million a year.

The United States telephone industry reached a turning point in January 1982 when the Department of Justice announced that it had reached an out-of-court settlement with influential AT&T, thus ending anti-trust lawsuits that the government had launched seven years earlier.

Under the terms of this agreement, AT&T was required to divest itself, over 18 months, of its 22 subsidiaries supplying local telephone service, whose revenues were estimated at nearly $US 80 billion. It would, however, continue to provide long distance service and retain Bell Telephone Laboratories and Western Electric, its principal subsidiaries.

Local subsidiaries have been prohibited from discriminating against AT&T's competitors with regard to the supply of communications equipment or services. In return, AT&T has been authorized to market its equipment in markets outside its territorial boundaries to which it did not previously have access.

Canadian communications equipment manufacturers have great expectations from this reorganization. The fact that AT&T's purchases of switching equipment totalled $US 3.3 billion in 1981 provides some idea of the size of the market open to them.

However, certain qualifications are in order. First, it is inaccurate to claim that this vast market was closed and that it is suddenly opening up to competition since Canadian firms had already dealt with AT&T, the parent company. In one respect, it was probably easier for them to do so at the time, as they were then facing a monopsony, which is no longer the case.

Moreover, it would be illusory to hope to benefit from the opportunities thus created as though they are being offered on a silver platter. The seven regional firms (holding companies) established following the dismantling of AT&T offer not only services, but equipment as well. Moreover, while AT&T was split up, Western Electric was not, and it continues to service the same telephone companies.

Competition will be fierce in the United States and Canada (where AT&T will now be allowed to compete), and only companies that display innovation and excellence will survive. The arrival of international firms on the American market, attracted by the same prospects for rapid growth, will lead to aggressive fighting with regard to prices and quality of products and service.

The opening up of the world's biggest market represents, nonetheless, a unique opportunity for Canadian manufacturers to compensate for the recent more limited demand from domestic telephone companies. If they are able to capture even a small share of the American market, Canadian communications equipment manufacturers might better protect themselves from fluctuations in the domestic economy.

Teleglobe Canada

Teleglobe Canada is a Crown corporation responsible for ensuring efficient worldwide telecommunications services. It links Canada to almost every country in the world, through a complex network of undersea cables and satellites.

Teleglobe Canada offers a wide range of services. In addition to telegraph and telephone services, and international telex communications, it provides high-speed digital facsimile transmission services (Globefax) and an electronic mail service (Intelpost) in collaboration with Canada Post. Its Globedat network links Canadian data bases and terminals to 36 destinations, using packet and circuit switching techniques. Teleglobe Canada also transmits radio and television programs.

As of March 31, 1983, Teleglobe Canada's capital expenditures (at cost) on cable, terminal, transmission and switching equipment, including equipment in the space segment of the international satellite telecommunications network (Intelsat), totalled $3.046 billion. Obviously, the company is a major consumer of communications equipment, part of which is purchased from Canadian suppliers.

For example, the DMS-300, a new digital telephone switch, was introduced at the Montreal international centre in 1982. Designed and manufactured by Northern Telecom in Canada, it should be able to process up to 200,000 calls an hour. By the end of 1984, a similar switch would be installed at the new international centre in Burnaby, British Columbia, and another in Toronto.

Canada will also benefit from fallout from the ANZCAN project, which will cost $US 500 million; Teleglobe Canada, the second most important partner, is contributing 15.5 per cent of this amount. The project, which ensures the connection of 15,000 km of undersea telephone cables between Canada, Australia and New Zealand, will generate expenditures of $60 million in this country, including $40 million for the purchase of high-technology and related equipment.

In 1983-1984, Teleglobe Canada was to incur record capital expenditures of $153 million, primarily for the purchase of cable, switching equipment, and miscellaneous plant and satellite transmission equipment. It estimated that nearly 74 per cent of these expenditures would directly benefit Canadian suppliers.

Broadcasting

Private sector

In 1981, 286 firms were operating 496 radio, and 69 television stations in Canada (not including CBC/Radio-Canada) and employed 16,534 people. Total employment, including the government-owned network's 12,258 employees, decreased in 1982, from 28,792 to 28,706.

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With respect to communications equipment, the broadcasting industry requires towers and antennas, and transmitting technical, and studio equipment. In 1981, investments (at cost) on such equipment by private Canadian stations totalled $375.5 million, or 64.4 per cent of their cumulative capital expenditures. It is estimated that the portion of this amount added during 1981 was in the order of $54 million.

CBC/Radio-Canada

CBC/Radio-Canada is the foremost broadcaster in the country, as indicated by its cumulative capital expenditures which reached $659.6 million (at cost) in 1981 compared with $583.2 million for all private stations.

CBC/Radio-Canada makes extensive equipment purchases. In 1981-1982, 61.3 per cent of its capital outlays ($404.7 million) were allocated to technical equipment. Of this amount, $61.7 million went for the acquisition of communications equipment of one form or another.

Cable television

In 1981, there were 610 licensed Community Antenna Television (CATV) systems in Canada. Of these, 86 were inactive because they were not yet entirely organized. Quebec had the greatest number of networks (180), followed by Ontario (151) and British Columbia (90); the other 189 networks were distributed throughout the rest of the country.

Among the industrialized nations, Canada, with nearly 90,000 km of trunk and distribution cables, has the biggest cable television network. In 1981, 8.3 million Canadian homes (78.4 per cent) could obtain this service; of that number, 4.7 million (74.3 per cent) actually subscribed to it.

The same year, 326 single-ownership companies or Corporations were operating; some of them are among the biggest cable television companies in the world. Rogers Cablesystems Inc., which has 1.24 million subscribers in Canada and about 650,000 in the U.S., is by far the biggest system in the country, with a penetration rate of 82 per cent in the communities it serves. Vidéotron, another major firm, serves 650,000 homes in Québec.

Six companies (Cablecasting Ltd, Cablenet Ltd., MacLean Hunter Cable TV Ltd., Moffat Communications Ltd., Rogers Cablesystems Inc. and Selkirk Communications Ltd.) have extended their activities to the American market by obtaining franchises. Several have also established offices in Europe with a view to profiting from the anticipated opening up of this market to cable television.

The CATV industry uses five main types of communications equipment: head ends and related components; distribution networks; customer devices and drop lines; test equipment and tools; and program production equipment. In 1981, such equipment was valued (at cost) at $754.5 million and made up 89.7 per cent of all cumulative capital expenditures of CATV Systems.

The cable television industry is currently in a period of transition. As it already serves most of its potential market, future capital expenditures will largely be for the purpose of replacing existing equipment. A considerable portion of its 90,000 km network of cables is in need of renewal. According to DOC studies, upgrading the system would cost the industry about $1.5 billion. In coming years, many new services are likely to broaden the scope of CATV and accelerate its rate of development. Pay-TV is just beginning. It should be followed by the introduction of interactive and inter-subscriber video games, remote

education programs, home transaction services (electronic mail, bank and business transactions), access to data banks, and others. Since less than five per cent of Canadian subscribers are presently served by bi-directional systems the introduction of such services will induce cable operators to increase their equipment purchases.

Telesat Canada

Established under the Telesat Canada Act in September 1969, the Corporation is the sole operator of the national satellite telecommunications system. It is a member of Telecom Canada and is governed by CRTC regulations.

As of December 31, 1982, Telesat Canada's cumulative capital expenditures (at cost price), without taking into account building projects under way, totalled $390.4 million. Earth stations accounted for 26.6 per cent of such outlays ($104 million), compared with 73 per cent for satellites ($285 million).

Telesat Canada's annual capital expenditures reached $99.5 million in 1982. Of this amount, $72.4 million was allocated to the space segment, and the rest to the earth segment. The Corporation was expecting capital outlays of $50 million in 1983.

Having successfully completed the launches of its Aniks C and D, Telesat Canada is now concentrating less on new spacecraft and more on the development of sophisticated terminal equipment and the marketing of new improved telecommunications services. One example of the latter is the integrated satellite telecommunications network implemented in 1983.

3 NORTHERN TELECOM LTD.

Northern Telecom Ltd. is by far the biggest manufacturer of communications equipment in Canada. In North America, it follows Western Electric, which dominates the world scene. Northern Telecom is a subsidiary of Bell Canada Enterprises Inc., which owned 53.2 per cent of its shares as of June 30, 1983, and is the sole Canadian firm offering a complete range of switching and transmission systems, wire and cable, outside plant, telephone equipment, and private telephony and data processing systems.

Northern Telecom Ltd., the parent company, is responsible for establishing guidelines and long-term growth strategies, and administering and co-ordinating the activities of its subsidiaries. The principal subsidiaries with head offices in Canada are:

- Northern Telecom Canada Ltd. (NTC), located in Islington, Ontario, is responsible for manufacturing, marketing and maintaining telecommunications products in Canada. It captures about 70 per cent of the market, and operates 30 manufacturing facilities and 17 R&D laboratories.

- Bell-Northern Research Ltd. (BNR), in which Bell Canada Enterprises Inc. holds 30 per cent ownership, is the biggest private research and development centre in Canada. BNR operates three laboratories in Ottawa and one each in Toronto, Montreal and Edmonton. It also owns four in the United States, operated by BNR Inc., its American subsidiary.

- Northern Telecom Electronics Limited (NTE) manufactures electronic components for the company's subsidiaries around the world. These include, in particular, integrated circuits, hybrid substrates and printed circuit boards.

- Northern Telecom International Ltd. (NTIL) is, along with Northern Telecom International Inc. (established in 1982 in the United States), responsible for marketing and maintaining telecommunications equipment used outside North America. It has sales offices in 14 countries.

- In the United States, Northern Telecom, Inc. (NTI), whose head office is located in Nashville, Tennessee, operates 13 manufacturing facilities and 9 R&D laboratories; it manufactures communications and office automation equipment.

Between 1972 and 1982, Northern Telecom underwent remarkable growth, as Table 3-1 indicates. Sales increased almost sixfold, from $531 million to $3.03 billion, an average annual growth rate of 19 per cent. During the same period, net profits increased from $20 million to $158 million, and the number of employees from 20,787 to 34,449.

Table 3-1

Northern Telecom sales, net profits and employees, 1972-1982

Year	in millions of $		Number of employees as of December 31
	Revenues	Net profits	
1972	531	20	20,787
1973	608	32	25,073
1974	958	54	26,147
1975	997	68	23,751
1976	1,084	77	25,277
1977	1,222	85	24,962
1978	1,505	101	31,756
1979	1,901	114	33,301
1980	2,055	(185)*	31,915
1981	2,571	137	35,444
1982	3,036	158	34,449

* Deficit.

Sources: Northern Telecom annual reports, 1972-1982.

Objectives and strategy

Northern Telecom's remarkable success results from objectives and a strategy that have been clearly outlined in all of the company's official documents since the mid-1970s. They are founded on two basic observations. First, the transition from an industrial to an information society (what Northern Telecom calls the Intelligent Universe) cannot be achieved with analog technology. Therefore, it is necessary to envisage a gradual - but eventually total - conversion from analog to digital, if networks originally designed to carry only voice are to be used to transmit data and pictures.

It is on the basis of this first observation that Northern Telecom became, in 1976, the first manufacturer in the world to announce firm delivery dates for a complete range of digital transmission and switching equipment. In September 1983, it recorded sales of, or orders for, entirely digital switching and transmission systems able to serve about 15 million telephone lines - more than any other company in the world. These systems include the DMS and SL product lines, which will be discussed later.

The second observation deals with the convergence of telecommunications and data processing, mentioned in the introduction. As both industries are based on large-scale integrated circuits and software, Northern Telecom has inevitably succeeded in producing "intelligent" switching and telephone equipment and office automation products.

To deal with this situation, Northern Telecom established a new operating group - integrated data communications systems - in 1982. The creation of these systems gives NTI a unified marketing, sales and service structure to serve this market, an approach that Northern Telecom expects to contribute significantly to its growth.

Northern Telecom's objectives are:

- vertical integration, from the manufacture of integrated circuits to the design of software;

- the creation of an entire range of digital products (from transmission to office automation). Based on high-capacity integrated circuits, they allow reductions in the price of equipment and enable software to perform functions once exclusively reserved for hardware.

Northern Telecom's strategy reflects both hypotheses:

- Massive investments in research and development (R&D), with a view to developing its own integrated circuits, thereby giving the company a competitive edge over its rivals, which can only rely on circuits available on the market. This helps ensure punctual product launches and lower the cost price of these products. The company's investments also cover the production of software to replace hardware in accomplishing various tasks.

- The use of networks belonging to Bell Canada, a subsidiary of Bell Canada Enterprises Inc., the parent company, to test new products and to quickly acquire funds, which enables Northern Telecom to at least partially amortize initial high costs. As discussed later, although its share of sales to Bell Canada has declined appreciably, Northern Telecom remains Bell Canada's single most important customer.

- Its relationship with Bell Canada facilitates some degree of synergy with respect to exchanges of information; the use of its products by a major telephone company enhances their credibility. Such interaction between the manufacturer, the customer and the research company (Bell Northern Research Limited) helps boost Northern Telecom's international sales, although the company also maintains similar links with foreign firms, such as MCI Communications Corporation and Southern New England Telephone, and with Canadian corporations such as Teleglobe Canada.

- The creation of products according to an "open" structure, based on compatibility with a wide range of office automation equipment, which reduces the risks of obsolescence.

- An increase in the volume of its sales outside Canada, whose limited market cannot, alone, absorb the high R&D costs necessary to maintain the company's position at the forefront of technology. An increase in its exports, the establishment of facilities outside Canada (especially in the United States), the acquisition of licence concessions, and the development of co-partnerships will contribute to increased sales.

Sales by sector

As Table 3-2 indicates, Northern Telecom operates in six principal sectors: public switching equipment; telephone equipment and private telephony systems; wire, cable and outside plant; transmission equipment; office automation systems; and R&D.

A seventh sector, "Other," was involved primarily in the sale of discontinued product lines and the distribution of electrical and electronic products. This sector was abandoned in 1979; however, the table takes it into account for the period 1972-1978. Doing so alters the average annual growth rate, which would have been 21.2 per cent instead of 19 per cent.

Public switching equipment

With sales of $904.3 million in 1982, this sector accounted for slightly less than 30 per cent of Northern Telecom's sales; its average annual growth rate since 1972 has been 18.8 per cent.

It is notable that $646 million (71.4 per cent of sales) was derived from digital systems. This is a remarkable achievement. In only four years, DMS switches, on which Northern Telecom based its strategy in the mid-1970s, caused sales of traditional switches for public exchanges (for example, step-by-step and crossbar) to plummet from 89.4 per cent to 28.6 per cent.

Table 3-2

Northern Telecom sales, 1972-1982

Year	Public switching		Telephone equipment		Wire and cable		Transmission		Office Automation		Research and development		Other*		TOTAL	
	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%
1972	161.2	30.1	106.7	20.0	119.4	22.3	56.0	10.5	N.A.	N.A.	N.A.	N.A.	91.0	17.0	534.3	100.0
1973	177.1	28.9	117.4	19.2	137.6	22.5	69.6	11.4	N.A.	N.A.	N.A.	N.A.	111.1	18.1	612.0	100.0
1974	313.7	32.3	181.4	18.9	190.8	19.7	103.2	10.6	N.A.	N.A.	N.A.	N.A.	181.6	18.7	970.7	100.0
1975	371.5	37.3	171.3	17.2	126.6	12.7	136.2	13.7	N.A.	N.A.	N.A.	N.A.	191.2	19.2	996.8	100.0
1976	401.9	37.1	213.8	19.7	146.0	13.5	124.5	11.5	N.A.	N.A.	12.6	1.2	184.7	17.0	1,083.5	100.0
1977	412.6	33.8	275.3	22.5	215.1	17.6	114.5	9.4	N.A.	N.A.	30.7	2.5	173.7	14.2	1,221.9	100.0
1978	338.9	22.5	374.3	24.9	276.6	18.4	141.3	9.4	171.5	11.4	39.1	2.6	162.8	10.8	1,504.6	100.0
1979	386.0	20.3	524.0	27.6	366.7	19.3	227.3	12.0	349.8	18.4	46.0	2.4	N.A.	N.A.	1,900.5	100.0
1980	505.2	24.6	618.6	30.1	349.9	17.0	277.6	13.5	258.9	12.6	44.4	2.2	N.A.	N.A.	2,054.6	100.0
1981	776.0	30.2	739.9	28.8	323.6	12.6	409.0	15.9	274.2	10.7	48.2	1.9	N.A.	N.A.	2,570.9	100.0
1982	904.3	29.8	958.3	31.6	291.5	9.6	534.1	17.6	287.7	9.5	59.2	2.0	N.A.	N.A.	3,035.5	100.0
Average annual growth rate 1972-1982	18.8 %		24.6 %		9.3 %		25.3 %		N.A.		N.A.		N.A.	N.A.	19.0 %	

* Abandoned in 1979, this sector included the distribution of electrical and electronics products, and discontinuted lines.

Sources: Northerm Telecom annual reports.

Thanks to its R&D projects, Northern Telecom, which used to manufacture products designed by others, has become a leader in digital switching. Sales of other switching equipment are now essentially aimed at the maintenance and equipment replacement markets. As Table 3-3 shows, such sales have hovered around $250 million a year since 1979.

Table 3-3

Sales of Northern Telecom switching products, 1978-1982

Year	DMS		Other products		TOTAL	
	in millions of $	%	in millions of $	%	in millions of $	%
1978	36	10.6	303	89.4	339	100.0
1979	127	32.9	259	67.1	386	100.0
1980	269	53.3	236	46.9	505	100.0
1981	521	67.1	255	32.9	776	100.0
1982	646	71.4	258	28.6	904	100.0

Source: Northern Telecom annual reports.

The success of DMS switches in the United States is due, above all, to sales to independent companies. However, sales to the subsidiaries of which AT&T has just divested itself are increasingly important, and will undoubtedly grow rapidly in the coming years.

Telephone equipment and private telephony systems

With sales of $958.3 million in 1982 (31.6 per cent of total sales), this sector is Northern Telecom's most important. Since 1972, it has grown at an average annual rate of 24.6 per cent. Once again, the company's strategy and the emphasis it has placed on R&D expenditures have contributed significantly to boosting sales. As Table 3-4 shows, in 1982, the SL-1 and SL-10 digital switching systems accounted for nearly 54 per cent of the sales of telephone equipment and private telephony systems.

Table 3-4

Breakdown of sales of telephone equipment and private telephone systems, 1982

Product	in millions of $	% of sales in sector
SL-1	480	50.1
SL-10	36	3.8
Other products	442.3	46.2
TOTAL	958.3	100.0

Source: Northern Telecom.

Since it was introduced in December 1975, the SL-1 has generated total sales of more than $1.3 billion. At the end of 1982, 5,687 SL-1 switching systems had been, or were about to be, installed in 40 countries, serving more than 2.2 million lines. Sales of the SL-1, which is the world's best-selling digital PBX, increased by 51 per cent in 1982.

Other sales in this sector include multi-line key systems, electronic and electromechanical telephone stations, hands-free speaker units, automatic diallers and telephone headsets.

Transmission equipment

Sales in this, the third most important sector, totalled $534.1 million in 1982. Since 1972, its average annual growth rate has been the highest; 25.3 per cent compared with 19 per cent for the firm's operations overall. Sales consist primarily of microwave systems and analog and digital multiplexers. Sales of opto-electronic systems totalled about $38 million (1.3 per cent of the total), although Northern Telecom management was expecting this figure to increase substantially in 1983 following the signing of a contract with MCI Communications Corporation, under which the company was to supply 100,000 km of optical fibers. It is estimated that this contract, which will be spread over a period of four years, will be worth about $100 million.

Wire, cable and outside plant

This sector, with sales of $291.5 million in 1982, ranks fourth; its average annual growth rate is the lowest of any in the Northern Telecom group (9.3 per cent since 1972). This is due in part to the fact that Northern Telecom divested itself of certain manufacturing facilities (feeder cable, in particular) and that the recession led to a slowdown in residential construction and telephone company capital expenditures, which adversely affected this sector in 1982.

Office automation systems

Between 1978 and 1982, the average annual growth rate in this sector was 14 per cent. It ranks fifth at Northern Telecom; sales in 1982 totalled $287.7 million (9.5 per cent of total sales). However, the sector has sustained major losses since 1980. The range of products includes data entry terminal systems, distributed data processing systems and the new Displayphone terminal, the first on the market to integrate voice and data.

Research and development

Bell-Northern Research carries out some work for third parties; in 1982, its revenues in this sector alone totalled nearly $65.4 million. However, Bell-Northern's sales to Northern Telecom are considered by the latter as expenditures, and are not included in this figure.

Range of products

Northern Telecom's major products can be divided into nine principal categories, according to the type of manufacturing unit:

- Subscriber equipment,
- Test equipment,
- Cable,
- Central office switching,
- Power equipment,
- Outside plant,
- Information processing equipment,
- Business communication,
- Transmission.

Table 3-5 indicates the principal products in each of these categories.

Table 3-5

Principal products manufactured by Northern Telecom

Business communications

Data packet switching networks
Basic and featured electronic key telephone systems
Electronic and digital PBX (combined voice and data)
Private and carrier network switching systems
Information processing equipment

On-line terminal systems
Data entry terminal systems
Distributed data processing systems
Remote batch terminal systems
Integrated voice and data terminals

Subscriber apparatus

Rotary dial, push-button and key telephones
Electronic and featured telephones
Style, decorator and novelty telephones
Coin telephones
Hands-free speaker units
Repertory diallers
Modular hardware
Headsets
Specialty and accessory terminals

Cable

Telephone wires
Composite coaxial cables
Switchboard wires and cables
Pulp- and paper ribbon-insulated telephone cables
Polyolefin-insulated telephone cables
Frame wires
PVC-insulated inside wiring cables

Outside plant

Customer premises distribution systems
Central office protectors and connectors
Subscriber protection devices
Terminals and closures
Splicing connectors
Loading devices
Outdoor cross-connect systems

Test equipment

Transmission test equipment
Signalling and supervision test equipment
Service observation test equipment
Service analysis equipment
PCM carrier test equipment
Loop test equipment
Trunk test equipment
Data communications diagnostic test equipment
Data communications patching and switching equipment
Data communications remote access switching and patching equipment

Central office switching

Step-by-step systems
Crossbar switching systems
Electronic switching systems
Digital switching systems
Traffic operator position systems
Centralized automated loop reporting systems
Peripheral systems

Power equipment

Power plants
Ringing and tone equipment

Transmission

Analog and digital carrier systems
Analog and digital multiplex systems
Analog and digital microwave radio systems
Voice frequency equipment and systems
Digital line transmission systems
Optical fibre transmission systems
Private network transmission systems
Special subscriber services

Sales by place of origin

Table 3-6, which shows the distribution of Northern Telecom sales by place of origin, highlights the remarkable growth in shipments from U.S. facilities. They increased from $193.5 million in 1977 to $1.47 billion in 1982. Similarly, their relative importance increased from 15.8 per cent to 48.5 per cent of the company's total sales.

Table 3-6

Northern Telecom sales by region, 1977-1982

Year	Canada		United States		Other countries		TOTAL	
	in millions of $	%	in millions of $	%	in millions of $	%	in millions of $	%
1977	1,014.4	83.0	193.5	15.8	14.0	1.1	1,221.9	100.0
1978	1,007.9	67.0	447.1	29.7	49.6	3.3	1,504.6	100.0
1979	1,000.8	52.6	739.6	38.9	160.1	8.4	1,900.5	100.0
1980	1,084.0	52.8	807.0	39.3	163.6	8.0	2,054.6	100.0
1981	1,334.6	51.9	1,047.0	40.7	189.3	7.4	2,570.9	100.0
1982	1,392.3	45.9	1,473.4	48.5	169.8	5.6	3,035.5	100.0

Sources: Northern Telecom annual reports.

Shipments from Canadian facilities rose from $1.01 billion to $1.39 billion during the same period; their relative share of Northern Telecom's total sales fell from 83 per cent to about 45.9 per cent. However, Canadian data must be interpreted cautiously, as the period under study coincides with the abandonment of fairly important activities in Canada, including the distribution of various feeder equipment and cables.

Sales by location of customers

Table 3-7 outlines changes in Northern Telecom sales according to the location of its customers, found in nearly 90 countries. Bell Canada, its subsidiaries and affiliated companies, are still Northern Telecom's biggest customers, although their importance is gradually declining. They accounted for 36.6 per cent of total sales in 1979, but only 30.1 per cent in 1982. Growth has been most marked in sales to American customers. In 1982, they accounted for 48.2 per cent of overall sales, compared with 39.6 per cent in 1979. U.S. sales exceeded those in Canada for the first time in 1982.

Table 3-7

Breakdown of Northern Telecom sales, 1979-1982*

	1979		1980		1981		1982	
	in millions of $	%**	in millions of $	%**	in millions of $	%**	in millions of $	%**
Bell Canada, subsidiaries and affiliated companies	695.9	36.6	722.2	35.2	911.7	35.5	913.2	30.1
Other Canadian customers	250.3	13.2	296.1	14.4	336.2	13.1	334.3	11.0
Subtotal Canada	946.2	49.8	1,018.3	49.6	1,247.9	48.5	1,248.1	41.1
United States	753.1	39.6	793.7	38.6	1,051.8	40.9	1,462.2	48.2
Other countries	201.2	10.6	242.6	11.8	271.2	10.5	325.2	10.7
TOTAL	1,900.5	100.0	2,054.6	100.0	2,570.9	100.0	3,035.5	100.0

* According to customer location, not sales point of origin.

** Percentage of total sales.

Sources: Northern Telecom annual reports.

Research and development

Table 3-8 shows Northern Telecom's R&D expenditures, which are of two types: gross expenditures, including costs incurred on behalf of Bell-Northern Research customers (including Bell Canada); and net expenditures, which represent costs incurred by Northern Telecom itself.

Table 3-8

Northern Telecom research and development expenditures, 1975-1983

Year	Gross expenditures in millions of $	Net expenditures in millions of $	Net expenditures as % of revenues
1975	N.A.	49.1	4.8
1976	88.1	61.5	5.5
1977	103.1	68.5	5.6
1978	135.5	97.8	6.5
1979	178.5	132.6	7.0
1980	193.2	140.9	6.9
1981	238.7	181.6	7.1
1982	N.A.	241.4	7.9
1983	N.A.	310.0*	N.A.

* Estimate by Northern Telecom management.

Sources: Northern Telecom annual reports.

Net expenditures have increased substantially - almost fivefold - since 1975, from $49.1 million to $241.4 million in 1982. Moreover, they indicate a percentage increase in revenues, from 4.8 per cent in 1975 to 7.9 per cent in 1982. Northern Telecom estimates that expenditures will reach at least 9 per cent of sales in the coming years. For 1983, the company predicted a 28.4 per cent increase in R&D expenditures, to a total of $310.0 million, in relation to the preceding year. Table 3-8 shows how much a manufacturer must allocate to research and development if he wishes to penetrate international markets. The company's 1982 expenditures, totalling $241.4 million, are higher than those of any other single firm manufacturing communications equipment in Canada.

Northern Telecom's true strength lies in it's R&D activities, which enable it to manufacture highly competitive products such as those in the DMS category and the SL system. Although it has, in the past decade, focused primarily on digital technology, the company will, in coming years, concentrate on the OPEN World Concept (Open Protocol Enhanced Networks), an important program announced in 1982.

The concept refers to the equipment, systems and services provided by the company that will control the flow of information in businesses and ensure the interconnection of several types of equipment in an integrated system, which can evolve according to technological needs.

The program will use up most of the funds allocated to R&D. Between 1983 and 1987, Northern Telecom plans to devote $1.2 billion to the project. However, the company hopes that these investments will generate revenues of about $13 billion during the same period.

Employment

Table 3-9 shows that between 1973 and 1977, the number of employees remained more or less stable at around 25,000. Since then, the number of jobs at Northern Telecom has increased fairly steadily; the company employed just over 34,000 people at the end of 1982.

However, the number of employees increased much less rapidly than the company's total revenues. Although revenues more than doubled between 1978 and 1982, from $1.505 billion to $3.036 billion, the number of employees increased only by 8.5 per cent during the same period. As a result, sales per employee rose sharply, and are a good indicator of Northern Telecom's productivity.

Table 3-9

Employees and sales per employee, 1977-1982

Year	Number of employees as at December 31	Sales of employee in $
1977	24,962	48,950
1978	31,756	47,480
1979	33,301	57,070
1980	31,915	64,377
1981	35,444	72,534
1982	34,449	88,116

Sources: Northern Telecom annual reports.

In light of a sharp upswing in the company's activities in the United States, the number of jobs has obviously increased there more rapidly, from slightly more than 4,000 in 1977 to 13,377 in 1982. As Table 3-10 indicates, Northern Telecom's American workers represented 39 per cent of its total staff in 1982, while the number of employees in Canada has remained more or less constant at around 19,000, or 55 per cent of the total.

Table 3-10

Employees by region, 1981-1982

Region	1981		1982	
	Number of employees	%	Number of employees	%
Canada	20,776	59	18,964	55
United States	12,737	36	13,377	39
Other countries	1,931	5	2,108	6
TOTAL	35,444	100.0	34,449	100.0

Source: Northern Telecom.

Some caution is warranted in the interpretation of Canadian data with regard to the following elements:

- As Northern Telecom divested itself of feeder cable facilities and stopped distributing electrical products during the period under study, jobs were transferred to other firms.

- Major changes occurred with respect to the makeup of the employment sector. For example, R&D projects are mainly concentrated at BNR, and involve nearly 14 per cent of Northern Telecom's employees in Canada. Sharp increases in the sales of such products as DMS switches and the SL system, at the expense of traditional products, imply that current jobs demand higher qualifications and that production requires greater investment.

Manufacturing facilities

Northern Telecom operates 30 manufacturing facilities in Canada, 13 in the United States, two in Malaysia and one each in Ireland, Brazil and the United Kingdom. Table 3-11 lists facilities according to their location and products manufactured.

Table 3-11

Northern Telecom manufacturing facilities and range of products

Products	Canada	United States	Europe	Other
Business communications systems	Belleville, Ontario	Santa Clara, California		
Cable	Amherst, Nova Scotia Calgary, Alberta Kingston, Ontario Lachine, Quebec Regina, Saskatchewan			
Components, hybrid substrates and printed circuits	Belleville, Ontario	West Palm Beach, Florida		Kedah, Malaysia Penang, Malaysia
Information processing systems and data networks	Belleville, Ontario Scarborough, Ontario	Minnetonka, Minnesota Richardson, Texas	Hemel Hempstead, United Kingdom	
Outside plant	Saint-Laurent, Quebec	Morton Grove, Illinois		Rio de Janiero, Brazil
Transmission	Aylmer, Quebec Saskatoon, Saskatchewan Saint-Laurent, Quebec Winnipeg, Manitoba	Atlanta, Georgia		
Repairs and maintenance	Calgary, Alberta Montreal North, Quebec North York, Ontario St. John, New Brunswick			
Semiconductors	Ottawa, Ontario	San Diego, California		
Switching	Brampton, Ontario Calgary, Alberta Charlottetown, Prince Edward Island LaSalle, Quebec Montreal, Quebec St. John's, Newfoundland	Creedmoor, North Carolina Morrisville, North Carolina Raleigh, North Carolina		
Test equipment		Concord, New Hampshire Moorstown, New Jersey		
Subscriber apparatus	Amherst, Nova Scotia Calgary, Alberta London, Ontario Regina, Saskatchewan St. John, New Brunswick	Nashville, Tennessee	Galway, Ireland	

Source: 1982 Northern Telecom annual report.

4. MAJOR MANUFACTURERS

This chapter examines Microtel Ltd., Mitel Corporation, Electrohome Ltd., Canadian Marconi Company Ltd., Spar Aerospace Ltd., and Gandalf Technologies Inc., which are classified as "major manufacturers," that is, those whose revenues exceeded $50 million in 1982. With the exception of Microtel, the firms' shares are listed on the stock exchange. As Table 4-1 shows, their 1982 revenues totalled more than $1 billion, compared with $680 million in 1980; they employed about 15,000 people. During the same year, their foreign sales exceeded $435 million.

Table 4-1

Revenues and employees of major manufacturers, 1982

Company	Revenues in millions of $	Number of employees	Fiscal year ending at the end of
Microtel	244	2,916	December
Mitel	204	4,160	February
Electrohome	196	2,347	December
Canadian Marconi	198.3	2,900	March
Spar Aerospace	177	1,902	December
Gandalf Technologies	53	910	July
TOTAL	1,020	15,135	

Sources: Annual reports of the various companies.

Microtel Ltd.

Microtel Ltd. resulted from the October 1979 merger of Lenkurt Electric (Canada) Limited and Automatic Electric (Canada) Limited, which were owned by General Telephone and Electronics (GTE) in the United States. B.C. Tel, another Canadian subsidiary of GTE, instigated the merger, then purchased both companies (which were its principal suppliers), with a view to rationalizing operations and increasing efficiency and competitiveness on the contemporary communications equipment market.

Lenkurt and Automatic had long specialized in the manufacture of switching and transmission equipment. Aside from these products, Microtel manufactures satellite transmission equipment, and various other apparatus (alarm and power management systems and test equipment). It also distributes other companies' products.

COMPANY PROFILE	
Company name:	Microtel Ltd.
Head office:	Burnaby, British Columbia
Principal products:	Central office switching equipment, subscriber equipment, multiplex and other systems
Sales in 1982:*	$243.6 million
Operating profits in 1982:**	$12.3 million
Number of employees in 1982:	$2,916

* Fiscal year ending December 31.

** According to B.C. Tel financial statements, profits before interest and tax in the manufacturing section.

Sources: Microtel and B.C. Tel annual reports.

As Table 4-2 indicates, Microtel's sales increased at an average annual rate of 6 per cent, from $153.5 million in 1974 to $243.6 million in 1982.

Table 4-2

Microtel sales and profits, 1974-1982
in millions of $

Year	Sales*	Profits**
1974	153.5	8.1
1975	177.1	9.4
1976	203.5	8.0
1977	166.0	2.0
1978	150.8	0.6
1979	164.6	N.A.
1980	188.4	12.5
1981	188.9	4.2
1982	243.6	12.3

* Automatic Electric (Canada) Limited and Lenkurt Electric (Canada) Limited sales until 1978, and Microtel sales from 1979 on.

** Automatic Electric (Canada) Limited and Lenkurt Electric (Canada) Limited net profits until 1978, and Microtel operating profits from 1979 on.

Sources: The supply of communications equipment in Canada, Department of Communications, 1981; B.C. Tel annual reports.

Range of products

Microtel mainly manufactures the following products: central office switches, multiplex systems, earth stations, PBXs and other subscriber apparatus, alarm and power management systems, and test equipment.

Table 4-3 breaks down Microtel sales. Those to the parent company accounted for 45.2 per cent of overall sales in 1982; sales to other Canadian customers, 40.5 per cent; and exports, 14.3 per cent (of which about 5 per cent, or $12 million, were destined for the United States).

Table 4-3

Breakdown of Microtel sales, 1980-1982

Breakdown	1980		1981		1982	
	in millions of $	%*	in millions of $	%*	in millions of $	%*
Sales to B.C. Tel**	73.5	39.0	79.9	42.3	110.1	45.2
Other Canadian customers	59.8	31.7	81.5	43.1	98.7	40.5
Subtotal Canada	133.3	70.8	161.4	85.4	208.8	85.7
Exports	55.1	29.2	27.5	14.6	34.8	14.3
TOTAL	188.4	100.0	188.9	100.0	243.6	100.0

* Percentage of total sales.

** Intersectorial sales.

Source: B.C. Tel annual reports.

Manufacturing facilities

Microtel operates manufacturing facilities (see Table 4-4) in five Canadian provinces and has three principal divisions: transmission, subscriber apparatus, and switching. It also owns two subsidiaries, Viscount Industries Ltd. and Control Devices Ltd.

Table 4-4

Microtel manufacturing facilities, 1982

Region	Number of employees	Division of subsidiary
Burnaby, British Columbia	820	Transmission (test equipment) Viscount Industries Ltd.
Edmonton, Alberta	34	Control Devices Ltd. (alarm and power management systems)
Lethbridge, Alberta	268	Subscriber apparatus
Saskatoon, Saskatchewan	180	Transmission
Winnipeg, Manitoba	110	Transmission
Brockville, Ontario	1,070	Switching

Source: Microtel.

Research and development

The company's R&D is carried out by its subsidiary, Microtel Pacific Research Ltd., also located in Burnaby, British Columbia. Table 4-5 shows it allocated slightly more than 6 per cent of its revenues to R&D in 1982, which marks a 4.7 per cent increase over 1980. This sector employed 278 people in 1982.

Table 4-5

Microtel research and development expenditures, 1980-1982

Year	in millions of $	% of sales	Number of employees
1980	8.8	4.7	241
1981	8.4	4.4	263
1982	14.9	6.1	278

Sources: B.C. Tel annual reports.

Employment

As Table 4-6 indicates, Microtel and its subsidiary, Microtel Pacific Research Ltd., employed about 3,000 people between 1979 and 1982.

Table 4-6

Microtel and Microtel Pacific Research Ltd.
employees, 1979-1982

Year	Microtel	Microtel Pacific Research Limited	TOTAL
1979	3,030	N.A.	3,030
1980	2,935	241	3,176
1981	3,038	263	3,301
1982	2,638	278	2,916

Sources: B.C. Tel annual reports.

Mitel Corporation

Established in 1971, Mitel Corporation has experienced spectacular growth: sales rose from $0.3 million in 1975 to $255.1 million in 1983, an average annual growth rate of 132 per cent. Compared with preceding years, the drop recorded in 1983 - when revenues increased by only 25 per cent - adversely affected the company.

Sales of various types of PBXs account for nearly 90 per cent of its total sales and, next to Northern Telecom, Mitel is Canada's second biggest manufacturer of communications equipment.

COMPANY PROFILE	
Company name:	Mitel Corporation
Head office:	Kanata (Ontario)
Principal products:	PBX
Sales in 1983:*	$255.1 million
Net profits in 1983:	$14.8 million
Number of employees in 1983:	5,210

* Fiscal year ending February 28.

Source: 1983 Mitel annual report.

Mitel's growth has resulted from the introduction, in 1979, of a complete range of PBXs that have been enormously successful in the United States, Canada and Europe. Prior to 1979, the company's revenues were generated by such products as tone receivers and generators, tone-to-pulse converters, and the sale of LSI circuits and manufacturing patents.

Table 4-7 highlights the remarkable increase in the importance of PBXs, which accounted for 90 per cent of the company's total sales in 1983.

Table 4-7

Mitel sales by type of product, 1977-1983*
in millions of $

Year	PBX	Other telecommunications products	Subtotal telecommunications equipment	LSI and VLSI circuits	Manufacturing patents	Total sales
1977	N.A.	4.7	4.7	0.2	0.5	5.4
1978	N.A.	9.6	9.6	1.3	0.6	11.5
1979	4.8	13.6	18.4	1.9	1.4	21.6
1980	24.3	14.5	38.8	2.7	1.9	43.4
1981	86.6	15.8	102.4	5.8	3.0	111.2
1982	180.5	12.4	192.9	8.6	2.7	204.1
1983	229.5	12.2	241.7	12.4	1.0	255.1

* Fiscal year ending February 28 or 29.

Sources: Mitel annual reports.

Mitel's success is attributable to its high-quality products and its marketing efforts outside Canada. Table 4-8 shows that 83.1 per cent of its sales in 1983 were made outside Canada, of which 51.9 were to American customers. That country's relative share of total sales dropped markedly in 1982 partly because of the recession, but also because of sharp increases in sales elsewhere (including Europe) and in Canada, where the effects of new regulations respecting the connection of terminals were strongly felt. In contrast, during the 1983 fiscal year, the economic recession was particularly acute in Canada, where Mitel made 17 per cent of its total sales, compared with 25.9 per cent the preceding year.

Table 4-8

Mitel sales by region, 1977-1983

Year	United States		Canada		Europe and other countries		TOTAL	
	in millions of $	%*	in millions of $	%*	in millions of $	%*	in millions of $	%*
1977	1.9	34.3	2.5	46.7	1.0	19.0	5.4	100.0
1978	6.6	57.4	3.0	26.2	1.9	16.3	11.5	100.0
1979	13.2	60.7	4.6	21.1	3.9	18.1	21.6	100.0
1980	28.7	66.1	8.8	20.2	5.9	13.7	43.4	100.0
1981	71.0	63.8	21.9	19.7	18.3	16.5	111.2	100.0
1982	101.9	49.9	52.9	25.9	49.4	24.2	204.1	100.0
1983	132.3	51.9	43.3	17.0	79.5	31.2	225.1	100.0

* Percentage of total sales.

Sources: Mitel annual reports.

Range of products

Mitel's principal products comprise a range of PBXs that it has marketed since 1979; they are listed in Table 4-9, along with the date they were launched, their capacity in terms of number of lines, and sales they have generated in 1981.

Table 4-9

Range of PBXs manufactured by Mitel

PBX	Date of introduction	Capacity (number of lines)	1981 Sales in millions of $
SX-200	1979	208	47.0
SX-100	1980	112	18.2
SX-20	1980	72	21.4
SX-10	1981	30	N.A.
SUPER-10	1981	16	N.A.
SX-5	1982	6	N.A.
SX-2	1982	5	N.A.

Sources: Mitel annual reports and various documents.

Once on the market, the SX-2000, the next product expected to be introduced, would mark an important phase for Mitel, and confirm its entry into the office automation market. The SX-2000 is the company's first digital switch and, in light of its features - there are three models with a capacity of between 150 and 10,000 lines, offering integration of voice and data - it is aimed at a somewhat different market than that served by other PBXs. It is the core of the integrated communications system on which Mitel seems to have largely based its medium-term expansion strategy.

The problems Mitel has encountered up until now in developing software for the SX-2000 have delayed its launching, which was scheduled for 1983. The company hopes that its initially limited production will continue to grow during the 1984 fiscal year and on into 1985.

In addition to PBXs, Mitel manufactures other communications equipment for sale to telephone companies and distributors which, in turn, rent or sell it to users. In 1974, the company began manufacturing such items as tone receivers and generators, tone-to-pulse converters and LSI circuits.

In 1982, Mitel entered the satellite communications sector with its Skyswitch[2], which connects its PBXs to earth stations, thus enabling it to install switching systems in remote areas or on drilling platforms, for example.

During the 1983 fiscal year, the company launched several new products, including the Kontact management terminal and Superset business telephones. The latter combine the features of traditional key systems with those of PBXs. In this series, the Superset 7, equipped with an SX-2000 digital switch, simultaneously acts as a telephone set, terminal and microcomputer.

Manufacturing facilities

At the end of 1983, Mitel products were manufactured in 15 plants around the world and were sold through more than 45 sales and service offices. Table 4-10 lists such facilities and the products manufactured in them.

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2. This system has since been sold to another firm.

Table 4-10

Mitel manufacturing facilities and range of products

Country	Region	Products
Canada	Kanata, Ontario Renfrew, Ontario Bromont, Quebec	All products PBX assembly Semiconductors
United States	Boca Raton, Florida Deerfield Beach, Florida Ogdensburgh, New York South Burlington, Vermont*	Switching Maintenance Other communications products Semiconductors
Central America and Caribbean	Bayamon, Puerto Rico Guadalajara, Mexico	PBX Semiconductors and switching
Other	Caldicot, South Wales United Kingdom Shannon, Ireland Steinbach, West Germany Tsuen Wan, Hong Kong Wellington, New Zealand	PBX assembly PBX and other communications products PBX other communications products PBX

* This plant has since been sold.

Sources: 1983 Mitel annual report.

It should be noted that Mitel directly or indirectly owns a majority share in all its subsidiaries (production and sales), with the exception of one each in Mexico and Canada, in which it owns 49 per cent and 50 per cent of the shares respectively.

Research and development

Mitel's R&D projects focus primarily on the application of new electronic technologies to telecommunications products, rather than on basic research. The company feels that this strategy has enabled it to develop a complete range of new products at lower cost.

However, as Table 4-11 shows, the company's research and development costs have risen considerably, from $0.8 million in 1977 to $36.6 million in 1983. To sustain growth and effectively confront fierce international competition, it allocated nearly 12 per cent of its total revenues to R&D between 1977 and 1983.

Table 4-11

Mitel research and development expenditures, 1977-1983

Year	in millions of $	% of total sales	Government assistance in millions of $
1977	0.8	14.8	0.2
1978	1.5	13.0	0.4
1979	2.8	13.0	1.0
1980	5.1	11.8	1.1
1981	9.4	8.4	0.8
1982	24.5	12.0	2.5
1983	36.6	14.3	4.6

Sources: Mitel annual reports and form 10-K.

Employment

Table 4-12 shows that the number of Mitel employees increased phenomenally between 1975 and 1983, from 30 to 5,210.

Table 4-12

Mitel employees, 1975-1983

Year	Number of employees
1975	30
1976	80
1977	230
1978	370
1979	640
1980	1,240
1981	2,500
1982	4,160
1983	5,210

Source: Mitel 1983 annual reports.

Table 4-13 presents overall data for January 1983, and emphasizes the fact that 62.3 per cent of all Mitel employees were found in the manufacturing sector, compared with 10.1 per cent in R&D, and 27.6 per cent in sales, administration and support.

Table 4-13

Breakdown of Mitel employees, January 1983

Country	Manu-facturing	Research and development	Sales, administration and support	TOTAL
Canada	1,552	417	713	2,682
United States	1,166	18	483	1,667
Europe and other countries	333	61	157	551
TOTAL	3,051	496	1,353	4,900

Source: Mitel.

Electrohome Ltd.

Established in 1907, Electrohome Ltd. operates in three principal sectors:

- Consumer products (furniture and service),
- Communications (broadcasting and Video-Q),
- Industrial (electronics and motors).

COMPANY PROFILE	
Company name:	Electrohome Ltd.
Head office:	Kitchener, Ontario
Principal products:	Satellite earth stations, monitors, videotex decoders, high-resolution graphics, work stations, display and graphics projector (monochromatic and colour).
Sales in 1982:	$196.3 million
Net losses in 1982:**	$1.1 million
Number of employees in 1982:	2,347

Source: 1982 Electrohome annual report.

Electrohome's sales, which ranged between $90 and $100 million from 1972 to 1978, have since increased annually by 24 per cent, reaching $232.2 million in 1981, for a net profit of $8.5 million.

However, because of the recession and the termination of certain operations in the consumer products sector, sales fell by 15.6 per cent in 1982 to $196.3 million. As was the case during the preceding year, about 45 per cent of sales were made in foreign markets.

Table 4-14

Electrohome sales, 1977-1982

Year	in millions of $
1977	92.1
1978	98.2
1979	128.7
1980	184.0
1981	232.2
1982	196.3

Sources: Electrohome annual reports.

Range of products

The consumer products sector comprises two divisions, Deilcraft furniture and AABEX electronics services, which provides maintenance to individuals and companies, regardless of what make of products they use.

The consumer products marketing division (humidifiers, air conditioners, televisions) was sold in 1982. All told, this sector (excluding the division that was sold) accounted for 18 per cent of the company's sales that year.

The communications sector, which is operated by CAP Communications Limited, a subsidiary, comprises the operation of one television and two radio stations. In 1982, it accounted for 11 per cent of sales (excluding the marketing division).

The industrial sector is made up of two units: the industrial products division, which manufactures and markets various types of motors; and the electronics division, which manufactures and markets communications equipment such as videotex terminals, monitors used by individuals and companies, and satellite signal amplifiers and receivers.

Exports and sales

In 1982, the industrial sector accounted for 71 per cent of Electrohome's sales. It is growing rapidly, and the company is banking on it to launch new products and consolidate future expansion. Both divisions in this sector depend on the international market to sustain growth. In 1982, exports totalled $81.8 million, most of which came from the electronics division.

Research and development

Electrohome allocated $5.7 million, or 2.9 per cent of its overall sales, to R&D in 1982, compared with $4.2 million in 1981 (1.8 per cent of its revenues). However, the company's R&D projects were centred above all on its industrial sector, which received 77 per cent of its investments in 1982.

Employment

In 1974, Electrohome's staff reached a peak when the company hired 3,900 people; it gradually decreased until 1978 (2,018), then increased again in 1981 (2,739). Staff numbers were further reduced by 14.3 per cent the following year, when they reached 2,347.

Table 4-15

Electrohome employees, 1977-1982

Year	Number of employees
1977	2,240
1978	2,018
1979	2,418
1980	2,561
1981	2,739
1982	2,347

Sources: Electrohome annual reports.

Canadian Marconi Company Ltd.

The Canadian Marconi Company Ltd. was incorporated in 1903; 51 per cent of its shares are owned by General Electric Company in the United Kingdom. The company has two American subsidiaries: CMC Electronics in Eatontown, New Jersey; and Sun World Circuits Inc., in Altamonte Springs, Florida.

COMPANY PROFILE	
Company name:	Canadian Marconi Company Ltd.
Head office:	Montreal, Quebec
Principal products:	Electronic products in the fields of avionics, radar, specialized components and business and tactical communications.
Sales and other revenues in 1982-1983:*	$198.3 million
Net profits in 1982:	$22 million
Number of employees in 1982:	2,900

* Fiscal year ending March 31, 1983.

As Table 4-16 shows, the company's revenues (sales and investment income) rose appreciably, from slightly more than $58 million in 1977 to $155 million in 1982, an average annual growth rate of 21.6 per cent. For the fiscal year ending March 31, 1983, its revenues increased by nearly 28 per cent, totalling more than $198 million.

Table 4-16

Marconi sales, 1977-1983
in thousands of $

Year*	Sales of electronic apparatus	Investment income	TOTAL
1977	55,569	2,756	58,325
1978	54,779	2,473	57,252
1979	81,287	2,936	84,223
1980	108,457	4,373	112,830
1981	123,928	5,489	129,417
1982	146,067	9,201	155,268
1983	190,720	7,907	198,627

* Fiscal year ending March 31.

Sources: Marconi annual reports.

Range of products

Marconi regards itself as a manufacturer of electronic apparatus, and operates in six principal sectors covering a wide range of products.

The avionics division manufactures electronic systems, especially for the aerospace industry. The principal products are the Omega and Doppler navigation systems, flight advisory computers, opto-electronic engine instruments, NAVSTAR global positioning receivers, microwave landing systems receivers (MLS), and status display systems for aircraft.

The components division manufactures high-precision, high-quality components for military and commercial applications, and for other divisions. It employed 550 people in 1982 and exported 90 per cent of its overall output. Its principal products include hybrid microcircuits, power supplies, magnetics, illuminated panels, alpha-numeric displays, multi-layer printed circuit boards, and tooled parts.

The business communications division's products include HF-SSB radio systems, rural radiotelephones, RACEs (Radio with Automatic Channel Evaluation), LN-66-10Kw naval surveillance radar, LN-66-735Kw naval helicopter radar, and the LW-66/SP portable submarine radar. The division employed 450 people in 1982 and manufactured more than 200 different products, sold in 140 countries.

The radar division, established in 1981 in Kanata, Ontario, is primarily interested in naval applications in the military field. It manufactures naval military surveillance radar, and coastal surveillance radar.

The special services division maintains precision instruments, repairs and tests electronic systems, and oversees field operations related to long-term installations and communications systems maintenance contracts.

The defence communications division manufactures tactical military communications systems, multichannel radio relay couplers, multiplexers and field switchboards.

The datacom products division manufactures advanced multiprocessor telex switching systems.

Exports and sales

As Table 4-17 indicates, the company exports a high percentage of its output. Over the past four years, exports have risen from 68 per cent to nearly 75 per cent of overall sales. During the same period, sales increased from nearly $110 million to more than $190 million.

Table 4-17

Marconi exports and sales, 1980-1983
in millions of $

Year	Exports	Sales of electronic products	% of sales of electronic products exported
1980	73.8	108.5	68.0
1981	87.0	123.9	70.2
1982	108.0	146.0	74.0
1983	141.9	190.7	74.4

Sources: Marconi annual reports.

Research and development

The company invests heavily in R&D, and, as Table 4-18 shows, benefits from government grants. About 200 of its 2,900 employees were assigned to R&D in 1982.

During the 1983-1984 fiscal year, the company anticipated allocating $28 million to this sector; the government and the company's customers will contribute half of the total.

Table 4-18

Marconi research and development expenditures, 1977-1983
in thousands of $

Year	Expenditures	Government assistance	TOTAL	% of sales of electronic apparatus allocated to R&D
1977	3,142	951	4,093	7.4
1978	2,105	777	2,882	5.3
1979	2,813	884	3,697	4.5
1980	5,564	868	6,432	5.9
1981	5,537	2,509	8,046	6.5
1982	5,181	7,916	13,097	9.0
1983	12,421	4,165	16,586	8.7

Sources: Marconi annual reports.

Spar Aerospace Ltd.

Spar Aerospace Ltd. is Canada's leading satellite communications equipment manufacturer. Established in 1967, the company entered the space and earth communications market in 1977 by acquiring a substantial portion of the facilities of the government and commercial systems division of RCA Ltd. in Sainte-Anne-de-Bellevue, Quebec. It subsequently bought facilities from Northern Telecom and established a manufacturing and test division for specialized electronic equipment in Kanata, Ontario.

COMPANY PROFILE	
Company name:	Spar Aerospace Ltd.
Head office:	Mississauga, Ontario
Principal products:	Development and manufacture of satellite systems and sub-systems, remote manipulator systems and earth station systems.
Sales in 1982:	$ 177.8 million
Net profits in 1982:	$ 8.6 million
Number of employees in 1982:	1,902

Source: 1982 Spar annual report.

The company's operating revenues increased from $37.3 million in 1976 to $177.8 million in 1982, an average annual growth rate of 30 per cent. As Table 4-19 shows, 1982 proved to be a particularly profitable year. Operating revenues rose by 45 per cent and net profits, by 296 per cent. The latter results are attributable mainly to the launching of a major space program in Brazil ($US 125 million over a period of three years), the Anik D-1 program, and higher profit margins.

Approximately 50 per cent of Spar's sales are made on international markets, while about 20 per cent result from contracts with the Canadian government.

Table 4-19

Spar operating sales, 1976-1982

	in millions of $		
Year	Operating sales	Net profits	Number of employees
1976	37.3	1.0	730
1977	70.1	1.3	1,400
1978	91.9	2.2	1,670
1979	108.8	1.6	1,900
1980	127.7	(0.9)*	2,100
1981	122.6	2.2	1,895
1982	177.8	8.6	1,902

* Deficit.

Sources: Spar annual reports.

Range of products

Satellites have obviously contributed a great deal to Spar's success. As early as 1962, the company supplied RCA Astro Electronics, the principal contractor in NASA's Project RELAY, with the wideband transponder used on board the satellite that became the precursor of the Intelsat global satellite system. This experience enabled Spar to assemble a strong team of engineers in the late 1960s, through participation in scientific satellite programs run by NASA and the Canadian government. Spar supplied components for the Alouette I and II, ISIS I and II, Pegasus and atmosphere exploration satellites.

In the 1970s, the company specialized in designing and supplying telecommunications transponders and antennas. These subsystems were developed under the following programs:

Program	Sponsor	Frequency band	Number of satellites
Hermes	Federal Department of Communications	12-14 GHz	1
SATCOM	RCA Astro Electronics	4-6 GHz	3
Anik B	Telesat Canada	4-6 and 12-14 GHz	1
TDRSS	NASA and Western Union	4-6 GHz	6
Anik C	Telesat Canada	12-14 GHz	3
Anik D	Telesat Canada	4-6 GHz	2

Spar is playing an increasingly important role in the production of Canada's telecommunications satellites. Although the principal contractor for the Anik C satellites is an American firm, Spar performed the final integration and testing of one of the satellites and supplied subsystems for all three. Spar is the prime contractor for the Anik D satellites.

In addition to the satellite and space systems division which we have just discussed, Spar owns nine other divisions, some of which are related to the telecommunications sector. Table 4-20 describes them briefly.

Tableau 4-20

Description of Spar products by group

GROUP	PRODUCT
SPACE AND ELECTRONICS GROUP	
Satellite and aerospace systems division	Satellite systems, subsystems and components
Remote manipulator systems division	Design, development and manufacture of remote manipulator systems for aerospace and terrestrial applications
Defence systems division	Remote heat sensing systems
MECHANICAL AND ELECTRICAL GROUP	
Gears and transmission division	Automatic transmission systems, turbo-engine equipment, aircraft wings and special gears
Aviation services division	Repair and reconditioning of aircraft components
Helicopter workshop	Helicopter service centre
Communications systems division	Communications satellite earth station systems
Northway-Gestalt Corporation	Acquisition, processing and analysis of topographical data; mapping services
Astro Research Corporation	Light, portable structures for aerospace and terrestrial applications

Sources: Spar annual reports.

Research and development

As Table 4-21 indicates, Spar's allocations to R&D expenditures decreased from 4.1 per cent of its revenues in 1979 to 2.2 per cent of its total revenues in 1982, excluding work carried out on behalf of customers. During the same period, government funds allocated to this activity also decreased significantly and steadily, from $2 million to $1.2 million.

Spar research is heavily centred on aerospace in general, and on new generations and new types of satellites in particular.

Table 4-21

Spar research and development expenditures, 1977-1982
in thousands of $

Year	Expenditures	Government assistance	TOTAL	% of sales allocated to R&D
1977	1,344	1,000	2,344	3.3
1978	1,842	1,100	2,942	3.2
1979	2,408	2,000	4,408	4.1
1980	2,295	1,500	3,795	3.0
1981	2,240	1,300	3,540	2.9
1982	2,800	1,200	4,000	2.2

Sources: Spar annual reports.

Employment

Spar employed over 1,900 people in 1982, including about 600 engineers and technicians, making it one of the biggest private companies operating in the high technology sector in Canada. Table 4-22 breaks down employees in each of the company's nine divisions.

Table 4-22

Spar employees, 1982

Group	Division	Number of employees
Aerospace and electronics	Satellite and aerospace systems	581
	Remote manipulator systems	298
	Defence systems	178
Mechanical and electrical	Gears and transmission	365
	Aviation services	151
	Helicopter workshop	15
	Communications systems	168
	Northway-Gestalt Corporation	139
	Astro Research Corporation	39

Source: Spar annual report.

Gandalf Technologies Inc.

Gandalf Technologies Inc. was established in Ottawa in 1970, where its head office is currently located. In 1981, following a change in its corporate structure, Gandalf became a public company with three subsidiaries: Gandalf Data Limited in Ontario; Gandalf Data Inc. in Illinois; and Gandalf Digital Communications Limited, in Cheshire (U.K.).

The company supplies several types of modems (LDM, LDS, Super Modem), which convert digital computer data for transmission via analog telecommunications systems. It also supplies private automatic computer exchanges (PACXs), which convert computer information for transmission over telecommunications systems. Gandalf manufactures multiplexers, mobile data transmission equipment and intelligent network equipment.

COMPANY PROFILE	
Company name:	Gandalf Technologies Inc.
Head office:	Nepean, Ontario
Principal products:	PACX, PIN, modems
Sales in 1982:*	$53.3 million
Net profit in 1982:	$6.7 million
Number of employees in 1982:**	910**

* Fiscal year ending July 31.

** Estimate.

Source: 1982 Gandalf annual report.

Since 1977, Gandalf's sales have increased at an average annual rate of 67 per cent, from $4.1 million to $53.3 million in 1982. This marked upswing in sales has resulted primarily from the frequent launchings of new products and numerous improvements made in existing models. For example, the company introduced PACXs in 1972, medium-haul modems in 1976, and intelligent apparatus and Super Modems in 1979.

As Table 4-23 indicates, of the company's $53.3 million in sales in 1982, the Canadian subsidiary accounted for 39 per cent; the American subsidiary, 50 per cent; and the British subsidiary, 11 per cent. In 1980, 1981 and 1982, the Canadian subsidiary's exports totalled $2.1 million, $2.9 million and $3.4 million, respectively.

Table 4-23

Gandalf sales by location of subsidiaries, 1977-1982
in millions of $

Year	Canada	United States	United Kingdom	TOTAL
1977	2.5	1.7	N.A.	4.1
1978	4.2	3.7	0.3	8.2
1979	5.4	6.5	1.0	12.9
1980	10.2	13.0	3.0	26.1
1981	15.9	19.9	4.5	40.2
1982	20.6	26.7	6.0	53.3

Sources: Gandalf annual reports.

As Table 4-24 shows, in 1982 the Canadian market accounted for 32.3 per cent of total sales, compared with 50.1 per cent for the American market, 11.3 per cent for the British market, and 6.4 per cent for other markets.

Table 4-24

Gandalf sales by location of customers, 1979-1982
in millions of $

Year	Canada	United States	United Kingdom	Other	TOTAL
1979	4.1	6.6	0.9	1.3	12.9
1980	8.1	13.0	3.0	2.1	26.1
1981	13.0	19.8	4.5	2.9	40.2
1982	17.2	26.7	6.0	3.4	53.3

Sources: Gandalf annual reports.

Range of products

The company's principal products are the PACX (private automatic computer exchange); the PIN (private intelligent network); short-, medium- and long-haul modems; multiplexers; intelligent network apparatus and mobile data terminals.

Gandalf's principal product line is the PACX, which provides a switching point between terminals and the mainframe computer in a modem-constituted private network, thereby allowing users to select and distribute points of access to the computer. The PACX eliminates the need to return to the public switched network to have a switching function performed on the private network. This enhances the security of the private network, as it is less accessible through the public network.

Telephone companies, banks, financial institutions, government departments and university computing centres use PACXs, sales of which rose from $4.1 million in 1979 to $19.7 million in 1982. For 1982, this represented 37 per cent of Gandalf's total sales, and an average annual growth rate of 69 per cent.

The second product line comprises modems and is divided into three categories according to the distance covered. LDSs (local data sets) have a range of between 4 km and 26 km; LDMs (long distance modems) cover a metropolitan region; while the Super Modem covers considerable distances. In 1982, modems accounted for 50 per cent of the company's overall sales.

The PIN, another important product, is used as a multiplexer or intelligent network apparatus. PINs accounted for 9 per cent of total sales in 1982, as indicated in Table 4-25, which breaks down Gandalf sales by product.

Table 4-25

Gandalf sales by product, 1979-1982
in millions of $

Year	PACX	LDS	LDM	Super modem	PIN	Other	TOTAL
1979	4.1	N.A.	N.A.	N.A.	N.A.	N.A.	12.9
1980	8.1	N.A.	N.A.	N.A.	N.A.	N.A.	26.1
1981	12.1	14.9	3.6	4.4	2.8	2.4	40.2
1982	19.7	18.1	3.7	4.8	4.8	3.2	53.3

Sources: Gandalf annual reports.

Research and development

Gandalf's R&D is centred on three objectives: improving existing products, increasing their sales, and developing new products. As Table 4-26 shows, the company's investments in R&D rose from $0.2 million in 1977 to $4.2 million in 1982; they were equivalent to 4.9 per cent of sales in 1977, and 7.9 per cent in 1982.

Table 4-26

Gandalf research and development expenditures, 1977-1982
in millions of $

Year	Research and development	Sales	Research and development as a % of sales
1977	0.2	4.1	4.9
1978	0.5	8.2	6.1
1979	0.9	12.9	7.0
1980	1.4	26.1	5.4
1981	2.8	40.2	7.0
1982	4.2	53.3	7.9

Sources: Gandalf annual reports.

Employment

Gandalf employed approximately 910 people in 1982, an increase of 25 per cent over the preceding year.

In 1981, 60 per cent of the company's employees worked in the manufacturing sector, 8 per cent were assigned to installation and customer service, 14 per cent to R&D and sales, and 9 per cent to marketing and administration.

Table 4-27

Gandalf employees, 1980-1982

Year	Number of employees
1980	612
1981	728
1982	910

Sources: Gandalf annual reports.

5 MEDIUM-SIZED MANUFACTURERS

By medium-sized manufacturers, we mean those that employ fewer than 100 people and have estimated 1982 sales of less than $50 million. This chapter presents a brief overview of these companies and their product lines, their geographical distribution, the nature of their ownership and the funds they allocated to R&D. The analysis is based on information obtained from 34 firms[1] included in this category.

Product categories

The products of medium-sized manufacturers are divided into eight categories, which include subcategories. Table 5-1 outlines the manufacturers and their products.

Foreign manufacturers

Foreign companies figure very prominently among medium-sized manufacturers; 17 of the 34 firms in question are foreign owned. Table 5-2 lists the companies and their country of origin by product category.

Geographic distribution

Of the 34 firms rated as medium-sized manufacturers, nearly two-thirds (22 companies) are located in Ontario and 7 in Quebec. Three are established in British Columbia, and two in the Prairie provinces.

Research and development

Manufacturers in this category allocate between 7 per cent and 8 per cent of revenues to R&D which, in 1982, totalled between $22 million and $23 million overall. However, this amount does not include R&D costs incurred on behalf of customers during consultations; such expenditures are quite high for certain companies.

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1. Three of these companies, Linear Technology Inc., NABU Manufacturing Corporation, and Central Dynamics Company Ltd. are listed on the stock exchange.

Table 5-1
Manufacturer/products chart, medium-sized manufacturers

	Subscriber apparatus (telephony)					Terrestrial and satellite transmission				Cable television equipment		Broad-casting equipment		Other communications equipment					
COMPANY	**Telephone exchange switches***	Components and subsystems	**Business communications apparatus and systems**	Data transmission equipment	**Other equipment used primarily in telephony**	Earth station components, subsystems and systems	**Terrestrial components subsystems and systems**	Satellite components, sub-systems and systems	**Mobile radio and radiotelephone equipment**	Transmission equipment	**Subscriber apparatus**	Transmission equipment	**Studio equipment**	Communications wire and cable	**Office automation products**	Videotex, teletext and other display equipment	**Integrated circuits**	Remote control and remote measurement	**Military communications**	Other
AEI Telecommunications (Canada) Ltd.					X															
Amphenol Canada Ltd.					X															
Andrew Antenna Company Ltd.						X														
Automatec Inc.																				
Canada Wire and Cable Ltd.																		X		
Canadian Astronautics Ltd.						X		X						X						
Canadian General Electric Company									X											
Canstar Communications Ltd.														X						
Central Dynamics Ltd.													X							
Com Dev Ltd.							X	X												
Delta-Benco-Cascade Ltd.										X	X	X								
ESE Ltd.				X																
Farinon Canada Ltd.							X													
Glenayre Electronics Ltd.									X											
ITT Communications Ltd.		X	X		X															
Linear Technology Inc.																				
Litton Systems Canada Ltd.																X				
MA Electronics Canada Ltd.																			X	X
Motorola Canada Ltd.						X	X													
NABU Manufacturing Corporation									X											
Norpak Corporation Ltd.											X				X					
Novatel																X				
Phillips Cables Ltd.				X					X											
Pirelli Cables Ltd.														X						
Plessey Canada Ltd.														X						
Positron Industries Inc.			X																	
Raytheon Canada Ltd.		X			X															
Rockwell International of Canada Ltd.						X	X													
SED Systems Inc.					X				X										X	
Siemens Canada		X				X														
SR Telecom Inc.			X																	
Triple Crown Electronics Inc.							X													
Varian Canada Inc.						X				X		X								
WR Communications Ltd.						X	X	X												
									X											

*The only two Canadian companies that manufacture such products are Northern Telecom and Microtel, which were discussed earlier.

Table 5-2

Companies and country of origin by product category

Subscriber apparatus used in telephone

Company	Country of origin
ESE Ltd.	United States
ITT Communications Ltd.	United States
Plessey Canada Ltd.*	United Kingdom
Positron Industries Inc.	Canada
Siemens Canada	West Germany

* Currently owned by Tie/Communications.

Mobile radio and radiotelephone equipment

Company	Country of origin
Canadian General Electric Company Ltd.	United States
Glenayre Electronics Ltd.	Canada
Novatel	Canada
Motorola Canada Ltd.	United States
Rockwell International of Canada Ltd.	United States
WR Communications Ltd.	Canada

Communications wire and cable

Company	Country of origin
Canada Wire and Cable Ltd.	Canada
Phillips Cables Ltd.	United Kindgom
Pirelli Cables Inc.	United Kingdom, Switzerland
Canstar Communications Ltd.	Canada

Other equipment used primarily in telephony

Company	Country of origin
AEI Telecommunications (Canada) Ltd.	United Kingdom
Amphenol Canada Ltd.	Canada

Cable television equipment

Company	Country of origin
Delta-Benco-Cascade Ltd.	United Kingdon
Triple Crown Electronics Inc.	Canada
NABU Manufacturing Corporation	Canada

Other communications equipment

Company	Country of origin
Automatec Inc. (division of BG Checo International Ltd.)	Canada
Linear Technology Inc.	Canada
Litton Systems Canada Ltd.	United States
Norpak Corporation Ltd.	Canada

Terrestrial and satellite transmission

Company	Country of origin
Andrew Antenna Company Ltd.	United States
Canadian Astronautics Ltd.	Canada
Com Dev Ltd.	Canada
Farinon Canada Ltd.	United States
MA Electronics Canada Ltd.	United States
Raytheon Canada Ltd.	United States
SED Systems Inc.	Canada
SR Telecom Inc.	Canada
Varian Canada Inc.	United States

Broadcasting equipment

Company	Country of origin
Central Dynamics Ltd.	Canada

6 SMALL MANUFACTURERS

This category encompasses communications equipment manufacturers with fewer than 100 employees. As was the case in the preceding chapter, we will briefly describe the firms in question and their product lines, their geographical distribution, the nature of their ownership, and how much they invest in R&D, according to information provided by the 42 companies included in the group.

Product categories

The products are divided into seven categories, which include subcategories. Table 6-1 indicates the firms and their products.

Data supplied by the 37 companies classified as small manufacturers enable us to present an accurate picture of their overall output and describe a typical firm in the group. In 1982, their communications equipment sales totalled $67.6 million, an average of $1.8 million per company. Altogether, they employed 1,342 people, an average of 36 employees per firm. Exports accounted for 40.1 per cent of communications equipment sales, and totalled $27.1 million, an average of $0.7 million per company.

Geographic distribution

Of the 42 firms classified as small manufacturers, nearly half are located in Ontario, 10 operate in Quebec, 8 in British Columbia, and 2 each in the Prairie and Atlantic provinces.

Table 6-2 shows the high Ontario concentration of firms in this category. In 1982, the 18 companies located there employed 57.8 per cent of total staff and accounted for 64.9 per cent of communications equipment sales and 67.9 per cent of exports.

Table 6-1
Manufacturer/products chart, small manufacturers

COMPANY	Subscriber apparatus (telephony)			Terrestrial and satellite transmission				Cable television equipment	Broad-casting equipment		Other communications equipment				
	Telephone exchange switches*	Components and subsystems	**Business communications apparatus and systems**	Data transmission equipment	**Other equipment used primarily in telephony**	Earth station components, subsystems and systems	**Terrestrial components, subsystems and systems**	Satellite components, sub-systems and systems	**Mobile radio and radiotelephone equipment**	Transmission equipment	**Subscriber apparatus**	Transmission equipment	**Studio equipment**	Communications wire and cable	**Office automation products**	Videotex, teletext and other display equipment	**Integrated circuits**	Remote control and remote measurement	**Military communications**	Other
AEA Electronic Ltd.					X															
Antech Antenna Technologies Ltd.						X														
Audor Communications Ltd.																				X
Baron Communications Ltd.		X																		
B.M.A. Ltd.									X									X		
Bristol Aerospace Ltd.									X											
Codalex Ltd.							X													
Communications Devices Inc.					X															
Culver Dynamics Ltd.					X															
DBA Communication Systems Inc.		X																		
Dees Communications Engineering Ltd.		X			X															
Digital Video Systems Corp.													X							X
Electroline Television Equipment Ltd.																				X
Ferritronics Ltd.		X																		
Harding Instruments Ltd.		X			X															
Intercontinental Data Control Corp.				X			X													
Istec Ltd.													X							
KB Electronics Ltd.																				X
Leitch Video Ltd.													X							
Lynch Transcom Inc.		X			X															
Microcom Systems Ltd.										X										
Miller Communication Systems Ltd.						X														
Mitec Electronics Ltd.						X	X													
MPB Technologies Inc.				X									X			X				
Multi-Vox Ltd.																				X
Nanotec Ltd.				X																
Nautical Electronic Laboratories Ltd.									X											
Nelma Data Corp.				X											X					
Nortek Electronics Ltd.																				X
Pamco Electronics Inc.		X																		
Pocatec Ltd.																				X
Primex Mfg. Ltd.					X															
Racal (Canada) Ltd.									X										X	
Racal Decca Canada Inc.					X															
Satel Consultants Ltd.						X				X							X			
Serabit Electronics Ltd.		X			X															X
Sinclair Radio Laboratories Ltd.																				X
Spillsbury Communications Ltd.									X											
Télédac Inc.																X				
T.I.W. Systems Ltd.						X														
Valcom Ltd.									X										X	
Westronic Eng. Sales Ltd.									X											

*The only two Canadian companies that manufacture such products are Northern Telecom and Microtel, which were discussed earlier.

Table 6-2

Concentration of small manufacturers in Ontario, 1982

	Total	Average per company	% of total number of small manufacturers
Number of firms located in Ontario	18	N.A.	47.2
Communications equipment sales in millions of $	43.9	2.4	64.9
Exports in millions of $	18.4	1.0	67.9
Number of employees	776	43	57.8

Foreign manufacturers

The presence of foreign firms among small manufacturers is much less pronounced than among medium-sized ones. Of the 37 companies that supplied information, only five were subsidiaries of foreign firms in 1982. Moreover, as Table 6-3 shows, the subsidiaries had only a limited effect on small domestic firms, as their communications equipment sales accounted for only 17.6 per cent, 14 per cent and 15.1 per cent of total sales, employees and exports, respectively.

Foreign firms are usually subsidiaries of multinationals (based above all in the U.S.), which establish themselves in Canada with a view to earning substantially higher revenues than a typical small manufacturer. It may be for this reason that they are more numerous among medium-sized, rather than small, manufacturers.

Table 6-3

Foreign ownership of small manufacturers, 1982

	Total	% of total of small manufacturers
Number of subsidiaries of foreign companies	5	13.5
Communications equipment sales in million of $	11.9	17.6
Exports in millions of $	4.1	15.1
Number of employees	188	14.0

Research and Development

A number of small firms carry on extensive R&D on behalf of customers, which hampers analysis of this activity. However, on the basis of the data obtained, we estimate that research and development expenditures are equivalent to about 8 per cent of total communications equipment sales among companies classified as small manufacturers; more or less the same percentage applies to medium-sized ones. We are unable to discuss the nature of expenditures in this sector on the basis of our information.

7 THE WORLD SCENE

This chapter compares the Canadian communications equipment manufacturing industry with the industry worldwide. Since the Canadian market is fairly limited, Canadian firms must look to foreign markets, either by exporting or, more directly, by establishing manufacturing facilites outside the country. However, entering international markets is a major challenge, given the competitors that Canadian companies have to face.

The world communications equipment market

In 1980, worldwide sales of telecommunications equipment were worth an estimated $US 40.2 billion[1]; this amount is expected to reach $US 60.7 billion in 1985, and $US 88.1 billion in 1990. As shown in Table 7-1, the North American market will dominate throughout this period, accounting for more than 40 per cent of the world market. Canada accounts for less than 4 per cent of it, with expenditures of $US 1.6 billion in 1980, $US 2.3 billion in 1985, and $3.4 billion in 1990.

The Canadian firms discussed earlier are active, above all, in the North American market. With sales of nearly $US 1.5 billion in 1980, Northern Telecom cornered 9 per cent of the market. Its sales outside of North America totalled only about $US 200 million, less than 1 per cent of the $US 23 billion spent outside the North American continent.

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1. A.D. Little, Inc., World Telecommunications Survey II, 1980. This information is drawn from a study published by Interesearch Inc. on behalf of the Department of Communications, entitled The World Telecommunications Market: Characteristics, Structures and Trends.

Table 7-1

Projected world demand for communications equipment
by geographic zone
in billions of $US

Geographic zone	1980	1985	1990
Canada	1.6	2.3	3.4
United States	15.4	22.7	32.3
Asia	10.0	16.7	26.8
Europe	10.8	15.6	20.8
Latin America	1.2	1.8	2.4
Oceania	0.8	1.0	1.4
Africa	0.4	0.6	0.8
TOTAL	40.2	60.7	88.1

Source: A.D. Little, Inc., World Telecommunications Survey II, 1980.

Moreover, Table 7-1 reveals that the next most important markets are those in Asia and Europe, while those in Latin America, Oceania and Africa account for scarcely more than 6 per cent of the world market.

Asia is among the markets that will probably show the most marked growth during the period under study. Its share of the world market will increase from 25.0 per cent in 1980 to 30.7 per cent in 1990.

For the purpose of its study, A.D. Little, Inc. includes the USSR, Japan and the People's Republic of China in this geographic zone, which puts up numerous barriers to foreign firms. The first two have, until now, more or less systematically closed their markets to outsiders, although their attitudes have recently changed. China is experiencing financial difficulties and prefers local production through joint ventures or licensing agreements rather than direct imports.

While Europe does not completely exclude foreign manufacturers, it nonetheless displays the characteristics of a fairly closed market. Most of the major western European nations (France, West Germany, the United Kingdom, Sweden and others) have one communications equipment manufacturer that ranks among the giants on the world scene and supplies much of the domestic market. In each country, the relationships between the government, telephone companies and these manufacturers are so close that foreign firms can hardly hope to make major inroads.

In eastern Europe, communications equipment is supplied by government-owned manufacturing facilities or state import-export agencies. Foreign manufacturers can only enter this market under technology transfer or joint manufacturing agreements.

The world communications equipment market can also be examined in relation to the extent of various countries' trade with Canada. As Table 7-2 shows, North America, western Europe and Japan spent $US 30.8 billion in 1980, which is equivalent to 76.6 per cent of the world market. This figure should fall to 71.0 per cent in 1985, and 65.8 per cent in 1990.

Table 7-2

Projected world demand for communications equipment by region
in billions of $US

Region	1980	1985	1990
North America	17.0	25.0	35.7
Western Europe and Japan	13.8	18.1	22.3
Subtotal	30.8	43.1	58.0
Soviet block and People's Republic of China	5.1	10.5	17.8
Other countries	4.3	7.1	12.3
TOTAL	40.2	60.7	88.1

Source: A.D. Little, Inc., World Telecommunications Survey II, 1980.

Table 7-3, which deals with world demand by category of equipment, reveals that telephony has a clear lead throughout the period under study, as it accounts for 80 per cent of the market. Two other categories, telegraph, telex and data, and satellite communications, should experience average annual growth exceeding that of telephony, without significantly altering the latter's importance.

Table 7-3

Projected world demand for communications equipment
by equipment category
in billions of $US

Category	1980	1985	1990
Telephony	32.7	49.2	70.6
Telegraph, telex and data	4.0	6.6	10.3
Satellite communications	0.4	0.7	1.1
Mobile radio and radiotelephone	2.7	3.8	5.2
Paging	0.1	0.1	0.2
Cable television	0.3	0.3	0.5
TOTAL	40.2	60.7	87.9

Source: A.D. Little, Inc., World Telecommunications Survey II, 1980.

Market forces

The Pink Book limited to 13 the number of major world manufacturers in the sector under study. In the general field of communications and in the more limited realm of information, the convergence of telecommunications and data processing is so significant that it seemed necessary to adopt a broader viewpoint in this study, in order to include firms that on the international level, will play a leading role with respect to information processing and transmission equipment.

The companies chosen are of interest for two reasons in particular. First, they are noteworthy because of the very basis for the convergence of technologies. The products of all the firms under study include microprocessors and software, which are also the components of communications or data processing equipment.

It is from this perspective that we examined the list of the world's biggest companies in 1981, established by Fortune, and selected those that operate in both industrial categories; that is, electronics and apparatus, and office equipment, including computers (see Table 7-4). However, we have not included certain manufacturers that primarily produce household appliances using relatively few microprocessors and little software (such as refrigerators and stoves). In contrast, Xerox, classified under the heading "Photographic, scientific and measuring equipment," has been included.

Second, we have taken into account other attributes that appear essential to companies wishing to capture an appreciable share of the world communications equipment market. These include various human, financial and technological resources required to support R&D, the development and operation of manufacturing facilities in the principal markets, and marketing and after-sales service.

In order to restrict our list to the biggest companies, we have only selected those with revenues of $US 2 billion or more in 1981; 47 firms operating in non-communist countries meet both criteria. Their total sales that year exceeded $US 330 billion. The only Canadian company in the group is Northern Telecom, which, with sales of $US 2.1 billion, ranked 44th.

Table 7-4

Profiles of the principal world information equipment manufacturers

Name of company	Country of origin	In billions of $US: Total sales	Communications equipment	Assets	Profits in millions of $US	Number of employees
International Business Machines	United States	29.0	N.A.	29.6	3,308	354,936
General Electric	United States	27.2	N.A.	20.9	1,652	404,000
ITT	United States	17.3	6.7	15.0	677	324,000
Philips Lamp Holding	Netherlands	17.0	N.A.	17.4	144	348,100
Siemens	West Germany	16.0	2.7	14.7	208	338,000
Matsushita Electric	Japan	15.7	N.A.	13.5	715	117,888
Hitachi	Japan	15.5	2.7	16.2	596	151,295
Western Electric	United States	13.0	13.0	8.3	711	168,000
General Electric	France	10.5	1.3	12.0	75	180,400
Toshiba	Japan	9.5	N.A.	9.7	231	99,000
Westinghouse	United States	9.4	N.A.	8.3	438	147,841
Xerox	United States	8.7	N.A.	7.6	598	120,981
General Electric (United Kingdom)	United Kingdom	8.1	1.3	7.5	755	193,000
Thomson Brandt	France	8.1	1.9	7.9	(1)*	129,000
Rockwell	United States	7.0	1.8	4.8	292	103,000
AEG Telefunken	West Germany	6.6	N.A.	4.8	1	123,700
Mitsubishi Electric	Japan	6.1	N.A.	5.5	158	60,011
Raytheon	United States	5.6	N.A.	3.4	324	76,500
Sperry	United States	5.4	N.A.	5.2	313	92,476
Honeywell	United States	5.4	N.A.	4.3	259	96,923
Thorn EMI	United Kingdom	5.2	N.A.	3.5	156	106,597
Nippon Electric	Japan	4.9	1.7	5.5	102	64,147
Litton Industries	United States	4.9	N.A.	3.7	312	76,700
Sony	Japan	4.7	N.A.	4.9	283	38,555

* Deficit.

Table 7-4 (cont'd)

Profiles of the principal world information equipment manufacturers

		In billions of $US				
Name of company	Country of origin	Total sales	Communications equipment	Assets	Profits in millions of $US	Number of employees
Sanyo Electric	Japan	4.5	N.A.	4.1	145	21,895
Texas Instruments	United States	4.2	N.A.	2.3	109	83,714
Hewlett Packard	United States	3.6	N.A.	2.8	419	41,100
IBM (West Germany)	West Germany	3.5	N.A.	2.5	240	27,263
NCR	United States	3.4	N.A.	3.4	208	65,000
Burroughs	United States	3.3	N.A.	4.4	149	66,900
Motorola	United States	3.3	N.A.	2.4	175	76,300
North American Phillips	United States	3.3	N.A.	2.9	104	49,021
Digital Equipment	United States	3.2	N.A.	3.5	343	63,000
Warner Communications	United States	3.2	N.A.	2.7	226	17,500
LM Ericsson	Sweden	3.2	3.2	4.0	85	69,860
Fujitsu	Japan	3.2	N.A.	3.1	124	46,603
IBM (France)	France	3.2	N.A.	2.0	156	20,596
Control Data	United States	3.1	N.A.	2.8	171	52,647
Sharp	Japan	2.8	N.A.	2.8	111	20,690
Singer	United States	2.8	N.A.	1.6	38	66,000
Rank Xerox	United Kingdom	2.7	N.A.	2.4	256	33,781
Olivetti	Italy	2.6	N.A.	N.A.	N.A.	53,471
GTE**	United States	2.2	2.2	N.A.	N.A.	N.A.
Northern Telecom	Canada	2.1	2.1	1.8	114	35,444
Canon	Japan	2.1	N.A.	2.3	79	24,300
IBM (United Kindgom)	United Kingdom	2.0	N.A.	N.A.	166	15,000
Plessey	United Kingdom	2.0	2.0	1.4	123	47,339

** Manufacturing only.

Sources: Fortune, August 23, 1982 and May 3, 1982. Information in the "Communications equipment" column is taken from Rockwell and Northern Telecom annual reports, and is also based on DOC estimates with regard to other firms.

Conclusion

This analysis of the world communications equipment market has, no doubt, served to emphasize the challenge that Canadian manufacturers face in the 1980s. Canada's presence among the principal international manufacturers is presently maintained only by Northern Telecom alone, whose human and financial resources seem modest in relation to those of its competitors.

Nonetheless, the company has undeniable assets. It is firmly established on the North American market which, in addition to being the biggest, is also the most open to foreign companies. Second, Northern Telecom offers a solid product line that will probably add substantially to revenues in the coming years. Increased revenues and the resulting profits will be essential if Northern Telecom is to accomplish its most recent project, that of being the system integrator of various communications technologies.

8 CONCLUSION

Overview

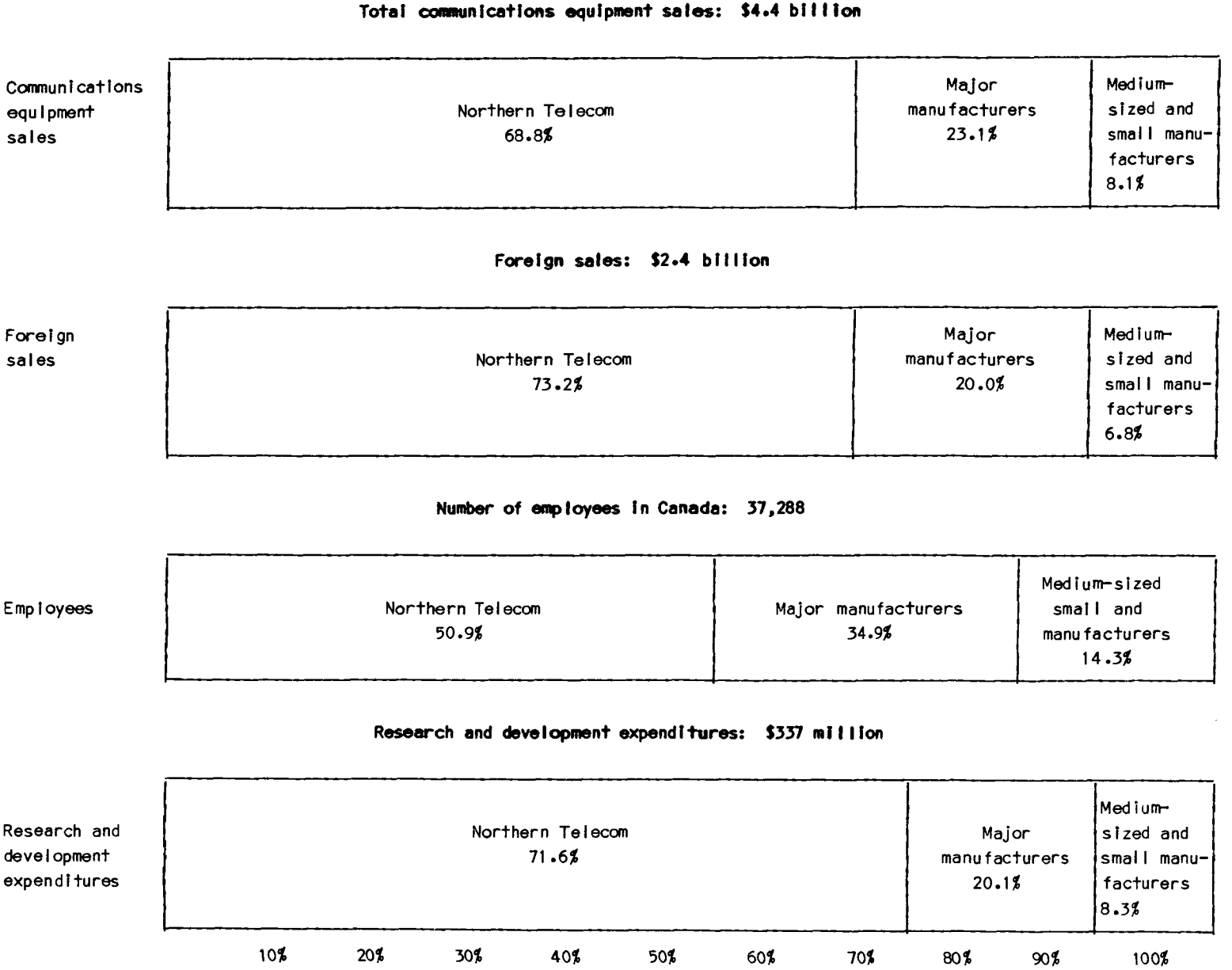
Northern Telecom is by far the biggest manufacturer of communications equipment in Canada and the gap between it and its closest rival in 1978, Microtel, has further widened since the publication of The Pink Book. Figure 2 shows Northern Telecom's importance on the Canadian market since 1982.

The six firms classified as major manufacturers made 23.1 per cent of total communications equipment sales and 20.0 per cent of foreign sales. They employed 34.9 per cent of workers in the communications equipment manufacturing sector in Canada. Northern Telecom's lead is attributable, among other things, to the fact that most of its competitors' manufacturing facilities are located in Canada, while its own more numerous plants are scattered around the world.

This concentration is also found with respect to medium-sized and small manufacturers, which account for 8.1 per cent of total communications equipment sales, 6.8 per cent of foreign sales, and employ 14.3 per cent of Canada's labour force. Because they are smaller, these firms have not yet succeeded in building many manufacturing facilities outside Canada.

Figure 2

Profiles of Canadian communications equipment manufacturers, 1982



Company growth: Northern Telecom and major manufacturers

As Table 8-1 indicates, revenues generated by Northern Telecom and other major manufacturers have increased at an average annual rate of 20 per cent since 1978, from slightly less than $2 billion to slightly more than $4 billion in only four years.

Table 8-1

Northern Telecom and major manufacturers' revenues, 1978 and 1982
in millions of $

Company	1978	1982	Average annual growth rate (%)
Northern Telecom*	1,505	3,036	19.2
Microtel*	151	243	12.6
Mitel**	12	204	103.1
Electrohome*	129	196	11.0
Canadian Marconi***	57	146	26.5
Spar Aerospace*	92	177	17.7
Gandalf Technologies****	8	53	60.4
TOTAL	1,954	4,055	20.0

* Fiscal year ending December 31, 1982.
** Fiscal year ending February 28, 1982.
*** Fiscal year ending March 31, 1982.
**** Fiscal year ending July 31, 1982.

Sources: Annual reports of various companies.

The spectacular growth experienced by this category of companies has resulted primarily from foreign sales. As Table 8-2 shows, they accounted for 56.6 per cent of the group's total sales in 1982.

Table 8-2

Northern Telecom and major manufacturer's foreign sales, 1978 and 1982

Company	1978		1982	
	in millions of $	% of sales	in millions of $	% of sales
Northern Telecom*	496.7	33.0	1,787.0	58.9
Microtel	38.9	25.8	34.8	14.3
Mitel	8.5	73.9	151.2	74.1
Electrohome	16.2	16.5	88.3	45.0
Canadian Marconi	43.8 **	80.0	108.0	73.9
Spar Aerospace	N.A.	N.A.	88.9	50.0
Gandalf Technologies	N.A.	N.A.	36.1	67.7
TOTAL	604.1	32.6	2,294.3	56.6

* According to the point of origin of sales for 1978, and the location of customers for 1982.
** Estimate.

Sources: Annual reports of various companies.

Table 8-3 indicates that the seven companies in question allocate a considerable portion of their revenues to research and development. Such expenditures represented 7.5 per cent of sales in 1982; this figure was expected to increase over the following two or three years.

Table 8-3

Northern Telecom and major manufacturers' research and development expenditures, 1978 and 1982

Company	1978		1982	
	in millions of $	% of sales	in millions of $	% of sales
Northern Telecom*	97.8	6.5	241.4	7.9
Microtel	5.3	3.5	14.9	6.1
Mitel	1.5	13.0	24.5	12.0
Electrohome	N.A.	N.A.	5.7	2.9
Canadian Marconi**	2.9	5.3	13.1	9.0
Spar Aerospace**	2.9	3.2	4.0	2.2
Gandalf Technologies	0.5	6.1	4.2	7.9
TOTAL	110.9	6.1	307.8	7.5

* Net R&D expenditures.
** Including government assistance.

Sources: Annual reports of various companies.

As Table 8-4 shows, Northern Telecom and other major manufacturers generated about 50,000 jobs in 1982, of which nearly 32,000 were in Canada.

Table 8-4

Northern Telecom and major manufacturers' employees, 1982

Company	TOTAL	Canada
Northern Telecom	34,449	18,964 *
Microtel	2,916	2,916
Mitel**	4,900	2,682
Electrohome	2,347	2,347
Canadian Marconi	2,500	2,500
Spar Aerospace	1,902	1,600 *
Gandalf Technologies*	910	800
TOTAL	49,924	31,809

* Estimate.
** In January 1983.

Sources: Annual reports of various companies.

Performance of canadian manufacturers by type of equipment

In light of Northern Telecom's importance, the supply of communications equipment in Canada is still highly centred on telephony. Northern Telecom's sales of central offices switches alone accounted for 21 per cent of the $4.4 billion in sales generated by the companies studied in this report. Taking into account the breakup of AT&T in 1982, which was discussed in Chapter 2, there is every reason to believe that growth in telephony will accelerate in the coming years. Microtel is, for the time being, the only other Canadian firm offering central office switching equipment, although Mitel plans to eventually enter this market, thanks to the technology employed with the introduction of the SX-2000.

Sales of PBXs and business communications systems dominate the telephony sector. Northern Telecom plays a leading role in the field, with nearly $1 billion in sales, followed by Mitel, with more than $200 million. Both firms' sales of these two types of equipment alone account for more than 25 per cent of the total revenues of the companies under study.

In the short and medium term, it is expected that sales of telephone exchange switches and PBXs will continue to dominate the Canadian communications equipment market. However, it should be noted that:

- Data transmission products and equipment will continue to experience high rates of growth.

- In view of the recent introduction in the United States of the cellular mobile radio, and its impending arrival in Canada, sales by relatively small firms could increase appreciably.

- Northern Telecom and Mitel, the leading manufacturers, are becoming increasingly interested in office automation. Northern Telecom, with the OPEN World project and substantial investments in research and development, would like to act as system integrator for various communications technologies. This also applies to Mitel, which introduced the SX-2000 and attendant work stations, as they will facilitate such operations as electronic mail and word and data processing.

Canadian manufacturers must prepare to face a new type of competitor, as a result of the convergence of various technologies discussed earlier. IBM is, undoubtedly, the biggest manufacturer among them.

The changes in question will certainly affect Canadian manufacturers like AES DATA and Micom, which were not discussed in this report, but whose output is expanding, as it is elsewhere in the telecommunications industry.

Rapid development in the communications sector at home and abroad is having significant repercussions on the consulting industry, which employs human resources similar to those required by the manufacturing sector.

The size of specialized consulting firms varies. Bell Canada International Limited (BCI) has 1,000 employees and operates 30 major projects. Other firms have only one employee, and work in highly specialized areas. Consulting firms offer all the services needed to carry out projects in the fields of traditional telephony, space communications, cable television, broadcasting, data processing and all other facets of civilian and military communications. They may provide specialized training for staff, or deliver a multimillion-dollar, fully operational communications system.

Although it is hard to assess this sector's contribution to Canada's economic vitality, recently announced projects clearly illustrate the importance of the consulting services sector. BCI has renewed a five-year contract with Saudi Arabia, worth more than $1 billion. The Elinca consortium, which comprises manufacturers Spar Aerospace, Raytheon and Mitel, and consulting firms SNC and Alberta Telecommunications International (ATI), has completed the last section of the Panaftel microwave network linking five West African nations, worth $50 million overall.

Table 8-5 lists firms specializing in consulting services, by activities and regions where they have already done business.

Table 8-5

Canadian consultants by activities and geographic region

	Activity						Geographic region							
	Training	Management	Telephony and data	Broadcasting	Aerospace	Radio, including station management	Asia and Pacific	East Africa	West Africa	Europe	Middle East	South America	United States	Canada
Bell Canada International Ltd.	x	x	x		x				x	x	x	x	x	
ATI	x	x	x			x	x				x			
MTX	x	x	x		x						x	x		
B.C. Tel. International	x	x	x		x	x	x	x						
Teletraining	x						x			x				x
DGB/SNC			x	x		x	x		x	x			x	x
J. Olivier Conseil			x	x							x		x	x
Douserv	x		x	x					x					x
CANAC	x	x	x				x							x
CBC	x			x			x		x		x			x
Ontel			x	x		x		x	x				x	x
Cablesystems Engineering	x	x		x						x			x	x
Crowder Communications				x	x					x				x
Telesat					x		x					x	x	x
TVOntario	x			x						x	x		x	
OESC	x			x					x		x	x		

The need for foreign sales

Foreign sales, the importance of which was emphasized in The Pink Book, are still essential. The Canadian market offers limited outlets, and communications equipment manufacturers were, as a result, significantly affected by the recession of 1982. Capital expenditures made by telephone companies, like those made by cable television operators - to mention just two categories of customers - dropped substantially.

Most Canadian small- and medium-sized businesses specialize in limited product lines. They generally offer sophisticated products which are exported, primarily to the United States. Canada's high levels of exports can be explained, in part, by the proximity of the American market and its similarity to our own. The American market has grown appreciably since the government adopted policies aimed at relaxing regulations governing communications, and since the breakup of AT&T. Such policies have also fostered competition among suppliers of services and strongly encouraged change within communications companies that seek the most advanced techniques. To ensure easier access to the American market,a number of Canadian companies have decided to establish plants in the United States. One example is Northern Telecom, whose activities south of the border have increased considerably; its sales there now exceed those which it makes in in Canada. The same applies to Mitel - which also manufactures equipment in the U.S.

However, it is harder for Canadian companies to capture the lion's share of the European and Japanese markets. Because they are traditionally served by domestic suppliers, competition in these markets is fierce. However, certain service providers in these markets are turning more and more to new suppliers. For example, NTT, a Japanese company, has accelerated its certification procedure for foreign equipment, thus enabling Canadian firms to penetrate the market by offering high-quality, sophisticated products at competitive prices. This situation will prevail as long as Canadian manufacturers maintain their technological lead.

Canadian companies should benefit from other markets that have been served for several decades by major European, Japanese and American manufacturers. These markets should grow considerably, and it is very likely that a supplier's choice will not always be dictated by technological superiority and price. For example, certain buyers will seek turnkey delivery of a system, while for others, training of maintenance staff and financing will be decisive. Given the structure and size of the Canadian communications industry, it would appear that the success of domestic manufacturers on these new markets hinges on closer collaboration among various Canadian partners, to ensure that the goods and services they offer are those being demanded.

The need for foreign sales will not diminish over the next 10 years. The American market will continue to be of prime importance to Canadian manufacturers, who will have to compete with growing numbers of European and Japanese suppliers in the U.S. Moreover, the need to conquer markets outside North America will lead to the signing of radically different trade agreements. Various federal government departments and agencies responsible for promoting exports of Canadian goods and services will undoubtedly play a key role in this respect.

APPENDIX A

Addresses of Northern Telecom and other major manufacturers

Northern Telecom Ltd.
33 City Centre Drive
Mississauga, Ontario
L5B 3A2
(416) 275-0960

Microtel Ltd.
4664-108 Lougheed Highway
Burnaby, British Columbia
V5C 5T5
(604) 294-0414

Canadian Marconi Company Ltd.
2442 Trenton Avenue
Montreal, Quebec
H3P 1Y9
(514) 341-7630

Electrohome Ltd.
809 Wellington Street North
Kitchener, Ontario
N2G 4J6
(519) 744-7111

Gandalf Technologies Inc.
33 Slack Road
Manotick, Ontario
K2G 0B7
(613) 692-2577

Mitel Corporation
350 Legget Drive
Kanata, Ontario
K2K 1X3
(613) 592-2122

Spar Aerospace Ltd.
P.O. Box 83
Royal Bank Plaza
Toronto, Ontario
M5J 2J2
(416) 865-0480

APPENDIX B

Addresses of medium-sized manufacturers

AEI Telecommunications (Canada) Ltd.
419 Notre Dame Avenue
Winnipeg, Manitoba
R3B 1R3
(204) 942-7221

Amphenol Canada Ltd.
44 Metropolitain Road
Scarborough, Ontario
M1R 2T9
(416) 291-4401

Andrew Antenna Company Ltd.
606 Beech Street
Whitby, Ontario
L1N 5S2
(416) 668-3348

Automatec Inc.
7700 de Lamartine
Anjou, Quebec
H1J 2A8
(514) 353-8940

Canada Wire and Cable Ltd.
250 Ferrand Drive
Don Mills, Ontario
M3C 3G4
(416) 242-5000

Canadian Astronautics Ltd.
1024 Morrison Drive
Ottawa, Ontario
K2H 8K7
(613) 820-8280

Canadian General Electric Company
1420 Dupont Street
Toronto, Ontario
M6H 2B2
(416) 530-5000

Canstar Communications Ltd.
1240 Ellesmere Road
Scarborough, Ontario
M1P 2X4
(416) 293-9722

Central Dynamics Ltd.
147 Hymus Boulevard
Pointe-Claire, Quebec
H9R 1G1
(514) 697-0810

Com Dev Ltd.
155 Sheldon Drive
Cambridge, Ontario
N1R 7H6
(519) 622-2780

Delta-Benco-Cascade Ltd.
124 Belfield Road
Rexdale, Ontario
M9W 1G1
(416) 241-2651

ESE Ltd.
1780 Albion Road
Rexdale, Ontario
M9V 1C1
(416) 749-2271

Farinon Canada Ltd.
657 Orly Avenue
Dorval, Quebec
H9P 1G1
(514) 636-0974

Glenayre Electronics Ltd.
1551 Columbia Street
North Vancouver, British Columbia
V7J 1A3
(604) 980-6041

ITT Communications Ltd.
175 Dawson Road
Guelph, Ontario
N1H 1A1
(519) 821-2000

Linear Technology Inc.
3435 Landmark Street
Burlington, Ontario
L7R 3Y3
(416) 632-2996

Litton Systems Canada Ltd.
25 Cityview Drive
Rexdale, Ontario
M9W 5A7
(416) 249-1231

MA Electronics Canada Ltd.
3135 Universal Drive
Mississauga, Ontario
L4X 2E7
(416) 625-4605

Motorola Canada Ltd.
3125 Steeles Avenue
Willowdale, Ontario
M2H 2H6
(416) 499-1441

NABU Manufacturing Corporation
485 Richmond Road
Ottawa, Ontario
K2A 3Z2
(613) 725-1820

Norpak Corporation Ltd.
10 Hearst Way
Kanata, Ontario
K2L 2P4
(613) 592-4164

Novatel
4900 Fisher Street
St-Laurent, Quebec
H4T 1J6
(514) 735-6441

Phillips Cables Ltd.
90 Nolan Court
Markham, Ontario
L3R 4L9
(416) 475-8550

Pirelli Cables Ltd.
1981 McGill College
Montreal, Quebec
H3A 2X6
(514) 282-1540

Plessey Canada Ltd.
300 Supertest Road
Donsview, Ontario
M3J 2M2
(416) 661-3711

Positron Industries Inc.
4810 Jean Talon Avenue West
Montreal, Quebec
H4P 2N5
(514) 731-3715

Raytheon Canada Ltd.
400 Phillip Street
Waterloo, Ontario
N2J 4K6
(519) 885-0110

Rockwell International of Canada Ltd.
(Collins Div.)
150 Bartley Drive
Toronto, Ontario
M4A 1C7
(416) 757-1101

SED Systems Inc.
P.O. Box 1464
23-66 CN Avenue
Saskatoon, Saskatchewan
S7K 3P7
(610) 731-1476

Siemens Canada
7300 TransCanada Highway
Pointe-Claire, Quebec
H9R 1C7
(514) 695-7300

SR Telecom Inc.
8150 TransCanada Highway
Saint-Laurent, Quebec
H4S 1M5
(514) 335-1210

Triple Crown Electronics Inc.
4560 Fieldgate Drive
Mississauga, Ontario
L4W 3W6
(416) 629-1111

Varian Canada Inc.
45 River Drive
Georgetown, Ontario
L7G 2J4
(416) 877-0161

WR Communications Ltd.
1655 West Third Avenue
Vancouver, British Columbia
V6J 4V7
(604) 732-3324

APPENDIX C

Addresses of small manufacturers

AEA Electronic Ltd.
P.O. Box 850
142 Perth Street
Richmond, Ontario
KOA 2ZO
(613) 838-2554

Antech Antenna Technologies Ltd.
16883 Hymus Boulevard
Kirkland, Quebec
H9H 3L4
(514) 694-6544

Audor Communications Ltd.
2700 Lancaster Road
Ottawa, Ontario
K1B 4T7
(613) 523-9933

Baron Communications Ltd.
6939 Hastings Street
Burnaby, British Columbia
V3C 5P3
(604) 291-8272

B.M.A. Ltd.
P.O. Box 11175, Station H
Ottawa, Ontario
K2H 7T9
(613) 692-4649

Bristol Aerospace Ltd.
P.O. Box 874
660 Berry Street
Winnipeg, Manitoba
R3C 2S4
(204) 775-8331

Codalex Ltd.
5780 Decelles Avenue
Montreal, Quebec
H3S 2C7
(514) 731-3251

Communications Devices Inc.
670 Progress Avenue
Scarborough, Ontario
M1H 3A4
(416) 439-6320

Culver Dynamics Ltd.
P.O. Box 4054, Station A
Victoria, British Columbia
V8X 3X4
(604) 382-4423

DBA Communication Systems Inc.
1201 East 4th Street
North Vancouver, British Columbia
V7J 1G8
(604) 985-9521

Dees Communications Engineering Ltd.
6475 C, 64th Street, R.R#5
Delta, British Columbia
V4K 4E2
(604) 946-8433

Digital Video Systems Corp.
716 Gordon Baker Road
Willowdale, Ontario
M2H 3B4
(416) 499-4826

Electroline Television Equipment Ltd.
8750 8th Avenue
Saint-Michel, Montreal, Quebec
H1Z 2W4
(514) 725-2471

Ferritronics Ltd.
222 Newkirk Road
Richmond Hill, Ontario
L4C 3G7
(416) 884-3180

Harding Instruments Ltd.
4608, 97th Street
Edmonton, Alberta
T6E 5N9
(403) 435-6180

Intercontinental Data Control Corp.
2373 Stevenage Drive
Ottawa, Ontario
K1G 3W1
(613) 733-4440

Istec Ltd.
1810 C, Route 6 North
Hamilton, Ontario
L9J 1H2
(416) 529-5132

KB Electronics Ltd.
150 Bluewater Road
Bedford, Nova Scotia
B4B 1G9
(902) 835-7268

Leitch Video Ltd.
10 Dyas Road
Don Mills, Ontario
M3B 1V5
(416) 445-9640

Lynch Transcom Inc.
239 Bélanger Street
St-Jerome, Quebec
J2Y 1K7
(514) 436-6225

Microcom Systems Ltd.
225 Nugget Avenue, Unit #1
Agincourt, Ontario
M1S 3L2
(416) 292-6640

Miller Communication Systems Ltd.
300 Legget Drive
Kanata, Ontario
K2K 1Y5
(613) 592-3020

Mitec Electronics Ltd.
104 Gun Avenue
Pointe-Claire, Quebec
H9R 3X3
(514) 694-8666

MPB Technologies Inc.
21001 North, TransCanada Highway
Sainte-Anne-de-Bellevue, Quebec
H9X 3L5
(514) 457-2035

Multi-Vox Ltd.
9967 Saint-Michel Boulevard
Montreal, Quebec
H1H 5G7
(514) 321-3130

Nanotec Ltd.
P.O. Box 610
1 Heritage Square
Almonte, Ontario
K0A 1A0
(613) 256-1483

Nautical Electronic Laboratories Ltd.
R.R.#1, Tantallon
Halifax, Nova Scotia
B0J 3J0
(902) 823-2233

Nelma Data Corp.
5170 A Timberlea Boulevard
Mississauga, Ontario
L4W 2S5
(416) 624-0334

Nortek Electronics Ltd.
293 Mansfield Place
North Vancouver, British Columbia
V7J 1E4
(604) 980-2811

Pamco Electronics Inc.
P.O. Box 134
Georgetown, Ontario
L7G 4T1
(416) 877-8411

Pocatec Ltd.
85, Route 132 West
La Pocatière, Quebec
G0R 1Z0
(418) 856-1454

Primex Mfg. Ltd.
17969 Roan Place
Surrey, British Columbia
V3S 5K1
(604) 576-1666

Racal (Canada) Ltd.
1806 Woodward Drive
Ottawa, Ontario
K2C 0P7
(613) 225-4640

Racal Decca Canada Inc.
71 Selby Road
Brampton, Ontario
L6W 1K5
(416) 457-8720

Satel Consultants Ltd.
2609 Fenton Road
Ottawa, Ontario
K1G 3N3
(613) 822-1166

Serabit Electronics Ltd.
4058 Jean-Talon Avenue West
Suite 300
Montreal, Quebec
H4P 1V5
(514) 739-2758

Sinclair Radio Laboratories Ltd.
122 Rayette Road
Concord, Ontario
L4K 1B6
(416) 669-1244

Spillsbury Communications Ltd.
120 East Cordova Street
Vancouver, British Columbia
V6A 1L1
(604) 684-4131

Télédac Inc.
1575 Taschereau Boulevard
Longueuil, Quebec
J4K 2X8
(514) 651-3716

T.I.W. Systems Ltd.
629 Eastern Avenue
Toronto, Ontario
M4M 1E4
(416) 549-5606

Valcom Ltd.
P.O. Box 603
Guelph, Ontario
N1H 6L3
(519) 824-3220

Westronic Eng. Sales Ltd.
7 West, 7th Avenue
Vancouver, British Columbia
V5Y 1L4
(604) 872-0636