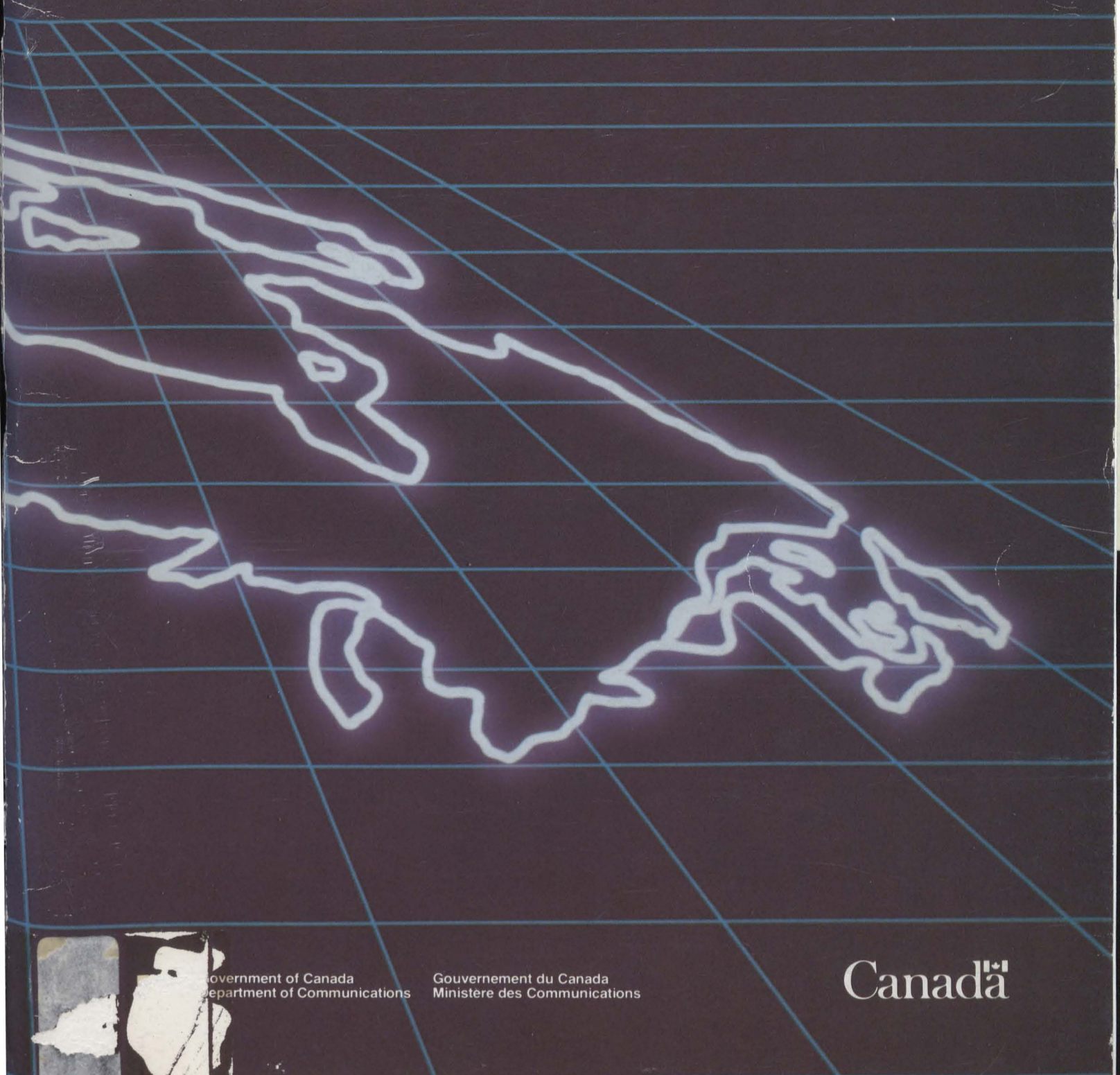
Suppliers of equipment and services to the cable television industry in Canada



overnment of Canada
epartment of Communications

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Ministere des Communications

Canada

SUPPLIERS OF EQUIPMENT AND SERVICES TO THE CABLE TELEVISION INDUSTRY IN CANADA

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In 1983 the Department of Communications commissioned Nordicity Group Limited to prepare a report on the "Suppliers of equipment and services to the cable television industry in Canada." The departmental scientific authority for the project was P. Julien.

The study team would like to acknowledge the co-operation of the Cable Telecommunications Research Institute, the Canadian Cable Telecommunications Association and the manufacturers and suppliers of cable television equipment which made the study possible.

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1. INTRODUCTION

This section describes the basic characteristics of the cable industry and the transition it faces in years to come.

1.1 PURPOSE OF REPORT

This report profiles the cable supplier industry in Canada, and documents the capabilities of Canadian suppliers; capabilities that will continue to be required to provide products and services needed by Canadian cable operators.

The intended audience of this report is the domestic and international cable industry. Although cable operators and suppliers in Canada are generally well acquainted with each others' needs and product/service lines, the company profiles included here may increase this knowledge. The report may also stimulate discussion on the need for industry-wide initiatives to ensure the continued strength of indigenous supplier capability. In addition, this summary may enhance Canada's international image as an important cable industry supplier.

The report does not necessarily represent the views of the Department of Communications or the federal government. No commitment for future action should be inferred from the document.

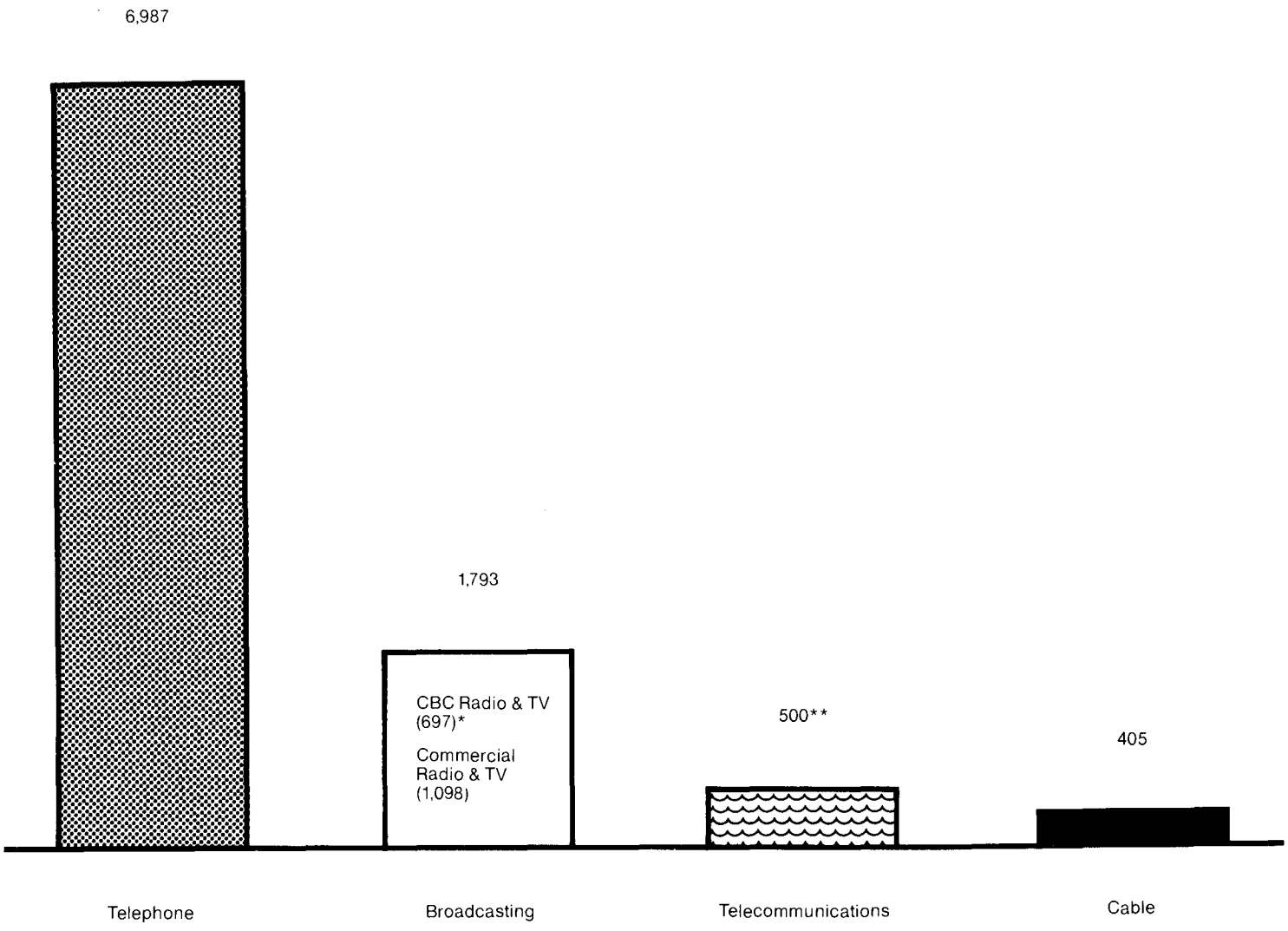
1.2 INDUSTRY IN PERSPECTIVE

The Canadian communications industry - including telephone, telecommunications, broadcasting and cable - had operating revenues of approximately $9.6 billion in 1981. Of this total, cable operators grossed about $400 million, directly employed over 5,000 people and reached about 5 million homes. Figure 1 sets the cable industry in the context of the larger communications picture. In view of recent and anticipated regulatory decisions on pay-TV and tiered services, the Canadian CATV industry has a dynamic future: its revenues could more than triple in this decade.

The demand for all related equipment and services should rise from the current annual level of $120-130 million higher to a figure which considerably exceeds that amount. Canadian suppliers have traditionally responded to most Canadian cable operators' equipment and service needs and can continue to do so, although competition from foreign suppliers is becoming more severe. New firms and companies supplying other delivery systems will contribute to the development of Canadian capability. In addition, Canadian manufacturers and service providers can play an increasingly international role in making their equipment and services available for American and other growing world markets.

Figure 1

COMMUNICATIONS INDUSTRY OPERATING REVENUE, 1981
($ MILLIONS)



* Includes CBC expenses and depreciation: excludes CBC revenues

** Estimated for 1981

Sources: Statistics Canada, Cable Television, 1981;
Telephone Statistics, 1981; and Radio and Television Broadcasting.

1.3 REPORT STRUCTURE

Section 2 of this profile of the cable supplier industry begins with a short history of the demand for CATV equipment and services in Canada and then projects future needs. Section 3 describes the structure of the industry, outlining the main product categories and characterizing the types of suppliers. Sections 4 through 8 provide basic facts about a selection of supplier companies. Section 9 surveys the key international companies. Section 10 provides major concluding observations on the issues facing the industry and its possible future directions.

2. BACKGROUND: CABLE INDUSTRY

This section describes the cable industry, including a very brief history. It describes the transitional stage in which the industry finds itself, and estimates the future demand for equipment and services, both from performance to date and from projections of new service development

2.1 CATV HISTORY

The origins of the Canadian cable industry are linked with the introduction of television in the early 1950s. Cable began as community antenna systems for multiple units or for connecting several homes to a single antenna in a neighbourhood; capacity in the early days was limited to five video channels. Over the years virtually all systems have been upgraded to 12 channels, and larger cable systems have expanded to 30 or 35 channels.

Basically, a cable television system uses coaxial cable to distribute television, radio and data signals from a central originating location to residences and businesses. Generally, the system comprises three principal components (illustrated in Figure 2):

- the headend -- the point at which all the program sources are received, assembled, and processed for transmission by the distribution network; programming services can be generated in local facilities or received directly off-air (and possibly microwaved into the cable system's headend) or off the satellite through an earth station at the headend;

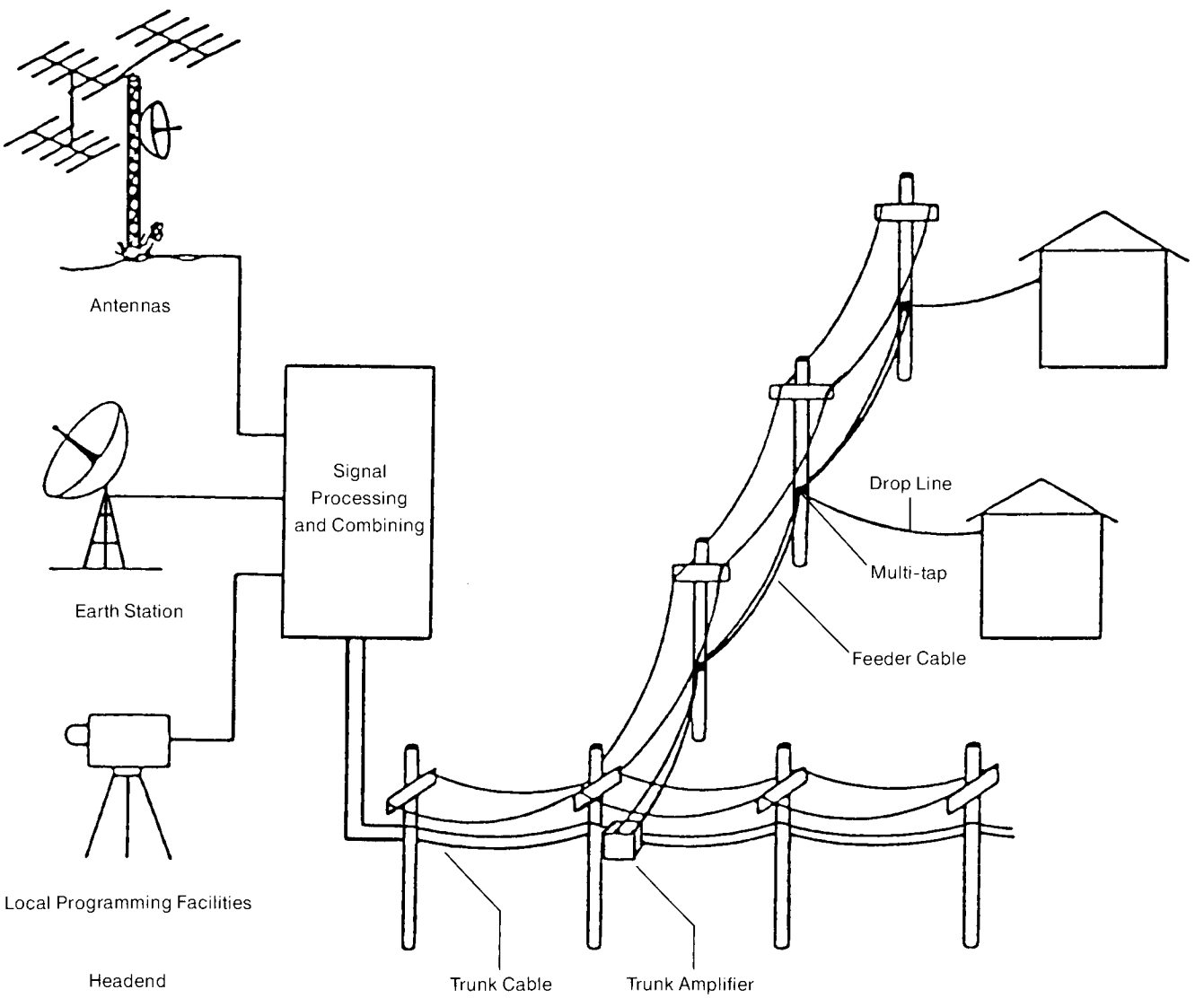
- the distribution network -- coaxial cable disseminating from the headend on power or telephone company poles or, in some cases, buried underground, and going down each street within the community served. Signals are amplified to ensure they are strong enough to reach each subscriber;

- the subscriber drop -- the coaxial cable going from the street into the individual subscriber's home or business, and the related equipment required to connect the cable to the subscriber's television receiver and other devices.

Due to an important federal government decision in the early 1970s, authorizing the delivery of U.S. border stations by microwave to distant cable headends, the cable industry experienced rapid growth in that period, beginning the decade with 1.2 million subscribers and reaching 2.9 million by 1975. Growth at over 20 per cent per year in the first part of the decade moderated in the late 1970s to less than 10 per cent annually.

Figure 2

PRINCIPAL COMPONENTS OF A CABLE SYSTEM



Source: T.F. Baldwin and D.S. McVoy, Cable Communication (Englewood Cliffs, N.J.: 1983).

By 1982 all large urban centres except Windsor[1] were wired, and approximately 58 per cent of Canadian television (5 million) households subscribed to cable service.

In Canada, the cable industry has reached a mature stage, having largely satisfied the demand for "basic" services. In contrast, the American cable industry has been spurred on in the late 1970s by new pay cable and other satellite delivered services. Large urban centres in the United States remain uncabled however, and penetration levels equivalent to Canada's 58 per cent are not anticipated until about 1988. Figure 3 compares the recent growth of cable in the United States and Canada.

Canadian cable operators have participated in this recent American growth partly because of an absence of investment opportunities in further development of Canada's cable systems. It is estimated that about 5 per cent of American cable subscribers are served by Canadian-owned operators. Thus, several medium-sized and large Canadian cable operators (notably Maclean-Hunter, Rogers, Cablenet, CUC, Selkirk and Cablecasting) have been able to develop operational experience in new services in the United States.

2.2 STRUCTURAL CHARACTERISTICS

The Canadian cable industry has grown through extension of distribution plant to cover most of urban Canada. Its structure has been shaped by corporate acquisitions and mergers along the way; two of the most notable received CRTC approval in 1980 (Rogers and Premier; Videotron and Cablevision Nationale). Many of the industry pioneers remain active and are indeed still at the forefront of cable's continued development.[2] The Canadian cable industry differs widely in system size, ownership, and technical capacity.

By 1981, the CRTC had issued licences to 610 cable systems, of which 524 represented operating entities.[3] There were 180 licensed systems in Quebec, 151 in Ontario, 90 in British Columbia and 189 in the rest of Canada.

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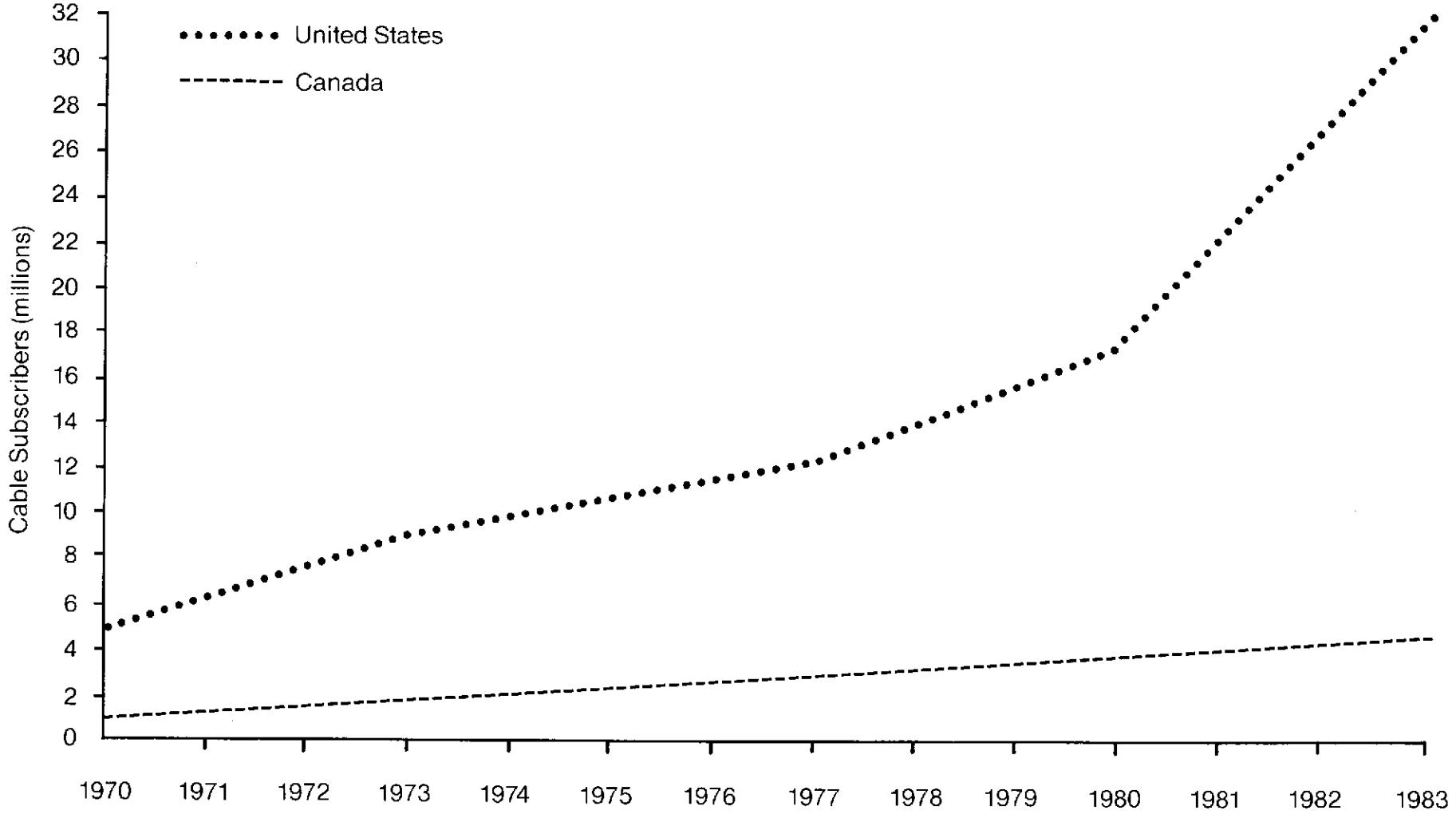
[1] In late 1982, the CRTC awarded the licence to cable the Windsor area to CUC Ltd.

[2] In 1976, for example, Le Groupe Vidéotron founded Microbec, which is a consortium of cable firms created to provide microwave interconnects between cable systems. These facilities enable several systems to be interconnected, including those on the periphery of major metropolitan areas and thus make available to their subscribers a much wider and richer variety of programming. Similar interconnected systems established by other cable companies exist in major urban centres in other provinces.

[3] Statistics Canada, Cable Television, 1981.

Figure 3

GROWTH OF CABLE SUBSCRIBERS: CANADA vs. UNITED STATES



Sources: CRTC, Special Report on Broadcasting in Canada, 1968-78, vol. 2 (1979). Arthur D. Little Inc., Pay Television Services Via Direct Broadcast Satellite: Demand and Impact in the 1980's, prepared for Comsat General Corporation (May 1980). CRTC, Facts Digest on Broadcasting and Telecommunications in Canada (Ottawa: January 1982). Paul Kagan Associates, Cable TV Data Book (1982).

Canadian CATV systems can be classified according to the following size categories:[4]

Category	Size	No. of Systems
Small	under 1,000 basic subscribers	more than 100
Medium	1,000-10,000 basic subscribers	more than 200
Large	10,000-100,000 basic subscribers	approx. 80
Very Large	over 100,000 basic	10

In many cases, a cable operator owns several systems. Rogers Cablesystems and Videotron, with 1.2 million and 545,000 subscribers respectively, are the industry leaders and the two largest multiple system operators (MSOs). MSOs with more than 100,000 subscribers are shown in Figure 4.

This structure allows for the provision of basic cable service to many Canadian communities. However, continued consolidation and rationalization are anticipated as the introduction of new services requires increased engineering, marketing, and management sophistication. In comparison, the telephone industry is significantly more concentrated: there are 153 telephone systems, of which 14 systems account for 98 per cent of telephone activity.[5]

2.3 TRANSITIONAL PHASE

Although many Canadian cable systems have upgraded from a 216 MHz, 12-channel operation, they are still mostly one-way systems designed for 270 or 300 MHz operation. Line extensions are often built with the same 400 to 440 MHz equipment that is being installed in the United States, but it will be several years before these broader frequency ranges are put to use on a large scale. Canadian cable systems have been a straightforward, cost-effective way to distribute the basic television services for which they had been authorized.

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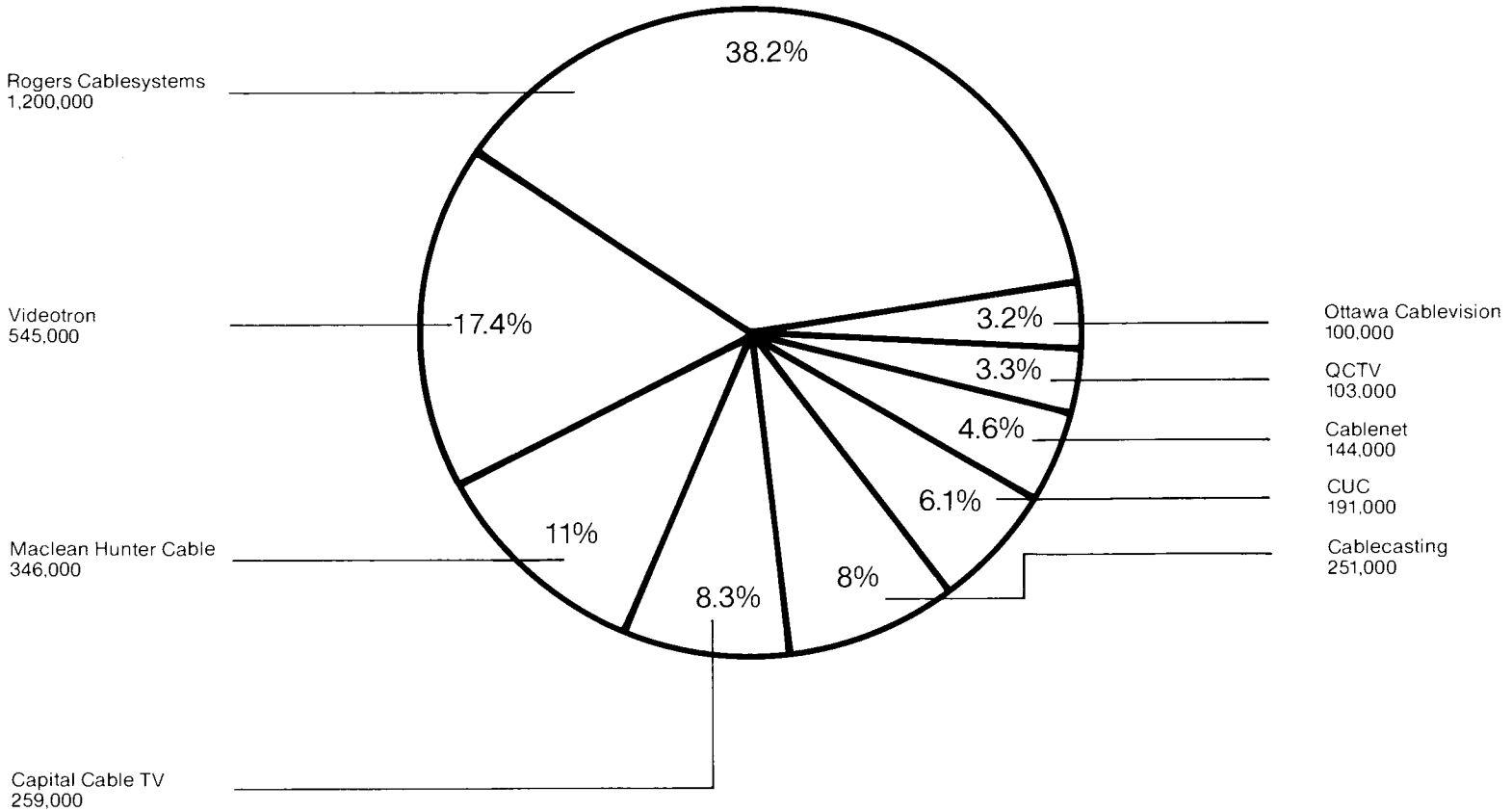
[4] CTRI, Cable Pay-TV Systems Planning, 1982.

[5] Statistics Canada, Telephone Statistics, 1981.

Figure 4

TOTAL CANADIAN SUBSCRIBERS OF
CANADIAN MULTIPLE SYSTEM OPERATORS (MSOs): 3,139,000



Note: Figures include subscribers in cable systems in which MSOs have a minority interest.

Source: Cable Communications Magazine, November 11, 1982.

With the CRTC authorization of pay-TV in 1982, the Canadian cable industry entered a transition phase that should enable it to break from its recent past as a stable, but slow-growing industry. The prospective licensing of tiered satellite-delivered video services should further stimulate its development. This new television services trend would appear to be reinforced by the recent federal broadcasting strategy, which places a greater reliance on cable as a delivery system for broadcast and non-broadcast services.

In the United States, deregulation and extravagant promises by franchise applicants are leading to the installation of modern two-way cable systems. These investments will force operators to establish new services in order to obtain the highest possible revenue per subscriber from their investment. Figure 5 shows projected revenue increases from $US 200/subscriber in 1982 to over $US 500/subscriber annually by 1990. In new franchise applications revenue expectations are even higher -- some are based on more than $400/subscriber by 1985 and over $600/subscriber in 1990.

Regulatory authorization of new services in Canada will motivate cable operators to make similar investments in upgrading their cable plant. As new services are proved to be commercially viable in the United States, there will be pressure to market them in Canada. With a greater potential return per subscriber, cable service will be extended to areas where sparse population formerly prevented it from being economically viable. The advent of pay-TV is already having this effect on the plans of some cable operators.

This projected growth in new services and the extension of cable services to remote areas in Canada will lead to a heightened demand by cable operators for these new services and equipment. Thus, Canadian suppliers will again have a potentially strong domestic market throughout the 1980s, particularly in the area of new services.

Two examples will illustrate the product/system/service development activity being undertaken by competitive Canadian suppliers. Ottawa-based NABU is producing a complete system, including personal computer, cable adapter, headend computer and a games/software/information service package (see Figure 6). Videoway, a Montreal-based company that is exploiting Videotron-developed technology, has developed an integrated video communications system for cable with a universal interface as the subscriber terminal (see Figure 7).

A thriving domestic market and access to the American demand for products and services will provide a solid foundation for Canadian firms to become internationally involved in the development of cable systems. As Figure 8 shows, the non-North American market will probably enjoy the greatest overall growth in subscribers, since the number of cable subscribers in other countries will surpass the North American figure sometime in the mid- to late 1980s.

Figure 5

PROJECTED REVENUE/U.S. CABLE SUBSCRIBER
(Actual Dollars)

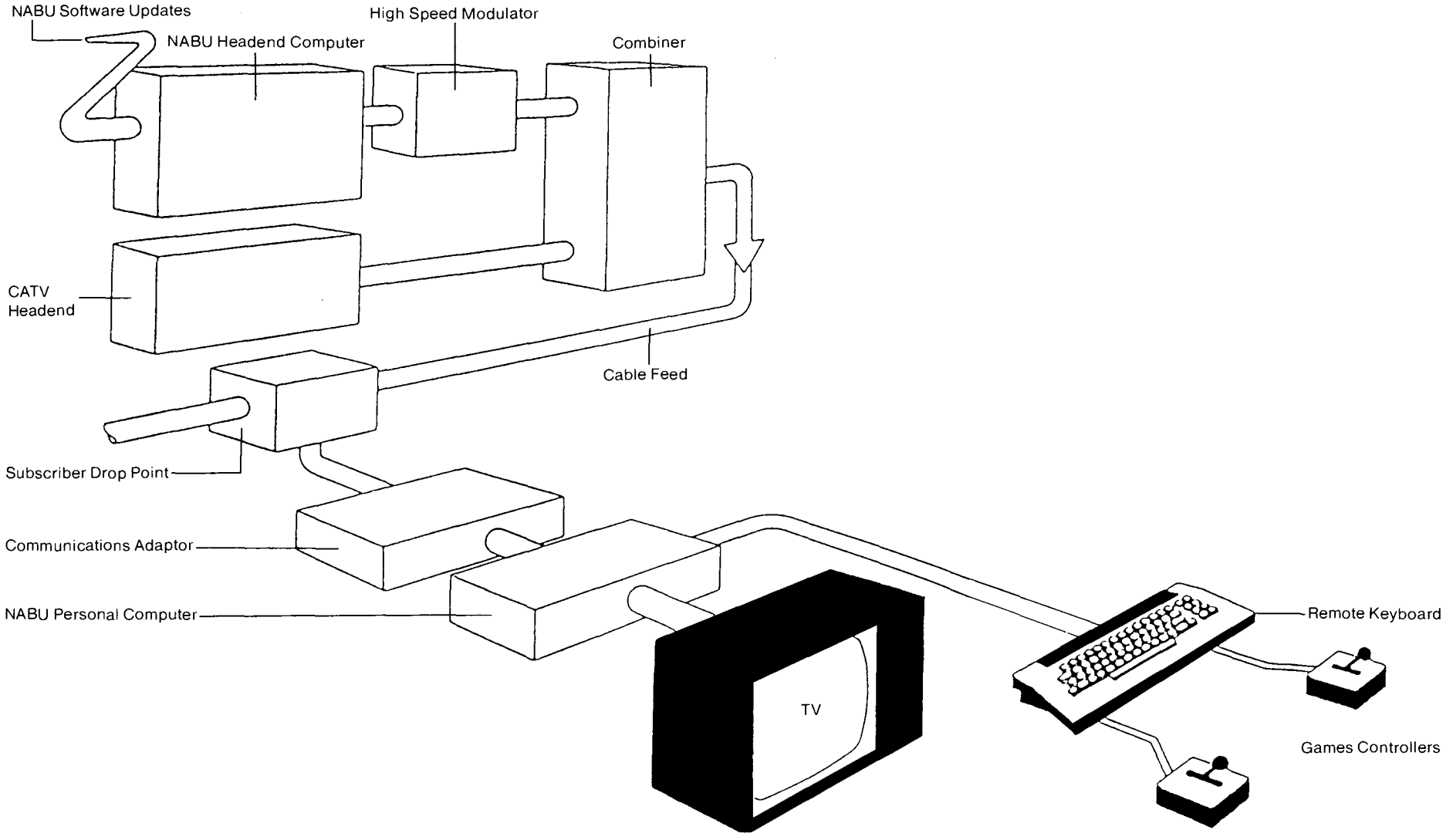
Year	Basic	Pay tiers	Other*	Total
1975	$75/sub.	-	-	$75
1982	$108	$96 (one tier at $8/mo.)	-	$200
1990	$144	$288 (two tiers at $12/mo.)	$85	$517

* Other includes advertising supported services, security and pay-per-view.

Source: Projections derived from discussions with a major Canadian MSO, and Nordicity Group estimates.

Figure 6

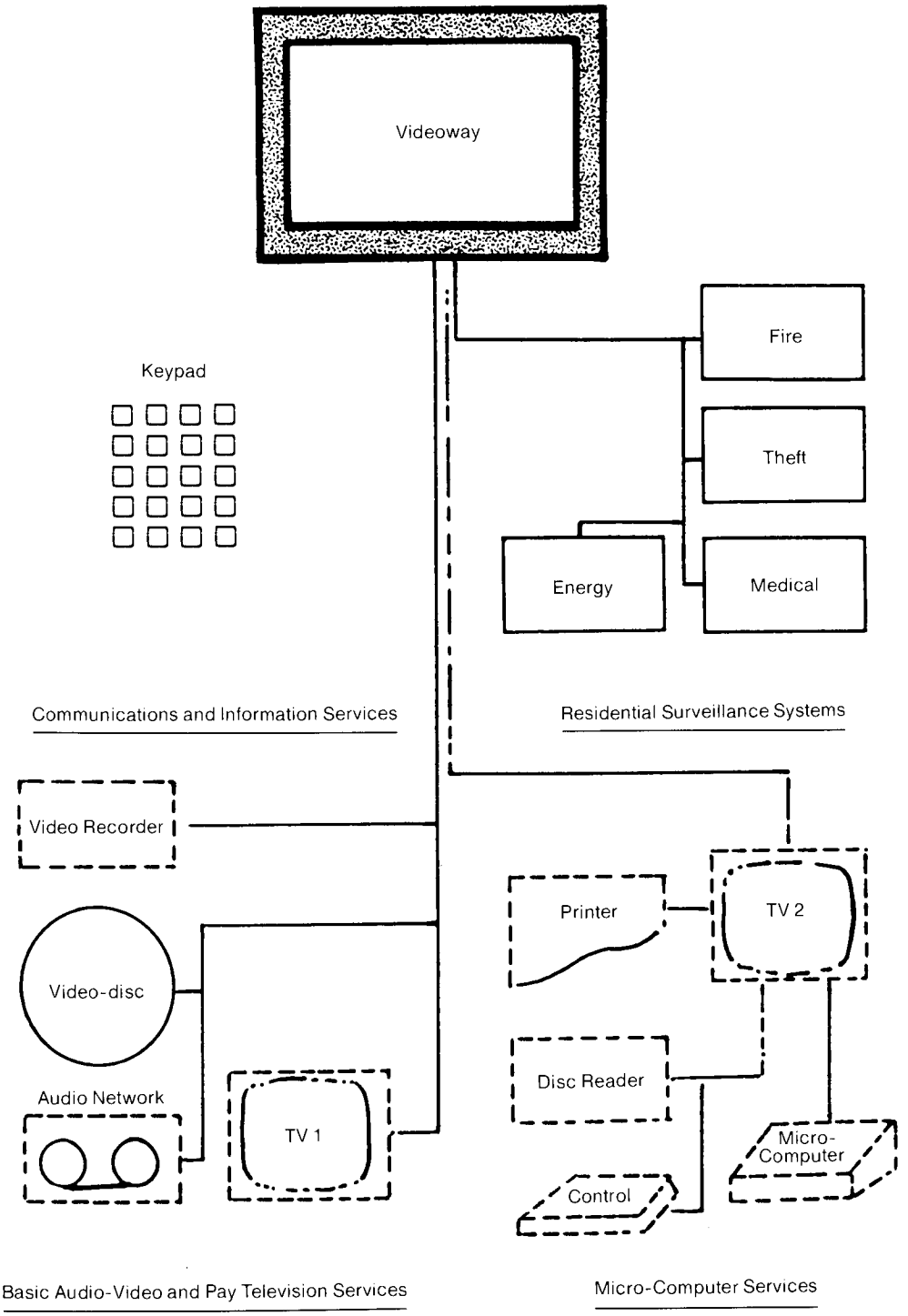
THE NABU NETWORK



Source: NABU.

Figure 7

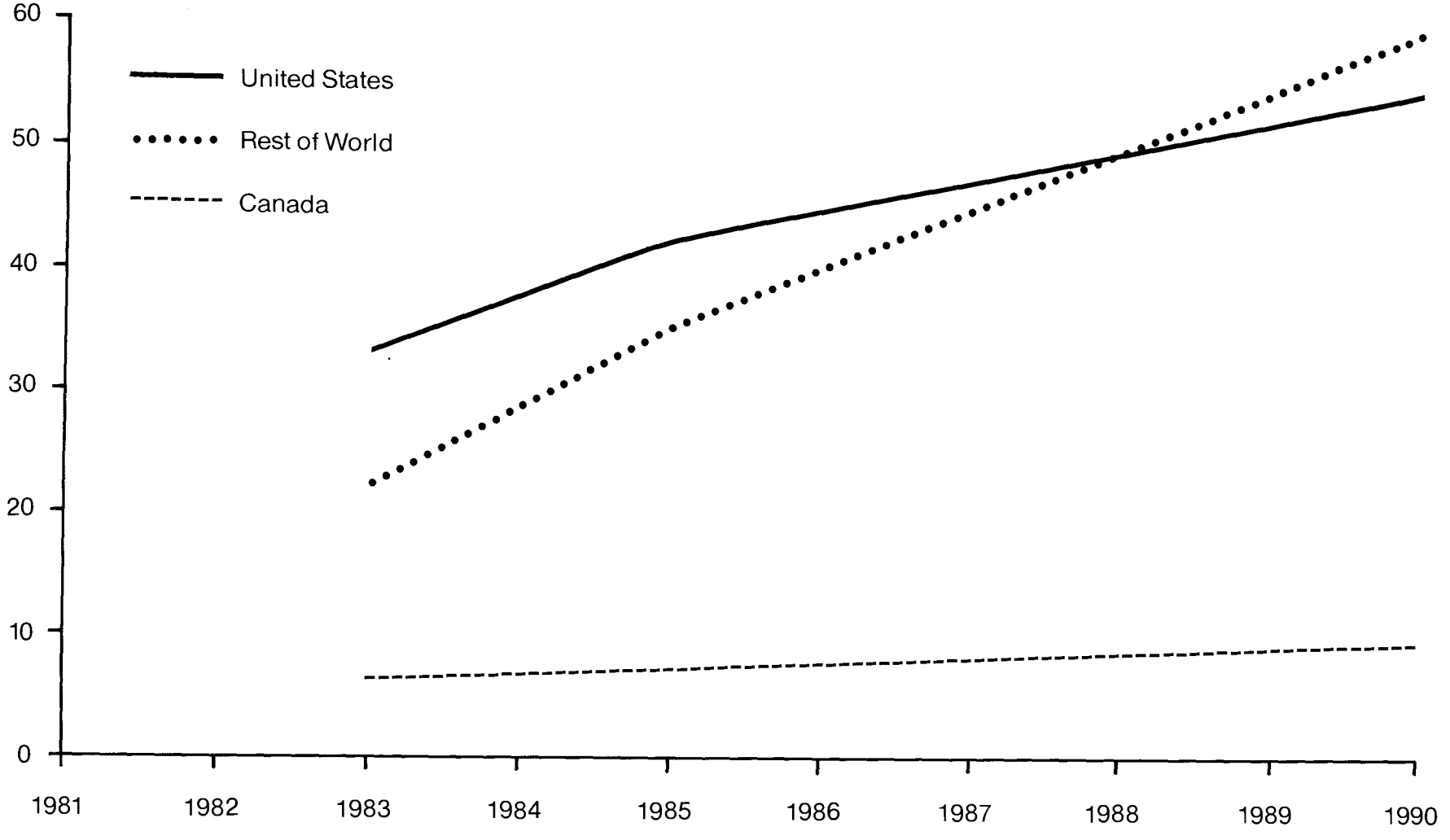
THE VIDEOWAY SYSTEM



Source: Le Groupe Vidéotron, Annual Report, 1982.

Figure 8

CABLE TELEVISION SUBSCRIBER POTENTIAL CANADA,
UNITED STATES AND REST OF WORLD



Sources: Kalba Bowen Associates, International Opportunities in Cable and Pay TV: Proposal, March 1982; and Nordicity Group Projections.

2.4 HISTORIC DEMAND FOR CATV EQUIPMENT AND SERVICES

Precise estimates of historic demand for CATV equipment and services are not readily available. However, estimates can be derived from Statistics Canada data based on assumptions obtained in industry discussions. Table 1 shows an estimated annual demand for CATV equipment and services of $114 million in 1981. This figure is generally in line with industry views.

As Statistics Canada is the only possible source of such data short of a full-scale survey, the estimates in Table 1 are conservative and reasonable measures of equipment demand broken down for key product categories.

These estimates do not include subscriber-purchased converters or money spent on support services. For 1981, wholesale converter sales are estimated at $10-15 million based on 250-300,000 units shipped at an average wholesale price of $40-50/unit. It is assumed that the majority of converters were purchased at retail outlets. No statistically reliable source exists for services; it would have to be estimated at several million dollars annually for administrative support systems, systems design, and maintenance. Thus, the overall total for the CATV equipment market probably reached $120-130 million immediately prior to the introduction of pay-TV.

2.5 FUTURE DIRECTIONS AND IMPACTS ON SUPPLIERS

The cable supply industry's development from 1981 to 1983 was affected by the delay of the introduction of pay-TV to 1983. Because of this, many large cable systems have adopted fairly sophisticated security methods, such as addressable descrambling systems. Jerrold and Zenith have dominated in the first wave of equipment decisions. With strong commercial interest in foiling pirates[6] and adding new services, many non-adressable security systems may soon be upgraded. Overall, the demand for new equipment will be paced by subscriber buildup in basic services, new television services and non-programming services (Table 2). Cable revenues resulting from basic and new services are estimated in Table 3 and graphically depicted in Figure 9.

Although the economic viability and market acceptance of many non-programming services have not yet been proven, it is clear that as the annual revenue per subscriber rises from the current $100 range to $300 in 1990, a strong demand for cable equipment and services will be generated.

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[6] Pirates are persons or households who illegally receive (pirate) a pay-television signal, without paying for the pay-television service.

Table 1

HISTORIC DEMAND FOR CATV EQUIPMENT

	1981	1980	1979
		(000,000)	
Net annual increase fixed assets	147.8	104.3	98.9
Less wages capitalized	14.1	11.4	10.9
Net expenditures on fixed assets excluding labor	133.7	92.9	88.0
Expenditures by major product group*			
Headend	6.7	11.5	2.0
Distribution	67.7	40.3	47.3
Costs of subs drops & devices	33.3	22.0	22.7
Test equipment & tools	2.5	1.8	1.0
Cablecasting equipment	3.8	5.8	5.2
Total CATV Equipment	114.0	81.4	78.2
Remaining equipment & property	19.7	11.5	9.8
Total	133.7	92.9	88.0

* Estimate based on proportional allocation of net expenditures on fixed assets (excluding labor) according to year-to-year differences of historical cost breakdowns.

Source: Statistics Canada, Cable Television, 1981.

Table 2

SUBSCRIBER PROJECTIONS

	Current (Mid-1983)	1985	1990
		(000)	
Basic Services			
Basic cable subs.	5,345	5,800	6,900
20 plus channel subs.	3,200	3,900	5,200
Subs with converters	2,100	2,400	4,400
New Television Services			
Pay-TV households	400	1,800	2,760
Addressable scrambling systems	124 (41%)	900 (50%)	1,820 (65%)
Non addressable scrambling systems	266 (59%)	900 (50%)	980 (35%)
Tiered service and pay-per-view households	-	675 (75% of addressable)	1,638 (90% of addressable)
Non-programming Services			
PC software/games (one-way)	-	75	750
Teletext (one-way)	-	25	1,000
Security/telemetry (two-way)	5	19 (7.5% of two-way)	75 (7.5% of two-way)
Interactive/transactional (two-way)	-	67 (7.5% of addressable)	273 (15% of addressable)
Institutional Services	minimal	some applications	some market penetration of data/video networks in in major urban areas

Source: Estimates prepared by Nordicity Group Ltd. for this study.

Table 3

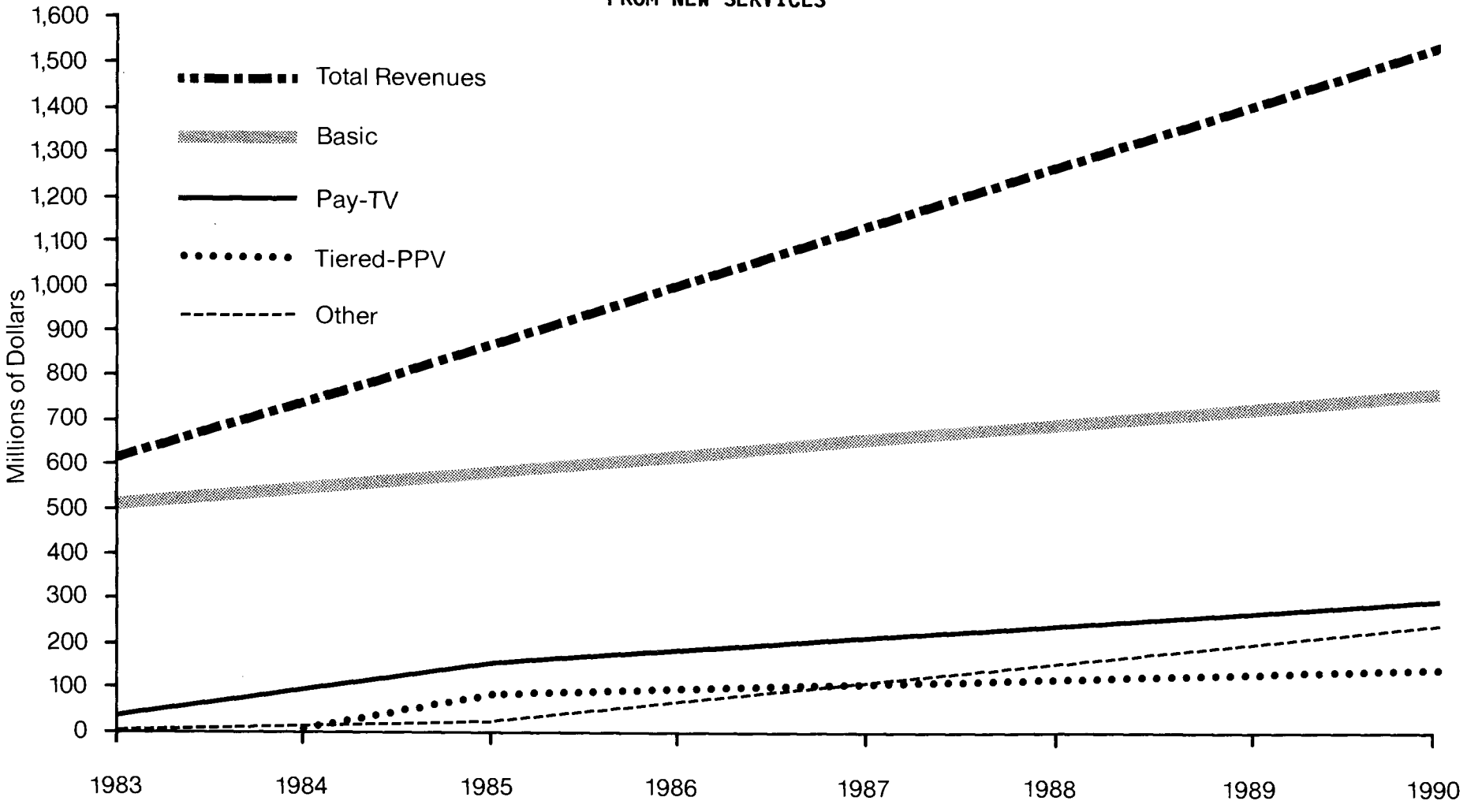
PROJECTED CABLE REVENUES

	Current (May 83)		1985		1990	
	Gross Revenues	Revenues to CATV Operators	Gross Revenues	Revenues to CATV Operators	Gross Revenues	Revenues to CATV Operators
	($000,000)					
Basic subs @ $8.00/mo. current, $8.90 in 1985, and $9.75 in 1990	513.1	513.1	619.4	619.4	807.3	807.3
Pay-TV @ $15.95/mo. retail and $9/mo. wholesale, assuming 10% multipay	84.2	35.0	379.0	157.7	581.1	240.0
Tiered services/PPV $5 for tier 90% to CATV and $10 for PPV 50% to CATV	-	-	121.5	77.0	294.8	186.7
PC's/games @ $18/sub./mo. retail and $9/mo. wholesale	-	-	16.2	8.1	162.0	81.0
Teletext @ $10/mo. retail and $5/mo. wholesale	-	-	3.0	1.5	120.0	60.0
Security/Telemetry @ 18/mo. retail, all returned to CATV	1.1	1.1	4.1	4.1	59.0	59.0
Interactive/Transactional @ $15/mo. retail and $10/mo. wholesale	-	-	12.1	8.0	48.6	32.4
Institutional services	-	-	2.0	2.0	50.0	50.0
Total Revenues	598.4	549.2	1,157.3	887.4	2,122.4	1,516.4
Revenue/sub./annum	112.0		199.4		307.7	
Revenue/sub./mo.	9.3		16.6		25.6	

Source: Nordicity Group projections.

Figure 9

PROJECTED CABLE OPERATOR REVENUES FROM NEW SERVICES



Note: Other services include personal computers, games, teletext and videotex, security and telemetry, and interactive and transactional services.

Source: Nordicity Group Projections.

For cable industry suppliers, long-term projections for individual services are not meaningful until some of the following questions are addressed.

- When will the new services be introduced and how fast will they grow?
- What will the equipment/service orders be? System-unique or standardized items? Dedicated or universal home devices?
- Does the new service require a system-wide introduction or can it be modular as subscribers grow?
- Who will be the end user for the new equipment needs - the cable operator or the subscriber?

Suppliers and cable operators must work closely to determine how best to answer these questions.

3. CATV SUPPLIERS: CORPORATE, PRODUCT AND MARKET STRUCTURE

This section provides an overview of the cable supplier industry. After a brief summary of the industry's development,[7] the major product lines, markets, and types of companies are discussed.

3.1 SUPPLIER DEVELOPMENT

The Canadian supplier industry has grown in parallel with the development of CATV in Canada. The first companies were really individuals operating out of garages, helping to install first community antennas (CATV) and then master antenna equipment (MATV). In some cases cable supplier companies and cable operators began as direct offshoots of each other. Essentially, the cable industry has historically been self-supporting, with domestic suppliers providing most of the operator's needs and some items coming from the United States. Indeed, with the initial lead in CATV in Canada in the early 1950s, many of these suppliers began exporting their products and services to the United Sates for its fledgling cable industry.

Despite the strong early linkages between operators and suppliers, there developed little long-lasting vertical integration. There are some exceptions to this general observation, such as Lindsay Specialty Products and Lindsay Cable; Tocom Canada and Selkirk; Cableshare, Cablesystems Engineering and Rogers; CUC and Microcom, Videotron and Videoway.

Although vertical integration is the exception, one key to supplier company success is a strong technical background in cable operations. Some of the larger supplier companies have ongoing contact with the engineering departments of major MSOs. Other successful suppliers are staffed by ex-cable operator engineers and technicians. Since the development of a cable system is a continual engineering design and improvement process, such a close relationship between supplier and operator can be important for success.

3.2 MAJOR PRODUCT LINES

As noted earlier, Statistics Canada breaks down product lines into distribution, headend, subscriber drops and terminal devices and testing equipment. These are fairly broad distinctions. For the purpose of this study, products were considered under the following groupings:

- towers and antennas
- satellite earth stations
- microwave systems and equipment
- headend equipment - amplifiers, channel processors, demodulators, signal monitoring systems, transformers, etc.

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[7] For a more complete historical treatment of the CATV industry in Canada, see K.J. Easton, Thirty Years in Cable TV: Reminiscences of a Pioneer (Mississauga: 1980).

- coaxial cable, fibre optics
- cable hardware - adaptors, connectors, pedestals, ties and harnessing, etc.
- cable installation tools and equipment
- amplifiers and power supplies
- passive devices
- converters
- information and surveillance systems
- test and monitoring equipment
- computer systems/services
- program origination equipment
- pay-TV security equipment
- pay-TV networks/programming services
- services - engineering and management consulting

These product lines cover the complete range of equipment for the CATV industry. Many of these products overlap into the telecommunications, broadcasting and electronics industries. There is a standard replacement market for many of these items. In many cases, however, replacements will be made by improved products, and in some cases by quite revolutionary new products. Thus, both cable operators and suppliers are highly active in product design in each of these areas.

3.3 SUPPLIER MARKETS

Markets for CATV suppliers can be defined by considering key market segments, other delivery system markets, geographic distribution of markets and estimates of CATV sales.

3.3.1 Market Segments

The key market segments can be roughly divided into four categories:

- procurements by major MSOs, which can provide a sufficient market for the supplier to undertake development of a new product or service;

- small MSOs and medium-sized single systems, which generally follow the leading equipment purchasers and order off-the-shelf equipment and services;

- smaller cable operators whose requirements may differ in some cases, so that products have to be downscaled to meet their modest demand;

- direct sales to subscribers, traditionally for converters, and in the future for other types of terminal devices.

Equipment manufacturers and cable services suppliers use a variety of arrangements to reach their end markets. There are some important Canadian and foreign distributors, as well as networks of manufacturers' representatives. Some suppliers handle the product lines of other manufacturers as

well as their own. Occasionally, joint venture efforts are used to market complementary products and services. Trade shows in Canada (CABLEXPO) and the United States (NCTA Convention) form important contact points for suppliers and cable operators.

In short, these arrangements are fairly typical of industrial marketing, although direct consumer marketing and distribution will be increasingly important for terminal devices.

3.3.2 Other Delivery System Markets

Besides the distinction between foreign and domestic markets, it should be recognized that CATV is but one delivery technology among several, and that suppliers often serve such multiple markets as the following:

- broadcasters (and satellite service providers), who also require studio facilities, earth stations, microwave facilities and, mainly in the future, security systems;
- MATV owners, who require earth stations, subscriber devices and scrambling systems;
- the emerging direct-to-home DBS market, which requires TVROs and descramblers for subscribers;
- alternative television delivery systems like Canadian Satellite Communications Inc. (Cancom)[8] and MDS (not yet authorized in Canada), which parallel CATV needs in security systems, earth stations and microwave facilities;

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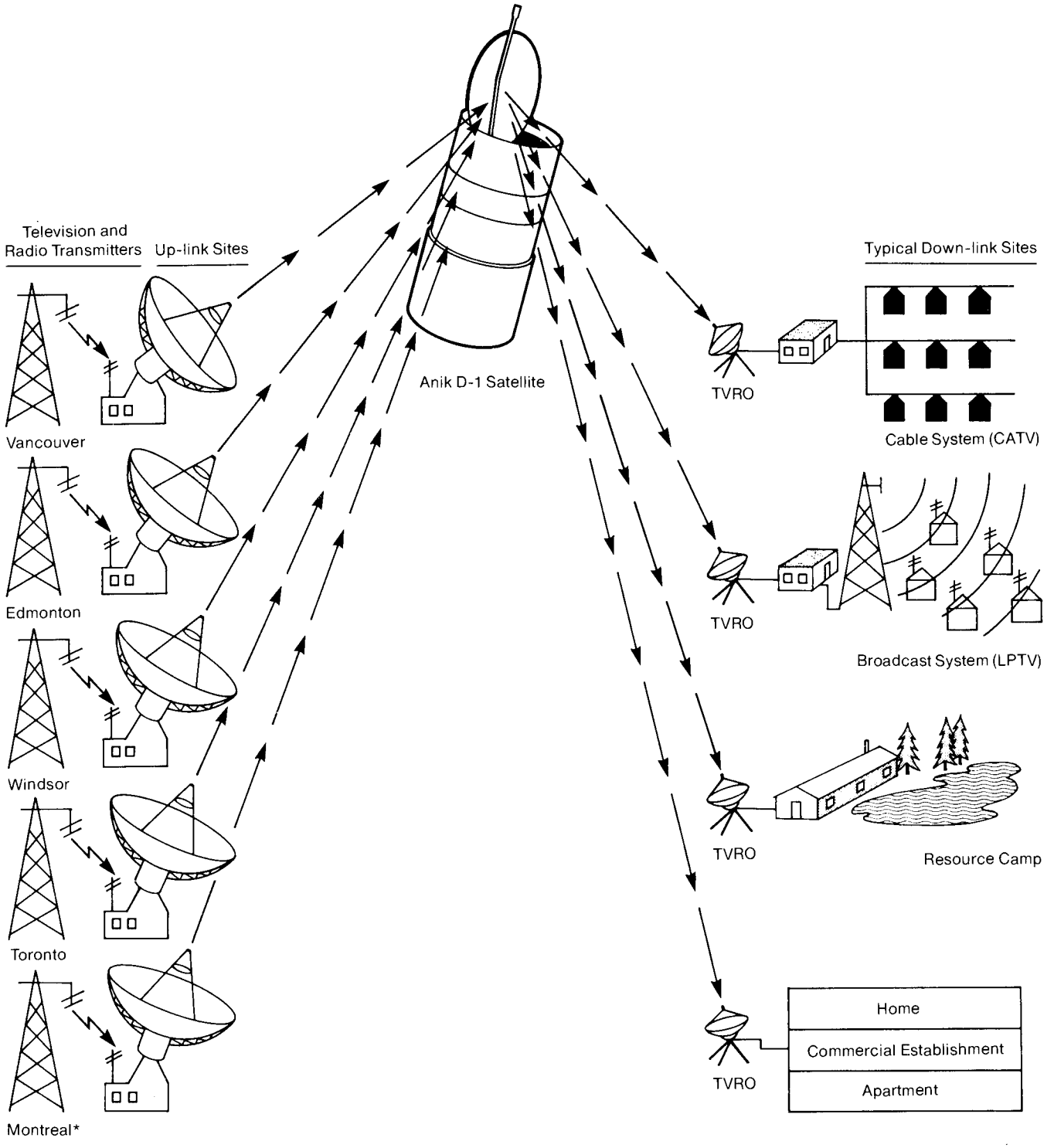
[8] Essentially, Cancom is a CRTC-licensed wholesaler of four satellite-delivered television stations -- BCTV (a CTV affiliate in British Columbia), CITV (Edmonton) and CHCH (Hamilton); two independent broadcasters; a French-language service (Telemedia); and ten AM/FM radio services (two native, six English, two French) to local cable and rebroadcasting entrepreneurs in small, rural and remote communities that are currently underserved in television. These local affiliates of Cancom in turn pay Cancom $4 per month per viewer hooked up to the service and charge an average of $17.50 per month for each subscriber. Cancom is seeking to enrich its package by adding Atlantic, Manitoba and Saskatchewan stations, similar to the way in which cable adds new channels for its subscribers. With such stations as part of the package, viewers in those areas would have their own regional television channel, which should increase Cancom's market appeal to those areas. Cancom has also been permitted to distribute at least one Canadian pay-TV service as well as "3+1" U.S. border stations (affiliates of the three major networks - ABC, NBC and CBS - and an affiliate of the PBS network).

Figure 10

CANCOM SPACE AND TERRESTRIAL DISTRIBUTION SYSTEM



* From its satellite operations control centre situated near Montreal, Cancom sends a data stream via Anik D1 to its other up-link sites, which allows the TV signals to be scrambled and also enables Cancom to instantly authorize or deny one or all of the signals distributed by Cancom to any Affiliate.

Source: Cancom preliminary prospectus, October 20, 1983.

- telecommunication, which includes terminals, headend and switching equipment that may overlap cable as non-broadcasting areas (and as telephone companies move toward non-voice consumer services);

- the standalone retail market for VCRs, videogames, personal computers etc, which can be hooked into the cable system through interface devices.

While some cable industry suppliers focus almost entirely on the CATV market, others treat it as a minor supplementary market, concentrating instead on one or more of the above markets. The cable industry demand is part of a broader communications marketplace for suppliers.

3.3.3 Geographic Distribution of Markets

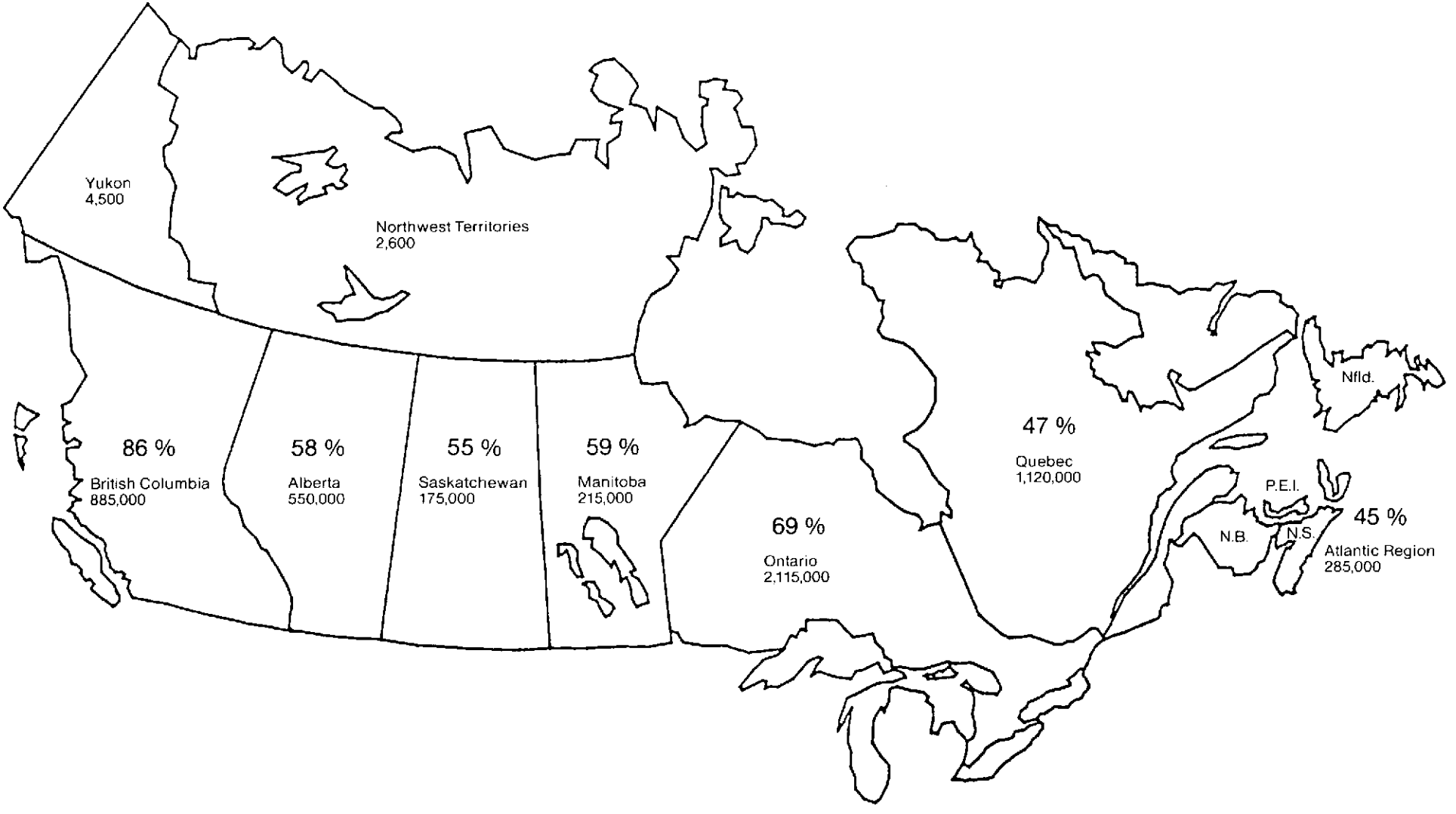
There are both domestic and export markets for Canadian CATV suppliers. Figure 11 shows the number of cable subscribers by province and cable penetration as a proportion of television households. Key areas include Vancouver, Victoria, Calgary, Edmonton, Saskatoon, Regina, Winnipeg, Southern Ontario, Ottawa, Montreal, Quebec City, Saint John and Halifax. The United States provides the major export market for Canadian supply companies. International opportunities will be discussed in more detail in section 10.3.

3.3.4 Estimates of CATV Sales/Industry Structure

The level and characteristics of CATV sales can aid in the definition of the industry structure. Since cable suppliers have not been singled out for special attention by Statistics Canada, systematically collected industry-wide data is not readily available and estimates are complicated by the multiple markets for suppliers, including foreign sales. For the purposes of this report, a rough estimate of the 1982/83 market size and its distribution has been compiled from confidential data obtained from suppliers (Table 4).

Figure 11

CABLE SUBSCRIBERS BY PROVINCE AND CABLE PENETRATION AS A PERCENTAGE OF TV HOUSEHOLDS



Source: Matthews CATV, February 1983.

Table 4

TOTAL DOMESTIC MARKET 1982/83

	Sales ($000,000)	% Distribution
Suppliers		
Canadian-owned producers	40-50	36
Foreign-owned producers	25-35	23
Imports	45-55	41
Total	110-140	100
Product line		
Headend	5-10	5
Distribution plant	50-60	45
Drops and customer devices	30-35	27
Devices	20-25	18
Other	5-10	5
	110-140	100

Canadian content of the domestic production is probably about 50-60 per cent. Exports by manufacturers based in Canada are approximately $50-60 million.

3.4 TYPES OF COMPANIES

There are over 200 companies listed in the Cable Communications Magazine directory issue of April 1983, although only about 50 or 60 are trade members of the CCTA. The annual national cable convention draws about 50 companies seeking to establish direct contacts with cable operators.

We have reviewed four major types of cable supply companies: manufacturers, distributors (some companies carry on both functions), new service and support service companies. There are also groups whose main activities focus on research and development.

3.4.1 Manufacturing Companies

The category of manufacturing companies includes all those manufacturing and/or assembling products in Canada. These firms are concentrated primarily in the Toronto area and secondarily in Vancouver, Montreal, Ottawa and Saskatoon. Table 5 summarizes their numbers and sales levels.

Table 5

DOMESTIC PRODUCERS
($000,000)

CATV Sales (1982) ($000,000)	Number of Companies
Greater than 20	2
From 11 to 20	1
From 5 to 20	7
From 1 to 5	16 plus

Table 6 shows the major product areas of Canadian manufacturers. Examination of the matrix allows for further categorization of these companies into traditional manufacturers -- involved in product lines such as signal reception equipment, headend, distribution, drops and subscriber devices including converters; and new services -- manufacturers, working in scrambling/descrambling technology, computer services, two-way information, network computers and other future services.

The traditional companies exhibit some mature market characteristics; four companies show integration in their product lines. These companies include - Jerrold, Lindsay Specialty Products, Delta Benco Cascade Ltd. and Triple Crown Electronics - a fully integrated product line is important for companies interested in playing a strong role in export markets.

The other traditional manufacturers specialize in one or two product areas:

- Microcom - passives, converters
- Canada Wire - coaxial cable
- Sachs - cable hardware
- Alpha - power supplies
- Wind Turbine - towers and antenna, microwave

Table 6

MANUFACTURERS AND MAJOR PRODUCT LINES

	Towers & antenna	Satellite earth stations	Microwave syst. & equip.	Headend equipment	Coaxial cable/fibre opt.	Cable hardware	Amplifiers, power supp.	Passive devices	Converters, descramb.	Info. & surv. syst.	Test & monitoring equipment	Comp. syst. & service	Program orig. equip.	Pay-TV networks services
INTEGRATED TRADITIONAL														
Jerrold		x		x			x	x	x	x				x
Lindsay	x			x			x	x	x					
Triple Crown		x					x							
Delta Benco				x			x		x					
SPECIALIST TRADITIONAL - CANADIAN														
SED Systems		x												
Microcom								x	x					
Canada Wire					x									
LeBlanc & Royle	x													
Abroyd	x													
Sachs Can.						x								
Wind Turbine	x		x											
Alpha Tech							x							
Leitch Video									x		x		x	
Electroline								x	x					
Teledac													x	
Viewstar									x					
Central Dyn.													x	
Stirling						x								
Source Communications				x			x							
Solutec			x										x	
SPECIALIST TRADITIONAL - FOREIGN OWNED														
Zenith									x					
Sci. Atlanta									x					
Andrew Antenna		x												
Amphenol				x										
NEW SERVICES														
NABU												x		x
Videoway									x	x				x
Electrohome			x							x		x		
Intl. Phasor			x											
Cableshare										x		x		
Norpak												x		
Gandalf										x				
Linear Tech.												x		

Source: Cable Communications Magazine, (April 1983).

The majority of these firms are Canadian-owned, although foreign-owned companies with manufacturing operations in Canada include Jerrold, Delta Benco, Zenith, Scientific Atlanta, Andrew Antenna and Amphenol. The manufacturing companies are discussed individually in sections 4 and 5.

3.4.2 Distribution Companies

These companies provide many domestic and foreign traditional manufacturers with an essential market link to the numerous medium- and small-sized cable operators throughout Canada. Distributors, with representation in most cities, are more evenly distributed throughout the country than are manufacturers.

Table 7 shows the significant distributors with outlets in Canada and their major product lines. Analysis of the matrix indicates that distributors are motivated to carry a full line of traditional products. The distributors with the highest revenues (in the $15 million range) are R.F. Communications and Anixter-Microsat, which carry the broadest selection of cable supply products. Distributors can be grouped into traditional Canadian, traditional foreign, and electronics - consumer and studio. The distribution companies operating in Canada are profiled in section 6.

3.4.3 New Service Companies

Firms in this category include those producing the scramble/descramble equipment for pay-TV, such as Jerrold, Zenith and Microcom. As well, there is a group of Canadian companies poised to play significant roles in the supply of equipment and software for future cable-related developments, such as institutional networks, computer services, two-way information, network computers and pay-per-view billing. Some of these companies, such as NABU, Videoway and Cableshare were established to serve the cable industry. Another group, including Gandalf, Linear Technology and Norpak, could apply expertise gained in other fields to the opportunities presented by the future cable services.

3.4.4 Support Service Companies

These firms, some which are described in section 8, provide engineering and management consulting services to the entire cable industry.

3.4.5 Research and Development (R&D) Activities

R&D is obviously crucial to the future of the supplier industry: some cable operators with large engineering teams play a key role in product development and improvement, and several suppliers of services and products also have R&D units - with emphasis on the development. Although the percentage of revenues spent on R&D by cable operators is relatively low (about 1.5 per cent of revenues) because of the nature of their operations, the R&D efforts of key manufacturers can be several times that amount.

Table 7

DISTRIBUTORS AND MAJOR PRODUCT LINES

	Towers & antenna	Satellite earth stations	Microwave systems & equip.	Headend equipment	Coaxial cable/fibre optics	Cable hardware	Cable install./tools & equipment	Amplifiers, power supplies	Passive devices	Converters, including pay-TV/ security equipment	Information & surveillance	Test & monitoring equipment	Consumer products & program origination equip.
Petro Comm							x	x	x				x
Allan Crawford												x	
Incospec	x	x		x					x			x	
R.F. Communications		x		x	x	x	x	x	x	x		x	
Source Communications		x		x	x	x			x			x	
Sigmacom	x	x		x					x				
Channel One Video	x	x		x				x					
Crowder Communications	x	x						x					
Deskin Sales		x		x		x		x	x				
White Radio			x			x					x	x	
Anixter-Microsat		x		x	x	x	x	x	x			x	
Texscan		x		x				x	x				
Philips Electronics										x			
Sony													x
Hitachi Denshi													x
Panasonic Canada													x
Tocom Canada													x

Source: Cable Communications Magazine, (April 1983).

Table 8

R&D EFFORT OF SELECTED CATV SUPPLIERS

Company	Number of Employees in R&D	Total Company Staff	R&D Employees as a Percentage of Total Staff
General Instrument	21	350	6
Lindsay Specialty	30	500	6
Triple Crown Electronics	12	120	10
Delta Benco	15	145	10
Microcom	10	80	13
Andrew Antenna	25	200	13

Table 8 lists the R&D efforts by number of employees of manufacturing companies operating in Canada, that are involved in R&D activities.

The establishment in 1979 of the Cable Telecommunications Research Institute (CTRI) in Ottawa has been an important step toward an orderly technology transfer process for the industry as a whole. As a non-profit research and development organization, CTRI's main objectives are to evaluate and plan new service opportunities for the Canadian cable television industry and to ensure that products are available to support service introduction. CTRI does some in-house R&D, primarily to demonstrate concepts and engineering feasibility at the level of prototype development. It also instigates R&D projects within the industry and provides a forum for technical exchanges and more organized priority-setting for the introduction of new technology. The annual budget for the CTRI is about $1.5 million.

Some universities have made interesting and important R&D contributions to the cable industry. The University of Saskatchewan, for example, helped spawn SED Systems; in Quebec several universities assisted with the development of Videotron's Videoway. Another example in Quebec is the Centre de Recherche Industrielle du Quebec (CRIQ), an industrial research centre associated with the University of Montreal's Ecole Polytechnique. The centre's research in descrambler technology and encryption (video and voice) has led to important product developments by Electroline.

Finally, Bell Northern Research (BNR), the giant joint venture research company of Bell Canada and Northern Telecom, has carried out work in areas where there will be crossovers in the technologies of cable firms and telecommunications firms. These include fibre optics, local-area networks, and the Bell/BNR Data Collection and Billing System (or "black box") proposed early in 1980. These items make up a very small part of BNR's activities, on which more than $300 million was spent in 1982.

4. INTEGRATED TRADITIONAL MANUFACTURERS

4.1 COMPANIES

4.1.1 Delta Benco Cascade Ltd.

Delta Benco of Rexdale, Ontario was formed in 1972 from three separate long-standing Canadian cable supplier companies; a public company, its majority shareholder is Rediffusion Ltd. of Great Britain. The company has three main product ranges. The first includes trunk amplifiers, line extenders, apartment amplifiers and other state-of-the-art active electronic products for the CATV industry. Secondly, there are low-power TV transmitters and translators covering VHF and UHF bands (of which Delta Benco is Canada's largest manufacturer). The "professional" range is utilized by Canada's major broadcast undertakings and the "economy" range is used extensively for rebroadcast of TV signals in remote areas of Canada (e.g. Cancom). Finally, there is the addressable range of products, which includes the remote-controlled "intelligent wallplates" for satellite master antenna (SMATV), hotel and hospital application and the recently introduced hotel pay-TV system. Complete R&D support is provided for the company's full product range, to ensure that the products remain at the leading edge of technological change. In addition, the company offers system design, engineering services and product seminars.

Sales in 1982 were $6.3 million, with 60 per cent of the products exported to the United States. The company's American subsidiary, Delta Benco-Cascade Inc., is headquartered in Texas; and there are sales offices in Alabama and Pennsylvania and distributors in California, Ohio and Atlanta. In central Canada the company sells its products directly. Sales arrangements in the west are handled through Channel One Video Corporation in Vancouver and in the east, through Page & Associates of Nova Scotia. The company employs 145 people, 15 people are committed to R&D activities and about 90 are involved in CATV activities.

4.1.2 General Instrument, Jerrold Division

The Jerrold Division of General Instrument of Canada Ltd., located in Toronto, is a subsidiary of General Instrument of New York and was established in 1961. Jerrold's product line covers the complete range of cable equipment: cordless and corded CATV converters, addressable and nonaddressable pay-TV systems, distribution amplifiers and passives, headend equipment, power supplies, connectors, taps, splitters and sealed engineering and systems design services. The company distributes its own products through Toronto and other sales offices.

The company estimates its share of the converter market at more than 50 per cent, resulting from Jerrold's lead position in the development of a microcomputer-based converter. In Jerrold's assessment, continued growth in the converter market can be expected over the next 5 years although at a reduced rate compared to the previous five years. Therefore, Jerrold is projecting a levelling in converter sales for the years ahead.

Jerrold has emerged as the industry leader in pay-TV security devices used in the United States (addressable add-ons and integrated converters/ descramblers). The firm has captured a major component of the first wave of Canadian pay-TV home terminals as well, particularly the programmable (non-addressable) add-ons. Jerrold Canada anticipates increased business in the traditional CATV distribution and headend segments brought about by the move to provide multi-tiered services in Canada. The Jerrold X series of distribution amplifiers employs conventional, redundant and feed-forward technologies.

General Instrument is looking to its Satellite Systems Division (SSD) for future growth. The Canadian division has a world product mandate and will develop hardware for the U.S. Communications (USC) DBS system in the United States and Northstar's DBS system in Canada. Although manufacturing will be distributed worldwide throughout General Instrument's plants, SSD is building a critical mass of Canadian technical skills that are expected eventually to overtake Jerrold Canada in size. In support of the activity, SSD has arranged a technology transfer agreement with SED Systems Inc. which should exploit that company's design advantages in TVRO manufacturing. As well, $10 million in development funding has been committed by the General Instrument parent organization.

4.1.3 Lindsay Specialty Products Ltd.

This Lindsay, Ontario private company was incorporated in 1953 and is 100 per cent Canadian-owned. It currently produces a variety of CATV products, including antennas, pre-amplifiers, band pass filters, in-line splitters, 500 MHz directional couplers, subscriber taps, trunk and distribution amplifiers, apartment amplifiers, indoor passives, VHF to UHF converters, JET 1 cordless CATV converters and TVRO packages.

Lindsay's sales are approximately 70 per cent Canadian and 30 per cent American. A successful export to China was recently undertaken. In Canada, Lindsay distributes through Incospec Electronics Inc. of Montreal and Mid-Sted Agencies Ltd. of Vancouver.

When operating at full capacity Lindsay employs 500 people, 30 of whom are involved in on-going R&D and engineering activities.

4.1.4 Triple Crown Electronics Inc.

Triple Crown Electronics Inc. of Mississauga, Ontario was founded in 1972. Its key products include TV channel modulators, CATV line and apartment amplifiers, TVRO satellite receivers, TV signal processors, test equipment and low-power rebroadcast transmitters.

Triple Crown is very active in export markets; 70 per cent of its sales were made to the United States, Central America and Europe. For domestic distribution, the company uses Incospec Electronics Inc. in Quebec, Sigmacon Systems Inc. in Ontario, Tech Comm Sales and Crowder Communications Ltd. in British Columbia, and Paar Industrial Electronics Limited in Calgary, Alberta.

This wholly Canadian-owned firm is privately held. It experienced major growth from 1980 to 1982, when its staff grew from 40 to 120. Currently there is an in-house R&D and engineering staff of 10 to 12. Total sales are between $5 and 10 million.

5. SPECIALIST TRADITIONAL MANUFACTURERS

5.1 CANADIAN-OWNED COMPANIES

5.1.1 Abroyd Construction

Abroyd Construction of Kitchener, Ontario is a division of Dahmer Steel Ltd. and was founded in 1972. This Canadian-owned company specializes in the design, supply and installation of microwave and CATV towers.

Its 1982 sales were $7-8 million: 85 per cent to the domestic market and the rest to American buyers. The company has had some CATV-related contracts over the decade, although recently its activity in that field has declined. The firm employs 50 people, with 12 involved in engineering and R&D.

5.1.2 Alpha Technologies Ltd.

This Burnaby, British Columbia company specializes in the manufacture of standard and standby power supplies complete with status monitoring and UPS systems for computer backup.

The company has sales facilities in Bellingham, Washington and Scottsdale, Arizona. In Canada, Alpha markets through Anixter-Microsat in Vancouver, Toronto and Montreal.

5.1.3 Canada Wire and Cable Ltd.

This is a wholly-owned subsidiary of Noranda Mines Limited. The Don Mills, Ontario company began producing cable in 1956 in competition with Northern Telecom and Philips. Currently, its key products are electronic wires and cables and fibre optic cables and systems. The company employs 2,500 people and sells its products throughout Canada and to countries in Central America, South America, Australia, South Africa and the Middle East.

There are production and sales facilities in Halifax, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Edmonton, Calgary and Vancouver.

In 1977 Canstar Communications Limited was established as a wholly owned subsidiary to develop fibre optics cable for integrated networks.

5.1.4 Central Dynamics Ltd.

Central Dynamics Ltd. of Pointe Claire, Quebec was founded in 1958. The company specializes in teleproduction equipment aimed primarily at the professional television and broadcast user. Its key products for the CATV market include master control switchers, routing switchers for video and audio, distribution switchers for video and audio and low-cost production switches. The firm sells directly to cable operators in Quebec and Ontario and through Applied Electronics in western Canada. There are sales offices

in New York, Illinois, California, Georgia, Texas and Colorado. In 1981, total sales were $9.2 million and the company employed 196 people. R&D investments represent 15 per cent of annual sales. The company has two wholly-owned American subsidiaries - Central Dynamics Corp. of Elmsford, N.Y., and Videometrics Inc.

5.1.5 Electroline TV Equipment Inc.

Electroline began in 1952 as a Montreal TV and antenna installation contractor and a manufacturer's representative and engineering consultant for master antenna (MATV) and CATV equipment. Electroline started manufacturing for Quebec and Ontario customers in 1963, and began selling its products in other parts of Canada and abroad in the early 1970s.

Electroline has five professional engineers, five qualified technicians, and a production staff of about 40 people. In addition to its basic cable passives product line, Electroline has designed and introduced the EAS addressable system for multi-unit applications. This system controls subscriber access and subscriber premium service in home-run wired multi-drop buildings. The home-run system brings the wire directly to the customer, as opposed to a loop-through system requiring entry into each apartment, and it has the chief advantage of being outside the subscriber premises, an important factor in the residential market.

The firm's 1982 sales were in the $2 million range, and are expected to triple with the full development of the EAS addressable security system. To handle the anticipated increased production Electroline is expanding its factory space from 13,000 to about 18,000 square feet. The EAS system has been primarily sold to apartments, hotels and institutions in the United States, although important cable orders have been received in Canada.

The EAS system was actually a joint development of Quebec's CRIQ and Electroline. The company is now establishing a small R&D unit and is committed to initiating development work in other areas. One of these is in local (or institutional) networking systems, where Electroline will seek to exploit its broadband switching capability.

5.1.6 LeBlanc and Royle Communications Inc.

This Oakville, Ontario company has been involved since 1962 in design, manufacturing and representing foreign manufacturers in Canada. LeBlanc and Royle produces mainly communications towers, AM radiators, antenna mounts, ice guards, grounding rods and other specialized steel products.

The company has services available in the design, erection and maintenance of communications towers, and complete installation of all items mounted on towers, LeBlanc and Royle represents Cableware Systems, Phelps Dodge Communications North Wind Power Company and Hilomast Limited. The company's distribution system consists of eight sales and service offices across Canada.

LeBlanc and Royle is 100 per cent Canadian and is employee-owned. There are two subsidiary manufacturing companies, Larcan Communications in Rexdale (previously the broadcast transmission division of General Electric), and SR Telecom in Montreal (previously owned by Farinon/Harris). Telcom Tower Services Inc., a sales and service company with three locations, covers the United States while another subsidiary company in Australia, Jennis Steel Construction, provides manufacturing and field services to Australia and portions of the Pacific Rim.

R&D is centered in Larcan and SR Telecom, whose activities are focused on broadcast transmission and subscriber radio/telephone systems. The company employs approximately 350 people worldwide. In Canada, less than 5 per cent sales and staff are attributable to CATV. There are no CATV exports from Canada.

5.1.7 Leitch Video Ltd.

Leitch Video of Don Mills, Ontario is a Canadian manufacturing firm that distributes its own products. Established in 1971, the company's key products include synchronizing pulse generators, test signal generators, video processing and distribution amplifiers, master clock systems, vertical interval processors, phase monitors and digital audio/video scrambling/descrambling systems.

The last-mentioned systems represent a major new thrust and feature hard security for video and audio, three high fidelity audio channels and one 1200 baud data channel, all contained in a single 7.5 MHz baseband video channel. No external aural/data modulators or demodulators are required.

The company has manufacturing facilities in Canada and the United States. The American facility is assembling products developed in Canada. U.S. sales originate completely from this site.

In 1982 about 20 per cent of the firm's $7-8 million in sales was directed to the CATV market. The Canadian-owned company employs 60 people, 5 of whom are engaged full-time in R&D activities.

5.1.8 Microcom Systems Ltd.

Microcom manufactures cable scrambler/descrambler systems, converters, encoder/traps and passives. Currently, the company has distribution and marketing arrangements with R.F. Communications, Cancom, Radio Shack, Jutan International and several distributors in the United States.

With sales at the $3 million level for the past two years, Microcom is projecting $5-6 million in sales for 1983. In recent years 70 per cent of its sales have been to export markets such as the United States, Peru and Belize. The company projects additional future growth in exports, although in 1983 Microcom is expected to show an increase in the domestic sales due to the introduction of pay-TV. In general, the company's sales are to both CATV and satellite-to-terrestrial rebroadcast markets.

Microcom is a Canadian-owned company with a 14,000-square-foot manufacturing facility in Agincourt, on the outskirts of Toronto. The plant has a complete engineering facility, four assembly lines, test equipment, quality control and a small machine shop. There are approximately 80 employees, of which 8 to 10 are involved in product development, with the main focus on addressable descrambler systems.

5.1.9 Sachs Canada Inc.

Sachs Canada Inc. of Dorval, Quebec was founded in 1974. It manufactures a variety of CATV accessory products, including lashing support straps, lashing wiring clamps, span clamps, drop clamps, service mast straps, drive rings, ram horns, cable fasteners, cable clips, ground blocks, wall plates, and custom-designed drop installation hardware.

The company is completely Canadian-owned and all products are manufactured in-house. Recently the company grew from eight to 20 employees while sales increased from $175,000 in 1981 to $350,000 in 1982. The growth has come from the export market, so that currently the sales split is 30 per cent domestic and 70 per cent export.

5.1.10 SED Systems Inc.

SED Systems of Saskatoon, Saskatchewan was incorporated in 1972 from a group that originated from the Space Engineering Division of the University of Saskatchewan. The company employs 300 people in a 60,000-square-foot facility that includes an electronics production area.

The company has products for three main markets: aerospace, communications, and instrumentation and control. The key products for the CATV industry include 4 GHz and 12 GHz TVRO systems, 6 GHz exciters and systems designed for turnkey requirements.

Currently, Comad Communications Ltd. of Toronto, Calgary, and Truro, distributes the SED 4 GHz TVRO. Jerrold Canada is in a joint venture with SED to develop 12 GHz TVRO equipment.

For several years, the company has had total annual sales in the range of $13 million.

Shares in SED are held by the University of Saskatchewan, Crown Investments Corporation of Saskatchewan, employees and members of the Canadian public. SED has a subsidiary, SED Electronics Inc. in Memphis, Tennessee.

5.1.11 Solutec Ltd.

Solutec Ltd. of Montreal, Quebec has been in operation for over 10 years. The company specializes in manufacturing video equipment, in addition to offering systems planning, turnkey installations and preventive maintenance services.

Currently involved in high-tech development, Solutec has developed a tele-management system featuring an automated broadcasting system with video/audio integrated and programmable switchers.

A large portion of its activities is dedicated to the R&D of new products. In collaboration with CRIQ, Solutec has developed co-channel adaptive filters and impulse noise reducers.

Solutec's products and systems are exported to Australia, Bermuda, the United States and Great Britain. It currently employs 14 people, 3 of which are directly involved in R&D.

5.1.12 Source Communications

Source Communications (a division of Sotelcom Inc.) of Rexdale, Ontario was formed by the 1983 merger of Kelcee Communications Inc. and Wilk Engineering. The company is involved in the research, development, distribution, manufacture and repair of a variety of products for the cable television and broadcasting industries.

Source owns Wilk Power and Video Inc. of Encino, California and Oakland, New Jersey; the subsidiary manufactures standby power supplies, video/audio switching equipment, CATV transceivers and UHF direct broadcast encoders and decoders.

Source acts as distributor for Magnavox CATV Systems, RCA Cablevision Systems, Intercept, Avantec, Cablematic, Tomco, Sadelco, Raychem, Stirling Connectors, Catel Video Precision, Wilk, and Scientific-Atlanta. Products carried include audio and video routing switchers, character generators, standby power supplies and FM modulators. The company operates in Canada and the United States. New warehousing locations have recently been added in Toronto, Montreal, Edmonton, Vancouver and Los Angeles, California.

Gemanco International, a Canadian investment firm, has acquired a controlling interest in the venture.

5.1.13 Stirling Connectors Ltd.

This privately-owned Canadian company in Unionville, Ontario was established in 1973 and employs 22 people. The company manufactures aluminum and brass connectors for the Canadian CATV market. Its 1982 sales were $1.5 million, 97 per cent of which went to the CATV industry. Current export activity is limited; the company plans to expand its sales to the American market.

5.1.14 Teledac Inc.

A Canadian-owned company in Longueuil, Quebec, Teledac specializes in character generators with remote editing and automatic error correction features. Teledac sells to cable and other markets in the United States and South America. The company has 10 employees.

5.1.15 Viewstar Inc.

Viewstar Inc. of Scarborough, Ontario has more than 250 employees manufacturing TV converters and pay-TV encryption systems for cable, satellite and off-air signal reception, along with a speciality line of radio communications equipment.

Founded in 1979, the company markets its products primarily in Canada and the United States; it is reported to be the third largest manufacturer of remote-control cable converters in North America. Viewstar is making significant efforts in R&D, with some government support.

5.1.16 Wind Turbine Co. of Canada Ltd.

An Elmira, Ontario firm, this venture was originally established in 1950 as a branch plant of a U.S. firm. Currently, the company is wholly Canadian-owned, and concentrates primarily on the custom-designed fabrication and installation of towers for AM, FM and microwave. Services such as site appraisal, analysis, investigation and repairs are also offered.

The company employs 45 people and has total sales of $7-8 million; about 15 to 20 per cent of staff and sales are related to the CATV market. There is virtually no activity in the CATV export market. Research and development activities are 1-2 per cent of sales and involve two or three people.

5.2 FOREIGN-OWNED COMPANIES

5.2.1 Amphenol Canada Inc.

This company had been operating in Scarborough, Ontario for 18 years when it was acquired by Allied Chemical in 1981. The company manufactures a number of electrical and electronics products for the military and telecommunications industries. In the CATV area, Amphenol produces drop cable for the domestic market only.

Amphenol's total 1982 sales were $72 million, of which CATV sales were a very small portion.

5.2.2 Andrew Antenna Company Ltd.

This firm, established in Canada in 1953, produces satellite earth stations, microwave antennas, coaxial HELIAX cable, HELIAX elliptical waveguide, rigid coaxial transmission line and RADIAX coaxial cable. In particular, Andrew is known for its high-quality 6/4 GHz and 14/12 GHz earth station antennas and 14/12 GHz AML antennas. The company also provides installation and field work related to antenna systems. The firm is a subsidiary of Andrew Corporation of the United States, but it manufactures all of its products in Canada for both the domestic and export markets. Approximately one-third of sales are exported to the United States and abroad. Total 1982 sales were about $20 million, with approximately 30 per cent in the CATV market.

The company employs 200 people, of which 25 are devoted to engineering, research and development of satellite earth stations.

Andrew is currently developing new low-cost TVRO antennas in the 4 and 12 GHz bands and a line of coaxial cable for the CATV market.

5.2.3 Digital Video Systems Corp.

Digital Video Systems Corp. (DVS) of Willowdale, Ontario was founded in 1976 and became a wholly-owned subsidary in 1983 of a Georgia based company, Scientific-Atlanta, Inc. DVS is the sole Canadian designer and manufacturer of time base correctors, synchronizers and frame stores, approximately 80 per cent of which are exported to the United States, Mexico and South America through 25 dealers, and other sales representatives throughout North America. Canadian representation is by such companies as Canamex Electronics and United Video of Ontario, Tresco Communications of Quebec, Vid Com Ltd. of British Columbia and Western Cinevision of Alberta.

The company's satellite encryption product, using a technology developed by DVS under licence from the Independent Broadcast Authority of England, makes it possible for reception with smaller dish-type antennas than otherwise would occur. This Canadian technology is therefore opening new markets in SMATV and DBS in both C and KU band. DVS currently has a staff of 80 with 23 involved in R&D. Total sales are between 5 and 10 million.

5.2.4 Scientific-Atlanta (Canada) Ltd.

Scientific-Atlanta (Canada) Ltd. of Mississauga, Ontario was established in 1975 as a wholly-owned subsidiary of its U.S. parent, Scientific-Atlanta, Inc.

The American firm is an international equipment manufacturer for the satellite communications, cable television, energy management and home security industries. The company's other area of concentration is the manufacture and sale of test and measurement instruments for industrial telecommunications and government applications.

In January 1983, Scientific-Atlanta acquired manufacturing capability in Canada through the purchase of Digital Video Systems Corp. (DVS) for $10.8 million. The seven-year-old firm was acquired because of its technological lead in techniques to interface digital video signals with existing television systems. DVS will be manufacturing pay-TV decoding/descrambling products for consumer markets in the United States, Canada, Europe and Australia.

5.2.5 Zenith Radio Canada Ltd.

Zenith Radio Canada Ltd. of Toronto is a consolidation of a wholly-owned distributor of Zenith Home Entertainment Products, the Heath/Zenith companies, Zenith Data Systems and the Cable Products Group.

In late 1982 Zenith established a manufacturing operation to supply pay-TV decoders to the Canadian market. It utilizes approximately 60,000 to 70,000 square feet of existing facilities. Because of the substantial demand for decoder products during the launch of pay-TV, Zenith operated three assembly lines on two shifts and employed approximately 300 people. Demand has since leveled off, however, it is expected to resume during the fall season.

Zenith Canada manufactures two basic models of baseband addressable decoders: the Tac-Along, which is used in conjunction with existing R.F. cable converters, and the full Z-Tac, which is a combination converter decoder. Both models have a list of options to meet customer requirements.

Although Tac-Along decoders are aimed specifically at the Canadian market, they are also manufactured in Toronto for certain Americain markets. The Z-Tac is designed for the North American market in general. Eventually, demand for Z-Tac is expected to exceed Tac-Along.

Zenith has also developed a decoder called Base-Tac that will be used on Zenith cable-ready television sets that already have built-in converters. This model allows the customer to use all the features supplied with the television set. Base-Tac will be available to Zenith customers by the spring of 1984.

6. DISTRIBUTORS

6.1 TRADITIONAL CANADIAN DISTRIBUTORS

6.1.1 Allan Crawford Associates Ltd. (ACAL)

This privately-owned Canadian company, established in 1959, operates only in Canada through distribution outlets in Toronto, Ottawa, Montreal, Edmonton, Calgary and Vancouver.

ACAL carries scientific instrumentation equipment, computer components and other lines of general-purpose instrumentation equipment. CATV product lines are focused on test and monitoring equipment and include Anatek power supplies, Amber audio distortion analyzers, Fluke multimeters, frequency converters, voltmeters and Wavetek signal generation equipment, sweep generators, signal analysis meters, attenuators and spectrum analyzers.

CATV sales make up approximately 5 per cent of ACAL's $20 million in total sales. The company has approximately 100 employees.

6.1.2 Channel One Video Corp.

Channel One Video of Vancouver, British Columbia was established in 1977 as a distributor of CATV products. The company distributes and services products manufactured by Andrew Antenna, CANTEL Engineering, Delta Benco, RCA, Sony, Nexus and Q-Bit. Its 1982 sales to the cable television industry amounted to $3 million, or approximately two-thirds of the $4.5 million total. Sales to the TVRO market accounted for the remaining one-third.

The company employs eight people in sales and servicing activities.

Channel One Video performs no R&D and does not export. Sales are concentrated in western Canada.

6.1.3 Crowder Communications Ltd.

A Burnaby, British Columbia company established in 1974, Crowder is a turnkey supplier of broadcast and CATV systems. The Canadian-owned company is an authorized Cancom sales agency and an authorized distributor for General Instruments, Microcom Systems, Microdyne Corporation, Scala Antennas, Teledac, Television Technology Corporation, and Triple Crown Electronics.

Products distributed include satellite TVRO systems (4 and 12 GHz), low-power television (LPTV) and CATV systems, and program protection equipment. Services include project management, feasibility studies, engineering, installation, commissioning, and maintenance.

The company has sales of $2.5 million and a staff of 25, including broadcast consultants, engineers and six service technicians working at its Edmonton subsidiary. CATV accounts for 10 to 15 per cent of sales. Crowder has exported products to Europe and is actively pursuing exports to the Pacific Rim countries.

6.1.4 Deskin Sales

Established in 1957, this company distributes for Eagle Comtronics Inc., Gilbert Engineering, Worden Industries Ltd., RMS, Honeywell, Cablematic, Sigmacom, Times Fibre Communications, Magnavox CATV, SDB, Pyramid, LAN, Tyton, Corex, Trionics, EEG and Jocelyn Hardware. As well as its main office in Markham, Ontario, Deskin has sales offices in Vancouver and Montreal.

With total sales of $23.5 million, the company has 70 employees. Approximately 50 per cent of the company's activity is in the CATV market, with the rest in OEM electronics.

6.1.5 Incospec Electronics Inc.

This is a privately-owned Canadian company established in 1978 that distributes Canadian, American and Japanese CATV industry products in Quebec and eastern Canada.

The product line includes TVROs, AM/FM modulators, VHF-UHF processors, amplifiers, cables, signal level meters, radiation detectors, and filters. The company also operates a well-equipped independent CATV service department in eastern Canada and provides proof-of-performance testing for cable systems.

The company has a staff of 11 and operates from St. Leonard, Quebec.

6.1.6 Petro Comm Industries Ltd.

Petro Comm Industries of Edmonton, Alberta was incorporated in 1978. The company's primary activity is the distribution of products (mostly of the "outside plant" type) to the telephone, CATV and power industries.

Its products include pedestal closures, wall-mounted enclosures (interior and exterior), splice connectors, test sets, hand tools and communications accessory items.

6.1.7 R.F. Communications Inc.

R.F. Communications of Markham, Ontario was established in 1973. The company distributes products manufactured for Comm/Scope, Magnavox, Andrew Antenna, M/A Com, Triple Crown, Utility Products, Sadelco, Phasecom, Slacan, and Sachs. A recent merger with Trainor Communications has added

Wavetek CATV equipment and Microcom's *STARS* pay-TV security equipment to R.F.'s product slate. The company has locations in Toronto, Montreal and Vancouver.

R.F. is Canada's largest CATV distributor, with sales of about $15 million range and 22 employees.

6.1.8 Sigmacom Systems Inc.

This company acts as a distributor for M/A Com's 12 GHz TVRO, Wegeners' Stereo audio subcarrier equipment, Andrew Antenna's earth stations and antenna systems and Triple Crown's products. Also offered are planning and services for Cancom, cable computer billing and management information systems and system engineering and installation services.

Since its founding in 1981, the Whitby, Ontario company has been owned and operated by its four Canadian partners. Sigmacom employs 10 people directly and 7 commissioned sales representatives.

6.1.9 White Radio Ltd.

White Radio Ltd. of Burlington, Ontario, is a Canadian-owned company incorporated in 1925. The company has two marketing groups - the Electronics Group, for industrial electronics (Belden wire and cable, Oak switch systems, etc.), and the Communications Group - both serving all of Canada.

Of the 85 employees, 20 are involved in the sales, field service, and repairs of communications products for Belden Corp., SED Systems Inc. and Oak Communications. Belden Corp's products include coaxial cables, video, studio and instrumentation cables. SED Systems Inc. products are satellite receivers with LNB technology - low noise blockdown converters that convert the signals down to 1 GHz. The Oak Communications home terminal systems consist of converters, VHF over-air security systems, and non-addressable or addressable pay-TV systems. The Oak satellite security system, called ORION, is used by Cancom.

White Radio's technical quality control centre ensures the quality of all Oak products from the United States or Taiwan, and is the Canadian service and repair centre for all Oak products as well as SED receivers.

There are preliminary plans for the manufacture or assembly of Oak equipment in Canada.

6.2 TRADITIONAL FOREIGN DISTRIBUTORS

6.2.1 Anixter-Microsat

Anixter-Microsat of Pickering, Ontario is 100 per cent owned by Anixter Canada Inc., a subsidiary of Anixter-Bros. Inc. of Skokie, Illinois. In Canada, the company distributes a complete line of products for the satellite and CATV industries, including Hughes AML microwave products, C-Cor Electronics Inc. transmission products, Comm/Scope Co. coaxial cable, Gilbert Engineering connectors, Alpha Technologies standby power supplies and Scientific-Atlanta satellite and headend equipment. There are sales outlets in Pickering, Montreal and Vancouver and inventory in 10 other Canadian cities.

6.2.2 Texscan Communications Inc.

This Markham, Ontario firm is a wholly-owned subsidiary of the Texscan Corporation of Phoenix, Arizona and was established in Canada in 1981. Although the company is now a sales operation, long-term plans are to have some manufacturing capability in Canada. Texscan's product line includes test, sweep, distribution and pay-TV security equipment, set top converters, cable connectors and drop installation materials.

The company's sales are in the $1-2 million range, of which 70 per cent are to the CATV industry. While there are no export sales as yet, the company has been given a free hand to pursue markets in the Middle East and South America.

6.3 ELECTRONICS - CONSUMER AND STUDIO EQUIPMENT

6.3.1 Hitachi Denshi Ltd. (Canada)

Established in 1974, this company is a wholly-owned subsidiary of Hitachi Denshi Ltd., Japan, which is a leading member of the Hitachi Group, Japan's largest manufacturer of electric and electronic products.

The company is one of the principal suppliers in the Canadian broadcast and cable industry, specializing in professional television cameras, videotape recorders and studio equipment.

The company has 30 employees, including seven technical service people, working at head office in Toronto and sales offices in Montreal, Ottawa and Calgary.

In 1982, approximately 30 per cent of the company's sales were to the CATV industry.

6.3.2 Panasonic/Ramsa Audio Video Systems - Matsushita Electric of Canada Limited

Matsushita Electric of Canada Limited, through its Industrial Audio/Video Department with offices in Mississauga and Ottawa and through dealers across Canada, distributes Panasonic 3/4" and 1/2" VHS video cassette recorders, editors and players; colour cameras; special effects generators; a range of colour and black and white monitors; closed-circuit TV systems; time-lapse video recorders; and interactive training systems. A range of professional audio systems, including mixers, speakers, and microphones, is also offered under the Ramsa brand names.

6.3.3 Philips Electronics Ltd.

This Scarborough firm controls a substantial share of the Canadian converter market. The company's CATV products, which are sold primarily through retail outlets, include the full range of cable converters - from a crystal-controlled block converter to a fully programmable multi-channel converter.

Philips employs about 1,500 people; 235 are in the company's consumer electronics group, which distributes Philips' converters.

6.3.4 Sony of Canada Ltd.

Sony of Canada, headquartered in Willowdale, Ontario, markets video cassette recorders (U-matic and Betamax), Trinitron and professional colour video cameras, Trinitron monitors/receivers and peripheral equipment and tapes. Sony has sales outlets in Halifax, Montreal, Ottawa, Toronto, London, Winnipeg, Edmonton, Calgary and Vancouver.

Total sales in 1982 were $1.6 million, of which 30 per cent was to the CATV industry. The company employs 30 people, including 6 technical servicemen.

6.3.5 Tocom Canada Ltd.

Tocom Canada of Toronto is a division of Tocom of Texas, which is partly owned by Selkirk Communications Limited (22 per cent equity interest). The company's main products are home security systems and addressable converters. There are plans to arrange assembly and/or manufacture of Tocom products in Toronto in the latter part of 1983.

Tocom Canada's penetration of the Canadian home security market has been limited to the Ottawa Cablevision and Victoria Cablevision, CRTC authorized security system demonstration projects. Tocom's line of addressable converters will be introduced to the Canadian market in 1983. Canadian 1983 sales are estimated at $60-$100,000.

7. SUPPLIERS OF NEW SERVICES

7.1 THE COMPANIES

7.1.1 Cableshare Inc.

Cableshare Inc. of London, Ontario was established in 1973 as a private Canadian company. In 1982 the company went public, and is currently held by Rogers Cablesystems Inc. (37 per cent), Terry Pocock (25 per cent) and the general public (38 per cent).

The firm markets computerized subscriber billing systems to CATV operators, develops and implements computer information systems, services and software, and sells computer hardware in support of its software packages. There are four product divisions:[9]

- The Electronic Marketing Division designs and markets electronic marketing products utilizing Telidon, touch screen, and videodisc technology;
- The Network Systems Division develops and markets data communication products for packet switching networks in Canada, the United States and other countries throughout the world;
- The Business Systems Division markets computer hardware, packaged software, and consulting and programming services for turnkey and customized business systems;
- The Computer Systems Division sells computer time-sharing services (using 14 computers located at the company's computer centre in London, Ontario), Inter-Office Communications System software, and cable television subscriber accounting software.

Cableshare has taken a lead in developing new services with a two-way cable test project in Syracuse, N.Y., and 'pay-per-view' to be launched in Portland, Oregon in late 1983. Future CATV applications under development include Telidon information processing and display, page service boards, real estate listing services, security and telequote stock market applications.

The company has experienced high growth; sales of $709,000 in 1977 increased to $7.2 million in 1982. The staff has grown from four in 1975 to 115 in 1982.

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[9] Prospectus Cableshare Inc., December 1981.

7.1.2 Cantel Data Systems Co. Ltd.

Cantel, founded in 1977, is a software development firm with its head office in Montreal and support personnel in Toronto. Cantel specializes in networks and communications software; it provides consulting, analysis, design, programming, hardware selection, installation, support and maintenance. Cantel also provides hardware and software for turnkey computer systems.

7.1.3 Electrohome Ltd.

Electrohome Limited of Kitchener, Ontario was founded in 1907 and has grown to a highly diversified company with business interests in the industrial, consumer and communications segments of the economy. In recent years, through its Electronics Division, Electrohome has developed a major thrust into products related to CATV services, especially in the areas of technology for Telidon/videotex integrated terminals, satellite TVRO receiving systems, double-sided and multi-layer printed circuit boards, data/graphics colour projection systems and open-frame monitors for applications ranging from computer terminals to electronic games. Electrohome and Microdesign of Toronto are partners in a joint venture, Gensat, established in 1981, to design, manufacture and market TVRO receivers, MATV products, low noise amplifiers and converters. There is currently a market development evaluation for Electrohome's subscription television (STV) terminal equipment.

The company has sales of over $160 million, employs more than 2,000 people, and has 150 involved in R&D.

7.1.4 Gandalf Data Ltd.

This subsidiary of Gandalf Technologies Inc. was established in 1970 and specializes in data transmission technology. Products include synchronous and asynchronous data sets and modems (standalone as well as rack mounted); private automatic computer exchanges (PACX); statistical and time division multiplexers, mobile terminals and radio modems.

Gandalf has embarked upon ventures that build on its traditional strengths by integrating coaxial cable and fibre optic technologies for data transmission in institutional networks for government and business applications. Field trials in this, the second generation of PACX systems, will be undertaken late in 1983.

Gandalf Technologies sales in 1982 were approximately $53 million worldwide.

The Gandalf group employs 900 people in Gandalf Data Ltd. in Ottawa, Gandalf Data Inc., in Illinois and Gandalf Digital Communications Ltd. in Warrington, England. The company also has distributorship agreements with companies in Europe, the Middle East, South America and Africa.

7.1.5 International Phasor Telecom Ltd.

International Phasor Telecom Ltd. is a newly established Vancouver-based supplier of scrambling technology for CATV and satellite-delivered programming services. It brings together International Phasor Telecommunications, with previous experience in encryption for data-based applications, and Norsat, a manufacturer of TVROs. The company has successfully tested its satellite encryption system on BCTV signals, and is seeking a licensing agreement with a suitable manufacturing partner.

7.1.6 Linear Technology Inc.

Linear Technology of Burlington was established in 1973. To date, its main product line has included linear monolithic integrated circuits, custom and semi-custom linear monolithic integrated circuits and miniature modular amplifier assemblies. The company's strengths in design and manufacture of integrated circuits could be readily applied to the next generation of CATV products in the mid-1980s. A vigorous R&D program is in place; 15 per cent of sales are applied to the development of new products for markets outside the company's traditional focus.

Ninety per cent of Linear's $5 million gross earnings came from exports to the United States, Europe and the Far East. The company employed 110 people in 1982.

7.1.7 NABU Manufacturing Corp.

Formed in early 1981, NABU Manufacturing Corp. was created to design, manufacture and market personal microcomputers that can receive software from a cable operator's headend through the cable television networks (see Figure 6 for an illustration of the NABU Network). The tie-in of microcomputers to cable systems creates a communication system in which cable subscribers can be provided with large computer data bases at a relatively small cost in comparison with alternative methods. The cable computer system includes a data broadcast computer, communications adaptors, personal microcomputers and software. This electronic cable distribution service, called The NABU Network, underwent market testing and field trials throughout the spring and summer of 1983 and was launched in Ottawa as the world's first full-scale commercial cable computing service on October 25, 1983.

More than 1,000 orders for the NABU Network were placed by Ottawa Cablevision subscribers within the first three weeks of the service, and it is expected that between 5,000-7,000 units will be placed in Ottawa Cablevision's territory by June 1984 - representing a market penetration of about 6.3 per cent to 8.8 per cent of potential subscribers (total Ottawa Cablevision subscribers equal 80,000 approximately).

NABU is involved in other activities in the computer and communications industries, including the design, manufacture and marketing of commercial microcomputers, terminals, and systems; the leasing of data entry systems; the provision of hardware maintenance and software consulting services; and the sale of microcomputers manufactured by other companies through a retail store network (Computer Innovations) and a direct sales force. The company has offices and retail operations across Canada, in the United States and abroad. The company reported sales of $58.9 million for the fiscal year ending July 1, 1983 compared with $35 million in 1982. Overall, the company employs approximately 700 people.

7.1.8 Norpak Corporation

Founded in 1975, this Kanata, Ontario company is a principal developer and major manufacturer of videotex and teletext system hardware. Key products include a variety of decoders, encoders and frame creation systems for videotex and teletext applications. Norpak has recently made a direct thrust into the CATV market with their Video Graphics Generator (VGG) for cable headends. The VGG delivers high-quality colour graphics for continuous rolling electronic slides that are used in advertising or for open-channel broadcast information purposes.

Norpak has approximately 175 employees and is a privately held, all-Canadian firm.

7.1.9 Le Groupe Vidéoway Inc.

Le Groupe Vidéoway Inc. of Montreal, Quebec is a new company formed by a joint venture between Le Groupe Vidéotron, G-TECH Corporation and the Société de Développement Industriel of Quebec (SDI). Le Groupe Vidéotron is the largest cable TV consortium in Quebec and the second largest in Canada with over 600,000 subscribers. G-TECH Corporation of Providence, Rhode Island specializes in computer equipment for lottery and games, and has lottery systems installed around the world. The SDI is a provincial government agency providing venture capital to high-technology firms. Initially, the federal government contributed financial support to the development of the project, and the Cable Telecommunications Research Institute (CTRI) along with several associated cable firms and suppliers of programming content have also been involved.

The company will produce an integrated home information system that uses proven high-technology methods in the field of teledistribution and data communications. It combines in a single terminal, a number of existing services and several new ones, turning the TV set into a home information system.

The Videoway System will enable the viewer to access information and entertainment through present-day broadcasts on cable TV channels and stereo radio stations. The user will benefit from special services including pay-TV, electronic data bases, news headline information, stock prices and other services offered by cable. From the outset, Videoway subscribers will have access to a 20,000-page NAPLPS-format data base, transmitted at the rate of 1,000 pages/second. The Videoway System will transform the face of the TV screen into a personalized, interactive multi-use terminal for both traditional video and the digital-based services.

Le Groupe Vidéotron is now installing 100,000 Videoway home interface units. Videoway is aiming at a production capacity of 250,000 units by 1984. Integration tests are now in the final stages for all procedures relating to transmission of these services on the cable systems and communications management from the headend. The product is designed to interface with any manufacturer's home terminal devices, and the Videoway technology is applicable to cable systems of all sizes.

8. SERVICE COMPANIES

8.1 ENGINEERING SERVICE COMPANIES

8.1.1 Cable Consulting Services Ltd.

The president of Cable Consulting Services is Ken Easton, P. Eng., who has been a leader in Canada's CATV industry since 1953. The company has been in operation since 1970 and specializes in engineering services for the CATV industry.

These include licence applications for cable TV systems, technical briefs on system assessments and proofs of performance, feasibility studies, cost estimates, and engineering designs for multi-channel and medium haul microwave systems, and the siting and design of satellite earth stations. The company has also had considerable experience in the evaluation of competing engineering applications for municipal cable TV franchises in major American markets.

8.1.2 Cablesystems Engineering

Cablesystems Engineering (CE) of London, Ontario, the in-house research and development arm of Rogers Cablesystems Inc., undertakes a variety of activities related to new applications of broad-band technology and advanced telecommunications. CE works in conjunction with private and public sector research laboratories and industry engineering groups and telecommunications consortia. It has developed and deployed various new service concepts, including Rogers' two-way security and interactive systems, being installed in several of the company's American operations.

8.1.3 CANTEL Engineering Associates Ltd.

CANTEL Engineering Associates Ltd. was incorporated in the Province of British Columbia in 1974. It represents the merger of N.M. Lopianowski & Associates Ltd. and Teleconsult Limited, both founded in 1972. Principals are Anthony C. Gardiner, B.Sc., P.Eng. and N. Mark Lopianowski, B.Sc. (Hon), P. Eng. The firm is owned and operated by its majority and minority shareholders.

CANTEL is a western Canadian independent consulting engineering firm and, as a member of the Association of Consulting Engineers of Canada, specializes in the field of telecommunications, ranging from the design, proof-of-performance testing and DOC brief submission of Cablevision, AM, FM & TV stations, through the engineering of point-to-point transmission systems (satellite, microwave, UHF & VHF).

The scope of work undertaken by CANTEL includes feasibility studies, systems engineering and design, cost estimating, specifications and tendering, proofs of performance, project management and inspection services.

CANTEL maintains its head office in Vancouver, B.C., with branch offices in San Francisco and Rwanda, East Africa. Its clients include private cablevision and broadcasting companies, large industry and governments (federal, provincial, municipal and foreign).

8.1.4 J. Cappon & Associates Ltd.

This is an engineering consulting firm, incorporated in 1969 and located in Toronto. It has provided the cable TV industry expertise in broad-band system engineering, equipment evaluations, proof-of-performance tests and custom RF circuit design. The company specializes in the transmission of audio, video and data via coaxial cable and microwave links.

8.1.5 Communications Engineering Services Ltd.

Communications Engineering Services Ltd. of Mississauga, Ontario was established in 1973. The company specializes in consulting in broad-band telecommunications and related areas. It provides services in field engineering, systems design, regulatory licensing and management services to cable operators and suppliers. There are 15 permanent employees.

8.1.6 D.E.M. Allen & Associates Ltd.

Since the company's inception in 1964, D.E.M. Allen & Associates Ltd. has become one of the largest consulting engineering firms in Canada specializing solely in broadcast communications engineering. In the course of the company's development, experience has been gained in every facet of broadcast communications engineering.

The company has, over the years, been involved in many projects, both large and small, ranging from small system design and specifications to turnkey implementation of major broadcasting systems. D.E.M. Allen & Associates Ltd. have full in-house capability for the design, specification and project management for small- to medium-size CATV systems, including microwave links, headend systems and satellite reception systems.

8.1.7 DGB Consultants Inc.

DGB Consultants Inc. of Montreal was established in 1960. DGB is a group of engineering and project management consultants offering independent professional services to private and public sector clients in the telecommunications and computer systems industries. Areas of expertise include radio communications, telephone systems, computer system applications, radio and television broadcasting, audio-visual facilities and security systems, and aviation and transportation systems.

Through its affiliation with The SNC Group, DGB has access to that group's systems, procedures and project management experience and civil, mechanical and electrical engineering expertise.

8.1.8 Douserv Group Inc.

Douserv Group Inc. of Montreal was established in 1974 and now consists of several separate firms located in St. John's, Halifax, Quebec City, Montreal, Toronto and Dallas. The professional and technical services provided by Douserv include the application of high technology systems for telecommunications, electronics, and automation and control. For the CATV industry, Douserv has provided the following types of engineering, planning and project management services in Canada, the United States and internationally;

- study, design and preparation of technical briefs for major changes to existing CATV systems;
- testing, analysis and supervision of the implementation of corrective measures and preparation of proof-of-performance of existing CATV systems;
- project management services for the rebuilding of a CATV urban network;
- study and design of cable distribution systems in the United States, Puerto Rico and Mexico;
- study and design of very high capacity microwave systems for regional reception and distribution of television and FM radio signals for CATV distribution;
- study, engineering and supervision of the installation of a satellite television network and earth stations for CATV distribution;
- engineering of television and FM radio rebroadcast stations for construction camps in the north.

8.1.9 Elinca Communications Ltd.

Elinca Communications Ltd. of Ottawa is a Canadian company created by members of the Canadian electronics industry. The rationale behind the consortium was to provide the international market place with a complete turnkey capability in the electronic systems field. The consortium includes high-level technical and management competence; it was established because several Canadian companies recognized the need for an on-going consortium that had a long-term commitment to its customers.

The member companies can provide both telecommunications systems and vehicular control systems. In conjunction with other suppliers, both Canadian and foreign, Elinca will undertake any type of electronic communications system.

8.1.10 Fortier, J. Olivier Consulting Inc.

This is a research and consulting firm with an office in Saint Bruno, Quebec. The principal of the firm, J.O. Fortier engineer, has extensive experience in several subsectors of telecommunications, particularly in the specialized areas of cable television, audio-visual, microwave, telephony, broadcasting and mobile communications. During the last eight years, J.O. Fortier has participated in the development and implementation of very important projects in cable TV, namely the MICROBEC inter-city network, the SETTE transcoding and satellite distribution system, and regional VHCM systems. Since its inception in 1981, Fortier, J. Olivier Consulting Inc. has provided the communications industry, particularly the cable television segment, with consulting services in the areas of feasibility studies, system valuations, CRTC and Department of Communications briefs and applications, engineering design, proofs of performance, system management and organization.

8.1.11 HN Engineering Inc.
(formerly Hoyles Niblock International Limited)

HN Engineering Inc. (HN) is a successor company to the partnership Hoyles, Niblock and Associates, which was established in 1959. The company has been providing engineering, technical and project management services to the broadcasting, telecommunications, CATV, resource development, transportation and manufacturing industries and to governments in Canada and abroad since its inception.

Because of its multi-discipline capability, HN has been able to apply new and effective techniques to the solution of many unusual telecommunications problems.

Current domestic projects include design and supervision of the VHF radio communications facilities for the new British Columbia Railway system tunnels. CATV distribution techniques have been applied to this industrial application. HN Engineering, Leigh Instruments of Ottawa and the Canadian Commercial Corporation have co-operated in preparing specifications for a radar based vessel traffic management system for Hong Kong.

The firm has, in addition to these industrial applications of CATV techniques, continued to provide the cable industry with engineering services and technical expertise in the preparation of CRTC applications.

Services provided include preparation of reports and documents, rate and tariff studies, field surveys, system and project planning and design, specification preparation, bid evaluations and supervision of construction.

8.1.12 Imagineering Ltd.

Imagineering Ltd., founded in 1971 and based in Toronto, is a company of consulting engineers and project managers offering a comprehensive range of design, engineering, implementation and management services for broadcasting and telecommunications undertakings.

The company has considerable experience with AM and FM radio, broadcast, cable and pay television, as well as microwave and satellite distribution systems, audio/video production facilities, fixed and mobile two-way radio, radio paging and general communications. Particular specialities are broadcast and CATV studio and transmission systems design, propagation analysis and telecommunications systems design and engineering.

Also provided are engineering management services such as feasibility studies, capital and operating cost estimates, project scheduling, preparation of tender documents, project and construction management, presentations to government agencies, proof-of-performance testing, and inspection and evaluation of existing facilities.

8.1.13 Ontel Communications Inc.

This Toronto-based firm is a planning, engineering, project management and implementation group offering a comprehensive range of services for broadcasting and telecommunications undertakings, including electronic systems and facilities and associated civil/structural works.

The company has experience with AM, FM and shortwave radio; broadcast, cable and pay television; microwave and tropospheric scatter radio; satellite distribution and earth stations; audio/video production facilities; fixed and mobile two-way radio; radio paging and general communications. Ontel also provides related management services, such as feasibility studies, capital and operating cost estimates, project scheduling, preparation of tender documents, project and construction management, presentations to government and funding agencies, inspection and evaluation of existing electronic and civil/structural facilities and training.

8.1.14 Saperstein & Associates Ltd.

Saperstein & Associates is a firm of consulting engineers offering services in broadcasting, cablevision, telecommunications, telecontrol, vehicular communications and microwave systems. The organization's typical assignments include the design of AM, FM and TV broadcast stations; the design of CATV and MATV systems; the design of communications/data acquisition systems; the design and planning of corporate voice/data communication networks, and liaison on behalf of clients with common carriers; the preparation of Department of Communications technical briefs, and the equipment type approvals; the preparation of reports, submission of applications, and representation on behalf of clients to the CRTC.

8.2 MANAGEMENT CONSULTING COMPANIES

8.2.1 The Canada Consulting Group

In 1970 a group of experienced technical specialists established this Toronto-based firm to serve clients in Canada, the United States, and Europe. The company provides management consulting services to the communications industry - strategy, organization, business planning, marketing and productivity - and works with government bodies on questions of policy. It is particularly active in managing special projects such as design and development of businesses based on new technologies, the preparation of licence applications and government interventions, and the introduction of new business ventures and products.

8.2.2 CEGIR

CEGIR is a firm of management consultants established in 1970; it has since gained wide and diversified experience in the telecommunications sector, namely broadcasting, cable television, content production, office communications, regulatory matters, as well as experience in the education and finance sectors. CEGIR has completed special assignments for a number of major financial institutions, various government departments and agencies, and several foreign governments. It presently employs 150 professionals and has annual revenues of about $10 million. It maintains permanent offices in Montreal, Ottawa, Washington, Geneva, Algiers, Dakar, Manila and Bogota.

8.2.3 Econotec Inc.

Econotec Inc. is a Montreal-based firm of consulting economists. Since its creation in 1976 it has provided a wide variety of services to both private and public organizations in the communications sector, nationally and internationally. The company particularly specializes in techno-economic assessment for new services, market and feasibility studies, and financial evaluation of projects in the telecommunications, energy, transport and resource development sectors.

8.2.4 Nordicity Group Ltd.

Nordicity Group Ltd. (NGL) is a research and management consulting firm with offices in Ottawa and Toronto. Since its inception in 1979 NGL has provided various segments of the communications industry with consulting services in the areas of policy formulation and analysis, economic and technological impact analysis, market research, regulatory matters and new services development.

Nordicity Group has particular experience in preparing pay-TV and new television service business plans and licence applications for the CRTC. Nordicity is rapidly developing operational marketing experience in Canadian French- and English-language pay-TV services. As well, the company has an active interest in the introduction of non-programming services over cable, including the downloading of games, home computer software and information.

8.2.5 Peat Marwick and Partners

Peat Marwick offers a full range of management consulting, auditing, accounting, tax and business advisory services through a network of 25 offices across Canada.

In the communications sector, the firm has as clients broadcasting companies (including cable and pay-TV), telecommunications carriers, the CRTC and the federal Department of Communications.

Peat Marwick has provided these clients with services in the areas of market research and planning, financial and economic analysis, financial management, accounting and auditing, tax planning, information systems, organizational planning, operational reviews for profit improvement, project management, and regulatory matters.

8.2.6 Philip A. Lapp Ltd.

Philip A. Lapp Ltd. of Toronto and Ottawa was established in 1969. The company provides scientific and technological management consulting services to the cable industry, including proof of performance, policy issues, regulatory issues, appearances at hearings, and microwave and satellite system design licence applications.

8.2.7 Storey Saxe Communications Inc.

This Ottawa firm was founded in 1976 to offer consulting services to the communications industry. The company provides assistance with applications to the CRTC and other franchising and licensing bodies as well as government liaison and information services, financial and management services, co-ordination of technical services and programming-related work.

8.2.8 Woods Gordon Management Consultants

Woods Gordon is Canada's oldest and largest management consulting firm; it has traditionally had a strong interest in communications, and the cable television industry in particular.

For individual CATV operators, Woods Gordon provides assistance in assessing potential markets, developing business plans, completing licence applications, and preparing briefs on issues before regulatory agencies. Similar services have been provided to program producers and pay-TV operators. The firm also undertakes domestic and export market research for CATV equipment suppliers.

Woods Gordon analyzes broad economic and policy issues as well. Examples include the effects of regulation on Canada's CATV industry, the impacts of cable television on the Ontario economy, and the implications of introducing both pay-TV services and a direct broadcasting television system in Canada.

9. MAJOR GLOBAL PLAYERS

The major global players in cable supply include U.S.-based RCA, N.A. Philips, Zenith, General Instrument, M/A Com, Oak Industries and Scientific-Atlanta, and Pioneer, based in Japan. As CATV is only one of those companies' product areas, direct comparison of key parameters is difficult. However, the companies range in size from Scientific-Atlanta, with sales of $337 million, to RCA with sales of $8.2 billion. When CATV-related activities are considered exclusively, the revenues of major players range from $50 million for Oak Industries to $450 million for Anixter Bros. Inc. As the largest Canadian manufacturers and distributors generally have CATV sales of $10-20 million, they are small firms in comparison to their global competitors. This section describes each of the major international suppliers that will continue to have a major presence in the domestic, American and growing international markets.

Table 9 summarizes the sales, R&D capacity and staff in each of these firms.

9.1 DESCRIPTION OF FIRMS

9.1.1 Anixter Bros. Inc.

Anixter is a major distributor of electrical wire and cable, mining and industrial supplies and cable television and telephone products. The company also manufactures products used in the transmission of telephone communications or electricity. Net sales from distribution operations in 1982 ($456.1 million) accounted for 85 per cent of total net sales of $537.8 million. The other $81.6 million in sales came from the company's manufacturing operations. Much of Anixter's distribution revenue is earned from sales of equipment to the CATV industry in the United States and Canada. Over the past three years, Anixter's distribution business has grown at an average annual rate of 24.3 per cent, while its manufacturing business grew between 1980 and 1981 but leveled off between 1981 and 1982.

Anixter has 42 distribution facilities in the United States, 12 in Canada, 3 in the United Kingdom and 1 in the Netherlands. Also, Anixter has 17 manufacturing plants in the United States, where 1982 corporate sales amounted to $487.5 million. Canadian sales that year were $34.9 million and European sales reached $17.9 million. Sales of CATV products were concentrated in the United States and Canada.

Of Anixter's staff of 2,550, 1,500 work in its distribution sector and 1,050 in manufacturing.

Table 9

MAJOR MANUFACTURERS AND SUPPLIERS OF CATV EQUIPMENT

Manufacturer/ Distributer (ranked by total sales)	1982 Total Sales	Estimated CATV Equipment Sales	Total R&D Expenditures	Expenditures as a % of Total Sales	Total Number of Employees	Base Country
	(US $ million)					
RCA	8,237	300	505	6.1	110,000	U.S.
N.A. Philips	3,168	320	NA***	NA	45,823	U.S./Netherlands
Zenith	1,239	80	64	5.2	45,000	U.S.
Pioneer	1,128	120	NA	NA	40,000	U.S./Japan
General Instrument	957	410	22	2.2	12,000	U.S.
M/A Com	588	194	51	8.7	8,700	U.S.
Oak Industries *	546	50	21	3.8	11,985	U.S.
Anixter Bros. **	538	456	-	-	2,550	U.S.
Scientific-Atlanta	337	185	15	4.4	4,960	U.S.

* Major communications related revenues from Oak's subscription television operations (ONTV).

** Primarily a distributor.

*** Not available.

Sources: Annual Reports and 10-K Reports to the U.S. Securities and Exchange Commission.

9.1.2 General Instrument

In 1982 General Instrument (GI) reported total revenues of $957.1 million and a net income of $90 million. In Broadcasting's Electronic Communications Index[10] GI ranked 34th among the top 100 American electronic communications firms. Revenues in 1982 increased 16 per cent over 1981 revenues of $825.1 million.

GI's operations are organized into four separate segments: broad-band communications, data systems, semiconductor products and component products. The Jerrold Division of GI, which operates in the broad-band communications segment, is a leading manufacturer and supplier of systems and equipment such as RF headend systems, RF distribution systems, converters, pay and addressable systems, and home-security cable equipment. Jerrold was founded in 1948 as Jerrold Electronics Corporation; in 1967 it became a subsidiary of GI and in 1980 was made a division. GI's broad-band communications segment, which sells principally to the cable industry, accounted for 42.8 per cent of the company's total revenues in 1982. Table 10 shows the revenue earned by each of GI's four segments in 1980, 1981 and 1982.

Over the past three years, sales to the cable industry have accounted for an increasing share of GI's total revenues.

The Jerrold Division, which is headquartered in Hatboro, Pennsylvania, has manufacturing, assembly and distribution facilities in Tucson, Arizona; Nogales, Mexico; Brussels, Belgium; Taipei, Taiwan; and Toronto, Ontario. GI's data systems, semiconductor and component products divisions also have manufacturing, assembling and distribution facilities in the United States, Europe and the Far East.

GI's research and development spending in 1982 was reported at $21.5 million - 2.2 per cent of total revenues. Most of GI's R&D activities are carried on in the United States and Canada. In Canada, for example, GI has given its Satellite Systems Division the world product mandate to develop the company's DBS TVRO earth station.

9.1.3 M/A Com

M/A Com, founded in 1950 as Microwave Associates, Inc., was established initially to design and manufacture microwave products for the American military. Since its inception M/A Com has evolved into one of the leading designers and manufacturers of equipment and systems for satellite communications, data communications, television broadcasting and cable television. Net sales in 1982 amounted to $587.6 million, up 17.9 per cent over 1981 sales of $498.5 million. Including its subsidiaries and divisions, M/A Com employed about 8,700 persons in 1982.

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10 Broadcasting, May 9, 1983.

Table 10

GENERAL INSTRUMENT REVENUE BY SEGMENT
($ million)

Year	Broad-band Communi-cations	Data Systems	Semi-conductor Products	Component Products	Total
1982	409.5	154.9	269.6	123.1	957.1
	(42.8%)	(16.2%)	(28.2%)	(12.8%)	-
1981	301.3	134.6	244.0	145.1	825.1
	(36.5%)	(16.3%)	(29.6%)	(17.6%)	-
1980	193.1	150.1	202.6	172.3	718.1
	(26.9%)	(20.9%)	(28.2%)	(24.0%)	-

The firm addresses three major market segments: components, cable/home communications and integrated digital communications. Table 11 shows the growth in sales within each segment.

M/A Com is widely recognized as the major American supplier of coaxial cable. Recently, M/A Com Comm/Scope, Inc., a wholly-owned subsidiary, introduced a new coaxial cable called Quantum Reach (QR). QR has greatly improved physical and electrical characteristics that enable it to be installed at lower cost because it requires fewer line amplifiers.

Through its subsidiaries (M/A Com Video Satellite, Inc., M/A Prodelin, Inc. and M/A Com Linkabit, Inc.) the company designs and manufactures satellite earth station antennas and associated electronic equipment, TVROs and signal scrambling/descrambling systems.

M/A Com spends heavily on R&D activities: in 1982, it allocated $51 million, or 8.7 per cent of total sales to this activity.

9.1.4 North American Philips Corp.

In 1982 this company reported net sales of $3,168.1 million and employed over 45,823 people. N.A. Philips manufactures a variety of consumer products, electrical and electronic components and professional equipment for CATV, medical and business sytems. Professional equipment sales accounted for 27.5 per cent ($869.3 million) of the company's total 1982 revenues. Sales of consumer products and electrical and electronic components accounted for 49.9 per cent ($1,581.7 million) and 22.6 per cent ($717.0 million) respectively of total sales.

N.A. Philips' CATV products are manufactured and distributed by Magnavox Cable Television Systems, Inc., a wholly-owned subsidiary operating in the company's professional equipment segment. Sales of Magnavox CATV products, primarily to the American market, are estimated at about $320 million. Through distribution agreements with N.V. Philips of The Netherlands, Magnavox is also gaining a foothold in growing CATV markets overseas. Thus far, sales in the Canadian market have been marginal; very few distributors carry the Magnavox CATV product line.

9.1.5 Oak Industries

In 1982, Oak Industries reported net sales of $545.7 million, a 7.6 per cent increase over its 1981 sales of $507.1 million. Oak is a multifaceted communications conglomerate that provides over-the-air subscription television (STV) services, operates cable systems and manufactures equipment for STV and CATV systems. The company also manufactures precision components such as rotary switches, high frequency crystals and oscillators, potentiometers, and a variety of laminates and specialty materials used in printed circuit applications.

Table 11

M/A COM SALES BY BUSINESS SEGMENT
($ millions)

Year	Components	Cable/Home Communications	Integrated Digital Communications	Total
1982	208.4	189.1	190.1	587.6
	(36.3%)	(32.9%)	(30.8%)	
1981	185.7	178.9	133.9	498.5
	(37.6%)	(36.3%)	(27.1%)	
1980	137.9	108.1	95.2	341.2
	(40.4%)	(31.7%)	(27.9%)	

Source: M/A Com 10-K Report.

Through various subsidiaries, Oak's communications products and services generated sales of $260.5 million, or roughly half of total sales in 1981, sales of components and materials accounted for 30 per cent and 19 per cent, respectively. In 1981 Oak earned 87 per cent of its revenue from U.S. operations.

Oak's STV operation, ON TV, offers pay-TV services in Los Angeles, Phoenix, Ft. Lauderdale/Miami, Chicago and Dallas/Ft. Worth. At the beginning of 1982 the company reported earnings of $165 million from its 596,000 ON TV subscribers - 33 per cent of total corporate sales. The other 63 per cent of revenues came from the sale of communications products and services.

Oak Industries and its subsidiaries employ some 13,500 persons, 7,500 in the United States and 6,000 in South America, Europe, South Africa and the Far East. The company has manufacturing plants in the United States, Mexico, and Taiwan, and sales and distribution offices in South America, the United States, Europe, South Africa and the Far East. Oak's communications products are manufactured principally in the United States and Taiwan.

In 1981 Oak spent approximately $16.6 million (3.3 per cent of total sales) on R&D. Approximately 500 employees are employed in R&D activities, primarily in the company's corporate headquarters in Rancho Bernardo, California.

9.1.6 Pioneer Communications of America, Inc.

Pioneer Communications of America, Inc. (PCA) is a wholly-owned subsidiary of Pioneer Electronics (USA) Inc. (PE), which is itself a wholly-owned subsidiary of the Japanese parent, Pioneer Electronics Corporation (PEC). PCA was set up specifically to develop products for the cable television industry. Initially, PCA developed QUBE, a two-way interactive cable service designed exclusively for Warner Amex Cable Communications (inaugurated in Warner Amex's Columbus, Ohio system), which has made it a pioneer in interactive cable technology. Since 1980 PCA has introduced a number of converter products that have made it one of the leading manufacturers and suppliers of conventional converters as well.

PEC reported total sales of $1,128.4 million in 1982, down 4 per cent from 1981. The domestic market accounted for approximately one-third of this total while overseas sales accounted for the remaining two-thirds. Sales of PCA's products, entirely in the United States, amounted to approximately $120 million, or 9 per cent of total corporate revenue. Although PE's corporate revenue decreased between 1980 and 1982, PCA's revenue increased twelve-fold from approximately $10 million in 1980.

PEC reported research and development expenditures of about $40 million (3.5 per cent of total sales) and total employment of 11,600 persons in 1982.

9.1.7 RCA Inc.

RCA is a diversified multinational corporation with total 1982 sales of $8,237 million. It manufactures a variety of consumer electronics products (television receivers, video cassette recorders and videodisc players) and commercial electronics products (equipment for broadcasting cable television, communications satellites, colour television picture tubes and solid-state and electro-optic devices). The company also owns and operates the National Broadcasting Corporation (NBC), RCA Americom (which provides domestic satellites communications services) and data communications services, the Hertz Corporation (a major automobile and truck renting and leasing company), and financial and health insurance services. In 1982, RCA's electronics manufacturing activities earned revenues of $4,354 million, or 53 per cent of total corporate revenues. Commercial electronics products and services reported total sales of $1,204 million -- 15 per cent of total corporate revenues and 28 per cent of total revenues from the sale of electronics products. RCA spokesmen estimate that electronics products and services sold to the CATV industry amounted to about $300 million in 1982.

In 1982, RCA expended approximately $505 million for research, development and engineering activities. However, only $195 million of that total came from RCA itself. Major funding ($310 million) for RCA's R&D activities was provided by the U.S. government and private customers.

In 1982, RCA and its subsidiaries had employed 110,000 persons throughout manufacturing and distribution facilities in the Far East and sales and distribution offices across Europe, South America and Canada.

9.1.8 Scientific-Atlanta Ltd.

In 1982 Scientific-Atlanta of Atlanta, Georgia (SA) earned $337.2 million from the sale of communications and instrumentation products. Its communications products include satellite earth station antennas, transmitters, receivers, modulators, demodulators and other electronic devices related to CATV receiving and distribution systems, wireless home security and energy management. Sales of these products accounted for 64.5 per cent ($217 million) of total revenue, and most of this revenue came from sales of headend equipment to the CATV industry.

9.1.9 Zenith Radio Corp.

This Glenview, Illinois firm reported 1982 sales of $1,239 million. The company manufactures consumer electronics products, cable television products, computers and electronic components. Sales of cable television products made up for 6.5 per cent ($80 million) of total revenue; colour television and other consumer products, computers and components accounted

for 75.8 per cent ($939 million), 12.3 per cent ($152 million) and 5.5 per cent ($68 million), respectively. Between 1981 and 1982, Zenith doubled its sales of addressable pay-TV decoders, electronic studio equipment and videotex decoders. Zenith expects that its CATV product line will be its most promising line in the mid- to late 1980s.

10. CONCLUDING OBSERVATIONS

This section sums up the current development phase of the Canadian cable supply industry, including the international perspective. It reviews the potential regulatory/policy impact on the industry's further growth, raises industrial development issues for the cable industry and government to consider, and discusses areas for further policy deliberation.

10.1 NEW SERVICES EXPANSION

At the outset of this report, the cable industry was described as being in a state of transition from that of a traditional utility to having an expanding part of its operations devoted to the provision of discretionary services. Such activities require a more sophisticated technical, marketing, and management capability on the part of cable operators, and further demands that the cable operator's suppliers, provide an increasingly "electronics-oriented" product line.

The 12-month period prior to the inauguration of pay-TV in February 1983 was Canada's introduction to the purchase of equipment for new services. Although some problems have arisen, subscriber penetration targets are generally being realized and cable operators have tangible evidence that extra revenue can be derived from new services in Canada.

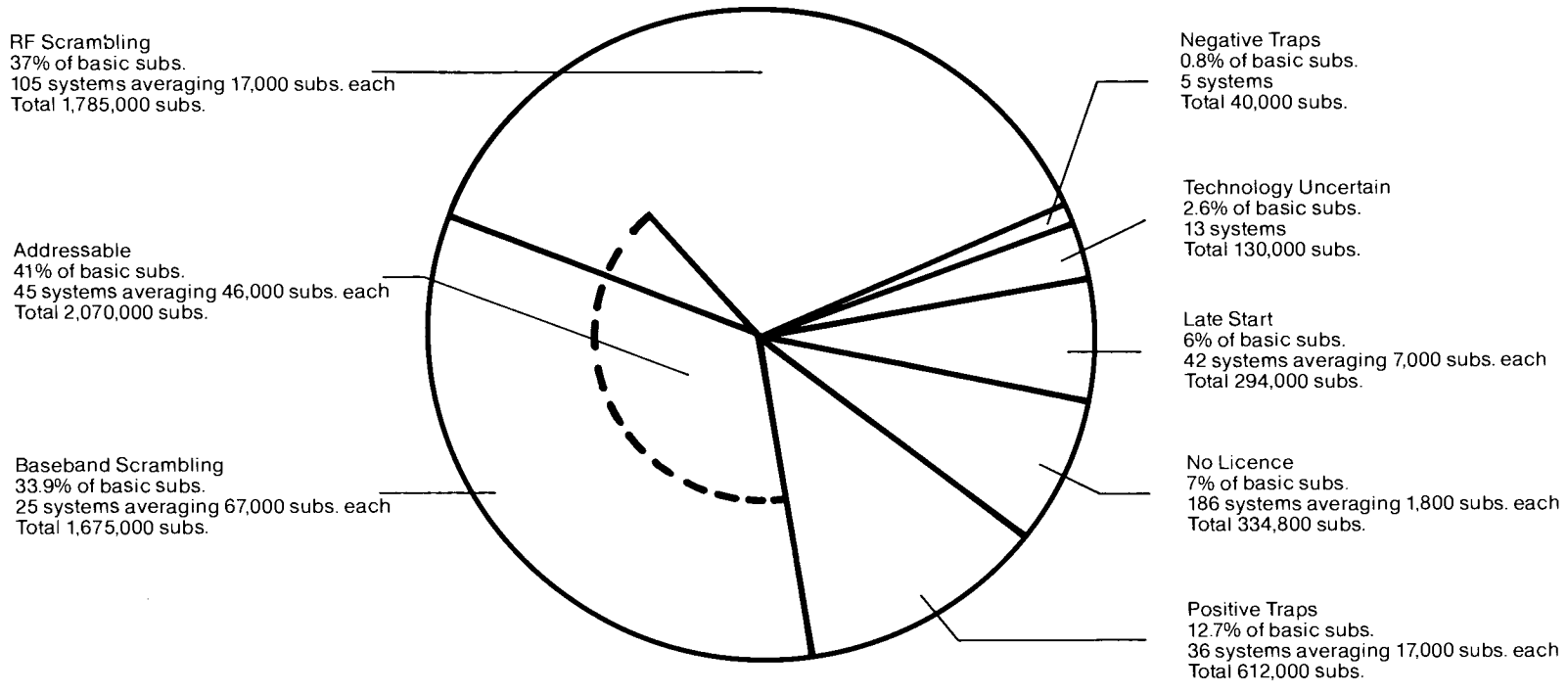
Several Canadian companies had expressed early interest in providing the security equipment required for the introduction of pay-TV. However, the start-up came precisely when the leading foreign manufacturers were finally able to arrange volume production of reliable and relatively low-cost addressable descramblers. Consequently, in the large cable operator market, Jerrold and Zenith dominated - Hemlin, Eagle and Oak obtained only fragments of the market. Microcom's indigenous Canadian design made some sales to the medium- to small-sized operators.

Figure 12 shows the results of the 1983 Cable Telecommunications Research Institute's survey of cable operators' decisions on scrambling equipment. About 41 per cent of decoder units purchased were for addressable systems. Where addressables have been ordered, Canada is regarded as having made a direct leap into the third generation of security systems as opposed to the more elementary positive and negative traps.

Since the amortization period for security systems can be as low as two years, the replacement and upgrading market could quickly become quite important for manufacturers. This need would generate a second round of security system purchases, particularly of the addressable kind, in view of the anticipated introduction of discretionary tiering of satellite delivered services and ultimately, a pay-per-view system. However, most cable operators who ordered programmable scrambling systems will probably

Figure 12

NUMBER OF CABLE SYSTEMS USING PAY-TV SCRAMBLING/DESCRAMBLING TECHNOLOGIES



Source: CTRI study, Cable Pay-TV Implementation Decisions - The Position at Launch, (Feb. 1, 1983).

try to make them last and thus delay a replacement order for four to five years.[11] Some Canadian manufacturers, particularly Videoway of Montreal, are aiming at this third-generation replacement market.

Currently, however, many uncertainties remain about equipment needs for future services: the nature and extent of consumer and institutional demand, the timing of their introduction by cable operators, their success against alternative delivery systems, and the technological developments that may occur in the meantime. The projections presented earlier indicated that cable gross revenue currently averaging $9.30/sub./mo. would climb rapidly to $16.60/sub./mo. in 1985 and to $25.60/sub./mo. by 1990. Despite such fairly specific projections, the uncertainties make investment, product development, and marketing/distribution planning by supplier companies a risky business.

10.2 INTERNATIONAL CABLE DEVELOPMENTS

Figure 4 (p.9) shows that Canada's future subscriber penetration growth is quite slow when compared with the United States and particularly with the rest of the world. While Canada's cable subscriber penetration is near maturity, U.S. operators are still extending cable into major unserviced areas. As well, many parts of Europe (and other parts of the world) have not yet achieved very significant cable penetration levels.

Figure 13 compares forecasted per-subscriber earnings for Canada, the United States, and the rest of the world. It is evident that the United States leads in the commercial exploitation of cable systems for the delivery of programming and non-programming services, and that further sustained growth in new services is projected throughout the 1980s. As for the rest of the world, the various institutional barriers will probably inhibit the attainment of North American levels until the early 1990s.

Growth patterns in the CATV industry, can differ markedly from one country to another. An example is the difference between the United States and Canada over the past 20 years, where Canada had rapid early growth generated by demand for U.S. programming, and U.S. growth developed later in response to the demand for new services. Each country in Europe is quite different; for example, the United Kingdom and France should undergo rapid growth over the next few years while countries such as Belgium are already heavily cabled. The latter group are, however, equipped with an aging system that does not have the capacity to provide the full variety of additional programming and services available in North America. The difference lies in the various policies and regulatory approaches - and indeed market forces - that have a critical effect on CATV growth patterns.

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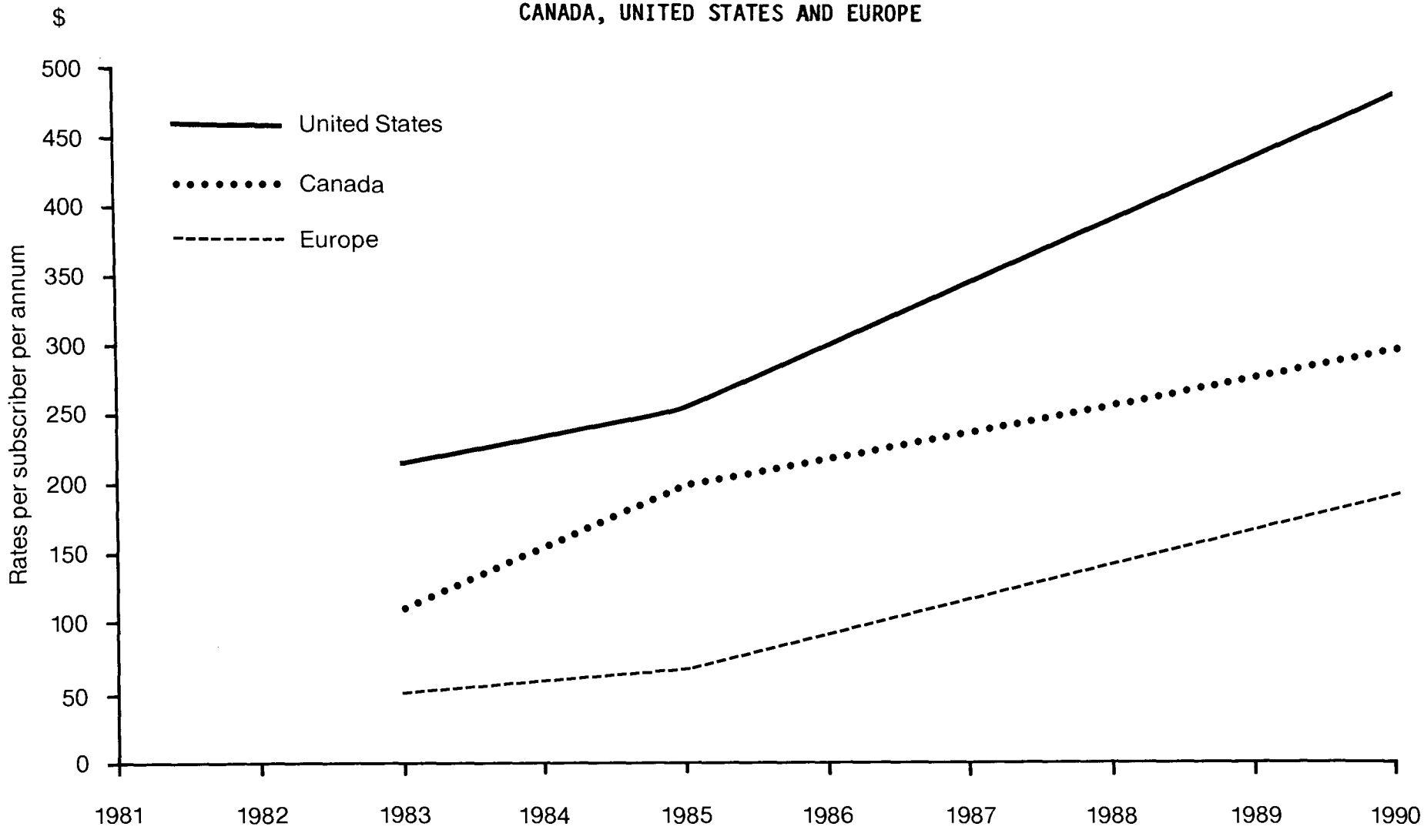
[11] The whole purpose of the CTRI's Cable Pay-TV Systems Planning 1982, was to assist operators in planning how they would advance into more sophisticated security systems.

Figure 13

CATV REVENUE PROJECTIONS -
CANADA, UNITED STATES AND EUROPE



Source: Link Corp., CATV and Satellites in Europe, 1982; Paul Kagan Associates, Cable TV Data Book, 1982; and Nordicity Group estimates.

From these general comparisons it is clear that since the United States leads in new services development, American CATV operators will set the pace for the introduction of new products and services. The larger American marketplace should have a dominant impact on the setting of standards for new products. Other countries will then follow as their regulatory regimes permit. This broad conclusion is confirmed by industry sources, who readily agree that the current American market is the dominant factor in expanding sales opportunities. Because of their proximity to the United States, Canadian-based manufacturers and service providers can more readily profit from American cable developments than can their European or Japanese counterparts.

10.2.1 The American Market

From industry surveys, it appears that 1982 will stand as the high water mark of American CATV construction. The 1984-86 CATV construction expenditure should be well below the billion-dollar mark, as compared with the $1.7 billion spent in 1982 alone.

Although construction will slow down, substantial capacity is still being installed in American cable systems. The total plant miles figure is expected to rise from 330,000 in 1982 to 529,000 by 1987. More importantly, there will be a major upward shift in the number of channels offered. In 1987, it is expected that 33 per cent of American CATV plant will provide 36 or more channels as compared with only 12 per cent in 1982.[12]

While a slowdown is forecast in cable plant construction, future opportunities lie in producing the equipment necessary to provide new or advanced cable services that will be offered over existing cable networks, such as pay per view, transactions and videotex.

10.2.2 Organizing for American Markets

Within the context of the American market, which still exhibits major growth and presents no major trade barriers (particularly in advanced services), Canadian suppliers enjoy several significant opportunities.

The classic Canadian opportunity in export markets is to identify a specialty market or "niche" that can be supplied by a relatively small firm, whose size does not draw the interest of large manufacturers. Electroline's multiple-unit exterior addressable descrambling system, Solutec's telemanagement system, Teledac's character generators and Microcom's entry into relatively small cable systems markets with its off-air or cable-connected scrambling and descrambling system are examples of Canadian firms with product lines filling these niches.

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[12] Multichannel Technologies Report, March 1, 1982.

Canadian firms can attempt to match the technical, marketing and financial strength of major foreign concerns in selling a total system or service package, including the headend/subscriber premises hardware and software. NABU's integrated cable/home computer system, including software, cable interface, and microcomputer and its peripherals, is the current leading example of this approach. This could be considered a high risk strategy, particularly for firms without the capability to develop systems in complementary CATV product lines.

An alternative for Canadian companies with strength in technical design is to license their technology to major foreign firms with international marketing and volume production capability. Such a licensing arrangement has been achieved by SED Systems with General Instruments, and is the objective of companies such as Phasor Telecom with its encryption capability. The Videoway integrated cable data/video system pioneered by Videotron is another example of an even more ambitious undertaking in view of its development as a joint venture with G-Tech.

Other Canadian operations with foreign-based parent companies can seek to gain "world product mandate" status. In this status, Canadian expertise and capacity is recognized by the foreign parent through the designation of the Canadian engineering and production facilities as the source of supply to international markets. The Canadian operations would have the world mandate for specified product lines, possibly with international marketing responsibility as well. The Jerrold Division and the Satellite Systems Division of General Instruments are examples of foreign-owned companies with world product mandates for their Canadian operations.

10.2.3 European and Other Markets

A market demand forecast for key European markets is shown in Table 12. In countries such as France, the Netherlands, Sweden, West Germany and Switzerland, 40 per cent of TV households subscribe to cable or a variation thereof, master antenna television systems (MATV). The United Kingdom has a large market, but cable penetration of only 15 per cent. According to the growth rates forecasted for each country, the increase in subscribers from 1982 to 1987 will be highest in West Germany at 5.1 million; France will increase by 2.2 million, and the United Kingdom by 1.5 million.

The forecasted high growth in subscribers, extensive system upgrading and relatively open market to outside suppliers makes the United Kingdom, the key European market for Canadian suppliers. American suppliers have already been quite active in forming joint ventures with U.K. firms as a strategy to penetrate British markets.

In general, MATV systems have a high proportion of the European subscribers. Thus, major opportunities exist for the introduction of CATV to provide up-to-date technology where less sophisticated systems exist. In France, for example, less than 1 per cent of cable subscribers are in fact CATV connections; the overwhelming majority subscribe to an MATV

Table 12

MARKET DEMAND FORECASTS IN KEY EUROPEAN MARKETS (000,000)

Country	1982 Population	TV Households 1982	CATV & MATV Subscribers	Penetration (% of TV Households)	MATV Subscribers (% of Total Subscribers)	Projected CATV & MATV Subscribers (1987)	Average Annual Growth Forecast (%)	Number New Subscribers (000)
France	53.0	15.0	8.3	55.4	99	10.5 (70%)	4.5	2,200
Netherlands	14.0	4.8	2.9	60.0	25	3.4 (71%)	3	500
Sweden	8.2	3.5	1.75	50.0	100	2.3 (66%)	5	550
U.K.	57.0	18.0	2.6	14.5	3	4.2 (23%)	10	1,500
West Germany	61.5	22.0	9.86	44.7	98	15.0 (68%)	9	5,140
Switzerland	6.3	2.0	1.1	55	36	1.45 (73%)	5	350
							Total	10,240

Source: Link Corporation, CATV and Satellite in Europe, 1982.

service. However, France is planning the introduction of pay-TV in 1984 on an STV basis. This is viewed as an interim step until cable systems are constructed and take over the distribution of new television (and non-programming) services.

Accessing the French and other European markets (e.g. West Germany, which is also mainly served by small community antenna systems) depends in part on intergovernmental arrangements. Cable systems in many of those countries will largely be organized by the PTTs or other government institutions. The recently announced Quebec-France accord on Quebec firms participating in French cable development is a major indication of the importance of these arrangements.

Other international markets of growing importance include South and Central America, Australia and Japan. The Japanese, for example, have recently recognized the huge market potential for cable in their urban areas. In 1982 there were only 3.3 million subscribers, mostly in remote areas. However, several experimental projects using advanced two-way systems are now underway.[13]

The Japanese will be looking for the most advanced developed technology in both traditional and new service products as they move to position cable into a more prominent position.

10.2.4 In Sum

The 1982 Canadian export figures have been estimated at $50 million. Exceeding or sustaining that level in a market where the growth is in the higher technology area depends on assumptions about the performance of Canadian companies. If certain individual company initiatives are successful, the current export figure could increase substantially. In any case, a sustained and dynamic effort to market Canadian products in the United States and abroad will be necessary as competition on the international scene intensifies.

10.3 INDUSTRIAL ISSUES

Assuming that there will continue to be a steady development of new services activity in Canada, some key issues will have to be addressed by the industry and government.

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[13] One experiment in operation since 1978 in Nara Prefectune called the Highly Interactive Optical Visual Information System ("HI-OVIS"), involves the full duplex video information system using optical fibres. The system, serving 156 households, schools and other public facilities, provides a full range of programming and information services and full two-way communication.

10.3.1 Volume Production

Canadian firms that are successful technological innovators can progress to the $5 to $10 million volume level for a particular product. However, to gear up to a production level in the hundreds of thousands of units per year can require penetration of world markets in the highly competitive consumer electronics industry.

Some form of joint venture with multinationals that have a strong market presence and established distribution channels, such as the proposed Videoway approach, is one alternative for indigenous firms.

10.3.2 World Product Mandate

One multinational corporate strategy approach that can be beneficial to Canada is the establishment of a so-called "world product mandate", whereby the Canadian operations of a multinational lead the development and marketing of specific product lines to world markets.

Although such a mandate may not be directly beneficial to indigenous Canadian competitors, the outcome is preferable to supplying the domestic market from offshore factories. It is also likely to be more beneficial than merely assembling products in Canada, because the latter approach lacks an R&D or a product improvement component that could form the basis for expansion. It is important to determine the conditions under which more multinational manufacturers will be encouraged to make world product mandate commitments to Canada.

10.3.3 Supplier/Buyer Relationships

One way of developing Canadian supplier capability is for major Canadian cable operators to place large orders with indigenous suppliers, so that development costs can be initially justified and amortized over a major initial sale. However, since cable operators already have constrained operating margins their ability to procure Canadian equipment in preference to foreign suppliers is quite restricted, unless Canadian suppliers offer very competitive terms and product lines.

In some cases, there are major investment interests between cable operators and manufacturers (e.g., Videotron and Videoway, CUC and Microcom). This can be a risky option for cable operators. If such products are reasonably competitive, the ownership linkage will be an important and even critical contribution to product development. However, if the product is overpriced or not appropriate, or if the timing is delayed, that cable operator may suffer financially for being committed to acquire the affiliate's equipment.

10.4 POLICY ISSUES

Although the Canadian content in cable equipment and services was probably 50-60 per cent prior to the start-up of pay-TV in early 1983, it may decline in the wake of the competitive efforts of major multinational electronics manufacturers. The key issue is to determine what policies will ensure that Canadian suppliers have the best opportunity to gain a proportionate share of the international market. Policy areas that should be explored in this context include the following:

- R&D stimulation through transfer of technology (fibre optics, signal compression techniques, etc.);
- across-the-board R&D and other tax incentive schemes to companies for the research phase of a product;
- design of tax shelter programs to encourage investors to provide start-up venture capital to young and inventive companies for the development of new or enhanced products;
- assistance in the tracking of international markets through focussed government to government relations in cable and other equipment areas;
- establishment of specific supplier development incentives for the cable industry, either directly or via cable operators;
- regulatory stimulation of marketplace development by encouraging the cable industry to advance more quickly into new services;
- the establishment of Canadian industrial benefits as one of the factors to be considered in the licensing process;
- development of cable research in government and laboratories, especially in those areas which may be too costly, despite their potential for Canadian firms.

In the opinion of the industry representatives interviewed during this study, a stimulative activity already in the hands of the federal government is the development of a more liberalized regulatory policy. The extent to which such policies can be changed before cultural objectives are adversely affected remains a key policy issue. Ensuring that Canadian suppliers obtain their share of increased cable operator orders is also an important complementary policy question.

Appendix A

OWNERSHIP OF CABLE EQUIPMENT SUPPLIERS

Company	Canadian Interest	Foreign Interest
Abroyd	private	
Alpha Technologies	private	
Amphenol	100% Allied Canada Inc.	100% Allied Corp. (U.S.A.)
Andrew Antenna		100% Andrew Antenna Corp. (U.S.A.)
Cableshare	35% Rogers Cablesystems	
Canada Wire & Cable	80% Noranda Mines	
Central Dynamics	15% Canadian Enterprise Development Corp. Ltd.	
Delta Benco		99% Rediffusion Ltd. (U.K.)
Electrohome	public	
Electroline	private	
Gandalf	public	
International Phasor	private	
Jerrold Canada	100% General Instrument Canada	100% General Instrument (U.S.A.)
Leblanc & Royle	private (employee-owned)	
Leitch Video	private	
Lindsay Specialty	private	
Linear Technology	public	

Company	Canadian Interest	Foreign Interest
Microcom	private	
NABU	13% Campeau Corp. 11% CICI Industrial Interest 10% Bytec Management Corp.	
Norpak	private	
Sachs	private	
Scientific-Atlanta (Canada) Ltd.		100% Scientific Atlanta (U.S.A.)
Solutec	private	
Source Communications	Gemanco International	
Stirling Connectors	private	
Teledac	private	
Triple Crown	private	
Viewstar	GSW Inc.	
Wind Turbine	private	
Zenith Radio Canada Ltd.		100% Zenith Radio (U.S.A.)

Appendix B

GLOSSARY OF CATV TERMS

DBS (direct broadcast satellites), a technology through which several channels of programming can be beamed directly to households equipped with small receiving dishes.

MATV (master antenna television), a cable television system set up entirely on the premises of an apartment building, condominium complex or similar urban dwelling units. The headend is usually located on the roof of the building being served.

MDS (multipoint distribution service), a system distributed by microwave on the super high frequency band, which is used for locally based pay programming.

SMATV (satellite master antenna television), a distribution system created by the installation of satellite receiving dishes at modern apartment complexes constructed with master-antenna systems.

STV (subscription television), a station whose signal is broadcast (off-air) or on the airwaves scrambled and requires decoding equipment in the viewer's home.

Tiering, a system of grouping different program services and offering them at different prices, according to each tier or step.

TVRO (television-receive-only), a satellite earth station capable of only receiving satellite signals.

Appendix C

INDUSTRY ADDRESSES

SUPPLIERS OF EQUIPMENT AND SERVICES

Abroyd Construction Ltd.
Division of Dahmer Steel Ltd.
68 Shirley Ave.
P.O. Box 460
Kitchener, Ont.
N2G 4A6

Allan Crawford Associates Ltd.
6503 Northam Dr.
Mississauga, Ont.
L4V 1J2

Alpha Technologies Ltd.
7033 Antrim Ave.
Burnaby, B.C.
V5J 4M5

Amphenol Canada Inc.
44 Metropolitan Rd.
Scarborough, Ont.
M1R 2T9

Andrew Antenna Company Ltd.
606 Beech St.
Whitby, Ont.
L1N 5S2

Anixter-Microsat
970 Brock Rd. S.
Pickering, Ont.
L1W 2A1

Cable Consulting Services Ltd.
R.R. 1
Terra Cotta, Ont.
N5W 2S9

Cablesystems Engineering
800 York St.
London, Ont.
N5W 2S9

Cableshare Inc.
P.O. Box 5880
London, Ont.
N6A 4L6

The Canada Consulting Group
87 Front St. E.
2nd floor
Toronto, Ont.
M5E 1B8

Canada Wire and Cable Ltd.
250 Ferrand Dr.
Don Mills, Ont.
M3C 3J4

Canadian Satellite
Communications Inc. (Cancom)
45 Charles St. E.
Toronto, Ont.
M4Y 1S2

CANTEL Engineering
Associates Ltd.
402 West Pender St.
Vancouver, B.C.
V6B 1T6

Cantel Data Systems Co. Ltd.
1610 Beauharnois St.
Montreal, Que.
H4N 1J5

J. Cappon & Associates Ltd.
1 Cathcart St.
Willowdale, Ont.
M2M 1E8

CEGIR
2 Complexe Desjardins
Suite 2301
Montreal, Que.
H5B 1B3

Central Dynamics Ltd.
147 Hymus Blvd.
Pointe Claire, Que.
H9R 1G1

Channel One Video Corp.
1601 West 2nd Ave.
Vancouver, B.C.
V6J 1H3

Communications Engineering
Services Ltd.
5790 Campus Rd.
Mississauga, Ont.
L4V 1G2

Crowder Communications Ltd.
4312 Norfolk St.
Burnaby, B.C.
V5G 4J9

D.E.M. Allen & Associates Ltd.
130 Cree Cres.
Winnipeg, Man.
R3J 3W1

Delta Benco Cascade Ltd.
124 Belfield Rd.
Rexdale, Ont.
M9W 1G1

Deskin Sales
77D Steelcase Rd. W.
Markham, Ont.
L3R 2M4

DGB Consultants Inc.
1 Complexe Desjardins
Montreal, Que.
H5B 1C8

Digital Video Systems Corp
716 Gordon Baker Rd.
Willowdale, Ont.
M2H 3B4

Douserv Group Inc.
1200 McGill College Ave.
Suite 1930
Montreal, Que.
H3B 4G7

Econotec Inc.
4 Place du Commerce
P.O. Box 278
Nuns Island, Que.
H3E 1J9

Electrohome Ltd.
809 Wellington St. N.
Kitchener, Ont.
N2G 4J6

Electroline TV Equipment Inc.
8750 8th Ave. Ville St. Michel
Montreal, Que.
H1Z 2W4

Elinca Communications Ltd.
12 Rutherford Cres.
Kanata, Ont.
K2K 1M9

Fortier, J. Olivier Consulting
Inc.
P.O. Box 207,
St-Bruno-de-Montarville, Que.
J3V 4P9

Fundy Cablevision Ltd.
55 Waterloo St.,
Saint John, N.B.
E2L 4V9

Gandalf Data Ltd.
Gandalf Plaza
9 Slack Rd.
Nepean, Ont.
K2G 0B7

Hitachi Denshi Ltd. (Canada)
65 Melford Dr.
Scarborough, Ont.
M1B 2G6

HN Engineering Inc.
(formerly Hoyles Niblock Int.
Ltd.)
4664 Lougheed Highway
Burnaby, B.C.
V5C 5R7

Imagineering Ltd.
95 Barber Green Rd.
Suite 112
Don Mills, Ont.
M3C 3E9

Incospec Electronics Inc.
4651 des Grandes Prairies Blvd.
St-Leonard, Que.
H1R 4S7

International Phasor Telecom Ltd.
305-1030 West Georgia St.
Vancouver, B.C.
V6E 2Y3

Jerrold Division, General
Instrument of Canada Ltd.
87 Wingold Ave.
Toronto, Ont.
M6B 1P8

LeBlanc and Royle Communications Inc.
514 Chartwell St.,
Oakville, Ontario
L6J 5C5

Leitch Video Ltd.
10 Dyas Rd.
Don Mills, Ont.
M3B 1V5

Lindsay Specialty Products Ltd.
50 Mary St. W.
Lindsay, Ont.
K9V 4S7

Linear Technology Inc.
P.O. Box 489
Station A
Burlington, Ont.
L7R 3Y3

Microcom Systems Ltd.
Unit 1
225 Nugget Ave.
Agincourt, Ont.
M1S 3L2

NABU Manufacturing Corp.
1051 Baxter Rd. W.
Ottawa, Ont.
K2C 3P2

Nordicity Group Ltd.
350 Sparks St.
Suite 409
Ottawa, Ont.
K1R 7S8

Norpak Corporation
10 Hearst Way
Kanata, Ont.
K2L 2P4

Ontel Communications Inc.
95 Barber Greene Rd.
Suite 112
Don Mills, Ont.
M3C 3E9

Panasonic/Ramsa Audio Video
Systems - Matsushita Electric
of Canada Ltd.
5770 Amler Dr.
Mississauga, Ont.
L4W 2T3

Peat Marwick and Partners
P.O. Box 31
Commerce Court Postal Station
Toronto, Ont.
M5L 1B2

Petro Comm Industries Ltd.
288 Kingsway Garden Mall
Edmonton, Alta.
T5G 3A6

Philip A. Lapp Ltd.
280 Albert St., Suite 904
Ottawa, Ont.
K1P 5G8

Philips Electronics Ltd.
601 Milner Ave.
Scarborough, Ont.
M1B 1M8

RCA Inc.
Corporate Division
North Tower, Suite 2300
Royal Bank Plaza
P.O. Box 161
Toronto, Ont.
M5J 2J4

R.F. Communications Inc.
120 Gibson Dr.
Markham, Ont.
L3R 2Z3

Sachs Canada Inc.
2095 Chartier Ave.
Dorval, Que.
H3P 1H3

Saperstein & Associates Ltd.
1130 West Pender St., Suite 320
Vancouver, B.C.
V6E 4B5

Scientific-Atlanta (Canada) Ltd.
1640 Bonhill Rd., Unit 6
Mississauga, Ont.
L5T 1C8

SED Systems Inc.
2414 Koyl Ave.
Saskatoon, Sask.
S7K 5Z9

Sigmacom Systems Inc.
111 Industrial Dr.
Whitby, Ont.
L1N 5Z9

Solutec Ltd.
4360 Iberville St.
Montreal, Que.
H2H 2L8

Sony of Canada Ltd.
411 Gordon Baker Rd.
Willowdale, Ont.
M2H 2S6

Source Communications
Division of Sotelcom Inc.
48 Galaxy Blvd.
Rexdale, Ont.
M9W 6C8

Stirling Connectors Ltd.
211 Telson Ave.
Unionville, Ont.
L3R 1E7

Storey Saxe Communications Inc.
430-130 Slater St.
Ottawa, Ont.
K1P 6E2

Teledac Inc.
1575 Tachereau Blvd.
Longueuil, Que.
J4K 2X8

Texscan Communications Inc.
7321 Victoria Park, Suite 304
Markham, Ont.
L3R 2M7

Tocom Canada Ltd.
2 Bloor St. W., Suite 710
Toronto, Ont.
M4W 3L7

Triple Crown Electronics Inc.
4560 Fieldgate Dr.
Mississauga, Ont.
L4W 1V7

Le Groupe Vidéoway Inc.
1010 Sherbrooke St. W.
Suite 2300
Montreal, Que.
H3A 2R7

Viewstar Inc.
705 Progress Ave.
Unit 63
Scarborough, Ont.
M1H 2X1

Wind Turbine Co. of Canada Ltd.
21 Howard Ave.
Elmira, Ont.
N3B 2C9

Woods Gordon Management
Consultants
P.O. Box 251 Toronto-Dominion
Centre
Toronto, Ont.
M5K 1J7

White Radio Ltd.
940 Gateway Dr.
Burlington, Ont.
L7L 5K7

Zenith Radio Canada Ltd.
1020 Islington Ave.
Toronto, Ont.
M8Z 5X5

A directory and buyers' guide covering the cable television, broadcasting and telecommunications industries is published yearly by:

Cable Communications Magazine
4 Smetana Dr.
Kitchener, Ont.
N2B 3B8

Research and Development (R&D) Centres:

Cable Telecommunications Research Institute (CTRI)
85 Albert Street, Suite 1100
Ottawa, Ont.
K1P 6A4

Bell Northern Research Ltd. (BNR)
P.O. Box 3511, Station C
Ottawa, Ont.
K1Y 4H7

Centre de Recherche Industrielle du Québec (CRIQ)
245 Boul. Hymus
Pointe Claire, Que.
H9R 1G6

National Associations:

Canadian Cable Television Association (CCTA)
85 Albert St., Suite 405
Ottawa, Ont.
K1P 6A4

Canadian Advanced Technology Association (CATA)
275 Slater St., Suite 803
Ottawa, Ont.
K1P 5H9

Electrical and Electronic Manufacturers Association of Canada (EEMAC)
77 Metcalfe St., Suite 809
Ottawa, Ont.
K1P 5L6

Canadian Association of Broadcasters (CAB)
P.O. Box 627, Station B
Ottawa, Ont.
K1P 5S2