TELECOMMISSION

Study 2(g)

Description of the Canadian Telecommunications Manufacturing Industry

The Department of Communications

Canada. TELECOMMISSION

STUDY 2(g)

Description of the Canadian Telecommunications Manufacturing Industry

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This Report was prepared for the Department of Communications by a project team made up of representatives from various organizations and does not necessarily represent the views of the Department or of the federal Government, and no commitment for future action should be inferred from the recommendations of the participants.

This Report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

TERMS OF REFERENCE

To:

a) describe the telecommunication manufacturing industry, its sales, product lines and marketing, and its corporate affiliations;

b) determine the relative importance of the telecommunication sector in the Canadian economy;

c) forecast future expansion of the industry, noting the effect technological change is having on manufacturing practices.

The statistical material in this report has been supplied by the Department of Industry, Trade and Commerce. References to DBS material have been noted in the text.

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CONTENTS

DESCRIPTION OF THE MANUFACTURING INDUSTRY

I INTRODUCTION

This paper is designed to serve as background material for related Telecommission studies, and by describing the manufacturing segment illustrates its importance and relationship to the communications sector. An expository section is presented first to define the industry, its dimensions, composition and structure. This is followed by more detailed descriptions of products, sales, and other pertinent data. These descriptions have been compiled by the industrial sector. An assessment of the relative importance of the industry in the Canadian economy is made. Lastly a discussion is undertaken on the future of the industry.

II EXPOSITORY REVIEW OF THE INDUSTRY

1. Definition of the Industry - The Telecommunications Manufacturing Industry, for the purposes of this report, has been interpreted as meaning "Manufacturers of equipment employed directly in the telecommunications media". Manufacturers of all basic electronic and electrical components for such equipment, and also for electronic equipment not directly associated with the telecommunications media, have been excluded. It should be recognized however that some of the larger equipment manufacturers make a large percentage of the components they require. The following broad product lines have been included:

* a. Telephone and Telegraph equipment.

b. Radio Communications equipment.

c. Television and Radio Broadcast and Distribution equipment.

d. Television and Radio Receivers.

e. Telecommunications Wire and Cable.

f. Electronic computers and related equipment.

Note: Some published figures on the "Communications Industry" have related to communications services (i.e. operating telephone systems). This paper deals only with production and sales of products by manufacturers.

* This includes switching, transmission and station apparatus for telephone and telegraph and data network and line services.

2. Dimensions of the Industry - The telecommunications industry in Canada produces and sells nearly every kind of device or system which is required for the telecommunications media. In addition, the Industry provides research engineering and system engineering in depth to meet most market requirements. It also provides full installation and maintenance services. Notable exceptions are computer central processors which are not manufactured in Canada. The industry is geographically centered in Ontario, with fair penetration into Quebec and B.C., and scattered facilities in four other provinces. Altogether there are 167 industrial plants. Statistics based upon DBS surveys for 1968 are as follows:

employment - 44,600

payroll - $269 millions

shipments - $600 millions

manufacturing establishments (1967)

New Brunswick	1
Quebec	34
Ontario	112
Manitoba	1
Saskatchewan	1
Alberta	6
British Columbia	12

3. Composition of the Industry - The industry is composed of two large manufacturing organizations, each one integrated with large Canadian carriers; approximately a dozen substantial non-integrated companies; and a variety of small specialist companies. The Electronic Industries Association of Canada is the principal spokesman for the industry. Figure 1 is a sketch showing the corporate structure, and the related product lines for Bell Canada Ltd. and Figure 2 is a similar sketch for General Telephone and Electronics International, parent of the other Canadian "vertical".* The Bell organization is much the larger of the two "verticals". The larger Northern Electric factories are concentrated in Quebec and Ontario at Montreal, Lachine, Belleville, London and Bramalea. There are smaller works in Halifax, Saint John, Toronto, Winnipeg and Calgary. Microsystems International, a newly incorporated subsidiary of Northern Electric, is located at Ottawa. The company also has subsidiary companies in Turkey, Greece and the Caribbean. The General Telephone and Electronics complex has large plants in Brockville, Ontario and Burnaby, B.C. The telecommunications organization of G.T. & E. also has small plants located in Lethbridge, Alberta, Regina, Saskatchewan, and Rimouski, Quebec. Another division of the G.T. & E. organization includes Sylvania Electric of Canada Ltd.

* vertically integrated from production facilities to customer telephone.

FIGURE I

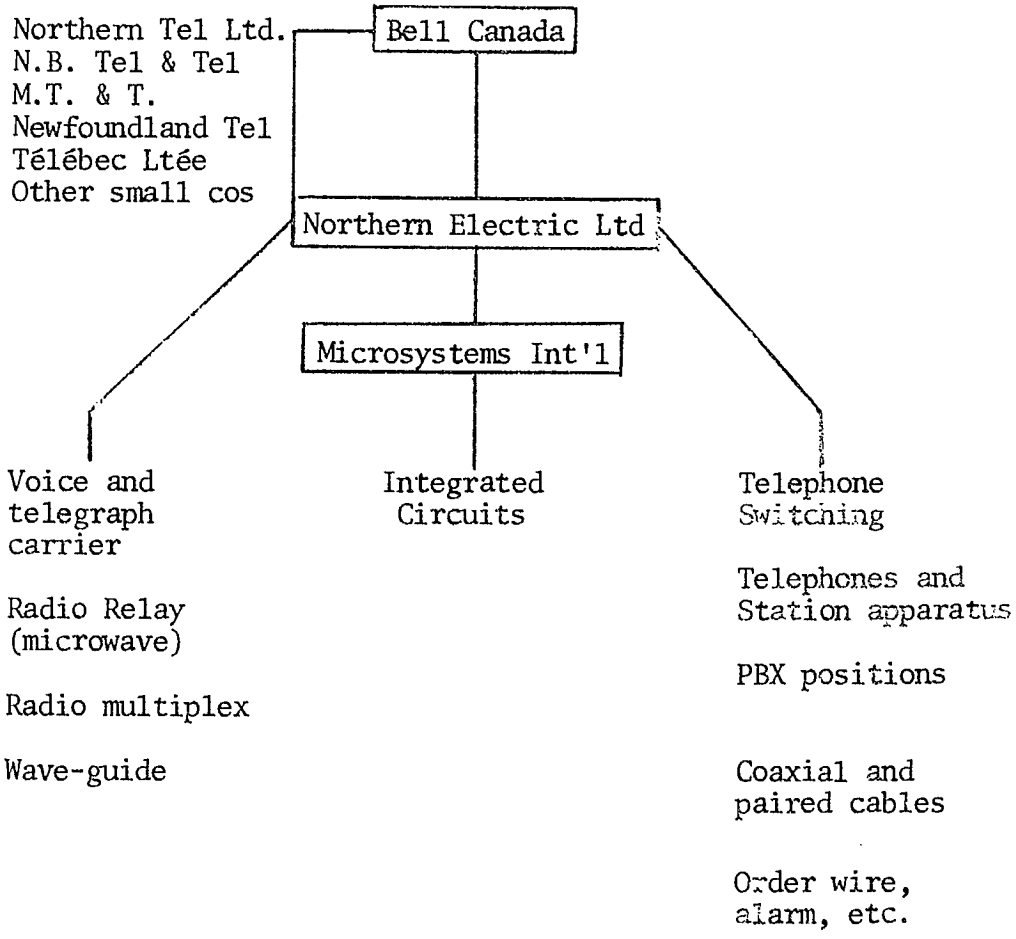
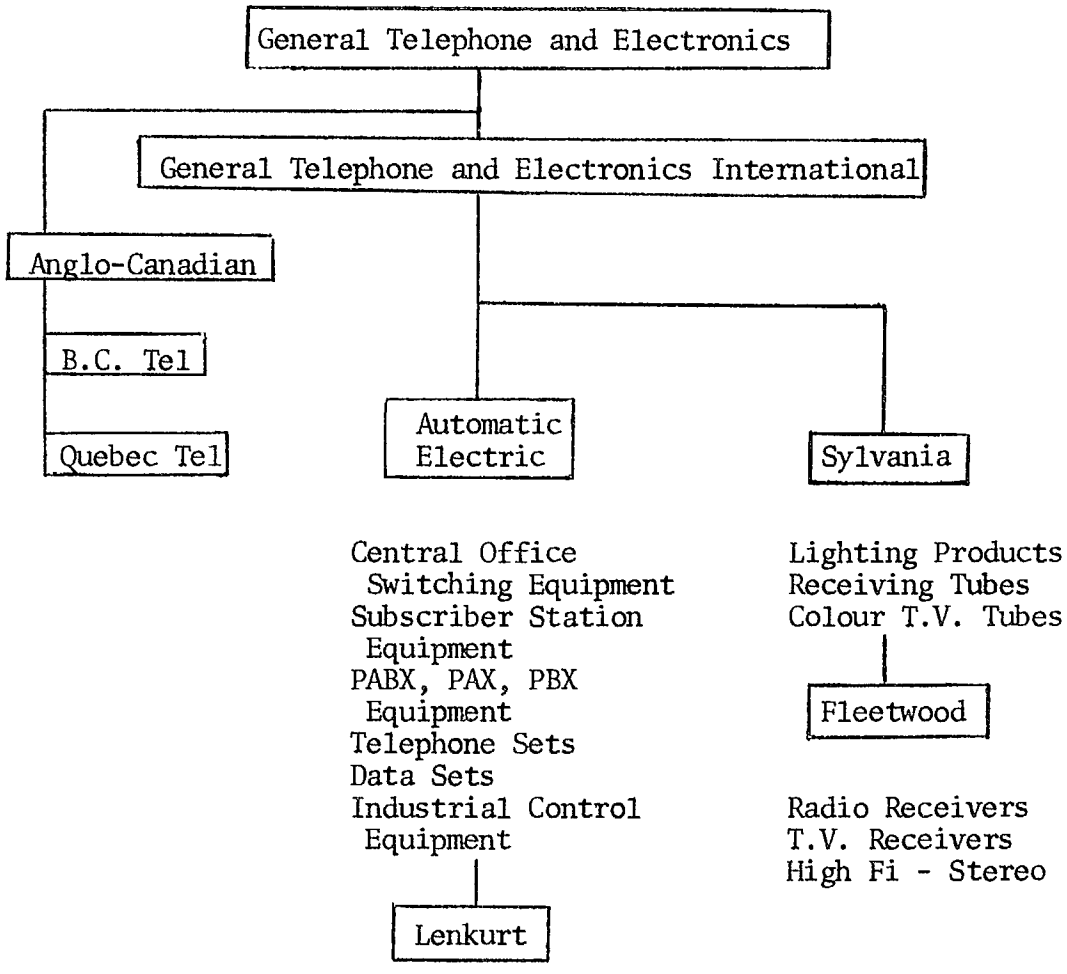

Northern Tel Ltd.
N.B. Tel & Tel
M.T. & T.
Newfoundland Tel
Télébec Ltée
Other small cos
Bell Canada
Northern Electric Ltd
Microsystems Int'l
Voice and telegraph carrier
Radio Relay (microwave)
Radio multiplex
Wave-guide
Integrated Circuits
Telephone Switching
Telephones and Station apparatus
PBX positions
Coaxial and paired cables
Order wire, alarm, etc.

FIGURE 2


General Telephone and Electronics
General Telephone and Electronics International
Anglo-Canadian
B.C. Tel
Quebec Tel
Automatic Electric
Sylvania
Central Office Switching Equipment
Subscriber Station Equipment
PABX, PAX, PBX Equipment
Telephone Sets
Data Sets
Industrial Control Equipment
Lenkurt
Microwave
Radio
Carrier
Multiplex
Supervisory Control
Data Sets
Satellite Communications Systems
Waveguide
Order Wire
Lighting Products
Receiving Tubes
Colour T.V. Tubes
Fleetwood
Radio Receivers
T.V. Receivers
High Fi - Stereo

with its main plant located in Drummondville, Quebec and a subsidiary plant in Cornwall, Ontario. Another subsidiary of Sylvania is Fleetwood, located in Montreal.

These organizations dominate the manufacture, sale and installation, of telephone, telegraph and switching equipment as well as of cables. They do a substantial proportion of their own research, development, and product design but at times do purchase manufacturing rights to make products of others. The trend is towards greater self sufficiency in designs.

The larger non-integrated companies including RCA Ltd., Collins Radio Ltd., CGE, Canadian Westinghouse, Canadian Marconi, Philips Electronics Industries, Canada Wire and Cable, typically operate divisions which are concerned with manufacture and sale of telecommunications equipment, but most of these companies also have other major interests. The non-integrated companies, particularly those which are U.S. owned, may manufacture products which have been designed by the parent organization. A growing trend where there is U.S. control, is for the U.S. parent to assign products for global production in Canada, frequently on a short term basis. Some of these companies have corporate responsibility for design, development, and international marketing of complete product lines.

The integrated and the larger non-integrated companies are accustomed to supplying systems to specification, and have the necessary depth in their organizations to assume full responsibility from contract award to customer acceptance.*

The small businesses in telecommunications manufacturing tend to be Canadian owned and to be engaged with specialties, for example, Central Dynamics and McCurdy Radio Industries Ltd., produce audio and video studio equipment and Spilsbury and Tindall Sales Ltd. produce certain types of radio communications equipment. These companies generally create their own designs.

On the other hand the industry is well supported by small firms engaged in specialty manufacturing processes. There are firms in Canada with superior skills in the manufacture of printed circuit boards; in silk-screen processes, in fabrication of illuminated panels and in sophisticated welding, soldering, and brazing techniques. Of considerable significance also is an active group of producers of sheet metal products such as chassis, cabinets and consoles. Latterly too, the development of satellite systems, and particularly the demand for earth stations outside of Canada has brought the Canadian construction industry into the sphere of support for the telecommunications industry. Thus we find that Dominion Bridge offers a facility for the design, fabrication, assembly and

* commonly described as "Turn-Key" contracting

installation of large earth station antenna structures. Canada Iron Works also is engaged in the fabrication and assembly of large antennas on a sub-contract basis for a Texas based U.S. firm. Canada has therefore a capability to supply world markets in this highly sophisticated field and this must be recognized as a plus measure of the depth of the Canadian industry.

The Bell Canada system including Northern Electric is Canadian owned. Northern Electric has control of its subsidiaries. With the exception of some of the smaller specialties companies the rest of the industry is affiliated to foreign companies, the majority of them being located in the U.S. (Table 1. Page 47)

4. Marketing in the Industry

4.1. General - The Canadian non-consumer product telecommunications market has developed two characteristics. On the one hand there is a continuing requirement for voice frequency and telegraphy equipment which can be supplied by imports, or by manufacturing in Canada to designs imported from the U.S. or the Continent. On the other hand there is a demand, arising from the Canadian environment, for equipment with innovative features designed to cope with local geographical, climatic and operational problems. This has led to Canadian designs for HF, VHF radio telephony equipment and for microwave relay equipment. Such products, developed in Canada, to meet Canadian technical requirements, have found acceptance by foreign nations which have similar problems, and which lack the capability to create their own products. There has been a pattern established for U.S. firms to rely upon their Canadian subsidiaries to supply their needs for certain foreign markets which can be served by equipment designed and produced in Canada.

In the development of telephone networks, however, various world regions have come under the influence of specific design and service philosophies. The European countries banded together early within the ITU Study Groups, and their suppliers produced similar designs. The North American region integrated with the leadership of the Bell System which also saw great

advantages in a one system approach. Other developing regions have tended to be influenced by the international suppliers to the European networks. Consequently, telecommunication products, especially switching systems, designed for North American use, require substantial redesign for offshore use (and vice versa).

4.2. Domestic Marketing - The major suppliers of telecommunications products operate without intermediary distributors, and deal directly with the end users. This is because much of the business involves systems technology. The marketing process involves preparation of technical proposals in response to customer specifications, supplemented by schedules and plans for delivery and installation of components of the system, together with an overall quotation. A single system, from the time of a customer inquiry, until the date of customer acceptance of the finished installation will span a period of one to three years. Servicing such a market is a highly technical process and requires engineering and logistic support as well as a manufacturing capability.

Marketing practices for radio and television broadcast equipment generally fall under the category of systems technology as discussed above. Supply of computers and peripherals requires marketing techniques that are systems oriented.

The consumer product market is really three quite different markets as far as supply is concerned. The major market is television, about one-third of all T.V. sets being imported complete, mostly from Japan and the U.S.A.

Radio spans two markets, the major portion (in units) is in portable and small home radios (about three per home) and over 88 per cent of these are imported complete (almost

entirely from the Far East). The other part of the market is for console combination radio and record players, most of which are designed and manufactured in Canada. The style and quality of these products are building a steady export market to the U.S.A.

The automobile radio market is largely influenced by the automobile makers, as about 80 per cent of new cars are sold with radio installed. These are in two cases made by subsidiaries of the automobile makers, from largely U.S. designs. But a substantial quantity of radios is designed and manufactured in Canada. Many units are exported to the U.S.A. either directly, or included in cars exported under the Auto Pact.

In summarizing then, we have seen that the Canadian domestic market has innovative and non-innovative requirements and that the former are being met by Canadian designed and produced equipment. The market is also broadly divided into systems, and consumer products. And finally we note that the major manufacturers of the "verticals" service the system-oriented section of the market and dominate that portion of the industry.

4.3. Foreign Marketing - The general pattern of our exports of telecom capital equipment is shown in Table II on page 50.

Telephone equipment (microwave, multiplex, exchanges, outside and inside plant, subscriber equipment and other peripherals) accounts for nearly two thirds of our exports.

Our sales to the USA are about 60 per cent of the total. This is in part due to the production sharing program and production orders placed by USA parents on their Canadian subsidiaries, often for shipment to a third country. Sales of telephone equipment are higher to the U.S. due partly to Canadian products being suitable for U.S. application with virtually no re-design. An undetermined proportion of exports to the other regions shown is a result of parent marketing and shipments from the Canadian facilities. One may thus conclude that our dependence on USA orders is somewhat higher than the 60 per cent shown above.

Northern Electric is by far the largest and most active Canadian controlled company in export activities. It has made important market penetrations in many areas of the world, based upon its own design effort and its own sales effort. Many of the other Canadian owned companies lack the necessary capital to develop complete systems for foreign customers.

Of the foreign subsidiaries, export marketing practices vary. While Lenkurt and Automatic Electric and Canadian Marconi actively pursue exports sales opportunities, few of the remainder have foreign marketing sales offices in Canada for non-military lines. Many of the major telecommunications manufacturers have some proprietary product lines which they promote with their own Canadian marketing staffs in foreign markets.

Table II indicates that there is a developing export market for radio communications equipment. The exports rose from a low figure in 1962 to a level of almost $19 million in 1968, indicating an acceptance of Canadian communications technology and abilities for start of successful international marketing. The majority of exports in radio communications is shared by Northern Electric, RCA Limited, Canadian Marconi Company, Lenkurt Electric of Canada and Collins Radio of Canada. Over the past few years, satellite earth stations have arisen as a major item of potential export of communications equipment.

For a number of companies which are subsidiaries export opportunities are limited by the parent's global marketing strategy. This has had a limiting effect on the export potential of Canadian manufacturers. The maximum support of the Canadian economy by a foreign

subsidiary occurs when there is the greatest degree of product rationalization. This implies that development, production and foreign marketing be done from the Canadian facility.

Smaller Canadian companies are taking advantage of licensing sales agreements with larger foreign firms to significantly develop their export sales.

5. Manufacturing Technology in the Industry - Manufacturing procedures, tooling, and proprietary electronic test equipment in Canadian industry are practically identical to those which will be found in plants of comparable size in the U.S.A. This reflects U.S. world leadership on a price-quality basis in this field. Too, the subsidiaries of U.S. firms have had made available to them, by the parent companies, and at little cost, a large body of technology in the form of manufacturing process specifications, engineering standards, quality control and inspection procedures and practices, and assembly techniques.

Canadian manufacturers nevertheless exert themselves to develop their own techniques to better the productivity indexes of their parents and of competitors. Every production line requires a special mix of proprietary test equipment and machinery together with specially designed jigs, fixtures, test set-ups, wiring harness boards and automated or semi-automated electronic test equipment. In fact at least one Canadian firm pioneered designs for paper tape controlled automatic testing for faults in electronic assemblies, sub-assemblies, wiring harness and cables. Canadian manufacturing ingenuity has found wide scope in this field.

Principal U.S. made production and test equipments which are found in many Canadian plants, include shake

tables, coil winders, hand tools, inspection and test equipment for testing metal parts, shielded screened cages, environmental chambers for humidity, temperature and altitude testing, oscilloscopes, multimeters, signal generators and many others. Also some metal cutting machines, particularly jig borers are imported from Europe as are also a few items of laboratory electronic test equipment. Canadian designed and manufactured wave-soldering machines are a notable exception to this pattern.

The foregoing comments apply principally to the manufacture of non-consumer products where, owing to the specialized user requirements, there are limited production runs and consequently there is a relatively high percentage of labour (including labor requiring manual skills) and also of engineering. Examples are microwave systems, radio multiplex, and switching systems. In this area automation has advanced as far inside Canada as outside.

Consumer products and wire and cable are basically the only products in the industry which can be produced on a scale to permit the capital outlays required for reducing labour content to a minimum.

6. Installation and Maintenance - As we have seen, the "verticals" and the larger non-integrated companies will supply systems on a Turn-Key basis so that in general they are prepared to install the equipment. This activity can include preparation of sites, fabrication of buildings, erection of towers and initial system testing. The operating groups of common carriers in Canada are well organized and well equipped to perform the maintenance required after formal site acceptance of the equipment.

These comments do not of course apply to consumer products. In this field installation is performed by small service companies. Warranty is limited to short term parts replacement. With the advent of colour television, the additional complexities of the sets over "black and white" designs, has created new problems. Service organizations lack the additional test equipment and personnel training. This has resulted in the introduction or at least the expansion of factory supported maintenance.

7. Industry Position in the Canadian Economy - It is important to keep in mind that the electronics industry which provides services to all other industries, is the base upon which the next stage of our industrial and cultural development will grow. The telecommunications industry which is the largest part of the electronics industry is becoming vital to the health and growth of all other industries and to the economy in general through the services it provides. The pace of modern Canadian business is directly related to the advancement of telecommunications technology and the expansion of the services offered by the telecommunications media. The strength of the industry compared to other industries cannot be found in statistics. For example, DBS 61-005 August 1969 shows that the industry provides slightly less than 1.0 per cent of the Real Domestic Product. However, it also shows the telecommunications industry to be in the top three with regard to growth rate of its output. The impact of the industry upon the economy must be considered to carry with it a multiplying factor relating to its catalytic action on the Canadian economy.

III DESCRIPTION OF THE INDUSTRY BY SECTORS

1. Basis for Classification and Description - Two categories, "A", "B", are defined. "A" is that part of the manufacturing industry which is most apt to be directly affected by telecommunication policy. "B" category groups manufacturing establishments whose products, while not usually directly affected by telecommunications policy, are heavily influenced by such policy as a result of direct relationships with the primary category products.

A Category: Telephone and Telegraph
Radio Communications
Radio and Television Broadcast and Distribution Equipment

B Category: Radio and Television Receivers
Telecommunications Wire and Cable
Electronic Computers and Peripherals

Descriptions of equipment types within these categories and groups closely follow the breakdown used in the Industry Commodity Classification now being considered by the Dominion Bureau of Statistics (DBS). Sources for the names of manufacturers listed as representative have been extracted from DBS annual census of manufacturers, the Electronic Industries Association of Canada (EIAC) and the Department of Industry, Trade and Commerce.

Industry statistics available through DBS publications are rarely in the specific format required for this type of analysis and figures quoted herein result from re-groupings of DBS figures modified by IT & C figures in some instances.

2. Telephone and Telegraph Equipment Sector - includes telephone sets, switchboards, private branch exchanges, teleprinters, line amplifiers, jack fields, central office switching equipment, regenerative repeaters, fault location equipment, broadcast routing equipment, multiplex and carrier equipment for open wire, cable, radio and power lines.

Employment: 18,200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	87.8	16.3	4.5
1962	103.1	27.7	5.9
1963	117.4	24.1	8.8
1964	127.0	24.7	10.9
1965	135.2	25.0	14.3
1966	186.4	30.2	10.9
1967	252.5	36.0	18.9
1968		32.1	48.5

Companies: Manufacturing activity, in this sector is undertaken principally but not exclusively by the following companies:

a) Dominant companies: Northern Electric Company Limited and Automatic Electric Ltd. Together these firms account for more than 70 per cent of the current sector manufacturing activity. Although Automatic Electric - Lenkurt manufacturing activities far exceed those of the firms listed under b), its activities are considerably less important than those of Northern Electric.

b) Other firms: AEI Telecommunications (Canada) Ltd., Brown Boveri (Canada) Ltd., Collins Radio Company of Canada Ltd., Farinon Electric of Canada Ltd., ITT (Canada) Ltd., Northern Radio Manufacturing Co. Ltd., and Radio Engineering Products Ltd., Philips Electronics Industries Ltd.

Sector Features:

- Extensive dominance of manufacturing activity by member companies of the "verticals".
- Dominant firms responsible for very great percentage of export activity.
- Telegraph equipment sector is a very minor part of overall sector in factory shipments and exports but practically equal to telephone equipment sector in imports.
- For most firms listed as "other firms" equipment manufactured for this sector represents a relatively minor portion of overall company manufacturing activity.
- Systems engineering capabilities are normally required of manufacturers as most sales are planned, systems engineered, manufactured, installed and tested before "turning over the key" to the customer. The value of this systems engineering, installation and commissioning tests, which sometimes can run as high as 20 per cent - 30 per cent of manufactured equipment sales, is not included in the sector statistics.

3. Radio Communications Equipment Sector - Includes point-to-point, line of sight, scatter, Very Low Frequency (VLF), Low Frequency (LF), High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF), microwave, portable, transportable, vehicular, space borne (satellites), air borne, ship borne radio communication transmitting and receiving equipment for commercial and military uses; earth stations; communications antenna; control and telemetering equipment.

Employment: 5,200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	27.6	12.3	N.A.
1962	28.7	11.9	N.A.
1963	37.7	12.6	2.0
1964	27.7	9.8	4.1
1965	32.0	10.0	5.0
1966	36.8	15.6	6.6
1967	37.6	23.0	12.9*
1968		24.0	18.9*

Companies: Manufacturing activity, as defined above is undertaken principally but not exclusively by the following companies:

a) Dominant companies: Canadian Marconi Company, Collins Radio Co. of Canada Ltd., Lenkurt Electric of Canada Ltd., Northern Electric Co. Ltd., RCA Ltd., Canadian General Electric Company Ltd. and Canadian Motorola Electronics Ltd. Together, these firms are responsible for 70 per cent of the current sector manufacturing activity.

* Certain manufacturers export under DBS Export Category 634-99. It was impossible to make the appropriate extracts to supplement these numbers.

b) Other firms: Andrew Antenna Co. Ltd., Farinon Electric of Canada Ltd., ITT Canada Ltd., Raytheon Canada Ltd., TMC (Canada) Ltd., Philips Electronic Industries Ltd., Pye Electronics Ltd., International Systcoms, and at least 10 other firms active in manufacturing some of the sector's products, but as a minor portion of their overall activity.

Sector Features:

- Again, systems engineering capabilities are required of manufacturers in the microwave line of sight and earth station activity areas. These activities dominate this manufacturing sector but systems engineering plus installation and testing costs between 5 and 30 per cent of equipment manufacturing sales are not reflected in the statistical description.
- Land mobile equipment manufacturing is comparable in size to the foregoing activity but DBS figures do not permit a quantitative breakout.
- In order of decreasing amounts of manufacturing activity the following sub-sectors are also identifiable -

  airborne HF, VHF and UHF equipment;
  HF, VHF and UHF land and marine radio equipment
  communications antenna equipment
  control and telemetering equipment
  other radio communication equipment as defined under "Equipment Manufactured".

- The degree of export activity closely follows that of manufacturing activity.

4. Television and Radio Broadcast and Distribution Equipment - Includes AM, FM and TV Broadcasting transmitters and distribution equipment; audio and video studio equipment; CATV and CCTV equipment (other than monitors, wire and cable), including educational television equipment.

Employment: 1200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	8.3	2.1	N.A.
1962	5.4	4.2	N.A.
1963	5.2	5.1	N.A.
1964	7.3	5.5	N.A.
1965	10.4	7.5	1.0
1966	15.8	18.8	2.0
1967	10.9	14.2	3.8
1968		13.4	5.8

Companies: Manufacturing activity as defined above is undertaken principally but not exclusively by the following firms:

a) Dominant firms: Canadian General Electric Co. Ltd. and RCA Ltd., together with Central Dynamics Limited and Cascade Electronics Ltd. and McCurdy Radio Industries Limited these firms are responsible for better than 70 per cent of current manufacturing activity.

b) Other firms: Benco Television Associates Ltd., Collins Radio Co. of Canada Ltd., Richmond Hill Laboratories, General Instrument of Canada Ltd.

Sector Features:

- Manufacturing activity is sporadic and highly dependent on Canadian Radio-Television Commission approval of broadcasting licenses.

- Technology, with the minor exceptions of a few Canadian firms, is largely imported from the U.S. through parent-subsidiary relationships and the adoption of U.S. standards.
- Approximately 80 per cent imports and exports are from and to the U.S.

5. Television and Radio Receivers, Domestic - Includes AM, FM multiband, domestic portable and car radio broadcast receivers; television receivers; combinations of radio and television receivers.

Employment: 7,000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	85.1	16.9	2.0
1962	107.4	15.5	3.3
1963	111.7	14.6	6.3
1964	128.6	18.2	7.7
1965	132.4	24.0	8.3
1966	162.8	36.5	20.3
1967	165.4	49.4	24.0
1968		59.5	29.6

Companies: Manufacturing activity, as defined above is undertaken principally although not exclusively by the following companies: Canadian Admiral Corporation Ltd., Canadian General Electric, Canadian Westinghouse Co. Ltd., Clairtone Sound Corporation Ltd., Fleetwood Corporation Ltd., Philco-Ford (Canada) Ltd., Philips Electronics Industrial Ltd., RCA Limited, Electrohome Limited, Canadian Motorola Electronics Ltd.

Sector Features

- Unlike previously discussed sectors, there exists no overall dominance by a small group of firms.
- There has been a rapid growth in imports from the United States and Japan; especially in television receivers with small screens.

- Export gains are attributable, almost exclusively, to car radio specialization as a result of the Auto-Pact. Exports of television sets have been decreasing for the past three years.

6. Telecommunications Wire and Cable - Includes manufacturers of exchange, toll and entrance telephone cables; switchboard wires, drop wires and other telephone wire; television and radio wire and cable; annunciator and office wire and cable; signal and control cables.

Employment: 3000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	46.1	2.9	2.5
1962	48.9	1.9	2.6
1963	52.0	2.2	3.2
1964	63.2	3.0	6.7
1965	79.1	3.0	8.2
1966	93.6	4.9	8.8
1967	86.1	5.5	8.6
1968	93.7	4.9	9.0

Companies: Manufacturing activity, as defined above is undertaken principally, although not exclusively, by the following companies:

a) Dominant companies: Canada Wire and Cable Company Ltd. (Noranda Mines), Northern Electric Co. Ltd. (Bell Canada) and Phillips Cables Ltd. These firms are responsible for well over 70 per cent of current sector manufacturing activity. The manufacturing activity at Canada Wire and Cable and at Phillips Cables Ltd. far exceeds that maintained in the firms listed under "other firms" but is considerably below that maintained at Northern Electric.

b) Other firms: Andrew Antenna Co. Ltd., Canadian General Electric Co. Ltd., Fabricon Manufacturing Ltd., General Wire and Cable Ltd., ITT (Canada) Ltd., Pirelli Cables Ltd.

Sector Features

- The statements made with reference to Northern Electric's predominance in manufacturing activity can also be extended to research, development and export activities.
- Predominant firm associated with large user i.e. Bell of Canada.
- Recently, a substantial number of firms have pooled their resources through acquisitions and/or mergers.
- Availability and price of copper are presently major concerns for this industry.

7. Electronic Computers and Related Equipment - Includes manufacturers of electronic computers and associated peripherals such as punched card and paper tape input/output equipment, magnetic tape and disk storage devices, line printers, key input and display terminals, etc.

Employment: 10,000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961			
1962			
1963	Not available		
1964			
1965	40.0	56.6	27.1
1966	60.0	105.1	32.9
1967	70.0	126.5	44.9
1968	94.0	121.0	41.4

Companies: Manufacturing activity, as defined above, is undertaken principally but not exclusively by the following companies.

a) Dominant companies: By far the dominant company, accounting for at least 70 per cent of manufacturing activity, is International Business Machines Inc.

b) Other companies: Applicon Computer Systems Ltd., Computing Devices of Canada, Consolidated Computer Services Ltd., Digital Equipment Corporation, Digital Systems Associates, Ferranti-Packard Electric, Honeywell Controls Ltd., I.P. Sharp Ltd., Litton Systems (Canada) Ltd., Canadian Westinghouse Company Limited.

Sector Features

- There is no production of large central processors, and manufacturing activity is primarily directed to the peripheral equipment area. This has been brought about by Canadian industry attempting to keep abreast of technology, by developing and marketing peripheral units which are not available in general from foreign sources. This activity has found a primary market in the U.S.

8. Summary Table

The following table has been extracted from individual tables on the preceeding pages and will serve as a basis for further discussions on export activities.

	1967 Shipments		1967 Exports		Per cent of total exports
	$millions	Per cent of total shipments	$millions	Per cent of shipments	
Primary Categories					
a) Telephone & Telegraph	252.5	40.6	18.9	7.5	16.7
b) Radio Communications	37.6	6.0	12.9	34.3	11.4
c) Radio & TV Broadcast	10.9	1.8	3.8	34.9	3.4
Secondary Categories					
d) Radio & TV Sets	165.4	26.6	24.0	14.5	21.2
e) Telecom. Wire & Cable	86.1	13.8	8.6	10.0	7.6
f) Computers	70.0	11.3	44.9	64.1	39.7
	622.5		113.1		

IV FUTURE EXPANSION OF THE COMMUNICATIONS INDUSTRY

1. The Present Fact - The electronics industry in Canada currently directly employs probably 58,000 people. Of these, 44,600 at least are employed in telecommunications manufacturing. Additionally, there are a large number of installation and service technicians working either with manufacturers, distributors and dealers, or independently to maintain electronic products. Of these, probably at least 6,000 are supporting the telecommunications manufacturing activity.

As has been described, primary telecommunications equipment has certain custom-made characteristics. This means that it is a labour intensive industry, where net output per employee is less than that found in other more highly mechanized industries. In the past five years productivity in telecommunications has risen. Exports are increasing at a greater rate than imports. While there are many reasons for this, increased productivity has to be a basic factor.

The annual increase in capital investment is $30-34 million. According to the EIAC brief of March 1969 the return on investment for the electronic part of the telecommunications industry, after taxes, is as follows:

	1965	1967
Per cent of Sales	3.1%	2.1%
Per cent of Invested Capital	10.8%	7.0%

By modern corporate standards a return of less than 7.0 per cent net on invested capital is not acceptable. Therefore, if the trend shown from 1965-7 continued to 1969 the industry would now be in a very difficult position from which to bid for capital to support expansion programs.

The future of the industry depends upon its capability to expand its facilities and to capture larger markets. Tomorrow's sales depend upon yesterday's R&D expenditures. According to the EIAC brief Canada currently spends about 1.4 per cent of GNP in R&D (or slightly less than half of the U.S. rate).

2. Basic Industry Trends - Statistics quoted in Part III reveal that in the sectors of industry relating to manufacture of telephone, telegraph, and radio communication equipment there has been a dramatic change in the past four years. Exports now approach the magnitude of imports, or exceed them, instead of the reverse. Canadian export products are more and more assuming characteristics suited to world markets. On the other hand, exports of radios and television receivers have fallen off to a negligible level while imports have risen.

The radio communications and radio (microwave) relay groups reflect differing influences. Currently microwave products are off the production peak reached during the fabrication of the main Trans-Canada networks. On the other hand major economic developments in the North centered on oil discoveries; the renewed emphasis in basic mineral exploitation in the Western Provinces, for coking coal and copper production to serve the Pacific rim is stimulating the market for radio communications, and for microwave equipment. Additionally, development of hydro power in more remote parts of Canada is sustaining the demand for microwave systems for control of hydroelectric grids. The extraordinary demand rate for expansion of the telecommunications media - at least 15 per cent per annum - has the effect of flattening the peaks and hollows in the demand curve for equipment.

Procurement by Telesat Canada of its initial earth stations and control centre equipment will introduce some $20 million in contracts awarded during early 1971. It is estimated that an adequate competitive climate can be maintained without resorting to bids on a world-wide basis. It is expected that six to ten Canadian-based companies will compete as prime contractors for the various types of stations in this system and that two to five companies will be successful in securing prime contracts. It is too early yet to assess the effect on the microwave terrestrial systems and therefore on the industry, of satellite routings of message and T.V. traffic.

The "A" category industry is expected to continue to concentrate on telephone and telegraph equipment. Considerable advance work is now under way to prepare for large scale usage of digital techniques in signal transmission. This will affect the manufacture of cables as well as of electronic equipment. For many years, paired telephone cable has been the most important item, in terms of value and volume, supplied by the wire and cable industry. The need for wide band transmission requiring coaxial cable is becoming more and more evident. While electronic devices will probably extend the life of paired cable by increasing its transmission capability, the demand for coaxial cable within 10 or 15 years may well overtake that for paired cable. When this occurs the

wire and cable industry must be prepared to invest in more R&D and new manufacturing facilities.

New large electronic switching systems are now being introduced into the telephone networks and will substantially take over sales from electro-mechanical systems by the end of the 1970's. Expansion of switching markets will continue as system growth, and replacements create demand for supply of new switches.

Terminal equipment for remote accessing of computer facilities and memory banks is seen as a burgeoning market. Canadian industry should make a concentrated effort to enter this field.

A paper produced by the executive of the IEEE in December 1969 is of great interest as it graphically discusses electronics industry trends in the U.S. and points out two major changes. Firstly, the paper notes a significant reduction in Government buying and also of sales of consumer products. Secondly, it notes an increase in sales to industry. These changes may be expected in Canada as well. The development of sales to industry will have far reaching results since telecommunications devices and systems are used largely to increase the efficiency of the industries which they serve. This trend could lead to a different product mix than now exists in the telecommunications industry, and be reflected in the output of the Canadian industry.

3. Prognosis From Industry - Industry spokesmen report that the growth experienced by the industry during the 1960 decade is unlikely to be retained during the 1970's, notwithstanding a continued high rate of growth of the world telecommunications market, without fairly severe adjustments within the industry itself and without further special government incentive assistance in certain segments.

The industry contends that continued health of the industry is predicated in great part upon achieving a deeper penetration in the export field than that attained during the 1960's, particularly in the high growth segments of telephone and telegraph equipment and radio communications equipment. In the face of increasing vigour of competition from Japanese, American and European companies, Canadian industry realizes that such deeper penetration requires exceptional business planning, covering both the innovative cycle attendant with new designs and exploitation of the selected international market areas.

The industry commented favourably upon the improvements in the practices and measures of the integrated government Department of Industry Trade and Commerce, to assist industry in its growth objectives. Spokesmen reported that the unfolding pattern of greater government/industry cooperation and coordination to attain greater exports through R&D, production,

and marketing, provided encouragement and challenge for greater reorientation of the industry towards the international market, notwithstanding the attendant business difficulties.

Industry considers that government-sponsored telecommunication programs, like the Canadian domestic satellite system, project a world image of the importance that Canada attaches to advances in telecommunications technology. Such major advanced domestic programs build industry expertise that greatly enhances the ability to contend in the international field.

4. Expansion of Exports - The development of the Canadian telecommunications industry is affected by the size of the domestic market, and its hope for greatest expansion rate will result from export sales. In addition to helping maintain a strong viable domestic industry, export sales have the additional salutary benefit of aiding the country's balance of payments position.

Canada's future in the field of telecommunication exports will most likely be in the area of large systems where we have proved our competitiveness in a number of international tenders. These systems consist mainly of microwave, multiplex, switching, VHF equipment and cable. Export sales of such equipment are often dependent on the seller having complete systems capability. Another important factor is the increasing tendency of the purchaser, usually a foreign government, or government owned company to insist upon the creation of a subsidiary manufacturing plant to maintain and expand the system it proposes to purchase.

It is shown in Table II* that the exports of telephone and telegraph equipment, although large in terms of total industry exports, represented only 7.5 per cent of total telephone and telegraph shipments in 1967. The very large domestic market of over $250 million, forms a sound base to bring about much greater exploitation of the international market. The 1968 exports of $48.5** million illustrate

** Not tabulated in Table II.

that this growth potential is beginning to be realized in part. As previously described, telephone and telegraph equipment manufacture is dominated in Canada by Northern Electric and Automatic Electric, both vertically integrated companies. Northern Electric, with its additional strength as a prime Canadian supplier of wire and cable, is in a favourable position to give stronger contention in the international market against foreign vertically integrated companies. Potential markets in this and other areas are illustrated in Table II on page 50.

In the sector for radio communications, the exports rose from zero in 1962 to a level of almost $19 million in 1968, indicating an acceptance of Canadian communications technology and ability to start successful international marketing. The majority of exports in radio communications has been in the field of microwave radio systems, often performed on a turn-key basis. This segment of radio communications exports is shared by Northern Electric, RCA Limited, Lenkurt Electric of Canada and Collins Radio of Canada. In the past two years, satellite earth stations have arisen as an item of major export potential.

Two major conditions for higher exports of telecommunications equipment are a reasonable domestic base,

which Canada has, and a forward research and development program aimed at higher performance, lower costs and faster production cycle. The fast growing evolution towards digital communications will require a large development investment in order for the industry to hold and improve its position in the international market. Other conditions for higher exports of telecommunications equipment are greatly improved marketing methods and practices, and greater degree of vertical integration such that an entire foreign telecommunications project can be carried out on a turn-key basis directly by the industry. The marketing expense is predicted to grow, at least by more than 30 per cent in order to compete effectively with American and European telecommunication companies. The prognosis is that larger and fewer companies in the world will handle the majority of world sales of telecommunications equipment.

Acquisitions, grouping and pooling arrangements, including consortia bidding or business mergers, all within government sanctions, and preferably with government influence and/or encouragement, would appear necessary in order to enable the industry to offer a complete integrated "package" of telephone and telegraph equipment and radio communications equipment. Limiting effective consolidation is the possibility of conflict of interest between parent and subsidiary firms operating in a multi-national strategy.

Without an appropriate degree of such consolidation of the industry for these two product lines, the non-integrated companies will face strong competition from new industries in the developing nations (e.g. Israel) and the eastern block countries (e.g. Czechoslovakia, Yugoslavia); and the two Canadian vertically integrated companies might well be unable to attain adequate strength in the broader product front for a required degree of market penetration ahead of American and European competition. Such industry consolidation has, and is, taking place in the United States and Europe. Canadian industry has a unique opportunity for strengthening in this regard, by using developed Canadian capabilities before there is any further capture by American and European enterprise.

Expanded exports of radio and TV sets has limited potential, largely because most foreign countries have, or will initiate, domestic production. Supply of kits has been appreciable and could well be increased again, often as a part of a complete telecommunication turn-key package.

TABLE 1 - OWNERSHIP

COMPANY	CANADIAN	FOREIGN
A.E.I. Telecommunications (Canada) Ltd.		X
Ainslie Antenna Co. Ltd.	X	
Andrew Antenna Co. Ltd.		X
Applicon	X	
Automatic Electric (Canada) Ltd.		X
Beaconing Optical Precision	X	
Benco Television Associates Ltd.		X
Boston Insulated Wire and Cable		X
Brown Boveri (Canada) Ltd.		X
Burroughs Mfg.		X
Canada Wire and Cable	X	
Canadian Admiral Corporation		X
Canadian Bridge Division of Hawker Industries Ltd.		X
Canadian General Electric		
Canadian Marconi Company		X
Canadian Motorola Electronics Ltd.		X
Canadian Westinghouse		X
Cascade Electronics Limited	X	
Central Dynamics Ltd.	X	
Clairtone Sound Corporation	X	
Collins Radio Co. of Canada, Ltd.		X
Computing Devices of Canada Limited		X

TABLE I (Cont'd)

COMPANY	CANADIAN	FOREIGN
Digital Systems Associates	X	
Digital Equipment Corporation		X
Electrohome	X	
ESE Limited	X	
Farinon Electric of Canada Ltd.		X
Ferranti-Packard Electric Limited		X
Fleetwood Corp.		X
General Instrument of Canada Ltd.		X
Heron Cable Industries	X	
Hermes		X
Honeywell		X
IBM Canada Ltd.		X
International Systcoms	X	
I.P. Sharp	X	
ITT Canada Limited Communications Division		X
KA-ME-CO Automation Electronics Ltd.	X	
Leigh Instruments Ltd.	X	
Lenkurt Electric Co. of Canada, Ltd.		X
Marsland Engineering Limited	X	
McCurdy Radio Industries Ltd.	X	
Mond Electronics	X	
Northern Electric Co. Ltd.	X	
Northern Radio Mfg. Co. Ltd.		X
Philco-Ford of Canada Ltd.		X

TABLE I (Cont'd)

COMPANY	CANADIAN	FOREIGN
Philips Electronics Industries Ltd.		X
Phillips Cables		X
Pye Electronics Ltd.		X
Pirelli Cables		X
Pylon Electronic Development Company Ltd.	X	
Radio Engineering Products Ltd.		X
Raytheon Canada Ltd.		X
RCA Ltd.		X
RACAL (Canada) Ltd.		X
Richmond Hill Laboratories		X
Sea Breeze Products	X	
Sinclair Radio Laboratories Ltd.	X	
Spilsbury and Tindall Sales Ltd.	X	
T-Scan Limited	X	
Topping Electronics	X	
TMC (Canada) Ltd.		X
Universal Wire and Cable	X	
Western Electronic Systems Company Ltd.	X	

TABLE II - MAIN CANADIAN CAPITAL TELECOMMUNICATION EQUIPMENT EXPORTS FOR 1969[1]

AREA	Telephone Equipment 634-19	Telegraph Apparatus 634-29	Radio Transmitting 634-90	Radio & TV Bcstg 634-95	Commercial Communication Eqpm 634-99[2]	TOTAL
1. USA	27,064,000	1,465,000	14,219,000	3,538,000	8,943,000	55,229,000
2. U.K.	57,000	-	74,000	545,000	533,000	1,209,000
3. Western Europe	3,317,000	12,000	1,567,000	472,000	2,434,000	7,802,000
4. Eastern Europe	-	-	18,000	-	4,000	22,000
5. Africa	1,792,000	4,000	122,000	43,000	392,000	2,353,000
6. Middle East	5,028,000	-	116,000	232,000	154,000	5,530,000
7. Asia	6,910,000	15,000	779,000	50,000	911,000	8,665,000
8. Australia, N.Z.	17,000	-	113,000	79,000	69,000	278,000
9. Central & South America & Caribbean	9,188,000	7,000	662,000	503,000	922,000	11,282,000
TOTALS	$53,373,000	$1,503,000	$17,670,000	$5,462,000	$14,362,000	$92,370,000

1. Based on DBS December 1969 catalogue Exports by Commodities, catalogue no. 65-004

2. Includes radio navigation equipment excluding radar, coin operated phonographs, sound detection equipment, tapes, video tape and sound recorders, transmitters, T.V. switching equipment, etc.

TABLE III - ESTIMATED WORLD DEMAND FOR COMMUNICATION EQUIPMENT IN 1968 AND IN 1980 ($MILLION)*

BY TYPE OF EQUIPMENT (IT&C)

Station Apparatus	Year	Total World	U.S.	Canada	Europe	Japan	Developing & Australia	Eastern Europe	China
1. Circuit Switching	68	3,551	1,513	113	1,061	253	307	292	12.5
	80	7,051	2,347	188	2,034	765	950	735	32
2. Subscriber Station		1,192	504	38	364	84	101	97	4
		2,274	736	61	660	272	298	237	10
3. Message Switching		152	50	4	50	16	25	7	.3
		314	85	7	95	52	53	21	1
4. Multiplex FDM		994	427	31	293	71	87	82	3.5
		2,178	736	60	678	243	236	216	9.5
5. Multiplex Digital		585	277	19	180	39	23	45	2
		2,917	1,681	77	619	194	30	303	13
6. Radio Relay		663	316	22	198	33	40	52	2.2
		2,093	829	69	678	128	164	216	9.5
7. Earth Stations		57	15	2	9	3	24	4	.2
		78	32	4	8	2	23	8.6	.4
8. Satellite		30	15	2	9	1	1	2	.1
		132	46	13	46	3	11	13	.6
9. Cables		1,622	697	51	478	115	141	135	5.8
		3,526	1,177	103	1,160	375	350	346	15.2
10. Totals		8,846	3,814	282	2,642	615	749	716	31
		20,563	7,669	582	5,978	2,034	2,115	2,096	91

* 1968 U.S.

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