e Electronics

IC

INDUSTRY PROFILE

Industry, Science and Technology Canada
Industrie, Sciences et Technologie Canada

ISTC Business Service Centres

These centres have been established in every Industry, Science and Technology Canada Regional Office and at Headquarters to provide clients with a gateway into the complete range of ISTC services, information products, programs and expertise.

Newfoundland

Atlantic Place
Suite 504, 215 Water Street
P.O. Box 8950
ST. JOHN'S, Newfoundland
A1B 3R9
Tel.: (709) 772-ISTC
Fax: (709) 772-5093

Prince Edward Island

Confederation Court Mall
National Bank Tower
Suite 400, 134 Kent Street
P.O. Box 1115
CHARLOTTETOWN
Prince Edward Island
C1A 7M8
Tel.: (902) 566-7400
Fax: (902) 566-7450

Nova Scotia

Central Guaranty Trust Tower
5th Floor, 1801 Hollis Street
P.O. Box 940, Station M
HALIFAX, Nova Scotia
B3J 2V9
Tel.: (902) 426-ISTC
Fax: (902) 426-2624

New Brunswick

Assumption Place
12th Floor, 770 Main Street
P.O. Box 1210
MONCTON, New Brunswick
E1C 8P9
Tel.: (506) 857-ISTC
Fax: (506) 851-6429

Quebec

Tour de la Bourse
Suite 3800, 800 Place Victoria
P.O. Box 247
MONTREAL, Quebec
H4Z 1E8
Tel.: (514) 283-8185
1-800-361-5367
Fax: (514) 283-3302

Ontario

Dominion Public Building
4th Floor, 1 Front Street West
TORONTO, Ontario
M5J 1A4
Tel.: (416) 973-ISTC
Fax: (416) 973-8714

Manitoba

8th Floor, 330 Portage Avenue
P.O. Box 981
WINNIPEG, Manitoba
R3C 2V2
Tel.: (204) 983-ISTC
Fax: (204) 983-2187

Saskatchewan

S.J. Cohen Building
Suite 401, 119 - 4th Avenue South
SASKATOON, Saskatchewan
S7K 5X2
Tel.: (306) 975-4400
Fax: (306) 975-5334

Alberta

Canada Place
Suite 540, 9700 Jasper Avenue
EDMONTON, Alberta
T5J 4C3
Tel.: (403) 495-ISTC
Fax: (403) 495-4507

Suite 1100, 510 - 5th Street S.W.
CALGARY, Alberta
T2P 3S2
Tel.: (403) 292-4575
Fax: (403) 292-4578

British Columbia

Scotia Tower
Suite 900, 650 West Georgia Street
P.O. Box 11610
VANCOUVER, British Columbia
V6B 5H8
Tel.: (604) 666-0266
Fax: (604) 666-0277

Yukon

Suite 301, 108 Lambert Street
WHITEHORSE, Yukon
Y1A 1Z2
Tel.: (403) 668-4655
Fax: (403) 668-5003

Northwest Territories

Precambrian Building
10th Floor
P.O. Bag 6100
YELLOWKNIFE
Northwest Territories
X1A 2R3
Tel.: (403) 920-8568
Fax: (403) 873-6228

Headquarters

C.D. Howe Building
1st Floor East, 235 Queen Street
OTTAWA, Ontario
K1A 0H5
Tel.: (613) 952-ISTC
Fax: (613) 957-7942

Publication Inquiries

For individual copies of ISTC publications, contact your nearest Business Service Centre. For more than one copy of ISTC publications, please contact

For Industry Profiles:

Communications Branch
Industry, Science and Technology Canada
Room 704D, 235 Queen Street
OTTAWA, Ontario
K1A 0H5
Tel.: (613) 954-4500
Fax: (613) 954-4499

For other ISTC publications:

Communications Branch
Industry, Science and Technology Canada
Room 208D, 235 Queen Street
OTTAWA, Ontario
K1A 0H5
Tel.: (613) 954-5716
Fax: (613) 954-6436

Canada

(V.5.91.06)

I N D U S T R Y P R O F I L E

1990–1991

DEFENCE ELECTRONICS

FOREWORD

In a rapidly changing global trade environment, the international competitiveness of Canadian industry is the key to growth and prosperity. Promoting improved performance by Canadian firms in the global marketplace is a central element of the mandates of Industry, Science and Technology Canada and International Trade Canada. This Industry Profile is one of a series of papers in which Industry, Science and Technology Canada assesses, in a summary form, the current competitiveness of Canada's industrial sectors, taking into account technological, human resource and other critical factors. Industry, Science and Technology Canada and International Trade Canada assess the most recent changes in access to markets, including the implications of the Canada-U.S. Free Trade Agreement. Industry participants were consulted in the preparation of the profiles.

Ensuring that Canada remains prosperous over the next decade and into the next century is a challenge that affects us all. These profiles are intended to be informative and to serve as a basis for discussion of industrial prospects, strategic directions and the need for new approaches. This 1990–1991 series represents an updating and revision of the series published in 1988–1989. The Government will continue to update the series on a regular basis.

Michael H. Wilson
Minister of Industry, Science and Technology
and Minister for International Trade

Structure and Performance

Structure

The defence electronics industry comprises companies that develop, manufacture and repair radio and communications equipment, radars for surveillance and navigation (both civil and military), air traffic control systems (both civil and military), acoustic and infrared sensors, computers for navigation and fire control, signal processors and display units, special-purpose electronic components, and systems engineering and associated software. Because of the diversity of products and customers, defence electronics cannot be treated as a homogeneous industry. At the same time, avionics is considered to be a subset of the aerospace industry, and this profile should be read in conjunction with the industry profiles entitled *Aerospace* and *Space*.

The Canadian defence electronics companies generally serve market niches; they do not address entire weapon systems, nor do they cover the majority of Canadian defence requirements. The industry's products are subsystems sold either to prime contractors for inclusion in larger defence systems (related to aircraft, ships or vehicles) or to users directly. End users of these products are limited to the military, government agencies or commercial airlines, which set stringent manufacturing process and product performance specifications.

There were an estimated 150 firms in the industry employing some 26 330 people in 1989. Geographically, the industry is concentrated in Ontario and Quebec, where about 91 percent of production and employment can be found. There are also companies in Vancouver, Calgary, Edmonton, Regina, Winnipeg and Halifax.

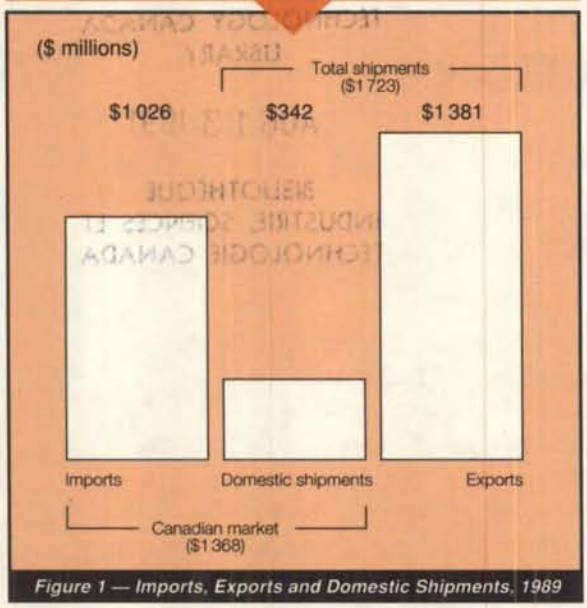

Figure 1 — Imports, Exports and Domestic Shipments, 1989

The industry is highly export-oriented. In 1989, exports totalled an estimated $1.4 billion, or about 80 percent of total shipments (Figure 1). Eighty percent of these were to the United States, with the remainder distributed worldwide. In the same year, imports were approximately $1 billion, with more than 90 percent coming from the United States. In comparison, domestic shipments amounted to only $342 million in 1989.

The major Canadian companies involved in the sector are supported by second-tier component suppliers (e.g., manufacturers of connectors and printed circuit boards) and third-tier services suppliers (e.g., firms that perform machining or plating), the latter generally being small enterprises. For reasons of convenience and service, these subtier companies are normally located close to the primary companies. Proximity to these suppliers and to centres of higher education are key factors in the decisions governing location for new entrants and plants in this sector. Foreign ownership in the industry is widespread; six of the ten largest companies are U.S.-owned, one is British-owned and three are Canadian-owned. Smaller firms are largely Canadian-owned.

Small in comparison with their major international competitors, Canadian-based companies must compete with subsidiaries of larger international defence firms (including their own affiliates), as well as with many other similar-sized independent companies. The major international competitors include divisions of GM-Hughes Electronics, Westinghouse, GE, Magnavox and Allied-Signal (United States); Thorn EMI and GEC-Plessey (United Kingdom); Thomson-CFS and Alcatel (France); Standard Electric Lorenz and Siemens (Germany) and Tadiran (Israel).

Performance

In 1989, the top 10 Canadian companies accounted for approximately 75 percent of the defence electronics industry's estimated $2.36 billion in revenue. To put this business into perspective, U.S. avionics sales for 1989 were just under $40 billion, and total U.S. aerospace sales were just under $140 billion.[1] Canadian revenues showed a drop of $500 million (17 percent) from 1988 to 1989. This marked reversal of the growth trend for the mid-1980s ended a period of sustained expansion which had lasted more than 10 years. Demand since 1988 has decreased; there are fewer shipments (Figure 2) and smaller order backlogs. In addition, two major Canadian firms announced plant closures: the first was Leigh Instruments in Carleton Place, Ontario, in April 1990; the second was Rockwell-Collins in Toronto in November 1990. As a result, employment in the industry also fell, after a period of fairly steady increase during the 1980s.

This slackening in sales performance reflects to some degree the sensitivity of the sector to recent cutbacks in U.S. and international defence spending and the much fiercer competition for the remaining business that this has engendered. U.S. defence capital expenditures[2] were $90.5 billion in 1989 in current dollars and are estimated at $90.4 billion and $87.9 billion for 1990 and 1991, respectively. Taking inflation into account, this decline from earlier levels of U.S. defence spending is significant. As well, the cancellations and delays of major Canadian defence projects (such as the nuclear submarine and new shipborne aircraft) have had an adverse effect on Canadian industry output.

Another factor slowing the sales growth of the sector is the rising value of the Canadian dollar, which was at U.S.$0.86 in 1990 (Figure 3). The rapid increase in the Canadian dollar relative to the U.S. dollar has effectively shrunk profits of firms whose contracts were quoted some time ago in U.S. dollars. Thus Canadian companies are caught in a squeeze that requires major improvements in productivity or in their products' technical features at a time when falling profits make the decisions to fund such investments much harder to justify. The reaction of industry to these pressures has been swift and, in many instances, painful.

Sharply reduced backlogs and profits have resulted in layoffs throughout the sector, as firms have struggled

[1]As reported in *Aviation Week and Space Technology,* 19 March 1990.

[2]As reported by the U.S. Office of Management and the Budget, *Budget of the United States Government, 1990,* (Washington, D.C.: Government Printing Office, 1990).

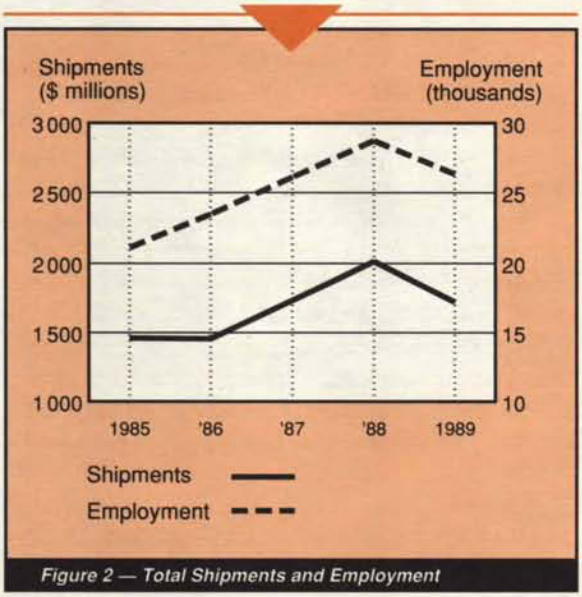

Figure 2 — Total Shipments and Employment

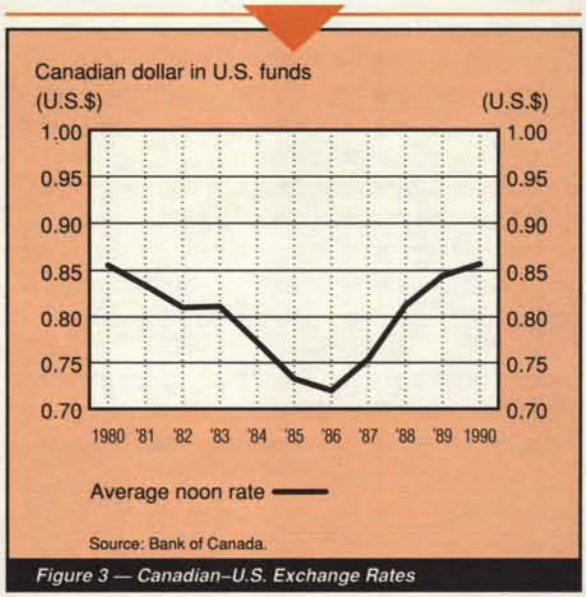

Figure 3 — Canadian–U.S. Exchange Rates

to maintain financial performance up to expected parent-owner standards. In addition, the reinvestment rate in research and development (R&D) and capital expansion projects has dropped slightly from almost 15 percent of annual revenues in 1988 to closer to 14 percent in 1989. While these reinvestment rates remain high compared to those of many other manufacturing sectors, only a return to healthy profit margins will prevent this decline from continuing in the future.

Canada's international competitors will benefit from reduced R&D spending in Canada, since advanced technical features have always been a hallmark of successful Canadian products. Many layoffs are occurring, not only among production personnel, but also among marketing and engineering staffs. These cutbacks could prove to be damaging to firms in the longer term. While some senior executives express great reluctance to cut back on development, they cite immediate survival of the firms as their most urgent priority.

Strengths and Weaknesses

Structural Factors

The key structural factors determining the competitiveness of the Canadian defence electronics industry are company size (Canadian companies are small relative to firms in the United States and Europe), the ability of the industry to keep advancing technologically and the ability of firms to market and sell to customers in foreign markets.

Because of the demanding nature of customers' specifications, the cost of doing business in the industry is substantial, making it difficult for smaller firms lacking adequate financial resources either to enter the field or to compete. These costs reflect the custom-made nature of defence products, the specialized manufacturing processes used, the rigorous test procedures specified in bid documentation, as well as the need to meet stringent financial and quality audit requirements. The time required to produce fully compliant systems is often measured in years, and this lengthy cycle before payoff requires a long-term commitment and substantial resources. The commitment is extended when companies are required to perform certain ancillary services, such as training, translation and provision of service manuals.

The orientation of the industry towards market niches, while supporting its international competitiveness, can also create problems. There are now strong pressures on companies to subcontract out work they can no longer do profitably in-house, and to concentrate on higher value-added activities, such as systems engineering and software (one company official describes this as "climbing the food chain").

Whereas many of the larger U.S. and European defence firms have followed the same path and have diversified during the past decade, Canadian-based companies generally find themselves with limited financial and human resources available to expand their product base upward at the same pace as their international competitors. With the major aircraft companies now turning towards totally integrated cockpit designs, procured as a package from the larger systems-oriented avionics firms such as Honeywell and Bendix, the smaller

Canadian operations, such as Canadian Marconi and Litton, are finding it more and more difficult to keep their traditional markets based on a relatively few stand-alone sensors, instruments and subsystems. This problem is compounded by the necessity for the subcontractor to accept a large part of the cost of developing such integrated cockpit designs, imposed by the major aircraft builders as a condition of being accepted as a qualified supplier.

The ability of Canadian firms to access R&D opportunities in the United States, obtained via the Defence Development Sharing Arrangement (DDSA), has long been a traditional part of doing business in the sector, and these developments normally form the basis for future foreign government systems purchases. However, since U.S. government R&D spending in real terms is now decreasing, the competition with American suppliers for these funds has become fierce, and Canadian firms are now finding it increasingly difficult to win such programs. In addition, U.S. military agencies generally start many more programs than they finish, and thus it is also difficult for Canadian firms to select high-priority projects that can be relied upon to go into eventual production. Virtually all of these projects become the subject of intense high-level political interest and debate, making decisions by Canadian industry leaders on such matters a high-risk proposition. Finally, U.S. agencies (and other foreign procurement offices) are learning that, in a buyers' market, they can insist on features and performance as part of a subsystem's basic price, which previously they were willing to negotiate as an added cost.

Despite these more demanding circumstances, Canadian companies have been successful in developing innovative, reliable, technologically advanced and cost-effective products. This has been achieved through a variety of means, including joint development programs with the Canadian government, participation in DDSA projects with the U.S. government and use of parent companies' proprietary world-class technologies. The participation of many major U.S. and European firms in procurement projects of the Department of National Defence (DND) has also benefited Canadian companies through technology transfers and licensing arrangements. Some of the better-known Canadian products that have their roots in these relationships are CAE Electronics' aircraft simulators, Canadian Marconi's communications and cockpit instrumentation, and Litton Systems' inertial navigation systems and cockpit displays.

Foreign parents have generally supported the development of these products, so long as the financial performance of Canadian subsidiaries came up to corporate standards and the products tended to complement, rather than compete with, other divisions' product lines. Conversely, a growing trend towards corporate product rationalization now makes diversification in Canadian firms more difficult to plan and carry out, owing to the decreasing cost advantage associated with the high Canadian dollar value.

Not one of the Canadian companies in the sector is large enough to support the large investments required to be self-reliant in the key components used to manufacture defence electronics products. The resulting dependence on foreign-made components has become a problem with the advent of devices using very high-speed integrated circuit (VHSIC) technology. Access to these components has occasionally been restricted by the U.S. government for national security reasons, yet this access is essential in the design and production of the next generation of defence electronics products. As a result, Canadian product development has been constrained. Some special efforts are being made in Canada in millimetre-wave integrated circuits, solid-state displays, optical components and application-specific integrated circuit (ASIC) encryption devices, where the high performance required in military products allows the incorporation of such devices, despite the high costs of developing them. It remains to be seen whether these limited types of investments will be sufficient to permit Canadian companies to remain viable in the changing environment.

Parent companies provide Canadian subsidiaries not only with technology and world product mandates, but also with corporate links and market presence, which are necessary elements for success in American and other international defence markets. Small Canadian-owned companies are at a disadvantage because they lack the contacts of larger foreign-owned firms, and many owners are reluctant to make teaming arrangements, which they fear could lead to the loss of control of their companies.

In the defence electronics industry, marketing requires direct contact with individual program officers in each of the relevant services as well as follow-through on each step of the bidding process, which is extremely complex and costly.

Finally, because of the importance of market presence and direct contact with military officials, Canadian-based firms will always be at a disadvantage when competing with companies manufacturing in the buying country. In too many instances, superior technology fails to overcome the advantages of a strong local presence. For this reason, some companies, such as Canadian Marconi, operate subsidiaries in the United States near their main customer locations.

Trade-Related Factors

Trade in defence electronics products is not covered either by the Canada-U.S. Free Trade Agreement (FTA) or by the General Agreement on Tariffs and Trade (GATT)

Procurement Code. Instead, this trade is governed by bilateral defence arrangements, which have roots going back to World War II. The trading patterns reflect the defence production and acquisition framework established in the late 1950s and early 1960s by the Canada-U.S. Defence Development Sharing Arrangement (DDSA) and the Defence Production Sharing Arrangement (DPSA). Under these arrangements, Canada discontinued its development of major weapons systems. Most Canadian defence equipment needs were to be obtained largely from the United States in return for access to the U.S. market on essentially the same basis as U.S. domestic producers, an arrangement that to this day is unique to Canada. This arrangement in part has given the Canadian defence electronics industry its export orientation — primarily towards the United States, focused on market niches.

As indicated, the DDSA supports Canadian companies' access to U.S. government development projects. The DPSA facilitates Canada-U.S. trade through the waiver of duties and some U.S. "Buy America" procurement preferences. However, not all U.S. procurement officers are familiar with these arrangements, and constant effort, assisted by External Affairs and International Trade Canada, is required to re-establish and reaffirm Canada's market access position.

Tariffs on defence products are generally not a major concern. Non-tariff barriers (NTBs) are of more consequence and concern.

Foreign government defence department regulations and restrictions can become NTBs. Security and technology transfer restrictions are the areas of most concern. The security clearance process in the United States is quite cumbersome, and companies often obtain security clearances too late to meet the closing date for bids.

The U.S. Small Business Set-Aside Program is another significant barrier to Canadian companies. Under this program, defence electronics firms in the United States are defined as small businesses if they employ fewer than 750 or 1 500 people (depending on the product area). The set-aside provision eliminates foreign competition (including Canadian companies) if sufficient U.S.-based competition (two or three firms) exists. Typically, the procurement set-aside for small business is of a size and scale that would otherwise allow Canadian companies to compete. In addition, the Small Business Subcontracting Program requires prime contractors to set aside a portion of subcontracts for U.S. small business, again excluding Canadian firms.

The U.S. budget process also presents problems. Individual defence budget items are subject to detailed congressional scrutiny and approval at every stage of development and procurement. An active congressional lobby is often successful in preventing the funding of projects proposing foreign weapons systems or systems with relatively high levels of foreign content.

In addition, the U.S. defence appropriations and authorization bills are used to introduce broader measures that eliminate foreign competition, although these measures generally have not been aimed at the Canadian electronics industry per se.[3] However, with the continuing tightening of the U.S. purse strings for both procurement and R&D, it is unlikely that Canada can expect much relief from the imposition of these kinds of defensive trade measures.

Direct government support of defence industries is significant in most fully developed countries. For example, in recognition of the high costs of doing business in the defence market, U.S. firms are assisted through numerous opportunities to carry out government-funded R&D on new products. Other U.S. programs in support of their industry include the Manufacturing Technology Assistance Program, the Industrial Modernization Incentive Program, targeted tax credits, depreciation allowances and special powers to subsidize elements of the U.S. industrial base for national security reasons.

Despite these measures, a number of major U.S. defence firms in recent years have scaled back, have diversified into commercial areas or have left the defence field entirely, because of uncertain returns on investment. The U.S. Electronics Industry Association had estimated in 1986 that the budget of the U.S. Department of Defense for research, development, testing and evaluation would be approximately U.S.$50 billion annually for the next 10 years. However, the amount enacted in 1990 was U.S.$39.9 billion. This is one measure of the extent to which U.S. military R&D spending has been cut. The main impact of these events on operations of Canadian subsidiaries has been to create pressure to lower reinvestment in R&D and capital acquisitions.

In Canada, the federal government sponsors defence development through the Defence Industry Productivity Program (DIPP). This support is now of the order of $200 million annually for the entire aerospace and defence sector. In response to the reduced reinvestment rate and lower profits, demand for DIPP assistance from the defence electronics industry has flattened somewhat from the high level of the late 1980s. The program assists companies through repayable assistance for capital investment, R&D,

[3]The Bayh Amendment introduced several years ago gives U.S. companies the opportunity to offer to do development work on which Canadian companies are bidding, if they are willing to do so at a cost lower than that quoted to the U.S. government by the Canadian firm through the Canadian Commercial Corporation.

modernization and marketing. As can be seen from the U.S. figures quoted earlier, DIPP assistance is very modest relative to similar U.S. programs. Nevertheless, Canadian industry executives believe it to be more focused and effective than the "shotgun" approach to R&D practised in the United States. DND funding through its chief of research and development's Defence Industry Research Program (DIRP), as a proportion of the defence budget, is also very limited relative to that of other member countries of the North Atlantic Treaty Organization (NATO).

Technological Factors

Although Canadian companies historically were in a favourable position internationally in critical technologies such as radar, telecommunications, simulators, navigation systems, instrumentation and software, this position has been eroded by many of the factors mentioned above. As previously indicated, the defence electronics industry in Canada is highly dependent on the development of new technologies and products for its continued existence. This situation reflects the defence posture of the United States and NATO — deterrence through technological superiority — which has created a constant demand for innovative products. The recent reduction in the perceived Soviet threat will probably modify this posture towards an emphasis on sensor, surveillance and light weapons technology as opposed to the heavy weapons capability of the "cold war" era. Canadian defence electronics products have tended to fall more naturally into the light weapons technology area than into the latter.

Despite the development of small but relatively concentrated centres of technological expertise in various locations (particularly in Ottawa, Toronto, Vancouver and Cambridge, Ontario), the reliance of the industry on imported technology and components in the field of microelectronics has not changed appreciably during the past two years.

Systems integration capability to put together sensors, communications, command and control computers, and weapons systems and to write the software enabling the total system to function as an integrated and effective system was thought to be an important attribute for firms in defence electronics; as it relates to specific, large DND systems procurements, this is undoubtedly true. What has become increasingly clear, however, is that such business has very sizable risks associated with it, to the degree that even companies of moderate size are having great difficulty in dealing with them. The failure of Leigh Instruments in April 1990 is a prime example.

Canadian capability to perform these large-scale, systems integration activities is still in the developmental stage. For companies already having a strong orientation towards export business, the move towards systems integration capability may be viewed as a risky step, as it diverts scarce human and financial resources from their major thrusts. To complement larger firms such as Litton Systems Canada, Unisys Canada and CAE Electronics, a number of smaller firms are entering the field in very specialized areas such as software and logistics support. These companies include Prior Data Sciences, Amtek and MacDonald Dettwiler & Associates. Gaining experience in the U.S. military's new software programming language ADA, which will be used in most large U.S. and NATO systems in the future, will be a challenge for these firms. This challenge is being met. In the application of production and manufacturing technologies, the Canadian industry increasingly uses computer-aided design and manufacturing (CAD/CAM) and just-in-time techniques.

Evolving Environment

The Canadian defence electronics industry is now facing, and will continue to face, fierce competition in selling to the U.S. and world markets over the next decade. The competition will come not only from U.S. firms, but also from European companies. Its intensity will be fuelled by a significant decrease in the demand for weapons systems, including planes, missiles, ships and vehicles. Furthermore, new protectionist pressures may arise in the United States in response to the continuing decline in domestic opportunities for its own domestic defence industry. The impact of the Middle East Persian Gulf War temporarily modified this situation.

The number and value of electronics subsystems is growing as a proportion of the total cost of each vehicle. This increase, to a degree, tends to offset the decline in overall numbers of vehicles.

Senior Canadian company executives have repeatedly stated that, owing largely to the current high value of the Canadian dollar, their existing manufacturing operations located in the larger cities in Canada are no longer competitive with plants located in low-wage areas of the southern United States.

Canadian firms have been undertaking extraordinary measures to cut overheads and improve efficiency in their operations, in view of the rising Canada-U.S. exchange rate, to try to protect their competitive position. There is a limit, however, on how far improvement in productivity and efficiency can go without damaging the structure of the business.

Avionics products such as discrete cockpit instruments are being replaced by highly integrated instrumentation.

Solid-state displays are going into the next generation of advanced aircraft and helicopters, where they will displace the cathode ray tube. Canadian companies are continuing to develop strong capabilities in this area. They are in a critical race with their international competitors and no longer appear to hold significant cost advantages. Similarly, conventional electronics wiring in aircraft is giving way to "fibre-optic-bus architecture." Canadian software houses are developing world-class capabilities in their areas of expertise. Development of systems integration capability is proving to contain many pitfalls and has yet to develop the potential business originally expected of this area of expertise. However, the steady evolution of a capability implicit in the cockpit systems, displays and simulation work currently going on in several Canadian companies involves the kind of systems integration capability that is vital to protect their markets in the near and long terms. Stretching out the time of new aircraft programs will make retrofit programs more critical as business opportunities.

The repair and overhaul (R&O) of Canadian defence systems will remain a source of work for the industry, although perhaps not as important as in the past. Modern solid-state equipment, while much more complex, is considerably more reliable than older systems; repairs will therefore occur on a reduced scale. There is also a trend towards repair by replacing throwaway modules.

The impact of these changes on Canada's defence electronics industry will be substantial. Many Canadian firms are now showing smaller bookings, as well as reduced revenue and profits, and are announcing layoffs, which signal a significant erosion in their international competitiveness. The underlying factors are both cyclical (e.g., variations in exchange rates) and structural (severe declines in defence markets). In spite of these developments, the majority of executives in the larger firms in the sector remain optimistic for the future of their firms and are maintaining critical product development efforts essential to future business, while at the same time working to make their organizations "meaner and leaner."

The FTA will not have a direct impact on the defence electronics industry. Indirectly, however, the process of rationalization going on throughout industry in general is having some impact on the defence electronics sector also.

At the time of writing, the Canadian economy had entered a recessionary period. The U.S. economy is also characterized by weak economic conditions. As a result, Canadian companies are facing significant cyclical pressures, in addition to underlying pressures for change of a longer-term, structural nature. This recession is affecting the defence electronics sector much more severely than the one that occurred in the early 1980s. On the earlier occasion, there was neither a rapid rise in value of the Canadian dollar nor a cutback in U.S. defence spending and, as a result, this sector was able to carry on with little or no evidence of faltering. This time, the sector faces a more serious problem, in which observed structural weakness may play a more significant part. In particular, it is possible that the lack of a broad R&D foundation in the industry, relative to international competitors, could give rise to the repatriation of advanced technology and product development activity to parent-company organizations in the United States and Europe. An example of this is the recent shutdown of the Honeywell Advanced Technology Centre in Toronto.

Another equally serious aspect of the current recession is that it is affecting not only defence business but also commercial business. While Canadian avionics suppliers do not undertake a great deal of their commercial business with Canadian airframe companies, they certainly do have considerable interaction with the major American airframe manufacturers. The general weakness now showing up in the U.S. and European commercial aerospace sector is adversely affecting Canadian avionics suppliers, and this is compounded by the tightening of their military markets.

Competitiveness Assessment

The Canadian defence electronics industry has been very successful until very recently in competing in the unusual conditions that characterize defence markets. Continued success will be more difficult. It will take better-managed, tougher and more diversified companies to survive in the long term, and one key factor to their success will be the continuation of well-planned, well-executed product development and capital acquisition programs. Other key factors are improvements in productivity and production costs.

A stronger and more aggressive science and engineering program in the research community in Canada may help to strengthen the smaller companies, which must depend upon such sources for basic research ideas and products. It may also help to influence the decisions of many of the top executives of larger U.S. and European subsidiaries (both in Canada and in their parent operations) who currently do not see Canada as a strong investor in basic technology areas and who are therefore inclined to look elsewhere in the world when placing their limited personnel and capital resources.

The continued emphasis on national security and defence objectives (as well as purely economic objectives) and the high costs and risks inherent in the industry mean

that governments must continue to play a role in the development of domestic defence electronics industries. This sector has become much more sensitive to cost variations than was previously the case, including among other things levels of DIPP support. Perceived erosion of this support instrument would send a negative message to the industry. Unless productivity is increased and R&D investment sustained, there will ultimately be pressure to relocate operations to countries with lower production costs.

For further information concerning the subject matter contained in this profile, contact

Defence Electronics and Space Branch
Industry, Science and Technology Canada
Attention: Defence Electronics Division
235 Queen Street
OTTAWA, Ontario
K1A 0H5
Tel.: (613) 954-3779
Fax: (613) 954-4246

PRINCIPAL STATISTICS[a]

	1982	1985	1986	1987	1988	1989
Establishments	150	150	150	150	150	150
Employment	N/A	21 100	23 450	26 100	28 728	26 330
Shipments[b] ($ millions)	740	1 461	1 455	1 735	2 013	1 723
Revenues[b] ($ millions)	905	1 976	2 015	2 390	2 854	2 358
Investments ($ millions)	133	266	284	312	424	346
Profits after tax ($ millions)	N/A	186	149	171	138	109

[a]All data are ISTC estimates.

[b]Shipment figures represent the value of manufacturing sales up to the point of installation. Revenue figures include shipment figures plus other revenues such as earnings from research and development, repair and overhaul.

N/A: not available

TRADE STATISTICS[a]

	1982	1985	1986	1987	1988	1989
Exports ($ millions)	583	1 169	1 164	1 388	1 599	1 381
Domestic shipments ($ millions)	157	292	291	347	414	342
Imports ($ millions)	565	1 110	1 106	1 319	1 252	1 026
Canadian market ($ millions)	722	1 402	1 397	1 666	1 666	1 368
Exports (% of shipments)	79	80	80	80	79	80
Imports (% of Canadian market)	78	79	79	79	75	75
Canadian share of international market (%)	N/A	0.3	0.3	0.3	N/A	N/A

[a]All data are ISTC estimates.

N/A: not available

REGIONAL DISTRIBUTION (average over the period 1986 to 1988)

	Atlantic	Quebec	Ontario	West
Establishments (% of total)	7	11	62	20
Employment (% of total)	2	32	59	7
Revenue (% of total)	2	32	59	7

MAJOR FIRMS

Name	Country of ownership	Location of major plants
Allied-Signal Aerospace Canada	United States	Cornwall, Ontario Montreal, Quebec Rexdale, Ontario
CAE Electronics Ltd.	Canada	Montreal, Quebec
Canadian Marconi Company	United Kingdom	Cornwall, Ontario Kanata, Ontario Montreal, Quebec
Computing Devices Company	United States	Nepean, Ontario
ITT Cannon Canada	United States	Whitby, Ontario
Litton Systems Canada Limited	United States	Halifax, Nova Scotia Toronto, Ontario
MacDonald Dettwiler & Associates Ltd.	Canada	Richmond, British Columbia
Raytheon Canada Ltd.	United States	Waterloo, Ontario
Spar Aerospace Limited	Canada	Montreal, Quebec Ottawa, Ontario Toronto, Ontario
Unisys Defence Systems Canada Inc.	United States	Montreal, Quebec Winnipeg, Manitoba

INDUSTRY ASSOCIATIONS

Aerospace Industries Association of Canada
Suite 1200, 60 Queen Street
OTTAWA, Ontario
K1P 5Y7
Tel.: (613) 232-4297
Fax: (613) 232-1142

Canadian Defence Preparedness Association
Suite 601, 100 Gloucester Street
OTTAWA, Ontario
K2P 0A4
Tel.: (613) 235-5337
Fax: (613) 235-0784

Printed on paper containing recycled fibres.