

QUEEN
HD
9505
.C3
I5
S10
1988
c.2

IC

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

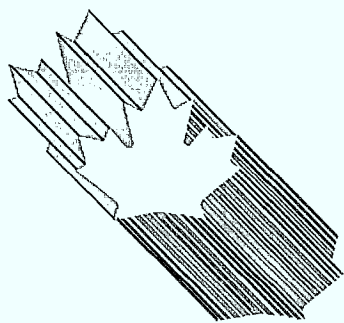


Industry, Science and
Technology Canada

Industrie, Sciences et
Technologie Canada

Space

Canada



INDUSTRY PROFILE SPACE

1988

FOREWORD

.....

In a rapidly changing global trade environment, the international competitiveness of Canadian industry is the key to survival and growth. This Industry Profile is one of a series of papers which assess, in a summary form, the current competitiveness of Canada's industrial sectors, taking into account technological and other key factors, and changes anticipated under the Canada-U.S. Free Trade Agreement. Industry participants were consulted in the preparation of the papers.

The series is being published as steps are being taken to create the new Department of Industry, Science and Technology from the consolidation of the Department of Regional Industrial Expansion and the Ministry of State for Science and Technology. It is my intention that the series will be updated on a regular basis and continue to be a product of the new department. I sincerely hope that these profiles will be informative to those interested in Canadian industrial development and serve as a basis for discussion of industrial trends, prospects and strategic directions.

Minister

Canada

1. Structure and Performance

Structure

The Canadian space industry is small by comparison with the space industries of other developed nations as well as other industries generally. Its 1987 employment was estimated at 3700. It generated sales of approximately \$400 million, some 70 percent of which was exported. Imports take the form of sub-assemblies and components used in domestic production and, while figures are not available, the import content of total sales is estimated to be about 30 percent. Revenues and employment are more or less evenly distributed between Ontario (39 percent) and Quebec (41 percent), with the remainder in British Columbia and Saskatchewan. There is significant concentration of activity in the Montréal and Toronto areas.

There are about 50 firms involved in space-related work in Canada but most industry sales are accounted for by approximately six firms. Spar Aerospace Limited is the largest and accounts for about one-half of total sales and employment. Other firms are relatively small, with sales between \$20 million and \$30 million.

Most of the companies in the industry are Canadian-owned. Ownership is generally closely held, with the principal shareholders often also occupying key executive positions. Foreign ownership is limited mainly to subsidiary plants of large, mostly American, integrated electronics and aerospace companies, which manufacture specialty space-related products (mostly components) along with other products developed by their parents. These companies do not have world mandates for specific space products and their space-related revenues are usually small in relation to total revenues.

Spar is the only Canadian company in this industry capable of assuming the role of a prime contractor and manufacturing complete systems. All others have a narrow product range and tend to concentrate on specialty products.

Space products and services cover a wide spectrum and can be categorized into four broad sub-sectors.

Communications satellite systems and sub-systems include satellite buses (spacecraft platforms) and payloads, antennas and transponders for space use, as well as antennas and reception and transmission equipment for ground use.

Remote sensing satellite systems and sub-systems include satellite buses and space-borne sensors for space use and antennas, and data and image processing equipment for ground use.

Robotics and space tele-operators include Canadarm-type remote manipulators (man-in-the-loop) and automatic "intelligent" dexterous manipulators.

Launch systems make up the fourth sub-sector.

Generally speaking, Canadian companies are active in communications and remote-sensing satellite systems and, to a limited extent, in space robotics.

DEPARTMENT OF REGIONAL
INDUSTRIAL EXPANSION
LIBRARY

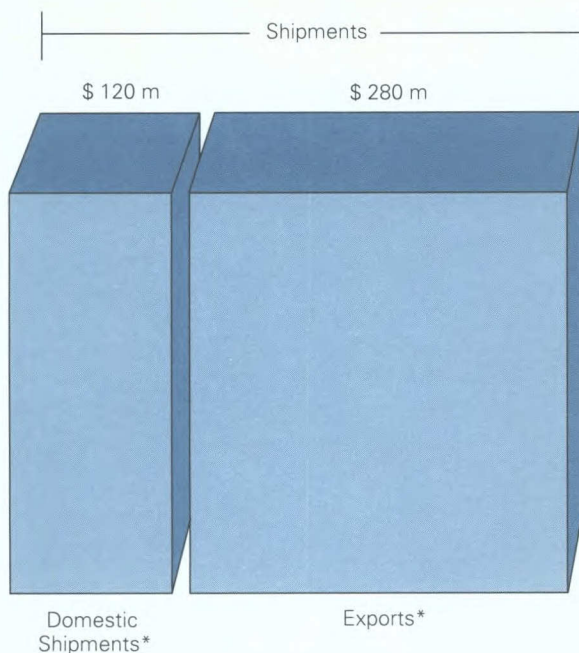
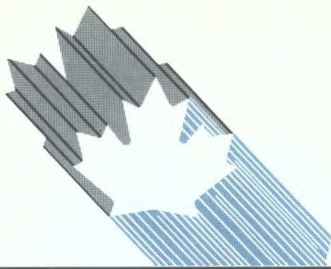
MAY 29 1988

Acx
BIBLIOTHEQUE
MINISTÈRE DE L'EXPANSION
INDUSTRIELLE RÉGIONALE



Industry, Science and
Technology Canada

Industrie, Sciences et
Technologie Canada



**Exports and Domestic Shipments
1987**

* ISTC estimate

In the communications satellite sub-sector, the Canadian space industry primarily designs, develops and manufactures systems and sub-systems. This includes systems engineering and consulting services; manufacturing space-segment payloads (antennas, transponders, signal processors); and the production of transmitting and receiving earth stations and antennas. The only significant part of a satellite not built in Canada is the satellite "bus" or platform.

In the remote sensing sub-sector, a few companies are highly regarded as developers and manufacturers of space-borne sensors as well as in the reception, processing and analysis of remotely sensed data.

In space robotics, Spar designs and develops tele-operators (Canadarm-type manipulators) and the next generation of automatic dexterous manipulators that is required in the international space station program.

Canada does not have a capability for launching satellites, although Bristol Aerospace Limited has developed small sounding rockets for scientific experiments.

Performance

The use of space for communications and surveillance is a national strategic consideration. High costs, high risks and the long period of time for economic returns have been deterrents to private-sector investment. As a result, governments generally play a strong role in the development of a domestic space industry through policy and financial support — either directly through R&D grants, or indirectly by providing a national market.

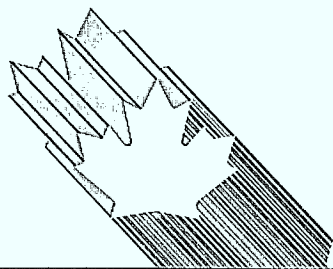
Government spending on space technology research and space product procurement for non-military uses has been increasing. Estimated 1987 annual civilian space expenditures are: the United States, \$9 billion; France and Japan, more than \$1 billion each; the Federal Republic of Germany (F.R.G.), \$480 million; Italy, \$365 million; India, \$325 million; the United Kingdom, \$220 million; and Canada, \$170 million. Expenditures for defence space procurement, while not available, are believed to be considerably greater than civilian expenditures, particularly in the United States. They are seen as indirect subsidies for many manufacturers involved in civilian commercial as well as defence markets.

The U.S. space industry is by far the world's largest, followed by those in France, Japan, the United Kingdom, the F.R.G., Italy and Canada. Competition among these nations is intense and increasing. Market access is a problem and non-tariff barriers (NTBs) can override the criteria of price, quality and delivery in the evaluation of bids.

Faced with a large land mass, a barren north and widely dispersed communities in remote areas, the Canadian government decided, in the 1960s, to use space technology to serve this country's unique requirements. This decision determined the Canadian industry's early, heavy orientation towards communications satellites.

Although small, the Canadian space industry is growing. Sales and employment over the last few years have grown steadily at more than 10 percent annually. Since the mid-1970s, significant government expenditures for contract R&D and procurement of systems have made a large contribution to the strength of the industry.

Most of the industry was founded on the demand created by government requirements for R&D and technology demonstration projects. This support encouraged entrepreneurial researchers and scientists to participate in government projects and establish small R&D-intensive firms. Growth was significantly aided by the procurement of the Anik series of domestic communications satellites by Telesat Canada, which owns and operates Canada's domestic satellite communications network. Telesat Canada is owned equally by the federal government and domestic telephone companies.



The government has maintained an ongoing relationship with the industry. An example of this is the encouragement and support it has given Spar Aerospace to help this company develop a prime-contractor capability for communications satellite systems. Spar's involvement in satellite production programs began with the Alouette in 1962, and continues in more than 50 private and government contracts, the most recent being the Anik-E contract with Telesat. As a result, not only has this Canadian company become a world-class satellite manufacturer, but many other smaller Canadian companies have established technological reputations as suppliers of satellite components and sub-systems.

In the early 1970s, as technology evolved, the government decided to assist Canadian companies in R&D relating to earth observation for resource management. This decision led to the development of highly specialized and regarded Canadian capabilities in remote sensing for the reception, processing and analysis of remotely sensed data. For example, MacDonald Dettwiler and Associates Ltd. (MDA) of Richmond, British Columbia, designed and installed many Landsat and meteorological satellite ground stations in several foreign countries, as well as processing systems for nearly every

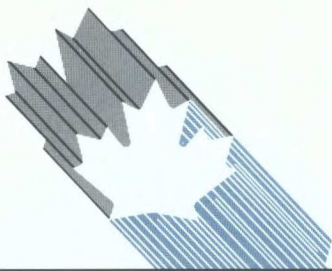
Landsat ground station in the world. Remote sensing received another boost with the approval, by the federal government, of the Radarsat program, a Canadian earth observation radar satellite program. The implementation of this program depends on the confirmation of participation by the provinces and the Canadian private sector, as well as a cost-free launch by the National Aeronautics and Space Administration (NASA) in the United States.

Given the periodic nature of government procurements and the limited size of the Canadian market, domestic sales have tended to be quite volatile, so that the industry has had to look to exports for survival.

Major markets and end users for space products and services are such developed nations as the United States, Canada, Japan and Europe; select markets include China, India, Indonesia and Brazil; and international and regional communications satellite system owners and operators such as Intelsat, Inmarsat and Arabsat.

The following table summarizes the products or services in the commercial, government procurement and military space markets. It indicates the principal customers in each market and identifies the areas in which Canadian companies have expertise.

Type of Market	Product or Service	Principal Customer	Canadian Expertise
Commercial	Communications satellite systems	Private companies, mostly American; Intelsat, Telesat	yes
	Remote sensing satellite systems	National Oceanographic and Atmospheric Administration (NOAA)	no
	Launch services	Private companies	no
Government Procurement	Communications satellite systems	Brazil, India, Indonesia, European Space Agency (ESA)	yes
	Remote sensing satellite systems	Canada, India, ESA, Japan	yes
	Space robotics	National Aeronautics and Space Administration (NASA), ESA, Japan	yes
	Launch services	Various governments	no
Military	Communications satellite systems)	Armed forces in the United States, Europe, Soviet Union, People's Republic of China	limited
	Remote sensing satellite systems)		
	Remote sensing satellite systems)		
	Launch services)		
			no



Access to the markets of developed countries is difficult, particularly in Europe and Japan, as NTBs tend to favour domestic industries. Canadian exports have therefore been largely limited to the huge U.S. market and the market for communications and remote sensing satellite systems in developing countries.

The industry has been successful in its export drive. Exports have grown from about \$10 million in 1977 (17 percent of sales) to an estimated \$280 million in 1987 (70 percent of sales). In some specific sub-systems, Canadian companies enjoy a significant market share. For example, about 70 percent of all RF (radio frequency) multiplexing sub-systems (signal-processing devices) used in communication satellites in the free world are built by Com Dev Limited; MacDonald Dettwiler and Associates Ltd. (MDA) is a world leader in reception, processing and analysis of remotely sensed data; Spar has built all the remote manipulators for the U.S. space shuttle; and the majority of SARSAT (search and rescue satellite) receiving stations are supplied by Canadian Astronautics Limited (CAL). In fact, Canada is one of the few countries in the community of space nations whose space industry revenues are greater than its own government expenditures on space.

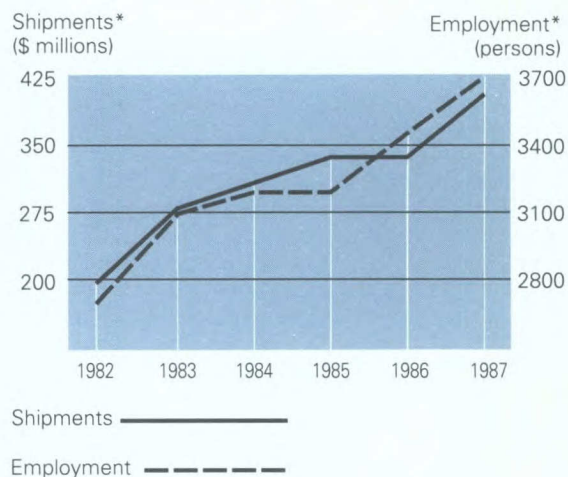
2. Strengths and Weaknesses

Structural Factors

The Canadian space industry produces high-quality products in market niches. It is well managed and adequately financed. Proximity to the U.S. market and space industry is an advantage that allows Canadian companies to meet requirements quickly and keep abreast of technological developments.

Key factors that determine the ability of Canadian space firms to compete depend on the market being targeted. General requirements for success in different markets are as follows:

- Price, quality and performance are all important in the space segment of the communications satellite sub-sector; in its ground segment, price alone is becoming the key determinant as technology is more or less standard.
- Developing country markets for communications and remote-sensing satellite systems require a competitive price and a package of other factors, including some (or all) of the following: low-interest financing for the buyer; export lines of credit, such as those made available by the Canadian Export Development Corporation (EDC) to certain countries; technology transfer; and countertrade.
- Government procurement in developed countries has the usual requirements of price, quality and performance. In addition, it requires domestic subcontracting, offsets and regional considerations.

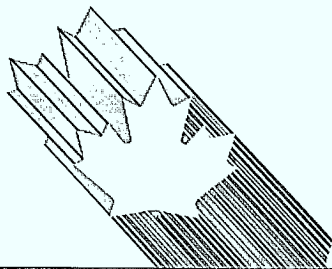


Total Shipments and Employment

* ISTC estimate

Canadian companies are generally known to produce high-quality and technically advanced products. However, lack of scale production and relatively high labour costs put them at a price disadvantage. This situation has forced many Canadian companies to specialize in market niches where they can compete on quality and performance alone. It is also apparent that government is essential in helping companies in the developing-country markets, where aid and concessional financing, training, countertrade, etc., may be important competitive considerations.

Space companies in the United States, Europe and Japan have large domestic markets which allow a secure base and permit economies of scale. Canadian companies, on the other hand, generally do not have opportunities for volume production because the domestic market is small and access to other markets limited. Their unit production costs are higher than those of competitors in the United States, Europe and Japan, which can spread their fixed costs, especially those for R&D (which in Canada range between 10 and 15 percent of sales), over larger production volumes. Consequently, Canadian companies are forced to look to export markets and compete on the basis of better technology. However, they are still at a disadvantage in markets for high-volume products, where cost largely determines success.



Trade-related Factors

Tariff rates on trade in space products between Canada and the United States are low (between five and 10 percent) and do not pose a serious impediment to trade. Data for Japan and the European Community (E.C.) are not available. However, Canadian exporters face a variety of NTBs and other restrictive practices that, in many cases, effectively exclude them from foreign markets. For example, the use of restrictive classification rules (related to security considerations) and the extremely complex military procedures in the United States have effectively restricted access by Canadian companies to the U.S. military market.

Domestic procurement in Japan is expected to be provided by Japanese companies as both government and industry are protectionist. Japanese companies have been known to bid unrealistic deliveries and specifications to drive out competition. With government backing, Japanese companies are aggressive in the use of countertrade and low-cost financing to secure contracts in developing countries.

Demand for space products in Europe is largely created by governments and met by European companies, many of them government owned. Some countries have policies that severely limit access by non-domestic companies. For example, Canadian participation in European Space Agency (ESA) programs is limited because Canada is not a full member of ESA. Work sharing will depend on how much money Canada puts into ESA. The use of *crédit mixte* and countertrade in developing country markets is also common, particularly by French companies.

Under the Canada-U.S. Free Trade Agreement (FTA), tariffs on trade in space products between Canada and the United States will be phased out over a five- to 10-year period. However, U.S. military security procedures are expected to remain in place, so that Canadian firms will probably continue to be largely shut out of the U.S. military market.

Technological Factors

The strength of the Canadian space industry lies in its sophisticated high-technology capability as a supplier of components and sub-systems for communications satellites, with some specialized capabilities in remote sensing and space telerobotics. This expertise is very company-specific.

For example, Spar Aerospace has been the prime contractor for the Anik-D and Brazilsat communications satellites and, more recently, has won the contract for the Anik-E. Com Dev is a major supplier of satellite multiplexers, while Canadian Astronautics Limited (CAL) has built the local user terminals for SIRSAT-COSPAS satellites. Finally, MDA has established a world-class reputation for the reception and image processing of remotely sensed data.

Canada is currently seen as the leader in tele-operator technology. The outstanding success of the "Canadarm" in the U.S. space shuttle program and Canadian participation in the U.S. space station program are notable examples of Canadian superiority in the field of tele-operator technology.

The technological capability of Canadian space firms is the result of significant government expenditures on contract R&D and demonstration projects. Access to U.S. technology developed under military programs or classified as strategic to U.S. interests is usually difficult. However, privately developed technology is usually available commercially.

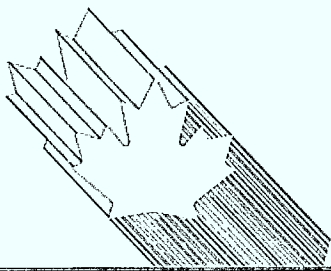
The Canadian government views space as a key strategic industry and continues to be strongly committed to the development of the Canadian space industry. It has supported the industry through contract R&D and procurement of technology demonstration projects. Government expenditures on non-military projects, worth about \$150 million annually over the last five years, have focused on communications and remote-sensing technology development, on space science research, and co-operative arrangements with the ESA and the National Aeronautics and Space Administration (NASA). The Canadian government operates and maintains world-class national test and research facilities, such as the David Florida Laboratory, which is available to Canadian companies on a cost-recovery basis.

In addition to the specific policies and measures described previously, Canadian space companies continue to benefit from funding under several federal assistance programs (the Defence Industry Productivity Program and the Industrial Research Assistance Program).

3. Evolving Environment

The use of space technology and products by governments and private users is increasing. A growing number of countries have dedicated space programs and are developing indigenous capabilities, while markets for some space products or services are reaching levels high enough to support commercial ventures.

The overall trend towards commercialization is broadly based. Satellites are getting bigger, more powerful and longer-lasting, allowing the use of smaller and cheaper earth terminals. As a result, the market for earth terminals to control private business communications networks will likely be strong over the short term. As well, the processing and sale of remotely sensed data available from French, American, Indian, Canadian and Japanese satellites for meteorological, geological, crop and geodetic uses will probably become commercially viable by the mid-1990s.



With the establishment of the permanently staffed U.S. space station in the mid-1990s, material processing in space (such as the manufacture of gallium arsenide crystals) may become commercially attractive in the late 1990s. Governments are generally supportive of this trend. Increasing co-operation between industry and governments in the transfer of technology, as well as the dismantling of government monopolies in space systems, are allowing industries to enter commercial markets for certain space products and services.

Because of the Canadian industry's dependence on export markets, the trend towards commercialization is a welcome development. The Canadian government recognizes the importance of the Canadian industry and is supporting its quest for commercial opportunities and export markets. Government initiatives, such as the sharing of R&D costs with Canadian space companies, help develop the Canadian subcontractor and supplier base and encourage companies to undertake activities in robotics, artificial intelligence and electro-optics. The role of the Canadian government as a purchaser of systems and facilitator in international markets in the space industry has produced results in the past and will continue to be crucial in the future.

The prospects for the Canadian industry are good, particularly in communications satellite systems and sensors and processing equipment for remote sensing satellites.

Canadian companies are also exploring new market opportunities based on the non-space application of technologies originally developed for space. For example, the Canadarm technology is being applied to develop robots for hazardous terrestrial environments, while expertise in sophisticated space hardware is being used to develop airborne electronic defence equipment.

Although markets are generally beginning to open up, access remains a problem, particularly to Europe and Japan. A significant role remains for government as facilitator. Inter-governmental links, joint ventures or consortia are necessary to improve market access and to share costs, risks and technology. Co-operation agreements were signed by the Canadian government with Japan, India, the ESA and NASA. Canada participates jointly with the United States in some defence programs, which allow Canadian companies opportunities for joint R&D and, eventually, manufacturing. Nonetheless, in the foreseeable future the bulk of Canadian exports will be destined for the U.S. commercial market and the space markets of some developing countries.

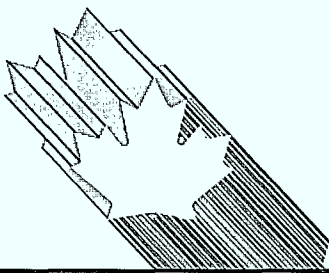
The big U.S. market remains vital to many Canadian companies. Some are actively seeking collaborative arrangements with U.S. companies to facilitate access. Even in Canada, Canadian companies have formed consortia to bid on major procurements which are too big for them to handle alone. Developing countries offer limited but accessible markets, although more than price and superior technology are needed to win contracts.

The role of government becomes crucial to success in these markets by providing marketing support and export financing through the EDC. Also of importance are technology and infrastructure development assistance to the client country, through the Canadian International Development Agency (CIDA), and the willingness of companies to enter into countertrade and technology-transfer arrangements.

4. Competitiveness Assessment

The United States continues to be the world's biggest commercial and military market for space products. It offers Canadian companies opportunities — either through co-operation with U.S. firms and subcontracts to U.S. prime contractors, or the establishment of an independent manufacturing presence in the United States. Recognizing its importance, some Canadian companies have already set up subsidiaries in the United States and formed joint-venture arrangements with American firms.

Canadian companies continue to be strong in high-technology, low-volume products. It is unlikely Canadian companies can compete in high-volume, low-cost products because these markets are relatively easy to enter. High-volume producers in Japan and the United States, which subcontract part of the manufacturing to low-cost countries, can quickly establish large-scale production and drive out competition on the basis of cost. Canadian companies are, therefore, most likely to compete successfully in market niches for high-technology systems and sub-systems, in which performance is of prime importance.



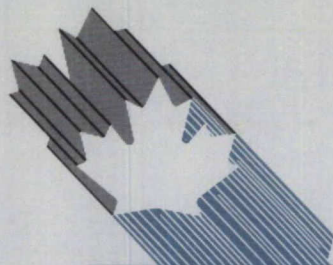
Canadian space companies, such as Spar, Com Dev, MDA, CAL and Intera Technologies Ltd., have succeeded in serving various such foreign market niches. As well, Spar has demonstrated an ability to provide total communications satellite systems both at home and abroad.

The FTA will reinforce the position of Canadian companies. Firms that have carved a niche for themselves on the basis of performance should benefit from easier and expanded access to the U.S. civilian market.

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

Aerospace, Defence and Industrial Benefits
Branch
Industry, Science and Technology Canada
Attention: Space
235 Queen Street
Ottawa, Ontario
K1A 0H5

(613) 954-3166



PRINCIPAL STATISTICS

SIC(s) COVERED: NOT AVAILABLE

	1982	1983	1984	1985	1986	1987
Establishments	N/A	N/A	N/A	N/A	N/A	50
Employment ^e	2 700	3 100	3 200	3 200	3 450	3 700
Shipments (\$ millions) ^e	196	277	314	340	340	400

TRADE STATISTICS

	1982	1983	1984	1985	1986	1987
Exports (\$ millions) ^e	122	180	220	240	240	280
Domestic shipments (\$ millions) ^e	74	97	94	100	100	120
Exports as % of shipments ^e	62	65	70	71	71	70

REGIONAL DISTRIBUTION — Average over the last 3 years

	Atlantic	Quebec	Ontario	Prairies	B.C.
Establishments — % of total	—	20	60	— 20 —	—
Employment — % of total	—	40	40	— 20 —	—
Shipments — % of total	—	41	39	— 20 —	—

MAJOR FIRMS

Name	Ownership	Location of Major Firms
Spar Aerospace Limited	Canadian	Montréal, Quebec Toronto, Ontario
MacDonald Dettwiler and Associates Ltd.	Canadian	Vancouver, British Columbia
Com Dev Limited	Canadian	Cambridge, Ontario
Canadian Astronautics Limited	Canadian	Ottawa, Ontario
SED Systems Inc.	Canadian	Saskatoon, Saskatchewan
Intera Technologies Ltd.	Canadian	Calgary, Alberta

^e ISTD estimate
N/A Not available

Note: Estimates have been obtained through company annual reports, Aerospace Industries Association of Canada (AIAC) statistics and ISTD industry consultations.

Regional Offices

Newfoundland

Parsons Building
90 O'Leary Avenue
P.O. Box 8950
ST. JOHN'S, Newfoundland
A1B 3R9
Tel: (709) 772-4053

Prince Edward Island

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

Nova Scotia

1496 Lower Water Street
P.O. Box 940, Station M
HALIFAX, Nova Scotia
B3J 2V9
Tel: (902) 426-2018

New Brunswick

770 Main Street
P.O. Box 1210
MONCTON
New Brunswick
E1C 8P9
Tel: (506) 857-6400

Quebec

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

Ontario

Dominion Public Building
4th Floor
1 Front Street West
TORONTO, Ontario
M5J 1A4
Tel: (416) 973-5000

Manitoba

330 Portage Avenue
Room 608
P.O. Box 981
WINNIPEG, Manitoba
R3C 2V2
Tel: (204) 983-4090

Saskatchewan

105 - 21st Street East
6th Floor
SASKATOON, Saskatchewan
S7K 0B3
Tel: (306) 975-4400

Alberta

Cornerpoint Building
Suite 505
10179 - 105th Street
EDMONTON, Alberta
T5J 3S3
Tel: (403) 495-4782

British Columbia

Scotia Tower
9th Floor, Suite 900
P.O. Box 11610
650 West Georgia St.
VANCOUVER, British Columbia
V6B 5H8
Tel: (604) 666-0434

Yukon

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

Northwest Territories

Precambrian Building
P.O. Bag 6100
YELLOWKNIFE
Northwest Territories
X1A 1C0
Tel: (403) 920-8568

*For additional copies of this
profile contact:*

*Business Centre
Communications Branch
Industry, Science and
Technology Canada
235 Queen Street
Ottawa, Ontario
K1A 0H5*

Tel: (613) 995-5771