



**Aerospace**  
*Québec : A Dynamic and Profitable  
Business Environment*

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## HOME

If you are planning to invest in this leading-edge industry, you will find optimum conditions for doing so in Québec:

- International-calibre prime contractors;
- An impressive suppliers and subcontractors network;
- The largest pool of engineers in Canada;
- Abundant, competitively priced specialized labour;
- Training facilities equipped with state-of-the-art technology;
- Abundant venture capital; and
- Assistance programs custom-designed for the industry.

Internationally, the Greater Montréal region is considered one of the major world centres for aeronautics, on the same level as Seattle and Toulouse.

Indeed 60% of overall Canadian aerospace industry production takes place in Québec, where sales reached some CDN\$12.4 billion in 2009.

The prominence of this industry is reflected in the presence here of **major prime contractors and technical centres** such as Bombardier Aerospace, Bell Helicopter Textron, CAE, Pratt & Whitney Canada, AVEOS, Rolls-Royce Canada, as well as **world-class manufacturers** like GE Canada, Héroux-Devtek, Lockheed Martin, MDA Space, Esterline CMC Electronics, Messier-Dowty and Thales Avionics.

In addition, the Canadian Space Agency has its headquarters in Québec, and is the site of important R&D initiatives in space technology, key among them the development of robotic arms (Canadarm) for space shuttles and International Space Station.

*"At GE Aviation in Bromont, we have been able to mobilize our workforce for projects that are important for the company's growth. We're capitalizing on one of the greatest competitive advantages that Québec offers in emerging sectors like ours: a qualified, stable labour pool that is able to innovate." - Philippe Simonato, Manager of the GE Aviation plant in Bromont, 2010*

**Your company is growth-minded. Expand your horizons in Québec.**

*Last update: July 2010*

## SECTOR PROFILE

Québec is truly a major engine of the Canadian aerospace industry, home to more than 234 companies employing some 40,000 specialized workers who are well trained in advanced production methods and techniques.

These include:

- World-class prime contractors;
- Major original equipment manufacturers (OEMs); and
- A vast community of subcontractors and special products manufacturers.

### Québec: Fifth in the World

Québec aerospace ranks fifth internationally in terms of workforce and sixth for sales, after the United States, France, Germany, the United Kingdom and Japan.

#### Snapshot of the Québec Aerospace Industry (2009)

Businesses	234
Jobs	40,200
Sales (billions of CDN\$)	12.4
• Québec/Canada (%)	60
Exports (billions of CDN\$)	9.8
• Québec/Canada (%)	60
Research and development (billions of CDN\$)	700
• Québec/Canada (%)	70

*Source: Ministry of Economic Development, Innovation and Exports.*

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## Sector Profile

### Prime Contractors

#### Prime Contractors: At the Core of the Industry

Annual sales by prime contractors amount more than CDN\$8.8 billion, equivalent to 71% of sales for the industry overall. Prime contractors also employ 58% of aerospace industry workers in Québec.

These world-leading companies include:

<b>Bell Helicopter Textron</b>	One of the world's leading manufacturers of light and intermediate-class civil helicopters
<b>Bombardier Aéronautique</b>	World leader in regional and business aviation World's third-ranked builder of light civil aircraft, after Airbus and Boeing
<b>CAE</b>	One of the world's leading flight simulator manufacturers, with 80% of the global market
<b>Pratt &amp; Whitney Canada</b>	World leader in low- and medium-power aircraft turbine engines, with a 30% market share

## Sector Profile

### Equipment Manufacturers

#### Major Original Equipment Manufacturers: a Key Role

Major OEMs, specialized suppliers of components and services, represent about 19% of the Québec aerospace industry's sales and about 19% of jobs. Like prime contractors, they operate their own design, engineering and manufacturing departments.

Esterline CMC Électronique	Avionics, electronic components
MDA Space	Satellite subsystems and components
Héroux-Devtek	Landing gear
Lockheed Martin Canada	Electronic systems integration
Messier-Dowty Montréal	Landing gear
GE Canada - Aviation	Compressor airfoils for aircraft engines
Rheinmetall Canada	Defence and communications systems
Rolls-Royce Canada	Gas turbine maintenance and repair
Thales Avionics Canada	Avionics, navigation, communications

## Sector Profile

### Subcontractors and Product Manufacturers

## A Peerless Network of Subcontractors and Special Products Manufacturers

Québec boasts a network of more than 216 small and medium-sized businesses with evolved knowledge and know-how in the following fields: machining, surface treatment, electronics and cabling, information systems, cutting tools, interior finishing, fasteners, die-cast parts, composites and optics.

Several of these companies have developed expertise with advanced scientific content. Some are global leaders in their field. The majority have annual sales representing 10% of total aerospace deliveries in Québec, and account for 23% of jobs.

## Sector Profile

### General Aviation

Canada has the second largest fleet of light aircraft in the world (33,000, including 5,000 in Québec) after the United States (223,000).

Québec offers a choice platform for penetrating the lucrative American market for light aircraft:

- Modern uncrowded airports, facilitating test flights and with large amounts of space available for industrial development projects: Mirabel, Saint-Hubert, Trois-Rivières and Saint-Jean-sur-Richelieu;
- Proximity to qualified aeronautics suppliers;
- Available skilled labour;
- Teaching institutions offering programs specializing in aeronautics;
- Preferred access to the American market.



## Sector Profile

### Available Labour

### Skilled, Available Labour

Working closely with industry, Québec has established a high-quality educational system providing teaching at all levels. Six universities, five technical colleges and one specialized trades school offer programs directly related to the aerospace industry. They produce more than 4,600 new graduates per year in aerospace-related fields.

The renowned **Montréal aerospace trade school (EMAM)**, the only institution of its kind in Canada, trains specialized workers in the manufacturing and assembly of aeronautical components.

The **National aerotechnical school (ENA)** is the largest aerospace technical education facility in Canada, training technicians in aircraft maintenance, aircraft construction, and avionics.

The **Institut de formation aérospatiale (IFA)**, the only one of its kind in North America, located at Mirabel international airport, brings together the expertise of three major teaching institutions at the vocational, technical and university levels to offer training tailored to the needs of businesses.

As well, new programs are regularly introduced to keep pace with industry needs; an example is the **master's in aerospace engineering**, a joint program of six universities.

The **École Polytechnique de Montréal** began offering a **bachelor's program in aerospace engineering** in September 2009.

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## Sector Profile

### Airport Infrastructures

#### An Extremely Favourable Environment

Québec has an efficient network of air, road, rail and marine infrastructures, serving North American and international markets.

#### Air Transport

Three international airports (Dorval, Mirabel and Québec City), 82 regional and local airports serve Québec. More than 45 air carriers serve some 140 local and external destinations each week.

#### Mirabel: An Exceptional All-Cargo Transport Centre

Accessible 24 hours a day, Mirabel offers very flexible schedules for carriers and efficient modern installations at competitive costs.

#### Dorval

Montréal – Pierre-Elliott-Trudeau International Airport in Dorval offers airlines and passengers integrated connections on all types of regular flights.

#### Saint-Hubert

The Saint-Hubert airport zone offers excellent development potential for general aviation: more than 80 million sq. ft. of land and direct access to major road and public transit infrastructures 10 km from downtown Montréal.

#### Trois-Rivières

The Trois-Rivières region, with its airport, is Québec's second-largest aeronautics centre, after the Montréal region. Along with Montréal, it was the cradle of Québec's aeronautics industry and there are currently almost 300 jobs in the aeronautics field in the region.

## Saint-Jean-sur-Richelieu

The airport, located on Montréal's South Shore at 20 km from downtown, is one of the few airports with three runways.

### Flight Time Between Montréal and Selected Cities

Toronto	1:09
New York	1:12
Philadelphia	1:47
Chicago	2:19
Los Angeles	5:45
Dallas	4:13
Miami	3:25
Paris	6:47
London	6:35

## INDUSTRY-LEADING COMPANIES

### Industry-leading Companies

Montréal is a top international centre for aerospace and is the cradle of the industry in Québec as well as all of Canada. The Montréal area is home to several prestigious multinationals, which have attracted a host of secondary service and supply companies.

### Major Aerospace Companies Established in Québec

Company	Parent company	Employees in Québec (2009)
Bombardier Aerospace	Bombardier Inc. (Canada)	13,565
Pratt & Whitney Canada	United Technologies Corporation (U.S.A.)	5,100
CAE	CAE Inc. (Canada)	3,000
AVEOS	Air Canada (Canada)	2,083
Bell Helicopter Textron	Bell Helicopter Textron Inc. (U.S.A.)	1,675
Rolls-Royce Canada	Rolls-Royce Group plc (U.K.)	970
L3 Communications (L-3 MAS)	L-3 Communications Corporation (U.S.A.)	926
Héroux-Devtek	Héroux-Devtek (Canada)	864
Esterline CMC Electronics	Esterline (U.S.A.)	800
GE Canada Aviation	General Electric (U.S.A.)	555
MDA Space	MDA (Canada)	385
Messier-Dowty	Messier-Dowty International (France)	240
Sonaca NMF	Sonaca (Belgique)	235
Mecachrome	Groupe Mecachrome (Canada)	190
Lockheed Martin	Lockheed Martin	149
Thales (Aerospace Division)	Thales (France)	145

*Source: Ministry of Economic Development, Innovation and Exports, 2010*

**AVEOS** - The Technical Maintenance Centre operates an aircraft overhaul base in Montréal that provides maintenance services for C and D type cells, components, engines and auxiliary power units (APU). It also offers specialized services covering training, technical file management, technical publications, engineering, flight data analysis, supply chain, etc.

**Bell Helicopter Textron** designs, builds, assembles and supports civilian helicopters. The Mirabel facility is also engaged in systems analysis, the design and manufacture of composite material structures and parts, design using the finite element method, oscillation analysis, rotor dynamic analysis and flight tests.

**Bombardier Aerospace** is the world's third-largest maker of civilian aircraft, after Boeing and Airbus. It designs and builds business aircraft, regional aircraft and amphibious aircraft. The company has produced 16 new aircraft models over the last 16 years. In Québec, Bombardier Aerospace has plants in Ville Saint-Laurent, Dorval and Mirabel where it manufactures and assembles components and designs and assembles aircraft such as the Challenger 604, the Bombardier CRJ200 and the Global Express. The company selected Mirabel as the site for development of the future CSeries, an expected investment of CDN\$2.6 billion.

**CAE** is a pioneer and world leader in simulation and modelling technologies. It develops and makes complete flight simulators reproducing all major models of civilian aircraft and many military models. It also offers integrated aeronautics training services for civil aviation and defence forces.

**Esterline CMC Electronics** designs and makes electronic products for aviation and global positioning systems (GPS). Its products and services include aeronautic communications systems, enhanced vision systems, flight deck systems integration services and various specialized electronic products. The company also offers electronic equipment calibration, maintenance and repair services.

The **General Electric** plant in Bromont, Québec, is part of the GE Aircraft Engine (GEAE) division, a global builder of jet engines for civilian and military aircraft. The Bromont plant makes fan blades and compressors for many GE engines and for the CFM56 engine.

**Héroux-Devtek Inc.** specializes in the design, development, manufacture and complete maintenance and repair service for aerospace and industrial products. These products include landing gear, turbine components for aircraft engines and electricity production systems, structural components for the aeronautics and space sectors. The company also has a logistics and defence division with plants located in Ontario. Héroux-Devtek made its mark in particular by making the landing gear of the Apollo lunar excursion module (LEM).

**L3 Communications (L-3 MAS)** is one of the largest Canadian suppliers of services to support and extend the life of aeronautic products and aircraft maintenance services. It serves government ministries and organizations as well as commercial customers and its services affect both military and commercial aviation. Its facilities located at Mirabel airport, near Montréal, include a parts machining, overhaul and repair centre, a number of hangars as well as a stripping and paint workshop.

**Lockheed Martin** is a highly diversified global enterprise principally engaged in the research, design, development, manufacture and integration of advanced-technology products, as well as providing lifetime support. As Canada's premier supplier of electronic defence and surveillance systems, the company develops and manufactures innovative system solutions for naval, airborne, land and civil operations both in Canada and around the world.

**MDA Space** is the world leader in space robotics and a leading supplier of satellite information missions. The company built the famous Canadarm and Canadarm2 for the International Space Station and is responsible of the operations of RADARSAT-2. It provides operating satellite systems and robotic engineering solutions for space- and ground-based applications.

**Mecachrome** specializes in manufacturing metallic parts for aeronautics, the automobile industry, auto racing and industrial equipment. Its products are used in aircraft and helicopters made by Boeing, Lockheed, Sikorsky, Bombardier, Airbus, Embraer, Israel Aircraft Industries, Parker Aerospace, SAAB and many others.

**Messier-Dowty**, a SAFRAN group company, is the world leader in the design, development, manufacture and support of landing gear systems. The company supplies 33 airframe manufacturers and supports 3,000 operators of large commercial aircraft, regional and business aircraft, military aircraft and helicopters. It brings a systems approach to a wide range of development programs, for which it integrates the various subassemblies provided by partners and subcontractors.

**Pratt & Whitney Canada (P&WC)** produces engines for helicopters and business and regional aircraft. The company also manufactures high-tech engines for industrial applications. Its worldwide service centre network comprises over 30 overhaul shops authorized or owned by P&WC, located in strategic locations throughout the world. P&WC is the number-one R&D investor in Canada's aerospace industry.

P&WC's engineers have designed 65 different engines over the last 12 years. In 2006, the company announced it would invest CDN\$1.5 billion in R&D over the next five years to develop new engines.

**Rolls-Royce** is active in the civilian and military aeronautics, marine and energy fields. The Montréal facility is focused on the repair and overhaul of civilian and military aircraft engines. In addition, it carries out R&D for the energy industry, assembly and testing of RB211 turbines and Trent engines, as well as component repair services.

**Sonaca NMF** is a worldwide aviation industry leader in developing, machining, shot peen forming and assembling large aluminum wing panels and other structural components, including wing spars, ribs, frames, stiffeners and tail unit stabilizers.

**Thales Avionics** is one of the world's top suppliers of onboard and ground-based systems for the civil aviation market. The company supplies systems and functions for all kinds of aircraft: commercial airliners, regional and business aircraft, and helicopters. It offers leading-edge expertise in the field of onboard electronic systems.

## Industry-leading Companies Maintenance and Repair Organizations

Québec is home to some 30 aircraft maintenance and repair companies with a workforce of over 7,500 specialized employees, 2,700 of whom are certified.

### Main Inspection, Maintenance and Repair Organizations in Québec

Company	Maintenance and repair employees	Specialization
AVEOS	2,153	Tests on B, C and D type airframes, engine tuning, etc.
Air Transat Maintenance Centre	400	Repair and maintenance of B and C type aircraft, L-1011s, B-757s and A-330s
Héroux-Devtek	125	Complete landing gear maintenance and repair service
L-3 Communications MAS	975	Testing and repair of CF-18 aircraft
Pratt & Whitney Canada	450	Overhauling and repair of its engines
Rolls-Royce Canada	1,000	Overhauling and repair of BR-710, RB-211, Allison AE-3007, Spey and Tay engines
Turbomeca	122	Overhauling and repair centre for helicopter engines (Arriel)

Source: Ministry of Economic Development, Innovation and Exports, 2008



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**Air Transat** operates a major maintenance centre at Montréal-Mirabel international airport for its Airbus A310 and A330 fleet. Some 200 mechanics are employed at the centre.

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**Turbomeca** is a global company specializing in the design and sale of small- and medium-power gas turbines for helicopters. Its subsidiary Turbomeca Canada, located in Mirabel, concentrates on the maintenance and repair of Arriel engines. In March 2007, the subsidiary was awarded the tooling support mandate for the entire group.

## Industry-leading Companies International Organizations

Several Canadian and international organizations are headquartered in Québec, a reflection of the province's especially dynamic and stimulating aerospace industry.

- International Air Transport Association (IATA)
- International Civil Aviation Organization (ICAO)
- Canadian Space Agency (CSA)
- International Business Aviation Council (IBAC)
- International Council for Aerospace Training (CIFA)
- Institute of Air & Space Law, McGill University (IASL)
- IATA Aviation Training and Development Institute (ATDI)
- International Cospas-Sarsat Headquarters (satellite search and rescue)

## Industry-leading Companies Québec Aerospace Association

Industry players can also rely on the services of the Quebec Aerospace Association (AQA), whose members are sector SMEs with fewer than 250 employees. The AQA works to enhance relationships between its members and original equipment manufacturers (OEMs) in the industry, promote commercial representation of its members nationally and internationally, stimulate innovation and competitiveness, and facilitate networking and partnerships.

The AQA gives its members access to business opportunities both at home and abroad, thanks to its up-to-date information on the Québec market and its involvement in international trade missions and expositions.

The AQA ensures that its members are represented with the governments of Québec and Canada and within industry associations.

Among other measures, the AQA has an Innovation & Technology and Supply Chain Committee made up of seasoned members from the industry.

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## Industry-leading Companies

### Aéro Montréal-Aerospace Cluster of Metropolitan Montréal

Aéro Montréal, the think tank of the Greater Montréal aerospace cluster, is a private-public partnership (PPP) that brings together all decision-makers in the region's aerospace sector, including companies, educational institutions, research centres, associations and unions.

Aéro Montréal's mission is to rally all the players in the Montréal and Québec aerospace sector around common goals and concerted actions to increase cohesion and optimize the competitiveness, growth and influence of the Greater Montréal aerospace cluster.

Its mandate is to:

- Mobilize all the players in the aeronautic and space sectors;
- Coordinate the development, approval and follow-up of the implementation of the cluster's strategic plan;
- Foster coherence and cohesion of the sector's representation among governments, the public and media;
- Promote the cluster's profile and visibility in the local, national and international arenas;
- Initiate structural or value-added projects;
- Foster synergies and optimize the impact of actions and contributions by existing organizations, institutions and associations in alignment with the objectives, priorities and projects of the cluster;
- Support the interests of cluster partners.

## LABOUR

The aerospace industry employs some 40,000 people in Québec, who have diverse, complementary training.

- Québec's skilled labourers are masters of such leading-edge technology fields as CAD-CAM, information systems, robotics and composite materials. This pool of expertise is periodically upgraded by our specialized teaching institutions.
- Montréal is the Canadian city with the largest population of engineers (more than 57,000 in 2009, including 10,000 in the aerospace sector). Some 60% of Canadian engineering firms are headquartered in the area.
- In the Montréal area, one person in 95 works in aerospace.
- Montréal ranks first in North America in terms of the number of students per capita.

### Leading-edge Training for a State-of-the-art Sector

When it comes to training of engineers, technicians and specialized workers, over the years Québec has developed, in concert with key industry players, specialized undergraduate, graduate and postgraduate training programs, all adapted to industry needs. A committee of aerospace workers in Québec (CAMAQ\*), for instance, ensures liaison between industry companies and the educational system in Québec.

Six universities, five technical colleges and one specialized trade schools offer programs directly related to the aerospace industry and each year produce some 4,800 graduates (3,100 engineers and scientists, 800 technicians as well as more than 900 operators and assemblers) who join Québec's qualified, available aerospace labour pool.

*\*Comité sectoriel de la main-d'oeuvre en aérospatiale du Québec*

## Québec Aerospace Industry Labour Pool

Profession	Workers (2009)	Graduates/2007 (aerospace-related industries)
Engineers/scientists	9,645	3,114*
Technicians	8,845	800
Operators/assemblers	16,885**	903
Administrators	4,825	-
<b>Total</b>	<b>40,200</b>	<b>4,817</b>

\*Aeronautical (44), mechanical (1,091) and software/electronics (1,450) engineers.

\*\*Over 2,700 certified aircraft repair and maintenance mechanics.

Source: CAMAQ, MDEIE and MEQ, 2009.

## Labour stability means savings for businesses

Québec is recognized around the world for the stability of its manpower. For companies in the aerospace industry, the low turnover rate of Québec workers (3%) is an appreciable advantage compared to the United States where the turnover rate is very high up.

## Labour Training

### University—Graduate (Master's)

Program	Institution
Aerospace Engineering	Concordia, Laval, McGill, Sherbrooke and Montréal universities and École de technologie supérieure (ETS), in partnership with major companies
IA MBA	Concordia University (IATA MBA)
Aero and space	McGill University

### University—Undergraduate (Bachelor's, Certificate)

Program	Institution
Certificate in Aeronautics	École Polytechnique de Montréal
Certificate in Quality Management and Assurance	École de technologie supérieure (ETS)
Automated Production Engineering; Aeronautics Production option	École de technologie supérieure (ETS)
Electrical Engineering, concentration in Avionics	École Polytechnique de Montréal
Mechanical Engineering, concentration in Aeronautics	Université de Sherbrooke
Mechanical Engineering, Space Technologies	École Polytechnique de Montréal
Aerospace Engineering	École Polytechnique de Montréal

### Technical Training

Program	Institution
Avionics	École nationale d'aérotechnique (ENA)
Aeronautics Construction	École nationale d'aérotechnique (ENA)
Aircraft Maintenance	École nationale d'aérotechnique (ENA)
Mechanical Engineering with CATIA application	Cégep du Vieux-Montréal
Metallurgy	Cégep de Trois-Rivières
Piloting	Centre québécois de formation en aéronautique at Cégep de Chicoutimi
Composite Materials Transformation	Cégep de Saint-Jérôme

## Specialized Worker Training

Program	Institution
Numerically controlled machine tools	École des métiers de l'aérospatiale de Montréal (EMAM)
Aerospace mechanics and sheet metal work	Centre de formation professionnelle Pierre-Dupuy
Assembly of cabling and circuits, printed circuits, structures, mechanics and photonics, toolmaking, aircraft upholstery; machining using numerically controlled machine tools	École des métiers de l'aérospatiale de Montréal (EMAM)
Precision sheet metal work	Centre de formation Gérard-Filion

## Continuing Education

Program	Institution
ISO training	Accademia Qualitas Professional development at École de technologie supérieure (ETS) Continuing education at École Polytechnique de Montréal
CAD/CAM training	Accademia Qualitas Professional development at École de technologie supérieure (ETS) Continuing education at École Polytechnique de Montréal
Continuous-improvement training for the aerospace industry	CAMAQ
Professional development in collaboration with École de technologie supérieure (ETS), the National Aerotechnical School (ENA) and the Montréal Aerospace Trade School (EMAM)	Institut de formation aérospatiale (IFA)

Source: CAMAQ, 2010



## Labour Specialized Schools

### **The National Aerotechnical School (ENA)**

The National Aerotechnical School (ENA) is Canada's largest aerospace technical training institution and the only one in the country to train technicians in aircraft maintenance and construction as well as avionics. The facility boasts the latest-generation equipment, and has some 1,550 students enrolled in its regular program along with another 800 in adult education.

### **The Montréal Aerospace Trade School (EMAM)**

The Montréal aerospace trade school (EMAM) is the first of its kind in Canada to employ the innovative school-factory concept. Programs available vary from airframe assembly to machining techniques and precision sheet metal work. EMAM also runs on-demand training courses adapted to industry needs, which are given either at the school or on company premises. The school welcomes some 700 students each year.

### **The Institut de formation aérospatiale (IFA)**

The Institut de formation aérospatiale (IFA), the only one of its kind in North America, located at Mirabel international airport, brings together the expertise of three major teaching institutions at the vocational, technical and university levels to offer training tailored to the needs of businesses.

The IFA's partner institutions are:

- École des métiers de l'aérospatiale de Montréal (EMAM);
- National Institute of Aeronautics (École nationale d'aérotechnique, or ENA);
- École de technologie supérieure (ETS).

## RESEARCH & DEVELOPMENT

Aerospace is Canada's fourth-largest industry when measured in terms of R&D investment, with Québec getting the lion's share. Each year more than CDN\$700 million is invested in the Québec aerospace industry, which accounts for 70% of overall R&D spending in Canada. Besides corporate-run R&D centres, there are several public and para-public research centres in Québec.

### Key Public Aerospace Research Centres in Québec:

Canadian Institute for Photonic Innovations (CIPI)  
Canadian Space Agency  
Centre de Recherches avancées en micro-ondes et électronique spatiale (PolyGRAMES)  
Centre d'optique, photonique et laser (COPL)  
Centre technologique en aérospatiale (CTA)  
Chaire J.-Armand-Bombardier  
Concordia Institute for Aerospace Design and Innovation (CIADI)  
Consortium de recherche et d'innovation en aérospatiale au Québec (CRIAQ)  
Defence Research and Development Canada, Valcartier (DRDC Valcartier)  
Groupe de recherche en mathématiques de l'ingénierie assistée par ordinateur (GRMIAO)  
Industrial Materials Institute (IMI)  
International Centre for Aviation Management Education and Research (ICAMER)  
McGill Aerospace Materials and Alloy Development Centre  
National Optics Institute (NOI)  
NRC Aerospace Manufacturing Technology Centre (AMTC)  
NSERC-J. Armand Bombardier-Pratt & Whitney Canada Industrial Research Chair in Integrated Design toward Efficient Aircraft (IDEA)

### Canadian Institute for Photonic Innovations (CIPI)

The CIPI conducts advanced photonics research with applications to the computing and telecom industries as well as to biophotonics and ultra-fast photonics technology. More than 70 researchers are part of programs conducted in the Institute's national network for photonics research, present in 24 universities.

## Canadian Space Agency

The mission of the federal-government-run Canadian Space Agency (CSA), whose headquarters and main facilities are located in the Greater Montréal area, is "to promote the peaceful use and development of space, to advance the knowledge of space through science, and to ensure that space science and technology provide social and economic benefits for all Canadians." The CSA employs over 800 regular employees and service contractors.

## Centre de Recherches avancées en micro-ondes et électronique spatiale (PolyGRAMES)

This research centre at Montréal's École Polytechnique specializes in, among other things, microwave applications for space and mobile communications.

## Centre d'optique, photonique et laser (COPL)

COPL is a university centre for optics, photonics and laser research and training consisting of some forty professors, researchers and research assistants. The research thrust is five-fold:

- Optical imaging, metrology and instrumentation;
- Guided-wave and fibre optics;
- Ultrabrief-burst laser experimentation;
- Optical communications;
- Photonics materials.

## Centre technologique en aérospatiale (CTA)

Created in 1993, the Centre technologique en aérospatiale (CTA) focuses on the application of technology to the aerospace field (technology transfer centre). With a 15-member board of directors that includes representatives of prime contractors and SMBs from the aerospace sector, this non-profit agency plays an active role in aeronautical and aerospace R&D, as well as supporting SMBs in these industries.

## Chaire J.-Armand-Bombardier

A joint initiative of Université de Montréal and École Polytechnique de Montréal, this centre is devoted to nanoscience and nanotechnology research, a leading-edge area of materials technology that is of crucial interest to the aerospace industry.

## Concordia Institute for Aerospace Design and Innovation (CIADI)

CIADI was created by Concordia University in collaboration with seven leading aerospace industry players, including Pratt & Whitney Canada. The Institute has so far partnered with an impressive roster of internationally renowned centres, including:

- the newly formed Advanced Design and Manufacturing Institute (ADMI), a Canadian university consortium;
- the MIT Gas Turbine Laboratory;
- the Von-Korman Institute in Brussels; and
- Vermont-based Concepts ETI.

## Consortium de recherche et d'innovation en aérospatiale au Québec (CRIAQ)

CRIAQ, a unique model for collaborative and precompetitive research, brings together representatives of the major prime contractors in the Québec aerospace industry (26 firms in all) as well as the eight engineering schools and faculties of the province's university network. This consortium's role consists in promoting and carrying out joint research projects at the pre-tender phase.

## Defence Research and Development Canada, Valcartier (DRDC Valcartier)

This research centre in Valcartier, run by Canada's federal Department of National Defence, performs technology advancement in optronics systems, information systems and combat systems. DRDC Valcartier houses specialized engineering, testing and evaluation facilities, where work is conducted on civil as well as military applications.

## Groupe de recherche en mathématiques de l'ingénierie assistée par ordinateur (GRMIAO)

Affiliated with Montréal's École Polytechnique, the GRMIAO is a computational engineering research group whose chief focus is digital simulation of fluid flows, with various industrial applications, among them aerodynamics of advanced wing designs. The group has a staff of some 30 professors, graduate students and assistants.

## Industrial Materials Institute (IMI)

The National Research Council of Canada's Industrial Materials Institute is an R&D centre focused on materials formulation, forming and process control. The IMI has around 190 employees, hosts an average of 100 guest workers per year and works with some 225 partners on more than 250 projects annually.

## International Centre for Aviation Management Education and Research (ICAMER)

ICAMER, at Concordia University, develops projects for conducting research into various aspects of aviation management ranging from airport capacity and design to commercialization and privatization of airports and airlines, globalization of air transport markets and strategic alliances, flight schedule planning, tariffs, human-resources management and the use of communications systems.

## McGill Aerospace Materials and Alloy Development Centre

A collaborative initiative between the National Research Council of Canada (NRC) and McGill University, this centre was created to develop a new generation of highly-resistant materials, surface treatments and manufacturing processes designed to meet the extreme requirements of the aerospace industry. The new centre, inaugurated in February 2008 at a cost of \$8 million, comprises four laboratories:

- Cold Spray (NRC-IMI)
- Electron Beam Physical Vapour Deposition (McGill) - surface coating
- Electronic Speckle Pattern Interferometry (McGill)
- Isothermal Forging (NRC-AMCT) - specialized titanium parts

## National Optics Institute (NOI)

The NOI's research activities encompass four fields: photonics materials and processes, photonics and guided-wave optics, laser systems technology as well as optical and digital systems. The Institute employs 235 people, including 81 researchers.

## **NRC Aerospace Manufacturing Technology Centre (AMTC)**

Inaugurated by Université de Montréal in May 2004 and affiliated to the Institute for Aerospace Research, the AMTC will eventually employ 120 highly specialized aerospace technology workers. The centre's mission is to develop aerospace manufacturing technologies and other industrial practices. Four main research groups are active:

- Advanced metal products;
- Information systems and computational methods;
- Advanced composite products; and
- Functional materials.

## **NSERC-J. Armand Bombardier-Pratt & Whitney Canada Industrial Research Chair in Integrated Design toward Efficient Aircraft (IDEA)**

The NSERC-J. Armand Bombardier-Pratt & Whitney Canada Industrial Research Chair in Integrated Design toward Efficient Aircraft (IDEA) was inaugurated in April 2010 at École Polytechnique de Montréal. In the coming decades, as aircraft design R&D increasingly targets reductions in fuel burn, pollutant emissions and noise, innovative and more integrated design methods will be needed to fully realize the synergies between aerodynamics and propulsion systems.

IDEA Chair research projects include:

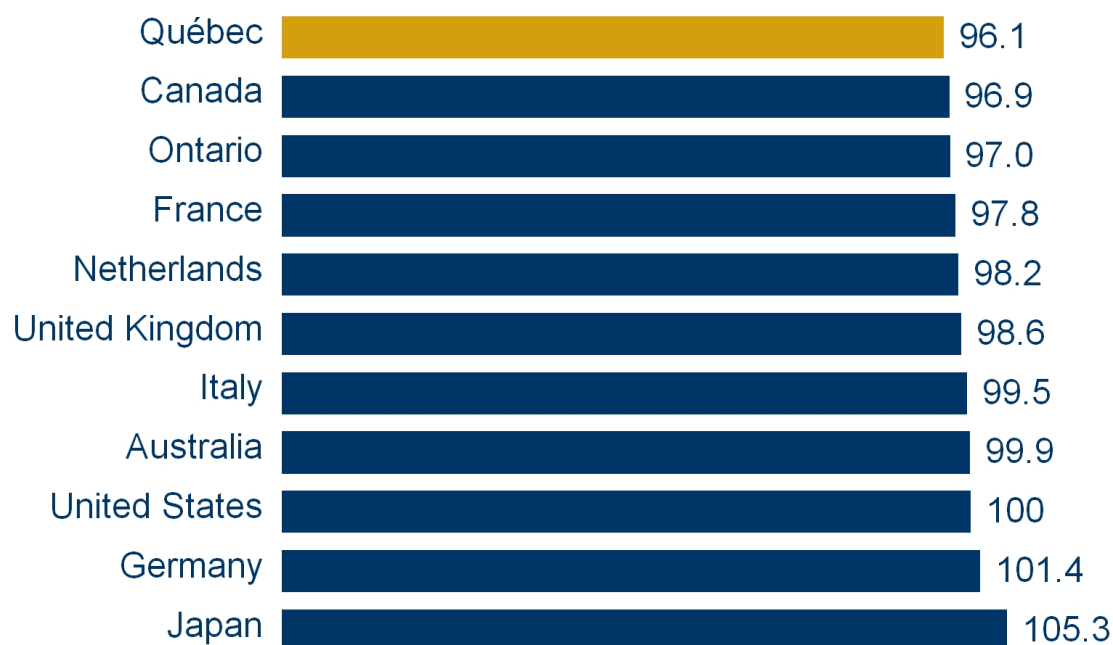
- developing forecasting and aircraft-drag decomposition tools;
- developing a multidisciplinary design methodology for a transonic fan, integrating aerodynamics, vibration and noise;
- integrating high-fidelity analysis into a preliminary design tool for a turbocharger;
- applying B2B multidisciplinary design to the optimization of turbocharger diameters;
- developing a preliminary design methodology for blended-wing-body aircraft;
- predicting aerodynamic stability and control coefficients through CFD simulation.

## OPERATING COSTS

According to the 2010 KPMG comparative study on international business location, the annual operating expenses for a firm in the aerospace industry were, on average, 3.9% lower in Québec than in the U.S.

### Comparative Annual Operating Expenses

Aerospace - Aircraft parts (United States = 100)



Source: KPMG's Guide to International Business Location—2010 Edition.

## Operating Costs

### Labour

### Competitive Labour Costs

According to a KPMG study (2010), labour costs are more competitive in Québec than in other industrialized countries.

Here is an example of cost differential and distribution in total pay for a worker in Québec and in the United States.

**Comparison of Average Salary**  
**In Québec, in the United States and in Other Countries**  
 (US\$ - Aerospace Industry)

	Average salary (KPMG)	Statutory benefits	Optional benefits	Sub-total: Social benefits (Statutory & optional)	Total pay
Montréal, QC	56,694	7,024	14,412	21,436	78,130
Dallas, TX	55,905	5,482	20,635	26,117	82,022
Hartford, CT	59,282	6,047	23,247	29,294	88,576
Seattle, WA	60,212	5,647	24,070	29,717	89,929
Wichita, KS	53,541	5,388	21,400	26,788	80,329
Albuquerque, NM	53,329	5,294	21,306	26,600	79,929
Lyon, FR	48,118	21,753	10,082	31,835	79,953
Paris, FR	52,812	23,835	11,082	34,917	87,729
Frankfurt, GE	71,600	12,082	15,400	27,482	99,082
Naples, IT	56,235	11,941	16,365	28,306	84,541
London, UK	57,576	5,529	19,330	24,859	82,435

Source: KPMG's Guide to International Business Location-2010 Edition.



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## FINANCIAL SOLUTIONS AND TAXATION

### Financial Solutions

Investissement Québec can assist you with your expansion plans, providing consulting services as well as financing assistance. In addition to being an economic development agency, we are also a financial institution. We have several financial solutions for you.

### Financing of refundable tax credits

Businesses can obtain a loan guarantee or a loan so they can enhance their liquidity.

### UNIQ Financing

We can provide you with a **loan**, a **loan guarantee** or **quasi-equity** financing to help you continue to grow in Québec. UNIQ Financing comprises two components, depending on the nature of your project:

Working Capital »

Capital Assets »

Other government programs can assist companies in the aerospace sector:

### Investment Tax Credit

A business that acquires new manufacturing and processing equipment before January 1, 2016 can receive this tax credit, which can vary between 5% and 40% depending on the region.

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## Emploi-Québec Employment Assistance

Financial assistance provided by Emploi-Québec, jointly with administrations in Québec's regions, in order to share of the cost of training and recruitment of the employees needed for project start-ups.

## Feasibility Study of an Investment Project

Financial contribution to companies that want to carry out an investment project in Québec. The program is administered by the Québec government's Ministry for Economic Development, Innovation and Exports and can cover up to 40% of the fees of experts to carry out feasibility studies to a maximum grant of CDN\$100,000. Eligible activity sectors are manufacturing, recycling, business services, industrial research and development, and scientific services.

## Industrial Research Assistance Program

Shared-cost financial assistance tied to research and development of technical projects at the pre-competitive stage. This National Research Council program is available to Canadian SMBs; i.e., companies with fewer than 500 employees.

## Strategic Aerospace and Defence Initiative (SADI)

This Industry Canada initiative launched in April 2007 encourages industrial research and pre-competitive development for the private sector in the Canadian aerospace, defence, security and space sectors, through repayable contributions (generally 30% of eligible costs).

## Financial Solutions and Taxation

### Measures to Stimulate R&D

Certain Québec tax measures enable companies to realize considerable savings on R&D costs. The real cost of a CDN\$100 R&D expenditure may be as low as CDN\$42.

#### Net Cost of R&D Expenditures Large Corporation or Foreign-controlled Corporation<sup>1</sup>

**Example 1:** A corporation incurs expenditures of \$100,000 on R&D; i.e., \$65,000 for the salary of a researcher, \$15,000 for subcontracting in Québec and \$20,000 for materials.

**Example 2:** A corporation incurs expenditures of \$100,000 on R&D; i.e., \$60,000 for the salary of a researcher, \$30,000 for materials and \$10,000 for equipment.

Expenses	Example 1 (\$)	Example 2 (\$)
A Salaries	65,000	60,000
B Subcontracting services	15,000	—
Materials	20,000	30,000
Equipment	—	10,000
<b>C Total R&amp;D expenditures</b>	<b>100,000</b>	<b>100,000</b>
Québec tax credit (A + B/2) X 17.5%	12,688	10,500
Federal tax credit		
Total expenditures (C)	100,000	100,000
Overhead (A X 65% <sup>2</sup> )	42,250	39,000
Less Québec credit	<u>(12,688)</u>	<u>(10,500)</u>
<b>D Expenditures eligible for credit</b>	<b>129,562</b>	<b>128,500</b>
E (D X 20%)	25,912	25,700
<b>F Total tax credits</b>	<b><u>38,600</u></b>	<b><u>36,200</u></b>
<b>Net cost for the corporation before income taxes (C-F)</b>	<b><u>61,400</u></b>	<b><u>63,800</u></b>
Tax savings (when profits are earned)		
Federal ((C - F) X 16.5%)	10,131	10,527
Québec ((C - E) X 11.9%)	<u>8,816</u>	<u>8,841</u>
<b>G Total tax savings</b>	<b>18,947</b>	<b>19,368</b>
<b>Net cost for the corporation (C-F-G)</b>	<b><u>42,453</u></b>	<b><u>44,432</u></b>

1 Profitable corporation.

2 Proxy method used to calculate overhead. Under this method, overhead actually incurred is replaced by 65% of R&D salaries.

Source: Investissement Québec and Raymond Chabot Grant Thornton, April 2010. (Update: January 2011)

## Financial Solutions and Taxation

### Corporate Tax Rates

### A Competitive Tax System

Québec's corporate tax rates are among the lowest in North America. As such, Québec's offers an advantageous tax system that favours investment.

#### Comparison of Income Tax Rates, 2011 Québec, Other provinces and American States Manufacturing Companies

	Effective Tax Rate (%)			
	Federal <sup>1</sup>	Province/State	City/ <sup>2</sup> Certain states	Total
Québec	16.50	11.90	--	28.40
California*	29.03	8.84	--	37.87
Kansas	29.62	6.37 <sup>3</sup>	--	35.00
Texas*	31.50	1.00 <sup>4</sup>	--	32.50
Washington	31.85	--	--	31.85

[1] In Canada, the federal tax rate is 11% for private Canadian-controlled companies with taxable income of less than CAN\$500,000. In certain provinces, reduced rates are also applicable to small businesses. The 2011 general rate of 16,50% (18% before that date) will pass to 15% as of 2012.

In the United States, the general tax rate of 35% varies depending on the corporation's taxable income. For U.S. manufacturing companies, a deduction of 9% of the profit related to production activities or taxable income is available for 2010 and thereafter, which means an actual rate reduction of 3.15%. This deduction was 3% for 2005, 2006 and 6% for 2007, 2008 and 2009.

\* Certain States, such as Arkansas, California, Connecticut, District of Columbia, Georgia, Hawaii, Indiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, Texas, West Virginia and Wisconsin do not apply the federal deduction for manufacturing production. For the taxable years beginning on or after January 1, 2010, Kentucky and Virginia apply a 6% rate in regards to the deduction for manufacturing production.

City and state taxes are generally deductible from U.S. federal tax. The actual U.S. federal tax rate takes this deduction into account.

*[2] Most of the rates provided for cities are from 2010, since some rates for 2011 were not available when this document was published.*

*[3] The rate on corporate taxable income is 4%; a surtax of 3% on all income exceeding \$50,000 is added thereto. The surtax was 3,05% for 2009-2010, 3.1% for 2008 and 3.35% for tax year prior to 2008.*

*[4] The State imposes a Franchise Margin Tax at a rate of 1%. The "Margin" equals the lesser of the three following calculations: (1) Total revenues minus cost of good sold; (2) Total revenues minus compensation; and (3) 70% of total revenues. For tax years 2010 and 2011, if the revenue is less than \$1,000,000, the entity is exempt to the tax liability. The threshold will be reduced to \$600,000 after January 1, 2012.*

*Source: Investissement Québec and Raymond Chabot Grant Thornton, April 2011.*

## Financial Solutions and Taxation

### Tax Holiday and Refundable Tax Credit

#### Validation Certificate for Precompetitive Research Consortiums

This tax measure aimed at companies conducting pre-tender research seeks to promote consortiums among companies so that they may enhance their science and technology expertise, reduce costs and share risks related to complex pre-tender phase R&D projects. Member companies of recognized research consortium can obtain a refundable tax credit of up to 35% of the dues or fees reasonably attributable to scientific research and experimental development carried out by the consortium in Québec.

#### A Tax Holiday for Foreign Researchers and Experts

Foreign researchers employed by a company in Canada that does R&D in Québec benefit from a provincial tax holiday on their salary for five consecutive years. It is a declining tax holiday computed as follows: 100% of employment income the first two years, 75% the third year, 50% the fourth year and 25% the fifth year. This measure also applies to other foreign experts; e.g., managers working in innovative fields.

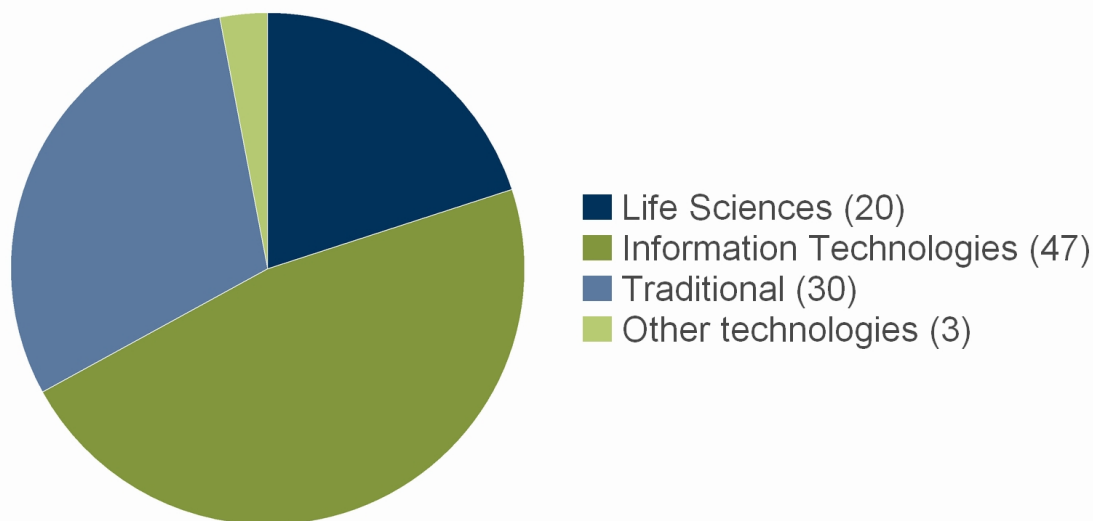
## VENTURE CAPITAL

### Québec is Canada's leading venture capital manager.

Quebec has the largest proportion of venture capital backed firms, with 42% of the Canada-wide total.

In 2009, venture capitalists injected CDN\$432 million into 159 Quebec businesses.

### Breakdown of Venture Capital Investments in Quebec, by Sector, 2009 (%) (\$432 million)



Source: Thomson Financial, 2010.



## CHOOSE INVESTISSEMENT QUÉBEC

Are you looking for the right place to grow your aerospace company?

Call Investissement Québec.

We combine the advantages of a financial institution and an economic development agency, so we have what it takes to meet your needs.

**Our team of experts can help you :**

- Gain insight into the challenges and opportunities offered by Québec's aerospace industry;
- Build productive, strategic alliances with local and international partners;
- Find a location that suits your needs;
- Benefit from attractive tax incentives;
- Find the right financing solutions including loans, loan guarantees and working capital.