

Aeronautics/Aerospace Québec/Montreal

Canada is in the analysis, view and perception of the Netherlands diplomatic missions in Toronto, Vancouver and Ottawa wrongly not listed as a (potential) target country for the "Knowledge and Innovation Agenda" for the top sector High Tech Systems and Materials. Together with the Innovation network in Washington and Boston focus for 2016 and beyond is to raise awareness for the innovation, research and development potential of Canada in the framework of the actual and roadmaps in force for top sector HTSM. In 2014 the Innovation network in Washington produced a back ground document regarding developments in aerospace.

On April 7, 2016 the global Dutch Innovation network will gather in the Netherlands at the annual "HTSM" event with a focus on roadmaps: Aeronautics, Automotive, Health and Semiconductor Equipment. Innovation network in Washington and Boston will put emphasis on "Aerospace" development in Montreal/ Quebec.

(Business and sustainability) **Challenges** for aerospace both in Canada and the Netherlands: the European aviation – (including Netherlands manufacturing for value chain aerospace industry) keeps on growing: 5.2% increase in number of passengers in 2015 to an impressive total of 1.95 billion; on our home market Amsterdam Schiphol *kept its top five position*. Through innovation and research aircrafts becoming more fuel efficient, saving money as well as the environment. How does the aviation industry improve on CO2 emission and noise pollution? Capacity constraints: 1.9 million flights cannot be accommodated by 2035 in Europe. Innovation/ new technologies/ research and development are the buzz word for aerospace development. It is safe to assume that Canada will remain an import player and front runner for aerospace both civil and defense industry.

Facts/National impact

Canada's national aerospace industry is vibrant, innovative and complex, with a rich history and elite reputation on a global stage. At present Canada is the world's fifth-largest aerospace industry. Sector generates more than \$25 billion, exports 80% of its output. Investments of over \$2 billion make the aerospace industry the second largest R&D investor in Canada. Aerospace is responsible for the employment of 180,000 Canadians. The leading branch federation AIAC represents the interests of over 700 aerospace companies across Canada. The Canadian aerospace manufacturing industry encompasses *civil* and *defense* activities as well as space systems manufacturing, including satellite operations.

- Central Canada accounts for the majority of the manufacturing industry
- Western Canada plays a dominant role in terms of the MRO
- Atlantic Canada was the fastest growing region in MRO over the past five years.

Quebec/ Montreal

Québec is one of the global leaders in the aerospace industry, attracting major international companies such as Bell Helicopter Textron, Bombardier Aerospace, CAE, Pratt & Whitney Canada and nearly 70% of all Canadian aerospace R&D is carried out in the Greater Montréal area, representing an investment of approximately \$700 million a year. Québec has about 20 public and private research centers that work closely with private companies and play a key role in driving innovation for products and services.

Québec aerospace industry is an excellent example and role model for *public/private/science-knowledge partnerships*.

Science/knowledge: Aerospace at McGill University- takes a multi-disciplinary approach, with members drawn from disciplines in electrical and computer, civil, materials, and mechanical engineering, as well as law. Important current research programs worth over \$20 million in funding, supported by federal, provincial, international, and industrial programs. Key areas important for the Netherlands Roadmap Aeronautics include among others: -Aerodynamics and Fluid Mechanics, Aero-icing, Aerospace Coatings and Tribology, Aerospace Materials and Alloy Development, Composite, Light metals Research, Nanomaterials and last but not least Space Robotics and Space Systems.

McGill Launched in 2014/2015 New Aerospace Engineering CREATE Program. Competitive Manufacturing for the Aerospace Industry: Technology and Design. This training program will prepare graduate-level engineering students to step directly into industry from university research projects, thereby helping to maintain and expand Canada's strong presence in the global aerospace industry.

Concordia/Montreal

The objective of the Concordia Institute of Aerospace Design and Innovation (CIADI) is to promote awareness and provide leading edge know-how among engineering students in aerospace design and innovation. CIADI's approach is multi-disciplinary in nature and its efforts are focused on ever-evolving aerospace technologies. CIADI, part of the Faculty of Engineering and Computer Science, provides excellent training opportunities for students seeking a career in the aerospace industry. CIADI collaborates with similar institutes at École de Technologie Supérieure, École Polytechnique, McGill University and Ryerson University. As of 2015, CIADI started international partnerships and student exchange programs with among others NASA, Poland, Italy, Belgium, Germany, France, and Brazil. Aim is to establish contacts with Universities and knowledge institutes in the Netherlands.

Public

National Research Council Aerospace in Canada conducts research and technology development (R&TD) across the full spectrum of issues related to the design, manufacture, qualification, performance, use and maintenance of air and space vehicles. This work entails all of the major concerns in aerospace—cost, weight,

safety, and most recently, environmental footprint. NRC Aerospace focuses on advancing aerospace research and technology developments in the core areas of aerodynamics, flight research, gas turbines, structures and materials, and manufacturing. NRC Aerospace plays a critical role in facilitating the introduction of new technologies into both civilian and military markets. Current interesting programs are research on icing, use of unmanned aerial system technology and flight safety.

Quebec/ Montreal

Montréal is Québec's largest city and one of the world's *top three aeronautics hubs*, alongside Seattle and Toulouse. Québec accounts for 60% of Canada's aerospace production and nearly 55% of the Canadian aerospace industry's production is based in Québec, representing sales of \$16.1 billion in 2015. Composite materials have become an absolute must in the industry, and in the Greater Montreal metropolitan area manufacturers are investing more in research and development with an ambition to become a major player.

Establishing contacts between Composites network partners in Quebec/ Montreal and DPI and M2i in the Netherlands to collaborate on composites research program has innovative and economic potential.

In Quebec and Montreal composites institutes, work together with their industrial and academic partners, in setting up joint research programs. The research focus is on the technological and scientific aspects of composites as well as on the application of these materials in practice. Aerospace and aviation industries operate on the cutting-edge of advanced composites. The market demands high-performance products that are lightweight and high-strength. Composites institutes offer all of the necessary technical resources and products for the manufacture of a variety of composites aerospace and aircraft components, including general aviation, commercial aircraft, or military aircraft and spacecraft applications. International recognised innovation and new technologies in PEI. Polyetherimide (PEI) is an aerospace grade thermoplastic. When expanded to produce various densities of foam, it exhibits good mechanical properties and passes the most stringent aerospace fire standards. Priorities and key areas for research and development are: automated manufacturing of thermoset and thermoplastic composite structures: automated dry fiber placement, automated manufacturing of composite structures with complex shape and Mechanical performance of fiber placed composite structures.

Forecast for the Canadian Aerospace Industry:

<http://aiac.ca/industry-statistics/>

Economic Impact

The Canadian aerospace industry will remain strategically important contributor to the Canadian economy in terms of employment, innovation, productivity, R&D, GDP and trade. Among important facts:

- Made up of over 700 companies of all sizes from coast to coast, the industry is responsible for the employment of more than 180,000 Canadians;
- Canada's aerospace manufacturing and MRO sectors are both expanding rapidly, growing 29% and 37% respectively over the last 10 years (2004-2014)
- Canada ranks third in terms of global civil aircraft production activity
- The Canadian aerospace defense sector represents 25% of the total Canadian defense sector and is responsible for close to 60% of the total R&D investment

Innovation

The Canadian aerospace industry is an innovation leader with stellar R&D performance:

More than 20% of the industry's activity is dedicated to R&D²;

5 times the R&D intensity of Canada's total manufacturing average

Each year the industry invests \$1.8 billion into R&D

- No. 1 in terms of strategic importance over total manufacturing
- No. 3 in terms of R&D intensity²
- No. 5 in terms of GDP and revenues
- 62% of total product exports to the US, **23% to Europe**, 8% to Asia and 7% to Africa, the Middle East, and Central and South America.

Business opportunities for the Netherlands

With international companies such as Boeing, Bombardier, Lockheed Martin, GE Aviation, Mitsubishi Aircraft and CAE, the Netherlands' aerospace industry is innovative, competitive and thriving. In terms of strategic acquisition Holland's world-class logistics infrastructure, strategic location, competitive tax structure and highly trained, English-speaking workforce provide an ideal environment for aerospace operations—whether its maintenance, repair and overhaul (MRO), spare parts logistics, manufacturing, training facilities or office functions. Europe's fourth largest airport by passengers flown and third largest by cargo volume, Schiphol Airport in Amsterdam is the second best-connected airport on earth. That makes it a perfect logistics hub, hosting numerous specialized third-party logistics providers with dedicated aerospace verticals, including Aviall, DB Schenker, IJS Global and Wencor. Major aerospace companies, including VTOC Fokker, CAE and FlightSafety International, have set up their training facilities in the Netherlands, fueling Holland's dedicated, flexible and multilingual workforce.

One of the gaps and challenges in the Canadian Aerospace market and industry is to bridge the gap between innovation and commercialization and facilitating the introduction of new technologies into both civilian and military markets.

Netherlands Aerospace group, National Aerospace Laboratory, Schiphol Development and Maastricht Maintenance Boulevard are possible interesting network partners for innovation and commercialization and contacts with the Knowledge and Innovation agenda for HTSM/ Roadmap Aeronautics and partners will open a broad panorama of opportunities.