GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS

ONTARIO AEROSPACE

2017

Regional Hubs - OEMs - Supply Chain Providers
Education - Advanced Manufacturing - R&D - Prospects

ONTARIO CANADA

Where Innovation Soars

When you take off and land during a flight, we are likely right there with you. That's because Ontario, Canada provides landing gear for 75% of Boeing and Airbus commercial aircraft programs. And as you reach for your phone and check your GPS to find your hotel, there's a good chance we're there too; made-in-Ontario parts are on-board 80% of all commercial communications satellites.

Discover where advanced R&D facilities, world-class academic institutions and the top aerospace manufacturers collaborate to transform game-changing ideas into expertly crafted products for the global market.

Ontario is home to over half of the world's top 25 aerospace companies.

EXPAND YOUR BUSINESS IN ONTARIO
InvestInOntario.com/aerospace

SOURCE PARTS FROM ONTARIO
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Ontario

Paid for by the Government of Ontario

Dear Reader,

Ontario is among the most comprehensive, innovative and globally connected aerospace jurisdictions in North America.

Our unique combination of talent and expertise in aerospace, advanced manufacturing and information technology—underpinned by the most educated workforce in the G7—makes the province a natural innovation partner. We welcome the industry's continued growth and its focus on disruptive technologies to become ever more connected, energy efficient and cost competitive.

Aerospace is a key contributor to Ontario's economy with about 21,000 direct jobs, and we know it will continue to be an engine of economic growth in the years to come. Over half of the world's top 25 aerospace companies have operations in the province and Ontario-based manufacturers are part of the supply chain for virtually every passenger aircraft in the world.

Since 2006, Ontario has provided over $130 million in support to aerospace companies, helping to leverage nearly $1.2 billion in total investment and contributing to the creation of nearly 1,900 jobs. We are proud of our recent investment of $26 million in the new Centennial College facility for aviation programs at Downsview Park—the first step in creating an aerospace training and research hub.

A strong innovation ecosystem requires great collaboration between industry, academia and government and the Ontario Aerospace Council has proven itself an effective and strategic partner in driving our industry forward.

Any company seeking to lead in the next generation of aerospace technologies would be well served to choose Ontario as its innovation and growth partner.

We look forward to working with you.

Sincerely,

Honourable Brad Duguid,
Ontario Minister of Economic Development and Growth

ONTARIO
CANADA

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Hudson Bay

Ontario

- Canada
- United States
- National Capital
- Province Capital

Ottawa

Toronto

0 75 150 Kilometers
0 75 150 Miles

Ontario Aerospace 2017
Industry Explorations
Global Business Reports

This research has been conducted by
Ty Jeevaratnam, Catherine Howe and
Camila Moscoso Román
Edited by Alfonso Tejerina and Mungo Smith
Graphic design by Designa / Özgür & Deniz

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Image courtesy of Air Canada

INTRODUCTION TO **ONTARIO AEROSPACE**

"Ontario's aerospace industry is a world leader in multiple areas including: business jets, turboprop aircraft, turbine engines, landing gear systems, avionics, environmental systems and space robotics. Ontario has good diversification of industry and tiers."

- Moira Harvey,
Director,
Ontario Aerospace Council (OAC)

Ontario's Aerospace Cluster: **The Unsung Hero**

Increasingly exposing Ontario's aerospace capabilities to international markets will empower the industry's continued growth.

Canada is recognized globally as having the fifth largest aerospace industry in the world and, within that, Ontario is its unsung hero. Ontario hosts the second largest aerospace industry in Canada after Quebec, containing more than 300 companies and generating over C$6 billion in annual sales. 21,000 skilled workers support the industry and 14 out of the world's top 25 aerospace companies have set up shop in the province. Ontario has a diverse and established supply chain, largely consisting of an extensive network of small to medium-sized enterprises (SMEs), each contributing their unique capabilities to the larger Ontario industry.

The driving force behind Ontario's aerospace activity is the ecosystem of advanced manufacturing companies supplying industry-leading international original equipment manufacturers (OEMs) such as Airbus, Boeing, and Bombardier. The nimbleness and lean cost structures of SMEs in Ontario allows them to quickly respond to market demands through the implementation of innovative techniques and practices. However, this extensive aerospace activity is happening under the radar. Although Ontario has all the capabilities of an aerospace powerhouse, the industry needs to boast of its competitiveness internationally to retain, attract, and grow business within the region.

International promotion of its aerospace industry is vital because Ontario companies export 80% of their products and services to customers and project partners around the world. Ontario-made aerospace parts are used on virtually every commercial aircraft around the world. In fact, the region is a key hub for commercial landing gear manufacturing, and therefore holds an international leadership in these capabilities. The current global trends of increasing aircraft production will augment demand for Ontario landing gear systems. As a result of this expertise, many international landing gear titans such as Sumitomo Precision

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ONTARIO AT A GLANCE

Sources: Ontario Ministry of Finance / Statistics Canada / GBR

Provincial capital: Toronto

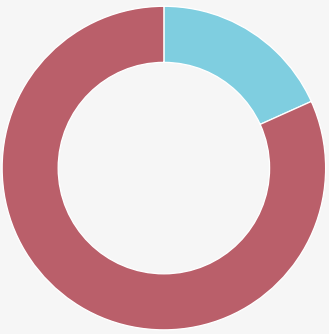
Premier: Kathleen Wynne (Ontario Liberal Party)

Surface: 908,607 km2

Population (rounded): 14 million (2016)

GDP Growth: 2.6% (2015)

Distribution of GDP (2015)



Manufacturing	**22.8%**
Services	**72.2%**

Population Profile

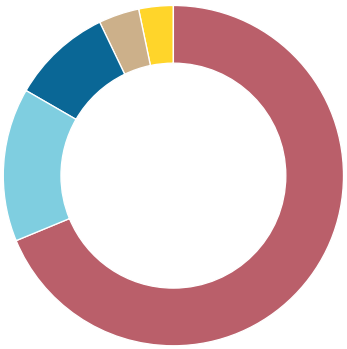
- Non-permanent residents **1.1%**
- Foreign Born **28.5%**
- Canadian Born **70.4%**

Life expectancy (2011)
Female 84.0
Male 79.8

Unemployment Rate (2015)
6.8%

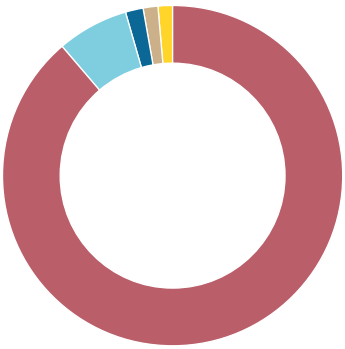
Average hourly wage (people aged 15+)
C$ 26.21

Top Five International Import Suppliers 2015 (%)



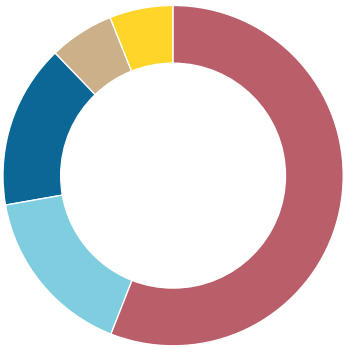
United States	**56.0**
China	**12.1**
Mexico	**7.6**
Japan	**3.2**
Germany	**2.6**

Top Five International Export Markets 2015 (%)



United States	**80.5**
United Kingdom	**6.4**
Mexico	**1.4**
Hong Kong	**1.3**
China	**1.2**

Top Five International Exports 2015 (%)



Motor vehicles & parts	**34.9**
Precious metals & stones	**10.3**
Mechanical equipment	**9.8**
Electrical machinery	**3.8**
Plastic products	**3.7**

Brad Duguid

Minister of Economic Development and Growth
GOVERNMENT OF ONTARIO

“

Ontario has the most generous R&D tax credits in all North America, and this is one of the reasons why we are second to the Silicon Valley in information communication technology.

”

Could you introduce your mandate since you assumed your position in 2014?

My mandate focuses on transitioning Ontario's economy to the new world economy. We are in the process of implementing our Business Growth Initiative, involving investing and driving innovation in Ontario further than where it is today, scaling up our small and medium sized companies (SMEs) globally in competitiveness, and investing in infrastructure. Another integral part of my mandate is education, and creating the most highly educated workforce in the industrialized world. Our goal is making Ontario the easiest place in the world to conduct business and invest.

Within Canada, Ontario leads in growth projections and number of jobs created. Ontario's growth is around 3% this year, which is ahead of all G7 countries. Our role is to support this growth and encourage more development.

How strategically important is Ontario's aerospace sector to the province's economy?

Aerospace is important because it has about a $5 billion (direct and indirect) impact on our GDP and employs around 21,000 workers. We also have the fastest growing aerospace sector in North America. Our advantages in artificial intelligence, sensor development, supercomputing, light weighting materials and other areas of innovation are contributing to our vibrant aerospace economy.

The aerospace sector has a myriad of SMEs, and we support them with the Jobs and Prosperity Fund, providing companies with funding to expand their businesses. In order to promote Ontario's aerospace exports internationally, we attend most aerospace trade shows, including Farnborough. We constantly reach out to global jurisdictions.

We also collaborate with institutions such as the Ontario Aerospace Council (OAC) to build a healthy aerospace cluster in the region. Our role is not only to help attract investment, but also to nurture our talent. We have partnerships with Centennial College, the University of Toronto, and a number of other academic institutions as well as private sector partners such as Bombardier in order to set up an aerospace hub at Downsview Park. This aerospace hub will increase linkages between industry and academia and will provide experiential learning opportunities for students.

How does the Ontario government support R&D initiatives?

Ontario has the most generous R&D tax credits in all North America, and this is one of the reasons why we are second to the Silicon Valley in information communication technology. When companies are striving for innovation from the top to the bottom, they need to engage in R&D to compete in today's global economy. Specific to aerospace, we have invested over $100 million since 2006, which has helped leverage $1.2 billion in investment, so we see ourselves as a partner for aerospace investment in R&D.

How does Ontario's aerospace cluster differentiate itself in terms of capabilities?

Ontario has the distinguished capabilities of producing advanced technological products, permeating from our long history of a strong manufacturing sector. In today's globally competitive economy, we have ensured that our expertise remains in advanced manufacturing, including aerospace. A particular area of specialization for Ontario is landing gears. There are very few airplanes around the world, if any, that do not have components of landing gears coming from Ontario.

Many people are migrating to the Toronto, Ottawa, and Waterloo hubs within Ontario to work in aerospace. Globally competitive aerospace innovation is taking place in the region, and Ontario is a North American leader in disruptive technologies, which is our competitive advantage.

What are some advantages for international businesses operating in Ontario?

Over half of the world's top 25 aerospace companies are located in Ontario, and I am not sure what has taken the other companies so long to locate in this region. Aerospace companies need to be at the cutting edge of technological disruption in order to remain competitive, and Ontario's leadership and commitment to innovation is what the aerospace sector globally is thirsty for. Ontario also has the lowest corporate tax rates in all North America, the most generous tax credits for R&D, and the best talent to drive business.

What is your final message to our international readers?

We are excited about the future of the aerospace sector in Ontario, which continues to grow rapidly, and we see it becoming a world leader in the industry across the world.

Moira Harvey

Executive Director
ONTARIO AEROSPACE COUNCIL (OAC)

Could you provide a brief introduction to the OAC?
The Ontario Aerospace Council is a not-for-profit organization established in 1993 comprising over 200 member companies, and representing approximately 70% of Ontario's aerospace industry employment base. The sector in Ontario boasts annual revenues over C$6 billion, with 80% export. Member programs cover a wide range of industry needs, from technology development and take-up to supply chain relationships and readiness, as well as skills development and workplace training.
Since 2014, OAC has increased efforts to ensure the programs offered through the association add value to its wide range of member companies. OAC members are solicited annually for their feedback on programming through a Member Survey. OAC works in partnership with the Province (Ministry of Economic Development and Growth and Ministry of International Trade) to support market access through various trade shows and missions.

Could you outline Ontario's capabilities in the aerospace sector and your role in developing the industry?
OAC has a diverse membership which includes OEMs, large companies and SMEs in aircraft manufacturing (Tiers 1–4); UAS/UAVs; maintenance, repair and overhaul; ground-based infrastructure; and space. In addition, the organization has educational members, colleges, universities and research institutions who offer more than 40 aerospace specific programs and support for R&T activities.
OAC works with all of these industry stakeholders to gather and share industry intelligence, identify and facilitate funding, and be an active catalyst for industry growth. Really, what we are all about is enhancing the recognition of Ontario's aerospace capabilities as a leader in global markets, and working with business leaders and government stakeholders to build greater expertise and continued growth and prosperity.

What makes Ontario's aerospace industry unique in Canada and internationally?
Ontario's aerospace industry is a world leader in multiple areas including: business jets, turboprop aircraft, turbine engines, landing gear systems, avionics, environmental systems and space robotics. Ontario has good diversification of industry and tiers. We are home to four of the world's major landing gear companies. This is supported by a highly skilled manufacturing sector. Canada's aerospace manufacturing sector outpaces the total manufacturing sector in terms of research and development intensity, and 30% of aerospace manufacturing R&D is done in Ontario. Partnerships between academia and industry enable innovation and growth. In total, Ontario companies have an active role in more than 150 aircraft and engine programs, defense systems, space systems and UAVs around the world.

Could you give an outlook for Ontario's aerospace industry?
The diversification of aerospace companies in Ontario is good and supported by an ecosystem that allows them to grow. New programs are ramping up production and Ontario companies are well positioned on all major aircraft programs. Areas with strong growth potential for Ontario include landing gear and structural airframe.
We see Ontario companies expanding beyond the province to establish an international presence close to their customers. These are exciting times because the industry is ramping up production rates and the supply chain has to respond quickly.

What are your objectives at OAC in terms of supporting the industry?
The support and involvement of the member organizations in OAC and our activities is key to ensuring Ontario aerospace companies grow and thrive. Recognizing our membership is made up of a very diverse group of companies with respect to organizational size and areas of expertise, we will continue to work to expand our programming to provide activities and events benefitting the broad cross-sections of our membership. Member participation and feedback is vital to our success.

Do you have a final message for international companies looking to establish themselves in Ontario?
Our Ontario companies and the Ontario government continue to invest in innovation and the knowledge, skills and abilities of our people to ensure the province is well positioned to meet the challenges of a highly competitive global market. Ontario offers: a diverse and established supply chain, a highly skilled workforce supported by respected academic institutions and industry-specific learning programs, a prime location in the heart of the North American market, competitive business costs, a strong innovation ecosystem with R&D incentives, and defense offset opportunities.

◂ 8

Products and UTC Aerospace Systems have established facilities in the province. These companies can take advantage of Ontario's strategic location in close proximity to the United States, which offers quick and easy access to that market. According to Bruce Simpson, senior partner at McKinsey: "The GDP in Ontario will double over the next 20 years because it is geographically in the perfect spot, with a large border next to the U.S. and at the center of trade flows."

Besides immense growth potential for Ontario, manufacturing costs for aerospace companies in the region are lower than in many of the large clusters in the United States, including Seattle and Wichita. Meanwhile, Toronto is more cost competitive than other international cities such as Tokyo, London, or Paris, according to KPMG's Competitive Alternatives 2016.

The Ontario Ministry of Economic Development and Growth is the primary governmental body helping attract international investment to Ontario businesses. Brad Duguid, Minister of Economic Development and Growth, said: "Our advantages in artificial intelligence, sensor development, supercomputing, light weight materials and other areas of innovation are contributing to our vibrant aerospace economy. Aerospace is crucial in our efforts to build the new economy in Ontario."

The Ministry supports aerospace SMEs, promotes exports internationally, and sponsors R&D efforts. The Ontario Aerospace Council (OAC) is the main organization dedicated to promoting the industry internationally. The OAC represents the interests of 70% of Ontario's aerospace companies and attempts to strategically position the sector as a competitive force in the global market. Also, the Consortium for Aerospace Research and Innovation in Canada (CARIC) serves an advisory role for aerospace companies to grow, and provides support for R&D projects. Marlene Conway-Diels, CARIC regional director for Ontario, said: "CARIC's main objective is increasing Canada's competitiveness and sustainable market share growth globally. The main challenge is for aerospace companies to innovate and improve their operations and products creating competitive advantages to facilitate further market penetration on an international level."

Additionally, the Aerospace Industries Association of Canada (AIAC) supports the development of aerospace in Ontario through collaborations and advocacy functions. "AIAC is the voice of Canada's aerospace industry," said Jim Quick, president of AIAC. These various institutions collectively serve as tools for the Ontario aerospace industry to flourish in the international scene.

R&D and technological innovation are key drivers attracting international business into Ontario, and contribute significantly to the region's aerospace's capabilities. Minister Brad Duguid said: "Aerospace companies need to be at the cutting edge of technological disruption in order to remain competitive, and Ontario's leadership and commitment to innovation is what the aerospace sector globally is thirsty for."

The region has an established ecosystem for R&D, and the aerospace industry further develops itself through research collaborations. Ontario accounts for 30% of all aerospace R&D in Canada, and many cutting-edge innovations are led by partnerships between the local universities and colleges and industry players. For example, Comtek Advanced Structures is an SME with an internal technical lead responsible for marshalling the company's R&D collaborations with academic institutions. Through their collaborations, they procure innovative products such as developing light weight, highly durable floor panels for airplanes.

The high levels of participation between academic institutions and industry players, ranging in areas from fuel efficiency and environmentally sustainable technology to automation and the future of digital manufacturing, are all attractive to international aerospace companies in Ontario. To further create linkages between industry and academia, the Downsview Park Aerospace Campus is a leading-edge project currently underway for integrated research, industry-leading innovation, and entrepreneurial business development. This academic aerospace center will strengthen Ontario's ranking in the fast-growing industry and also shed light on its innovation.

The aerospace industry in Ontario has all the capabilities of a major player in the international scene, however, due to regional and global competition, it needs to take additional strides to further feature its growing competences, create new linkages, and attract more international business into the province. "Demand for air travel is increasing quickly and is expected to continue growing over the next 20 years, resulting in global forecasts of nearly 40,000 new aircraft worth over $5.9 trillion USD," said Jim Quick, president of the AIAC. Ontario aerospace companies have to seize the opportunity and capitalize on this growth.

Ontario already has the fastest growing aerospace sector in North America, and there is incredible potential to be unlocked in the province to support the promising SMEs and collaborations between industry and academia. It is time for Ontario to capitalize on its strength in the aerospace industry and showcase it internationally. —

Jim Quick

President
AEROSPACE INDUSTRIES ASSOCIATION OF CANADA (AIAC)

Could you provide a brief introduction to AIAC?
AIAC is the voice of Canada's aerospace industry. We represent our members and their interests to policy makers at the highest levels of government. We ensure our members' engagement with the key industry decision makers and facilitate conversations relating to business and policy environments affecting the future of their companies and of the industry as a whole. We also support our members' growth and success by offering events, products, and services facilitating business development, networking as well as increased reach and visibility within the industry.

How does AIAC collaborate with industry and government to strengthen the competitiveness of the aerospace sector?
AIAC's initiatives strengthen aerospace competitiveness. In 2012, we led the industry's participation in the Emerson and Jenkins reviews of aerospace and defence procurement policies and programs, resulting in new programs and policies supporting Canadian aerospace innovation and competitiveness, including the creation of the Technology Demonstration Program (TDP) and the Consortium for Aerospace Research and Innovation in Canada (CARIC). They also introduced better tools within the procurement process, such as the use of Value Propositions (VPs) and Industrial Technological Benefits (ITBs).
We work with the government to ensure the aerospace industry contributes to the growth of Canada's economy. Through our collaboration we promote the industry's competitiveness relating to R&D, supply chain development, and international trade. We also support aerospace competitiveness by facilitating industry participation in major international trade shows such as Paris and Farnborough and targeting trade missions to key markets. We also host the Canadian Aerospace Summit every November, which is the premiere conference and trade show for Canada's aerospace industry and partners worldwide.

What is AIAC currently working on to support innovation?
Innovation is central to the competitiveness of our industry and a key differentiator separating aerospace from other manufacturing sectors. In fact, aerospace leads Canadian manufacturing as the number one R&D investor in the country, accounting for nearly 30% of total manufacturing investments and spending $1.9 billion on innovation-related activity in 2015. Over 30% of Canadian aerospace employees work in innovation-related occupations, and that number goes up to nearly 60% in the space sector. In addition, nearly 40% of all innovation-related activity in Canada is being conducted by foreign-owned companies, indicating that aerospace innovators from all over the world are coming to Canada to conduct R&D.
We are proud of our innovation track record, but are also aware that other aerospace nations are pouring funding into their R&D capacities, so Canada needs to maintain its competitive edge. We need to continue working with government on the Innovation Agenda and also continue leveraging and refining the TDP and CARIC to better support the needs of businesses at all innovation stages.

What are the major trends you see affecting the industry in Ontario and across Canada?
Demand for air travel is increasing quickly and is expected to continue over the next 20 years, resulting in global forecasts of nearly 40,000 new aircraft worth over USD $5.9 trillion. Although growth presents incredible opportunities for Canada, there are challenges associated as well. Competition is becoming increasingly fierce, and supply chains are consolidating. The major global manufacturers are shifting their focus from aircraft development to delivery. Therefore, there are increasing pressures on suppliers to deliver cost-effective, timely, and scalable products and services. The greening of the industry also continues to present an important challenge. These trends impact the ability of our members in Ontario and across Canada to grow and compete in key global markets.

Canada is currently the fifth largest aerospace industry in the world. What are your objectives at AIAC in terms of supporting the sector going forward?
Our primary goal is to maintain our global position of leadership and grow it wherever possible. We are focused on developing policies in areas where we have a competitive edge to leverage our advantages and ensure that our companies continue to lead the way. Another important goal is growing our supplier base for SMEs to expand quickly and scale the supply chain at the same pace as global demand. Ensuring the competitiveness of the aerospace industry is paramount.

Bruce Simpson

Senior Partner
MCKINSEY & COMPANY

How is the economic profile of Ontario served by the aerospace sector?
Geographically, Ontario is in the perfect spot: sharing a large border with the U.S., and at the center of trade flows. As a result of its strategic location, Ontario is expected to double its GDP over the next 25 years and will receive 40% more benefits than geographies that are on the periphery of trade flows. In addition, more than 100,000 people move to Toronto every year, bringing languages and skills, and generating GDP growth. GDP growth correlates positively with passenger travel, so both will increase in the future. If Ontario's airports are able to serve the increased passenger traffic demand within the province, the region will accrue a $17 billion GDP increase over the next 25 years. This growth depends on strengthening airport infrastructure, investing in "the last mile" connectivity between rail and other ground transportation and the airports, particularly at Pearson airport.

What is McKinsey's role in the growth of Ontario's aerospace cluster?
McKinsey's role is to anticipate the future and help the industry move forward faster, improving the speed and impact of improvement efforts. For OEMs and suppliers, this could include improving quality and productivity, leveraging technology, and implementing the most advanced operations, manufacturing and supply chain techniques. We work with aerospace manufacturers, OEMs, and Tier 1 and Tier 2 suppliers on strategy, joint ventures and operational performance improvements. We also support aerospace companies in opening up new markets, increasing their revenues, and developing new products and services. We also help airports work together to manage increased demand across passengers, freight, and other areas.

What challenges are aerospace companies facing in Canada?
Productivity is the biggest challenge for the aerospace sector in Ontario. OEMs in Canada face a highly competitive global market and are increasingly finding skilled, low-cost suppliers outside North America. Ontario aerospace suppliers need to rise to this challenge and increase productivity, improve quality, and lower costs.

How can automation and Industry 4.0 address the productivity challenges in the aerospace industry?
There is a positive trend to integrating automation technologies now, as opposed to five years ago. Assembling a plane is still manually intensive, and fully leveraging advanced operations, advanced analytics, and the internet of things will be important. Aerospace should be a leader in looking at new automated technologies for manufacturing.
McKinsey has virtual factories where, through simulation and 3D technology, CEOs and managers can learn the latest techniques and gain valuable insights into how to make their operations more efficient. These factories also help our aerospace clients understand ways to increase productivity and transition into the future of manufacturing. In addition, we have small-scale model factories, with real production lines, to help our clients test new approaches "live."

How can Canadian government institutions support the aerospace industry?
Some of the options government institutions could consider to incentivize innovation include building more centers of competence on topics like composite manufacturing; establishing funds and helping SMEs access venture capital to improve scaling up new ideas; and opening up new markets abroad for local aerospace players through a combination of diplomatic and commercial resources.

Donald Gray

Partner and Head, Aircraft Finance, Aviation and Aerospace Group
BLAKES

Could you provide a brief introduction to Blakes as well as describe your work with the aerospace sector?
We are a full service business law firm and we are the number 1 ranked leading lawyers in *Aviation & Aerospace in Canada's Leading Lawyers for Business 2017*. In fact, we were significantly involved with the drafting and implementation of the Cape Town Convention, which has revolutionized aviation financing, and now aircraft financing in Canada is primarily international law. We focus primarily on the commercial side of aviation, and we represent most aircraft and engine manufacturers, aviation banks, and top aircraft leasing companies.
Our clients include Boeing, GECAS/GE, AerCap and Mitsubishi, among others. We perform substantial domestic and international aviation work for Export Development Canada (EDC). We also represent the U.S. Ex-Im Bank when they finance Boeing's and other U.S. aircraft manufacturers' export transactions in Canada. We also represent all of the banks that have completed EETC transactions for Canada.

Grant McDonald

Aerospace and Defence Industry, Sector Lead
KPMG

Could you introduce KPMG's role in relation to the aerospace industry?
We work closely with the industry associations, such as the AIAC and OAC. We are focused on engaging with our clients on emerging industry trends and thought leadership, which includes participating with the KPMG global aerospace group. We work with clients across the spectrum in the industry. Canada is a mid-market country, and although there are few large aerospace companies, there are many Tier 1 and 2 SMEs. There is also significant merger and acquisition opportunity.

What is the necessity for increased collaboration between industry stakeholders?
Of course companies should protect their intellectual property, but they should also realize that collectively they are stronger and that their main competition comes from outside our own border. The question is whether we have the culture of trust, in this province and this country, to work together. In general, the big companies recognize the necessity of working with their lower tier suppliers. However, many are trying to slim their supply chains and are encouraging efficiency improvements from the firms within them.

Could you provide a case study of how you worked with a client in the aerospace sector?
We have acted for Boeing's commercial aviation division for over 20 years, assisting with the sale and financing of their airliners in Canada. For example, Boeing sold a number of B777, 787 and 737 MAX aircraft to Air Canada. In addition to working with Boeing on the sales and support transactions, we worked with all of the financiers to date for these various deliveries including GE, the largest financier of airliners in Canada, with almost 100 aircraft, Ex-Im Bank, Morgan Stanley and Credit Suisse for various capital markets (EETC) transactions, and other lessors, such as Air Lease and AerCap.

What are your plans for growth in the aerospace industry?
Right now, we perform most of the available work in Canada in our primary field, which is aircraft financing. Our biggest growth area in the aerospace sector is the M&A front. Due to the stability of Canada as a place to invest, and the fact that aerospace is one of the areas where Canada is a world leader, there has been an increasing interest internationally to invest in Ontario, and we have negotiated deals for investments in original equipment manufacturers, parts manufacturers, aviation training units, military procurement projects, airlines and others.

What are some of the changing trends you see in the aerospace industry?
One of the biggest things to watch for is the future of export credit financing for aircraft. Most aerospace manufacturers in Canada use EDC to certain extent. Currently, in the United States, Ex-Im Bank is under considerable pressure. If the U.S. government, the largest player in the field, stops financing aircraft exports, that will put pressure on other governments, including the Canadian government to follow suit. This could bring revolutionary changes in the financing of aerospace businesses around the world. Also, another important trend is the increasing emphasis on carbon credits and jet engines' effects on the atmosphere.

How can aerospace SMEs in Ontario remain competitive in an international marketplace?
SMEs need to recognize the importance of scaling up to go global with their offerings. Although a company may have the most innovative idea, if it remains within its own little bubble it will struggle without the sales force, marketing and agents to take it elsewhere. This is where larger companies, industry associations, or the government, can help.

How can companies achieve cost reductions and productivity increases?
Labor rates being what they are, it is not uncommon for some work to be done in a lower-cost environment. This is just part of global business today, although it may be harder for SMEs to outsource work, it is important to be nimble, flexible and innovative. Canada, and Ontario in particular, focus on innovation in aerospace, and government supports R&D, giving companies the confidence to invest. For instance, the Strategic Aerospace and Defence Initiative is a major government funding program, with billions of dollars for innovative ideas.

What trends are you seeing for automation in the Ontario aerospace sector?
Internally, KPMG is discussing the Fourth Industrial Revolution and what it means for the industry, whether in relation to robotics, artificial intelligence, additive manufacturing or new materials. Globally, KPMG produced a report on the top ten global manufacturing trends which includes many of these areas. Both OEMs and SMEs are participating in these developments in Ontario. Aerospace is sometimes more conservative and risk-averse than certain other industries, such as automotive, partly due to lower volumes and safety concerns. Taking reasonable risks, however, can help companies in aerospace jump ahead of the competition.

Do you have any final message for our international readers?
Ontario has a large number of highly respected aerospace companies, expertise in advanced manufacturing and MRO, world-class academic institutions, and extensive support from associations and government. The region needs to increase its awareness of its existing capabilities in order to grow the sector into the future.

Image courtesy of Toronto Pearson International Airport

ONTARIO'S AEROSPACE HUBS

"We incentivize investment through programs such as the Ontario government's $26 million manufacturing investment strategy. Also, the recent partnership between Invest Toronto and the Greater Toronto Marketing Alliance will result in increased FDI within the region."

- Frank Bedard,
Aerospace Sector Specialist,
City of Toronto

Southern Ontario's Key Hubs

Southwest Ontario has the highest concentration of advanced manufacturing industries in Canada, including aerospace manufacturing. Along this southwest corridor, there are local aerospace hubs, notably Mississauga, Toronto, Peterborough, Waterloo, and Durham. Each hub has its local nuances, with a unique variety of aerospace companies across the supply chain.

In particular, Mississauga has historically been known for hosting a large network of manufacturing companies. "The variety of different aerospace companies in Mississauga creates a significant hub in the industry. Most maintenance, repair, and overhaul companies are based in the area, which is advantageous for us, as there is a pool of capabilities elevating our business," said Terry Hope, president for Hope Aero Propeller & Components Inc.

The City of Mississauga strategically identified aerospace as a key economic driver for growth, and their efforts to develop the supply chain include supporting the airlines, the manufacturing companies and the maintenance and support service companies. The City helps companies access provincial and federal funds as well, and fosters linkages between industry and academia. Mississauga attracts international industry leaders in aerospace, particularly Japanese companies, including Mitsubishi Heavy Industries and Sumitomo Precision products. The hub in Mississauga is strong, and will continue to be a key driver for Ontario's aerospace growth as a whole going forward.

As the fourth largest city in North America, Toronto is a global hub for business, including aerospace business. The recent creation of the Aerospace Sector Development Officer reflects the increasing importance of the sector as well as the local government's efforts to develop the capacity of the industry. Frank Bedard, the aerospace sector specialist for the City of Toronto, said: "Toronto's high level of education, world-class academic institutions, low-cost business environment, strong design capabilities and excellence in landing gear and avionics all make the city a major center for aerospace business."

Toronto serves as the nucleus for Ontario's economy, and it is the center where the aerospace industry comes together with government stakeholders, academic institutions, advocacy organizations, and industry experts in consulting and law firms. Although the bulk of manufacturing does not occur in the city center, Toronto is vital for aerospace growth, creating linkages between different key players in the industry.

Peterborough is a vital up-and-coming hub for manufacturing and maintenance, repair and overhaul (MRO) services for the aerospace industry. Home to 20 companies with direct ties to aerospace, the hub is quickly growing, and the Peterborough Economic Development Agency has a strategy for the city to become a nexus for aerospace excellence. This strategy includes connecting companies to provincial and federal funds, hosting events to showcase Peterborough's capacities, and fostering linkages between industry and academia. The hub is tightly knit together: local government, academic institutions and industry leaders all work closely in their efforts to develop the sector.

Rhonda Keenan, CEO for Peterborough Economic Development, said: "We constantly promote a platform to educate the global industry about what Peterborough's capabilities are, and also leverage our networks and companies to attract their sup-

> Southern Ontario is the center of excellence for military land systems in Canada and we have the densest cluster of advanced manufacturing and IT-based industry in the country. Ontario SMEs operate in various sectors making products for various industries, including aerospace and defence.
>
> - Henrik Noesgaard, President, Southern Ontario Defence Association (S.O.D.A.)

ply chains to the region." The strategy is proving successful, and as more international companies move to Peterborough, the sector will be one to look out for in coming years.

The Waterloo region comprises the cities of Kitchener, Cambridge and Waterloo, and it employs over 2,500 people in the sector, hosting world-leading aerospace companies including Héroux-Devtek, Honeywell and Shimco. According to Tony LaMantia, CEO of The Region of Waterloo Economic Development Corporation, they represent the three cities because their collaboration makes them "stronger as a region." As an innovation center, Waterloo hub is a small pocket within Ontario's aerospace sector, but there are significant players in the region, making everything from radar systems and microsatellites to landing gear and airline scheduling software, and their continued growth throughout the years makes them important for Ontario's future.

Durham Region has historically had an array of advanced manufacturing companies in the automotive industry, now having expanded or looking to diversify into aerospace. Additionally, the region's technology expertise is exemplified through the

QUICK FACTS

Source: Ontario Aerospace Council

Employment of over **21,000** (direct aerospace employment)

Annual R&D spending of **$500 million**

Exports over **80%** of its finished product

Canada's aerospace manufacturing sector outpaces the total manufacturing sector in terms of research and development intensity, and **30%** of this aerospace manufacturing R&D is done in Ontario
Ontario's aerospace industry is a **world leader** in several areas including; turboprop aircraft, business jets,turbine engines, landing gear systems, avionics, environmental systems and space robotics

Ontario-made aerospace parts are used on virtually **every passenger aircraft** in the world

Approximately **18** universities and colleges offering over **40** aerospace-specific programs:
14 universities with engineering programs
PhD and Masters Programs in aerospace engineering offered at University of Toronto, Ryerson University (Toronto) and Carleton University (Ottawa)

highly technological aerospace companies such as Cleeve Technology. The Durham Region Economic Development is increasing their presence at international aerospace trade shows to attract investment and growth into the region's aerospace sector. With their competitive business costs and affordable land credits, the aerospace hub at Durham will only grow.

The Mississauga, Toronto, Peterborough, Waterloo, and Durham aerospace hubs owe much of their growth, success, as well as future potential to the airports in their vicinity. According to Bruce Simpson, senior partner for McKinsey Canada: "GDP growth positively correlates with passenger travel, so both will increase within the next 20 years. If the airports are able to maintain the passenger traffic within Ontario, the region will accrue a $17 billion uptake by 2030."

> "One of Toronto Pearson's goals is finding a common ground on which all the airports in Ontario can work together. We have met with airports across the region to identify the niche roles, such as flight training, freight services, or MRO services, being played by each airport. We strive to develop an integrated airports system and attract businesses to Ontario by showcasing our combined linkages and strength as a cluster internationally."
>
> - Howard Eng,
> CEO,
> Greater Toronto Airports Authority (GTAA),
> Lester B. Pearson International Airport.

Airports are key economic drivers for the local hubs. For example, Lester B. Pearson International Airport significantly fosters aerospace growth for the Greater Toronto Area (GTA). As the fourth largest entry point to North America, Pearson Airport serves as the access into the Mississauga and Toronto markets, as well as a departure point for their aerospace exports. Howard Eng, CEO of the Greater Toronto Airports Authority, said: "The aerospace industry in Ontario has an international span and they export 80% of their sales. Toronto Pearson's connectivity allows companies based around the airport to provide the best service in terms of quick response times. Since Pearson Airport reaches 65% of the global economy by direct flights, the aerospace cluster in Ontario transport their products and support services to international markets in a timely manner."

Pearson International also offers extensive MRO services, and Air Canada is investing $90 million in the construction of a new hangar to develop the airline's expansion of its Toronto global hub. As Pearson International Airport develops, the aerospace hubs of Mississauga and Toronto grow as well.

The Peterborough Airport serves the hub in Peterborough. The airport has received significant provincial and federal funds for growth and has expanded its runway to 7,000 feet to accommodate new aircraft, such as the Boeing 737 and Airbus 320 series. Trent Gervais, manager for the Peterborough Airport, said: "We have a full service facility catering to businesses and general aviation offering a range of services including fuel, oil, aircraft repairs, engine maintenance and overhaul, an aircraft completion center, avionics, parts sales, and aircraft modification. Going towards the future, the airport will be the controlling point for the aerospace sector in Peterborough. An increasing amount of high-technology aerospace manufacturing companies are moving to the area and setting up around the airport."

With the largest runway between Toronto and Ottawa, Peterborough Airport's unprecedented growth in the last six years has built the capacity to take some workload off Pearson International Airport and play a significant role in strengthening Ontario's aerospace southwest corridor. The Peterborough Airport will continue to be a key leader of aerospace development in the hub.

Similarly, the Waterloo International Airport has a $90-million-dollar impact on the region, and aerospace companies benefit from having a direct gateway to international markets within their proximity. Chris Wood, airport manager, explained: "Waterloo has 25 small to medium sized businesses operating at the airport including an avionics facility, repair facilities, and a sheet metal company for fuselage repairs." The airport is a driver for aerospace, and their business aviation park has 35 acres of land capable of sustaining more aerospace companies.

The aerospace hubs in southwest Ontario each have unique potential, but to ensure growth they need to continue rallying efforts to attract more business. Although local strategies will highlight their capabilities, they also need to strengthen inter-regional linkages and promote themselves as a united aerospace force to be reckoned with globally. Some efforts by the Ontario airports are already underway to try and integrate the airport systems and attract businesses to the region by showcasing their force as a cluster. Such efforts need to be fostered, and local hubs need to present themselves internationally as a joint Ontario aerospace powerhouse. —

Andrew Petrou

Executive Director
DOWNSVIEW AEROSPACE INNOVATION AND RESEARCH (DAIR) WORKING GROUP

Could you introduce the DAIR working group and outline its role in collaborative research?

The Downsview Aerospace Innovation and Research working group, also known as the DAIR consortium, has been working as a collective with industry, academic, and government players for the past seven years. Our collaboration brings together key pieces of infrastructure to Downsview Park.

The Downsview aerospace hub project has three main pillars. First, Centennial College is establishing a facility for training students. Second, the University of Toronto Institute for Aerospace Studies (UTIAS) is co-locating at the site. Third, the hub will host an innovation center, which will house aerospace companies and educational institutions to facilitate industry-academic collaboration. The goal is to work with academic institutions and industry players at all levels to build the innovation center.

By facilitating physical interaction between industry and academia, we eliminate isolation and create the ability to collaborate as well as a network. Everyone has a unique point of view to bring to the table. The aerospace hub will be neutral territory where we can incubate best practices. It will also provide an opportunity to showcase globally what Ontario's aerospace industry has to offer, which is less well understood than it should be.

All three levels of government support the DAIR project. International aerospace companies have also shown interest in participating in our project. The significant foreign investment opportunity here should not be overlooked. Downsview has a lot of land, so the hub has potential to grow exponentially to compete with Germany's or Singapore's hubs.

What are the goals for the aerospace campus at Downsview park and how will it help the aerospace sector in Ontario grow?

The aerospace hub will tackle R&D projects relating to relevant trends in the aerospace industry such as environmentally sustainable technologies as well as efficiencies in production, maintenance, and energy. Also, Ontario's aerospace industry needs to build up its SME base. A goal for the hub is to be a space where SMEs can come show their technologies or meet other aerospace players to penetrate global supply chains. We need to create this beacon to the world where they can come to Ontario and access the newest R&D projects and be at the cutting edge of innovation. Another goal for DAIR is educating Ontarians on the value the aerospace sector has in the province's economy and the future jobs it could create.

What is the strategic objective of having the aerospace hub at Downsview?

First, Downsview Park has a rich history in aerospace, housing the original De Havilland buildings. Geographically, the aerospace hub will be at the ideal location since Downsview is in the center of the GTA. The GTA has hundreds of aerospace companies, including 80% of the SMEs. Additionally, Bombardier, a wold-class OEM, has operations at Downsview with 4,000 employees. To the north is Defence Research and Development Canada (DRDC) and the Department of National Defence (DND). Toronto is also the ideal location for the Downsview Aerospace Campus, as it is the most populous city in Canada with a rich diversity and excellent public transportation. In fact, the go-train subway station will open at Downsview in 2017.

What is your vision for Downsview Park going towards the future?

Ontario's aerospace sector is all about innovation and growth. The Downsview Aerospace hub will address the main challenges in the industry, creating interlinkages between companies and strengthening the ecosystem. It will also be a touch-point for other companies to relocate to Ontario and capitalize on the advantage of having an aerospace hub. For example, Ontario is facing the challenge of an aging workforce in aerospace, which needs to be replenished. At Downsview, we want to incentivize youth to engage in aerospace. The hub will blur the lines between academia and industry and therefore address the challenge of lack of skilled workers.

The growth for Ontario's and Canada's aerospace industry is our long-term goal. Since the Second World War, aerospace has always been part of this nation's fabric. Downsview will be the gateway for the Ontario aerospace industry, driving its growth and innovation and bolstering its global reach. The Downsview Park Aerospace Campus will be heartbeat of aerospace in Canada.

Chris Wood

Airport General Manager
REGION OF WATERLOO INTERNATIONAL AIRPORT (YKF)

Can you provide a brief overview of the Region of Waterloo International Airport?

The Region of Waterloo International Airport is the busiest general aviation airport in Ontario and the 16th busiest airport in Canada. The airport occupies 1,000 acres of land, supports commercial, corporate and general aviation, and is home to 25 businesses employing over 300 people. We are also the home of the Waterloo Wellington Flight Centre, one of the top professional flight training schools in Canada. The airport is municipally owned and operated. A significant amount of money has been invested in airport infrastructure creating a state-of-the-art facility. We are working to grow scheduled air service, which is extremely important to our community.

The airport is currently updating its 20-year Master Plan, guiding the development through 2035. With air travel demand in southern Ontario projected to exceed 90 million passengers over the next 20 years, we are planning how to best meet our community's travel and connectivity needs.

Airports are key economic drivers for their surrounding regions. What is the economic profile of Waterloo Region?

Waterloo Region has a highly mobile population of over 500,000 and is projected to grow significantly over the next 20 years. There is a strong demand for air travel by both business and leisure travelers.

A 2015 Wilfrid Laurier University economic impact study estimated YKF contributed $90 million to Waterloo Region's economy, including contributions of the 25 businesses operating at the airport, ranging from FBO's offering corporate aircraft charters, refueling and air cargo services to helicopter and aircraft flight training, and businesses focused on avionics and repair. The Canada Border Services Agency (CBSA) classifies YKF as an Airport of Entry (AOE), which is an added benefit to the local manufacturing industries.

How does the Region of Waterloo International Airport support the aerospace industry in Waterloo Region?

At YKF there are 35 acres of available fully-serviced airside land, ideal for light industrial, commercial or aviation-related businesses. This land is centrally located, competitively priced and provides direct access to a highly-skilled workforce. An additional 700+ acres of land is located adjacent to the airport, ideal for larger scale projects such as manufacturing and assembly. Funding and development incentive programs are available to support new initiatives through the Waterloo Region Economic Development Corporation. The growing aviation cluster in Waterloo Region includes businesses like Héroux-Devtek, who recently established a landing gear facility close to the airport, Raytheon, Brock Solutions, COM DEV, Navtech and Aeryon Labs.

What role does YKF play in the aerospace export industry?

Companies locate themselves near the Region of Waterloo International Airport to simplify their export activities. YKF is a stable airport with secure access. We are currently one of the only airports with Code-D serviced land availability.

Just-in-time parts delivery ensures businesses are able to receive materials when they need them and save money. Local access to global markets makes it easier to do business here.

There is an opportunity for us to play a larger role in the aerospace export industry. With Toronto Pearson reaching capacity in the near future, YKF may be one of a number of airports in southern Ontario that can help to address their capacity issues.

What maintenance and service facilities does YKF have?

YKF is a certified facility that complies with all Transport Canada regulations. We have a high level of maintenance service including: Kitchener Aero, an avionics facility; Chartright, an FBO with airline MRO capabilities; Flite Line, a Paragon Aviation Group FBO and Aero Structural, a sheet metal company that does fuselage repairs. We also have a number of companies that offer MRO services for smaller aircraft.

What makes Waterloo Region an aerospace hub?

YKF is located adjacent to the busiest airspace in Canada. Waterloo Region is one of Canada's most innovative communities. Having a facility housing aviation-focused startups would align with the high tech community and provide an added benefit to businesses looking to locate here. We also have the available land at the right price, access to a highly skilled labor force and our willingness to cooperate.

We are actively working to grow the aerospace cluster in Waterloo Region. We want to attract international companies to our region, because having more aerospace companies based at the airport strengthens our community from a global perspective. We are a world-class facility and we are ready for growth.

WATERLOO

Source: Region of Waterloo

POPULATION **575,000**

Plan to grow by over 200,000 people in the next 20 years.

20% of population employed in **manufacturing**.

15.36 patents per 10,000 people - 11.3 times higher than the Canadian average.

Over **1,000** technology firms

EDUCATION OPPORTUNITIES

65,000 post-secondary students, including over **15,000** co-operative education students

HOME TO

- **University of Waterloo:** high concentration of mathematical and computer science talent.

- **Wilfried Laurier University:** includes Canada's largest business co-op program.

- **Conestoga College Institute of Technology and Advanced Learning**

RESEARCH CENTERS INCLUDE

- Perimeter Institute for Theoretical Physics
- Institute for Quantum Computing
- Waterloo Institute for Nanotechnology
- Waterloo Institute for Sustainable Energy
- Waterloo Centre for Automotive Research
- Centre for Bioengineering & Biotechnology

Frank Bedard

Aerospace Sector Specialist
Department of Economic Development and Culture
CITY OF TORONTO

What is the aerospace industry's strategic importance for Ontario and Toronto in particular?

The Ontario aerospace sector is the second largest cluster in Canada with more than 300 companies and more than $6 billion in annual sales. The region has skilled and educated professionals focused on systems engineering, equipment production, and integration. As the fourth largest city in North America, Toronto is a global hub for business with a prime location due to the proximity to the United States. The aerospace sector in Toronto is of great strategic importance to the city's overall growth. Toronto's high level of education, world-class academic institutions, low-cost business environment, strong design capabilities and excellence in landing gear and avionics all make the city a major center for aerospace business.

As the Aerospace Sector Specialist of the City of Toronto, my role is to help build and develop the capacity of the industry. Originally a part-time position, the Aerospace Sector Development role became a full-time role last year in order to further promote the growth of the aerospace industry.

How does the City of Toronto promote the aerospace industry?

We have a tax incremental equivalent grant program, which is unique to Toronto. This program offers a property tax rebate to companies that are either building new facilities or expanding at approximately 60% to 70%. Additionally, we provide incentives for companies to relocate their business to the city of Toronto by eliminating many industrial development charges. The exemptions reduce costs for aerospace manufacturing in particular. In some cases, our incentives have amounted up to a million dollars in savings.

Furthermore, we incentivize investment through programs such as the Ontario government's $26 million manufacturing investment strategy. Also, the recent partnership between Invest Toronto and the Greater Toronto Marketing Alliance will result in increased FDI within the region. In terms of export development, our programs help SMEs develop their exports and open up to the global markets.

Could you give us further insight into the Downsview Park project?

The Downsview Park Aerospace Campus is one of the key projects we are currently developing. 80 acres of land in the north central part of Toronto are being dedicated to build this aerospace campus, which will be the hub for integrated research, innovation, and entrepreneurial business development in the industry. Adjacent to Downsview Park is the Department of National Defence, Defence Research and Development Canada (DRDC), and Downsview airbase. Also neighbouring the park is a Bombardier manufacturing facility, which includes production space. Downsview Park will be a hub for academia, industry leaders, and government, bringing stakeholders together to collaborate and encourage innovation. For example, the University of Toronto Institute for Aerospace Studies is looking to relocate to the hub, and Flight Safety Canada is also looking to expand its facilities to the park. Phase one of the campus project is the Centennial College Aviation technician program. The site plan has already been approved, so the project will be inaugurated in September 2018.

Phase two is the Innovation Centre, which will be an area to promote Research and Development and various innovative projects. The Innovation Centre will be the centerpiece for research consortiums between the major aerospace companies in the region. Much of our attention is revolving around creating infrastructure for the aerospace hub, which is a unique opportunity for Toronto, Ontario, and Canada to improve the aerospace industry as a whole.

What are the key objectives of Toronto's Economic Development & Culture Division with regard to the aerospace sector?

Our long-term goal is the economic well-being of the city of Toronto and its citizens. For this we need to increase revenue and the number of jobs created. The aerospace industry is a target sector to achieve these goals. We are primarily focusing on the Downsview Aerospace Centre as the campus hub will make the aerospace industry evolve and create a platform for further growth. We are also looking to participate in more aerospace and trade shows to create opportunities for business-to-business interactions. We are currently developing a rebranding strategy to attract more business to the Toronto area and showcase the advantages of working within our aerospace industry.

TORONTO

Source: City of Toronto

	CITY	REGION
Population	2.8 million	6 million
Labor Force	1.7 million	3.4 million
Number of Businesses	92,500	203,800

World's best place to live
- The Economist, 2015

APEC's most competitive, sustainable and liveable metropolis
- PwC, *Building Better Cities*, 2015

Best economy for young people
- Citi Foundation and Economist Intelligence Unit, 2015

The world's most tax-competitive major city
- KPMG Competitive Alternatives Report, 2014

Toronto's airports provide **non-stop** and **same-plane** service to **200 global destinations in 55 countries**.

The Toronto region's **GDP** accounts for **18% of Canada's GDP**.

Toronto Stock Exchange (TSX) is the **world's principal exchange for mining, oil and gas** and a leader in cleantech listings.

51% of Toronto's residents were **born outside Canada**. *Over 150 languages and dialects spoken.*

8 publicly-funded post-secondary institutions

245,508 full-time students (2014)

Susan Amring

City Manager,
Department of Economic Development
CITY OF MISSISSAUGA

What is the aerospace sector's strategic importance to Mississauga?

Mississauga's aerospace industry has long been important to the region. The Avro Arrow was first invented in the Malton area, and Canada's largest airport, Toronto Pearson International, is located here. Over the years, the industry has developed and continued to be a hub with an extremely talented workforce.

The City of Mississauga's Economic Development Office has defined an economic development strategy, identifying the key areas of growth for our city. We are building on the success of existing industries, and have identified four core focus areas: life sciences, information communications and technologies (ICT), financial services and advanced manufacturing. Aerospace is included within advanced manufacturing alongside a few other industries, including automotive.

In what ways does Mississauga's Economic Development division support competitiveness and productivity in the region?

There are a number of ways in which we aim to further develop the industry, which include creating a supportive business environment, fostering partnerships with our education sector and associations, eliminating any barriers for companies, and making sure we have the talent pool necessary to attract future business. Although we are prohibited in the Ontario region from giving financial incentives and support to companies, we work with our provincial and federal counterparts to support companies accessing particular programs.

Additionally, we recently hired a representative focused solely on the advanced manufacturing sector, with the objective of helping to build the cluster. The purpose of the role is to bring Industry 4.0 to the region's companies across the supply side, 3D printing and the Internet of Things. This is a key initiative to help support and grow the cluster.

Mississauga has a long tradition of promoting innovation. How do you support R&D efforts within the aerospace sector?

There are a number of initiatives in place, such as the laboratory currently under development by the National Research Council (NRC) around advanced materials, which is a partnership with Xerox Canada Research Centre located in Missisauga's Sheridan Park. We also work with the Sheridan College Brampton Campus, which has an advanced manufacturing center. The college works with companies, developing solutions within high technology areas such as robotics, and also forms part of Mississauga's Economic Development Advisory Board. The University of Toronto Mississauga campus also recently built the Institute for Management of Innovation (IMI) to provide students with practical programs in collaboration with the wider industry.

What are some of the factors that make Mississauga an attractive region in which to operate?

A notable factor is the high level of education in the area and resulting highly qualified workforce. We also have an international airport and, due to our position on the western edge of Greater Toronto, are located only 90 minutes from the United States border. Furthermore, Mississauga's large concentration of highways and rail links is also a great advantage. Our business costs are also ranked some of the lowest across large Canadian cities.

Mississauga has a very strong relationship with Japan. How important are such relationships for the region?

Some time ago we were approached by a Japanese company based in Mississauga, regarding a Japanese city– Kariya. Kariya has become our sister city, and we now have 100 Japanese companies in Mississauga operating across our main sectors, including aerospace. The companies see many advantages to operating in this region. MHICA Canada, for example, has grown from about 100 to 800 employees since the branch's establishment in 2003, and have often commented on the large number of talented employees they are able to attract. Japan is our strongest international partnership, but we have also been travelling to other regions such as Germany, Brazil, Chile and Colombia to test these regions with our partners in the Greater Toronto Area (GTA).

What are Mississauga's key objectives going forward?

Mississauga has a 10-year Economic Development Strategy that we are continuing to activate. We are now focused on building key clusters in both life sciences and advanced manufacturing, including aerospace through dedicated resources.

Mississauga will continue to attract the aerospace sector based on our highly diverse and integrated business community, our skilled and talented labor force, competitive business costs and our easy access to North America's richest markets.

MISSISSAUGA

Source: City of Mississauga

Over **70 Fortune 500 companies** with head office or major divisional head office are located in Mississauga

Mississauga's aerospace manufacturing sub-sector is the **largest** across all major Canadian centres **by total employment and number of businesses**.

LABOR POOL

4.3 million people
in the Greater Toronto Area

6 colleges
4 universities
31 aerospace-related programs

Pearson International Airport

- Canada's **largest airport**

- North America's **2nd busiest airport for international passengers**

- **44 million** passengers annually

- **180** destinations worldwide

-Processes **45%** of Canada's air cargo

- Cargo processing capacity: **1 million metric tons per year**

Kathy Weiss & Robert Nolan

KW: Director
RN: Investment Attraction Manager
DURHAM REGION ECONOMIC DEVELOPMENT

KW

Could you introduce the Durham Region Economic Development's role in promoting the economy of the region?
KW: Durham Region Economic Development's mandate is to attract investment and jobs to the region. We have a team focusing on investment attraction from global markets such as China, Germany, Brazil, and the U.S. We have a new economic development strategy, with aerospace as a key industry.

What is the strategic importance of aerospace for the economy of Durham?
KW: We have a diversified manufacturing sector. With declining employment in the automotive industry in Durham Region, the supply chain has diversified to supply the aerospace sector, taking advantage of the talent pool here.

How do you support the aerospace sector?
KW: At the regional level, we focus on investment and attraction and at the lower tier level, eight municipalities engage in business retention and expansion. There is a strong support system to helping companies grow and expand. Rob and I also promote the sector at different trade shows as well as on a regional stage.

Airports are key drivers for the aerospace industry and the economy. How will the Pickering Airport serve as a catalyst for economic development?
RN: There are lands designated for an airport in North Pickering, the decision on whether that goes ahead sits with the federal government and Transport Canada. In addition to that there are significant employment lands to the south of that called the Seaton lands, which will be a concentration of potential activity for aerospace companies coming into the region.
KW: The Pickering Airport will allow us to build a cluster such as the one around Pearson International. Companies gravitate to operate in close proximity to the airport and once you start getting a supply chain to a cluster, it continues to grow.

How does the Region of Durham collaborate with the rest of the regions?
RN: We market ourselves internationally as part of the GTA, because that is the key reference point for anyone who is coming in. However, we offer the lowest cost in terms of land and labor rates. We are a partner in the new investment attraction agency, Toronto Global, who is responsible for promoting all of the GTA on the global stage. We also collaborate with eight other municipalities in the Ontario Manufacturing Communities Alliance, in which we market the manufacturing capability of Ontario to get companies interested in the marketplace.

How do you support the innovation ecosystem in the Durham region?
KW: We are a funding partner with Spark Centre, which is the province's Regional Innovation Centre, and we are a major funder in the Business Advisory Centre Durham who are both part of the Province's One network. We are supportive of the entrepreneurial system that could lead to discovering technologies in aerospace.
RN: The municipal economic development officers are primarily responsible for the connection to local companies, and they focus on business retention and expansion. We are working to connect to both the colleges and universities' international departments and leveraging them further. They were primarily interested in student recruitment but now they are starting to delve into student placements and internships in international markets. We are making connections to internationalize the region in key markets such as China.

What is your vision of the future of Ontario's aerospace industry?
RN: The post-secondary institutions and research capabilities that we have in Durham provide an opportunity in Ontario to make sure we are on the leading edge of new technology in the aerospace industry. We aim to get research out of academic institutions and into the industry. We can leverage our experience and our contacts in international contexts to help businesses grow faster. We are looking to increase awareness on our capabilities to develop and grow aerospace business.

What is your final message to international companies looking to relocate to Ontario?
KW: Ontario has an educated and skilled labor force and fantastic transportation infrastructure. We are a stable province and country, with top notch post-secondary institutions.
RN: Canada is a safe place to invest and companies like the ability to access the U.S. and Mexican markets. The comprehensive trade agreement with Europe will open up another market for the Province.

DURHAM

POPULATION (2013)

650,000

FORECASTED POPULATION 2031

1 million

AREA

2,590 square km

UNIVERSITIES

- Queen's University
- Trent University
- UOIT
- Centennial College
- Durham College

70%
of the population aged 25 to 64
has post-secondary education

THRIVING SMEs

- **77%** of companies employ up to **25** employees
- **33%** of companies have expanded or upgraded their facility in the last **5** years.

Rhonda Keenan & Nancy Hewitt

RK: CEO,
PETERBOROUGH ECONOMIC DEVELOPMENT
NH: Airport Administrator
PETERBOROUGH AIRPORT

RK

NH

Could you introduce the Peterborough Economic Development office?
RK: Peterborough Economic Development is the lead regional economic development agency for both the City and the County of Peterborough. We have a full business enablement team working collaboratively, and our primary objective is promoting the community's assets for business attraction, investment and growth. We endorse our companies from within, and we target the key sectors with assets and value chains to support progress. The aerospace industry is a key driver for economic development in Peterborough.

Can you outline the specific aerospace companies in the region and their capabilities?
NH: In terms of maintenance, repair, and overhaul (MRO) services, Flying Colours Corporation, a global aviation company, is the major aerospace business located at the Peterborough Airport, where we also house Kadex Aero Supply, and we also have avionics and design engineering capabilities onsite. The airport is also home to Seneca College's School of Aviation, the only aviation technology-based degree program in Canada. Safran Electronics Canada is one of the manufacturers located in Peterborough.

What is the strategic importance of the airport for the Peterborough aerospace industry?
NH: The Peterborough Airport is an important economic driver for the region and has therefore received significant municipal, provincial, and federal support for growth. The presence of the airport is positive for all companies and organizations in the region because it supports their businesses, general aviation, and employs a large number of people. Also with the City's major investment in airport infrastructure, the economic impact of the Airport has grown substantially over the last six years. Airport tenant numbers have grown from 23 in 2008 to over 40 currently. Pearson International Airport is planning for future growth in Ontario, and Peterborough Airport is in a strong position to play a role in accommodating some of the growth with land prepared, ready for construction and further expansion.

In what ways does the Peterborough Economic Development agency assist in the growth of the aerospace industry?
RK: Peterborough Economic Development agency helps connect companies with provincial and federal funds. We collaborate with the Greater Toronto Airports Authority (GTAA) to identify Peterborough area opportunities and accommodate growth in a system of airports for Southern Ontario. Additionally, we foster collaboration between the aerospace industry and training institutions to develop programs specifically related to the sector. We also host events such as the Peterborough Aerospace Summit. At those events, we discuss the advantages Peterborough offers to the industry such as MRO services and aerospace education focus.

How does Peterborough Economic Development attract companies to the region?
RK: Working with the Business Enablement Team at the airport, we create awareness of the advantages Peterborough offers for aerospace companies, including the strategic location in proximity to Toronto, Ottawa, and Montreal. Over the last six years there has been major growth with the airport having the largest runway between Toronto and Ottawa.

What are some of the R&D initiatives of the academic institutions in the region?
NH: Peterborough's academic institutions, such as Trent University, Fleming College and Seneca College collaborate with industry players. Trent University has many R&D initiatives and has recently partnered with the City of Peterborough to create the Trent Research Innovation Park. Fleming College has partnered with Airport businesses such as Flying Colours to create a program for interior finishing and Seneca College to provide student support services. Peterborough Economic Development markets the local educational institutions as an asset and assists companies looking to relocate their business in the area by connecting them with academic institutions.

What is your vision for the future of Peterborough's aerospace sector?
RK: We strive to continuously grow the aerospace sector, and our key priorities are to attract more MROs to the region and continuously develop our infrastructure to support local businesses. Another goal is to take advantage of new technologies and identify all the opportunities for growth by adding capabilities to the aerospace supply chain. We also strive to attract more skilled worker talent into the region. Peterborough offers an authentic quality of life for the entire community. The cost of doing business in Peterborough is low compared to many other cities. We will continue positioning Peterborough as a nexus for aerospace excellence.

PETERBOROUGH

Source: Peterborough Economic Development

POPULATION
134,933

City of Peterborough
80,660

Peterborough County
54,273

Unemployment rate
6.4% **(Oct 2014)**

AEROSPACE-ORIENTED EDUCATION

- Seneca College
Bachelor of Aviation Technology program

- Trent University
Centre for Materials Science /
Centre for Biomaterials Research

- Fleming College
Aircraft Interiors Fundamental Co-Op program with Flying Colours

- Holy Cross Catholic Secondary School
Aviation & Aerospace SHSM program

Image courtesy of Airbus

OEMs and OPERATORS

“"The government should provide stronger support to the aerospace industry in Ontario, in order for the region to remain globally competitive. Also, Ontario should not be in competition with Quebec, but work together for the Canadian Aerospace industry to become a stronger competitor in the global aerospace market.”

- Romain Trapp,
President & CEO,
Airbus Helicopters Canada

Pushing for Further Efficiency

Industry leaders want the value chain to increase its competitiveness

Although the bulk of aerospace activity in Ontario comes from the network of SMEs comprised of advanced manufacturing to service and equipment providers, Original Equipment Manufacturers (OEMs) and operators are the key stakeholders in the region.

OEMs are the thought leaders of the aerospace industry and they set the tone and the trends in the sector. Suppliers throughout Ontario are feeling the pressures to lower costs, increase production, shorten time to market, develop new, lighter materials for manufacturing products, and consolidate the supply chain. Airbus Helicopters Canada, Bombardier, and Pratt & Whitney Canada (P&WC)'s presence in the region does shape the trends of the supply chain, and these companies play a role in ensuring increased competitiveness.

On the other hand, OEMs benefit from Ontario's extensive value chain. Airbus Helicopters Canada leverages the metallic manufacturing capabilities from local players, while Bombardier has a network of more than 300 suppliers in Ontario resulting in $800 million in business for Ontario-based suppliers annually. "Ontario's value chain offers Bombardier a mature, well-established industrial base, a highly educated workforce, value added activities and operations, and a diversified customer base," highlighted Graham Kelly, vice president global operations and Toronto site, Bombardier.

In fact, OEMs in Canada all boast a presence in Ontario at the top of the supply chain. These world renown OEMs are key economic drivers for the industry, investing in their facilities as well as creating jobs and economic growth for Ontario. Bombardier alone accounts for 16% of Ontario's aerospace employment with their facility at Downsview.

Similarly, operators are at the ultimate end of the supply chain, after the OEMs, and they also serve as economic drivers. In particular, Air Canada is a stakeholder for investment in the aerospace industry in Ontario. This airline has been working along with Toronto Pearson International Airport to transform it into a global hub. Specifically, Air Canada has commited a $90 million investment in a new hangar at Pearson International as part of this effort. Ontario will continue to be critical for Air Canada's global business in terms of maintenance services going into the future. Airbus Helicopters Canada has also invested significantly in their Ontario operations. Their facility in Fort Erie accounts for 25% of the company's total deliveries globally, and this year they invested in expanding their MRO capabilities by 65%. President and CEO, Romain Trapp, said: "Our Canadian operations are significant as we have a wide range of activities in the country. We provide overhaul services, such as dynamic component repair, to the entire Airbus Helicopter fleet flying worldwide. We also conduct composite manufacturing and we are the sole source supplier of 50 different parts installed on Airbus helicopters flying all over the world."

Both the Air Canada and Airbus invest-

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WE MAKE IT IN ONTARIO

As demonstrated by our 32 year history in Ontario, Airbus Helicopters is committed to doing its part to build an innovative manufacturing sector. Providing high-skilled, high-value jobs, Airbus Helicopters is proud to grow its Canadian economic footprint.

Important to you. Essential to us.
www.airbushelicopters.ca

AIRBUS HELICOPTERS

Image courtesy of Bombardier

◂ 34

ments represent the importance of Ontario for their future, long-term plans and their commitment to growth in the region.

Besides fostering economic growth, OEMs also drive innovation. They act as collaborative partners, ensuring that Ontario remains competitive, and they are prepared to invest to achieve that goal. For example, Bombardier and P&WC are investing in the region with the Aerospace Campus project at Downsview. Bombardier, being based in the area, is a leading stakeholder in the project that will bolster innovation in Ontario. Similarly P&WC, from their Mississauga operations, is investing in the development to be able to leverage the research capabilities the hub will bring.

Indeed, OEMs allocate large amounts of funds to R&D. Bombardier alone invested over $6 billion over the past ten years in R&D. Edward Hoskin, vice president at P&WC, said: "Over $150 million is invested each year in specific R&D activities at the Mississauga facility, and numerous collaborative programs are in place with universities and technical colleges to ensure a steady injection of talent and technology."

OEMs leverage the world-class academic institutions in the region in their R&D efforts. In particular, Bombardier and P&WC participate in collaborations with universities and colleges to partake in cutting-edge research. The University of Toronto's Institute for Aerospace Studies (UTIAS) engaged in a project with both Bombardier and P&WC to develop an environmentally sustainable aircraft.

OEMs and operators have a crucial role to play in Ontario's future growth, since their influence contributes to shaping market trends and resources to develop the sector's capabilities. Ontario's aerospace industry needs to leverage the presence and investment of OEMs and operators to strengthen its supply chain, innovate and grow the industry into the future. Romain Trapp of Airbus Helicopters concludes: "Aerospace has a major impact on the economy of Ontario and an immense growth potential, so the region needs to step up and highlight the importance of the industry." —

> "Twenty years ago, jet fuel was 60 cents a gallon, now it's $3 a gallon. People did not pay attention to climate change back then, we care very much now. As the world becomes more responsible, our industry must do an even better job of being a good steward of the environment."
>
> - Edward Hoskin, Vice President, Pratt & Whitney Canada

ONTARIO'S AEROSPACE INDUSTRY AT A GLANCE

Sources: Invest in Ontario, Ontario Aerospace Council

14 of the world's **top 25 aerospace companies**

Over **200 companies** supplying components to all major aerospace programs globally

Direct aerospace employment: **21,000 workers**

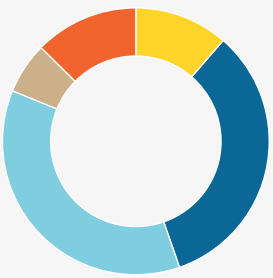
$6 billion in annual sales with nearly **80% in exports**

Approximately **a quarter of all Canadian aerospace activity** is done in Ontario

Ontario provides **landing gear for 75% of Boeing and Airbus** commercial aircraft programs

TIER 1, LARGE TIER 2 AND OEM COMPANIES

Sources: MEDEI Aerospace Sector Analysis; Ontario Aerospace Council



Aerostructures and landing gear	34%
Avionics and Electronics	36%
Satellite and Spacecraft	6%
MRO and Modifications	13%
Aircraft/Helicopter/Engine: OEM	11%

Graham Kelly

Vice President Global Operations and Toronto Site

BOMBARDIER BUSINESS AIRCRAFT

> We are proud that we have built over 8,000 aircraft here, both business and commercial. Bombardier's Downsview facility is the location of not only assembly and manufacturing operations, but is also comprised of engineering facilities including R&D. We have had a major industrial presence in Toronto for over 20 years.

Could you provide a brief overview of Bombardier's presence in Ontario?
Bombardier's aerospace presence in Ontario includes: more than 3,500 employees, which is 16% of Ontario's aerospace employment; a network of close to 300 suppliers across the province; manufacturing operations that span 5 aircraft; final assembly and interior completion of the technologically advanced Q400 turboprop; final assembly of the Global family of business jets –the most advanced, largest and longest range business aircraft in the industry; an engineering product development center; and a customer service and support center.

Could you outline the Downsview facility in Ontario and its distinct capabilities?
Over the years, we are proud that we have built over 8,000 aircraft here, both business and commercial. Bombardier's Downsview facility is the location of not only assembly and manufacturing operations, but is also comprised of engineering facilities including R&D. The site is important because we actually own and operate an active runway for flight testing operations. We have had a major industrial presence in Toronto for over 20 years.

You have about $800 million in business for Ontario-based suppliers. What are some of the advantages of Ontario's value chain?
Ontario's value chain offers Bombardier a mature, well-established industrial base, a highly educated workforce, value added activities and operations, and a diversified customer base. These attributes result in high quality work, efficiency, on-time delivery and stability on the manufacturing front.

With 16% of Ontario's aerospace employment, what are some of the trends you see with hiring skilled workers in the region?
We see a high level of attrition across all areas in aerospace due to the seniority of our workforce in the next five years. While we continue to see an available skilled workforce in the province, we must continue to work with educational institutions to ensure we develop local talent that will meet our demands going forward. We are also developing a new partnership with resource recruiters that are sourcing talent from other regions.

What steps need to be taken to bolster the province's global competitiveness?
With the increased availability of information and technology worldwide, it is necessary that each company works to become as nimble as possible and identify new trends and technologies that can be leveraged to increase productivity. Ontario can take advantage of global demand for aircraft and grow its aerospace capabilities by continuing to support its aerospace industry, including research and development.

What importance does Bombardier accord to R&D?
In the last 10 years alone, we have invested more than $6 billion in R&D. This type of focus is what gives birth to programs such as our new Global 7000 business jets, which will be manufactured right here at our Toronto facility. By looking towards the future and building for the long term, we believe we are positioned well within the province to support increased global demand.

How will Bombardier support the growth of Ontario's aerospace industry going towards the future?
We believe the growth of Ontario's aerospace industry will largely be a result of the talent that is being developed within the province. In January 2015 we launched a Structural Assembly training course in partnership with Centennial College, with the goal of preparing graduates to work for us. Recently, Centennial announced that it will build a new aerospace campus at our original Downsview facility, tripling the number of students in their aerospace program. Additionally, Bombardier is providing leadership to the aerospace sector in Ontario through our involvement with OAC.

What are some of your goals for the next three to five years?
As we look ahead to 2017, we are confident in our strategy, our turnaround plan and our ability to achieve our operational and financial goals. We have successfully completed the de-risking phase of our turnaround plan and have positioned the company to accelerate revenue, earnings and free cash flow growth in line with our plan. In Toronto, our near-term efforts are on ramping up production of the Global 7000 and Global 8000 programs, while ensuring that we maintain a strong focus on the core business of building aircraft, exceeding our customers' expectations in new product execution, delivery performance, and after-sales service.

Romain Trapp

President Canada,
COO North America Region
AIRBUS HELICOPTERS

What is the history of Airbus Helicopters Canada?

Airbus Helicopters Canada was established in 1984 and the company is currently the largest helicopter manufacturer in the world. Canada has the second largest and oldest helicopter fleet in the world and 90% of the fleet is used in commodity sectors. One in two helicopters manufactured in Canada over the last 15 years comes from Airbus Helicopters. Airbus Helicopters in North America represents 25% of the company's total deliveries globally. Our Canadian operations are significant as we have a wide range of activities in the country. We provide overhaul services, such as dynamic component repair, to the entire Airbus Helicopter fleet worldwide. We also conduct composite manufacturing and we are the sole source supplier of 50 different parts installed on Airbus helicopters flying all over the world.

What are Airbus Helicopters' capabilities at your facility in Fort Erie?

From Fort Erie, we offer a full range of maintenance services and support. In 2009, we expanded the size of our Fort Erie facility to add more composite manufacturing capabilities to our portfolio. In 2013, we won a contract to manufacture the engine cowling in composite for the H225 and H215 aircraft, leading us to further expansion. This year, we expanded our maintenance, repair and overhaul (dynamic component) workshop by 65%.

In terms of composite manufacturing capabilities, we recently invested in a new cutting table, significantly improving our efficiency, and reduced manufacturing waste. We have also invested in laser technologies, facilitating composite manufacturing jobs. Composite manufacturing has a competitive landscape, and as we operate in a low volume industry, we implement technologies bringing value to remain competitive in the market.

How does Airbus Helicopters Canada take advantage of the supply chain in the region?

Airbus Helicopters makes use of some local suppliers in Fort Erie and Ontario. For example, we leverage the metallic manufacturing capabilities of the local supply chain. However, for suppliers in Ontario to remain competitive globally, there has to be a consolidation of the supply chain. We are looking to reduce the number of Tier 1 and Tier 2 suppliers, and thus companies must merge or partner to provide a wide range of capabilities at one shop. The consolidation of the supply chain is currently a global trend, but SMEs are adapting too slowly to this new reality.

What are Ontario's strengths with regard to the aerospace industry?

One of Ontario's strengths is the availability of a highly talented and experienced workforce. The people in the region are passionate and motivated as well as engaged in their businesses. The strength of our Fort Erie operations lies in the people we employ. The current challenge is to engage the younger generation at an early age in the aerospace industry and to retain the talent.

The government should provide stronger support to the aerospace industry in Ontario, in order for the region to remain globally competitive. Also, Ontario should not be in competition with Quebec, but work together for the Canadian Aerospace industry to become a stronger competitor in the global aerospace market.

In 2016, the global demand for helicopters decreased. How is Airbus Helicopters Canada positioned in the current downturn?

Since 2013, the market has decreased by 40% and Airbus Helicopters Canada has been affected by the economic downturn generated mainly by the decrease in oil and gas prices. However, we have fully compensated by increasing our market share, and through business diversification in the composite manufacturing sector where we won a substantial tender.

How will the trend towards UAVs affect the helicopter industry?

Going towards the future, UAVs will have a greater impact on the helicopter market, and Airbus Helicopters has invested to enter the UAV market with the right product. The Airbus Group has launched UAV programs both on the commercial and military sides of our business. Although we are still in the development phase, these are markets we follow closely.

What is Airbus Helicopters' strategic growth plan for the next three to five years?

We expect the market to recover in two to three years and Airbus Helicopters Canada wants to continue to be the helicopter provider of choice for our customers when the demand increases. Our goal is to remain the number one helicopter manufacturer in the world and continue to be recognized for our customer service. We also aim to retain our high market share in the future. We will continue expanding our composite manufacturing and maintenance and overhaul capabilities in order to improve the competitiveness of our product.

Edward Hoskin

Vice President
PRATT & WHITNEY CANADA

What is the strategic importance of your Ontario operations to Pratt & Whitney Canada?

P&WC has more than 87 years of history in Canada with a strong presence across the country and major facilities in Alberta, Ontario, Quebec and Nova Scotia, employing more than 6,000 people. This includes 1,400 professionals in engineering at the R&D facilities in Ontario and Quebec.

In Ontario, our Mississauga facility was established in the early 1980s, and now is a 290,000 square foot state-of-the-art aerospace design, development and production center located near Pearson International airport. Approximately 700 employees work in our Mississauga facility and 450 of these are engineering professionals. The facility is a center of excellence for assembly and test of turbofan engines, and it has become a world leader in design innovation and manufacturing agility. The items produced here power some of the world's most successful aircraft.

As a leading investor in R&D, what R&D activities do you carry out from your Ontario facility?

P&WC has a long-established commitment to investing in R&D to spur innovation. With an average of $500 million in annual R&D investments over the past 10 years, it ranks among the top Canadian R&D investors. Generally speaking, over $150 million is invested each year in specific R&D activities at the Mississauga facility, and numerous collaborative programs are in place with universities and technical colleges to ensure a steady injection of talent and technology. Going forward, Mississauga will continue to account for approximately 35% of our R&D initiatives in Canada.

We currently produce several engines within our PW300 family for customers like Cessna, Dassault and Bombardier. We also test the PW100 turboprop engine in our Mississauga facility. Going forward, our Mississauga facility will continue to be very active in the development of the next generation of green engines.

How does P&W Canada support environmentally-sustainable initiatives?

Pratt & Whitney Canada's approach to sustainability is comprehensive. We are committed to bring to market environmentally friendly engines that are designed, produced and operated to minimize impact on the environment throughout their entire lifecycle. Today, Pratt & Whitney Canada is working on some 600 environmental projects in collaboration with 20 universities across the country.

Twenty years ago, jet fuel was 60 cents a gallon, now it's $3 a gallon. People did not pay attention to climate change 20 years ago, we care very much now. As the world becomes more responsible in terms of climate change it means our industry must do an even better job of being a good steward of the environment.

Additionally P&WC, as the rest of the aerospace industry, is working towards certifying all its engines for the new biofuels. Renewable fuels will be a major contributor to reduce aviation's carbon footprint over the next 40 years. These fuel sources must be renewable, sustainable and non-competitive with food and fresh water resources. Sustainable biofuels will be gradually introduced in small blend ratios, and their use will increase over time as the infrastructure is developed. P&WC is working closely with other divisions of UTC to further understand the applicability of alternate fuels, including fuels derived from coal, natural gas and other sources. The collaborative program funded by the Canadian and Indian governments provides opportunities to work with institutions in Canada such as Ryerson University in Ontario.

Could you provide examples of how you are incorporating Industry 4.0 into your technology?

In the long term, innovation will be the key global differentiator for manufacturing in Ontario. Therefore, a significant portion of our R&D investment is in advanced manufacturing technologies. These investments are key enablers in our overall strategy to deliver high performance, highly reliable and sustainable engines. The new PW800 engine family is one of the first products to benefit from these emerging technologies. Our market success with the PW800, and related product families, has allowed us to rethink our manufacturing strategies.

These new manufacturing cells leverage the concept of process intelligence. In practical terms, this means the convergence of human intellect and knowledge, advanced information technologies such as big data analytics, and advanced manufacturing science. This convergence has become known as Industry 4.0, or the 4th Industrial revolution. The resulting production systems are sometimes referred to as Smart Factories.

Benjamin Smith

President of Passenger Airlines
AIR CANADA

Air Canada is one of the country's flagship companies. Could you provide an overview about its operations?
Air Canada is Canada's largest domestic and international airline with more than 400 routes, serving more than 200 airports on six continents. Canada's flag carrier is among the 20 largest airlines in the world and in 2015 served more than 41 million customers. Air Canada provides scheduled passenger service directly to 64 airports in Canada, 57 in the United States and 90 in Europe, the Middle East, Africa, Asia, Australia, the Caribbean, Mexico, Central America and South America. Air Canada is a founding member of Star Alliance, the world's most comprehensive air transportation network serving 1,330 airports in 192 countries. Air Canada is also the only international network carrier in North America to receive a Four-Star ranking according to Skytrax.

What is Air Canada's economic impact in Ontario?
Air Canada is the largest carrier operating in Ontario, serving all regions of the province. It is the single largest carrier at Toronto Pearson airport. The airline has more than 15,000 active employees in Ontario, including Air Canada Rouge and Air Canada Vacations. It pays salaries and wages in excess of $1 billion annually and has total expenditures of approximately $3 billion.

How important is Ontario and the GTA for your overall global business?
Toronto-Pearson is Air Canada's global hub with 800 departures and arrivals per day. In 2015, we carried more than 21.7 million arriving and departing customers, which is roughly half of our customers. From Toronto, we provided scheduled passenger service in 2015 directly to 32 airports in Canada, and more than 50 in the United States and 75 in Europe, the Middle East, Africa, Asia, Australia, the Caribbean, Mexico, Central America and South America.

You recently started construction for a $90 million hangar that will be the largest one in Canada by 2018. What are your expectations for this project?
Air Canada is demonstrating its commitment to international expansion at its Toronto global hub by investing $90 million on this project. We have grown our Toronto operations by more than 50 per cent since 2009. This building, our second major construction project in the Greater Toronto Area following the opening of a $60 million operations center in Brampton in 2013, will support Air Canada's future growth by giving us state-of-the-art maintenance, storage and training facilities in an environmentally-friendly structure.

As President of Passenger Airlines Canada, what trends in air travel do you see in the coming 5 to 10 years?
We anticipate increased growth in all segments. We expect that a number of global hubs will emerge where international traffic flows converge and connect, and that Toronto is well positioned to capture a disproportionate share of this traffic. In particular, we have a focus on U.S. originating and destined connecting traffic and we believe we can attract an increasing share of this as Pearson is superior to other large U.S. international airports, such as Chicago or New York.

As a result of increased passenger air travel can you describe Air Canada's Toronto global hub expansion plans?
We have increased capacity from Toronto by 56% since 2009. We plan to continue adding international capacity as we obtain additional aircraft. In 2017 we will take delivery of nine additional Boeing 787 Dreamliners, bringing the number of these aircraft in our fleet to 30 (with the ultimate objective of having at least 37). As well, we begin taking delivery of new Boeing 737 Max aircraft this year (we plan to acquire 61 of these aircraft type) and the first of our order of Bombardier CSeries jets in 2018 (we have firm orders for 45 of these).

In what ways can Ontario leverage its capabilities and take advantage of the opportunity to grow its aerospace sector, particularly within the MRO segment?
The Ontario government can support our expansion in several ways. One is to ensure we are cost competitive and that is why we have asked the government to reconsider its plan to double aviation fuel excise taxes by 2017. A second opportunity for the Ontario government is to invest in transport infrastructure to improve access to Pearson. At present congested highways and limited rail access make it difficult to get to the airport.

The Productivity Challenge in Ontario Aerospace

Bruce Simpson, *Senior Partner, McKinsey (Toronto office).*

Pamela Cohn, *Engagement Manager, McKinsey (Washington, D.C. office).*

McKinsey&Company

The commercial aerospace industry is in the midst of one of the greatest "super-cycles" in the history of the sector. Commercial aircraft deliveries have been steadily rising since 2003 —a 13-year run of steady growth in a cyclical industry used to experiencing cycles of approximately 8 years. Over the past 10 years, the industry has seen deliveries grow at a steady rate of 5.7% per annum.

This upswing in the commercial aerospace industry has been driven largely by the rise in passenger traffic (growing at 5 to 6% per annum over the past 5 years), fueled in part by the rise in low-cost air carriers and record high backlogs that have insulated the industry from market fluctuations. In tandem, business aircraft have been slowly recovering after the financial crash, with aircraft deliveries growing since 2012, but levelling off to a flat to slightly declining market in 2015/2016.

This market upswing has been important for Ontario, which is a hub for aerospace activity. Fourteen of the top 25 aerospace companies have a footprint in the province, with $5.3 billion in annual sales and more than 17,000 skilled workers.

"The commercial aerospace industry is in the midst of one of the greatest 'super-cycles' in the history of the sector. Over the past 10 years, the industry has seen deliveries grow at a steady rate of 5.7% per annum."

This opportunity for the sector has been matched with increased pressure to tighten innovation cycles and "bend the cost curve" to provide more affordable solutions. This pressure has come from airline customers that are trying to increase the affordability of their services (i.e., low-cost carriers, greater fuel economy), as well as from new competitors as supply chains begin to globalize, and new, highly skilled competitors enter the market from lower-cost countries. As a result, aerospace players are facing the dual challenges of trying to increase innovation and performance, while cutting costs and boosting affordability.

Ontario is a relatively high-cost location. Therefore, aerospace suppliers need to take a hard look internally at their operations and cost structures to drive productivity, and they need to work with their own suppliers and OEM customers to improve performance along the entire supply chain.

Five levers can help them achieve operational excellence:

1. Drive engineering efficiency through design to value. Value engineering increases focus on delivering performance improvement where customers want it most, and it helps identify and pursue optimization and cost reduction throughout the engineering and supply chain management process. Engineering efficiency improvements can have an impact of greater than 30% on engineering costs.

2. Optimize labor efficiency. Ontario's aerospace suppliers can help drive affordability though optimizing labor spend. Companies can employ a variety of levers: improving labor productivity,

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To compete, this emphasis on operational productivity needs to extend far beyond the suppliers' corporate frontiers, expanding into their supply chains as well.

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reducing re-work, strengthening labor planning and scheduling, optimizing contractor spend and rates, reducing overtime usage, optimizing front-line leadership spend, etc. Labor efficiency savings potential tends to range from 20 to 30% for the sector.

3. Rationalize the cost base. Direct and indirect materials spend should be assessed for opportunities through re-using design and specs, designing to customer value, capturing value from suppliers, rationalizing footprints, optimizing *capex* and maintenance, etc. In the aerospace industry, direct cost savings tend to range from 10 to 25%, and indirect cost savings range from 20 to 30%.

4. Embrace digital. Digital has transformed many industries — and the aerospace industry is just beginning the journey. Adopting a digital approach can help Ontario's suppliers drive productivity and create value across a range of levers from labor costs to customer relationships. Digital adoption savings for aerospace companies range from 10 to 20% cost reduction on the Bill of Materials (BoM) to an additional 3 to 7% in labor efficiency.

5. Leverage Automation and Industry 4.0. Assembling a plane is still manually intensive. Fully leveraging advanced operations, advanced analytics, and the internet of things will be important at each stage of manufacturing and assembly. Aerospace should be among the leaders in seeking new automated technologies for manufacturing.

Comprehensive operational productivity programs that focus on applying these five levers are key to ensuring Ontario's aerospace suppliers' competitiveness in the increasingly global aerospace market. Leaning out the business and driving productivity will help them increase their performance and innovation, while helping bend the cost curve.

To compete, this emphasis on operational productivity needs to extend far beyond the suppliers' corporate frontiers, expanding into their supply chains as well. To achieve the quality and affordability required to compete in today's market, aerospace suppliers need to cultivate lean supply chains that encapsulate peak operational productivity, quality controls, and logistical excellence throughout the system. Aerospace players need to institute effective inventory management by avoiding WIP and inventory costs through streamlining delivery schedules and increasing their reliability.

Recognizing the need for operational productivity throughout the aerospace business system, OEMs have led programs to improve supply chain performance over the past few years. At a high level, these programs entail cutting costs, streamlining WIP and inventory costs—with suppliers holding more of the parts than before—and changing payment structures (with pay periods extending to 120 days). Some of these programs have already resulted in more than 15% in cost reductions throughout the supply chain.

Ontario has a strong track record of excellence in aerospace manufacturing. The province has high-quality and well-trained engineering and manufacturing workers that have consistently delivered world-class products and aircraft. As a result, Ontario's aerospace industry has a strong legacy. However, to successfully leapfrog other regions and win in an increasingly challenging global market, the sector needs to leverage these legacy strengths and increase its efforts to improve productivity. —

Image courtesy of Air Canada

LANDING GEAR EXPERTISE

"Ontario is the global hub for landing gear. With this established core of Tier 1 landing gear companies we also have a mature, well situated local supply chain which we rely heavily on for the manufacturing of smaller detail parts and special processing capabilities such as heat-treatment and plating."

- Deane Weatherby,
VP North American Programs, Landing Gear and Integration Division,
Safran Landing Systems

A Leading Provider of **Landing Gear Systems**

Ontario is increasing its dominance in this sector with new investments

Aerospace has a strong legacy in Ontario, and landing gear manufacturing has over a 100-year history in the region. Ontario began producing landing gear systems in the first half of the 20th century to accommodate demand during wartime, and continued exporting them internationally throughout the second half of the century.

Landing gear systems are a crucial part of every aircraft, and one that must function each and every time. They enable the suspension of the aircraft into the air during take-off, the landing back onto the ground, as well as braking the aircraft to a halt. Landing gears are therefore expected to hold the entire weight of an aircraft, arguably making them the most complex engineering aircraft subsystems.

Ontario manufactures between 40 and 50% of the world's commercial landing gear systems, and the region hosts four international landing gear titans: Héroux-Devtek, Safran Landing Systems, Sumitomo Precsion Products Canada (SPP Canada) and UTC Aerospace Systems.

Formerly Messier-Bugatti-Dowty, Safran Landing Systems has been operating in Ontario for over 70 years, and moved to their current facility in Ajax in 1949. Operating since before the Second World War, Safran continuously builds on its legacy to create expertise and sell their landing gears on major global platforms. Although Safran has worldwide operations, the deeply ingrained expertise in their Ontario operations is difficult to recreate. "Ontario is the global hub for landing gear and there is a significant concentration of landing gear manufacturers here bringing a wealth of experience and capabilities," said Deane Weatherby, vice president of North American programs for Safran Landing Systems.

UTC Aerospace Systems, formerly Goodrich Aerospace, has facilities in Oakville and Burlington with landing gear operations and MRO capabilities respectively. They pro-

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Deane Weatherby

VP of North American Programs, Landing Gear, and Integration Division
SAFRAN LANDING SYSTEMS

Could you give a brief introduction to Safran to our readers?
Our company, Safran Landing Systems, is part of Safran, an international high-technology group and member of the CAC 40 in France. The Group employs over 70,000 people worldwide, in 60 different countries and holds world leadership positions in its core businesses: aerospace, defense and security. Safran Landing Systems is organized into four operational divisions: Landing Gear and Systems Integration (the largest division), Systems Equipment, Wheels and Brakes, and MRO. In May 2016, Safran changed the names of all the Group companies to include the Safran name. We are thus no longer Messier-Bugatti-Dowty, but Safran Landing Systems. With over 50% market share in the landing gear sector, we are the world leader in aircraft landing and braking systems and a partner to more than 30 airframers, including Airbus, Boeing, Bombardier and Dassault.

Could you elaborate on Safran Landing Systems' presence in Ontario?
Safran has been operating in Canada for over 70 years and is now a major local player in our three core markets with 1,200 employees across the country. We moved our site to Ajax, Ontario in 1949 and consolidated operations at the current site in 1968. Safran's plant in Ajax is a full service facility where we specialize in the design, development, production and maintenance of aircraft landing systems for military and commercial aircraft. We employ approximately 700 people on-site, including technicians, engineers, MRO personnel, a systems integration team and other industry professionals. We have a specific systems and equipment skill set here in Ajax, as on the Bombardier platforms we supply all the systems and equipment as well as the landing gear. We also have on site a state of the art test facility where we perform various qualification tests on new landing gear such as strength, fatigue, endurance, environmental, and drop test.

What are some of the benefits of operating in Ontario?
Ontario is the global hub for landing gear. With this established core of Tier 1 landing gear companies we also have a mature, well situated local supply chain which we rely heavily on for the manufacturing of smaller detail parts and special processing capabilities such as heat-treatment and plating. Overall, Ontario has ingrained knowledge, a broad skill base and significant local expertise. The province has developed a very mature supply chain and a supporting infrastructure that includes world class technical post-secondary institutions.

What differentiates Safran in a competitive market?
Safran Landing Systems is the world leader in aircraft landing and braking systems. Operators and airframers understand that we are on the leading edge in terms of material technologies, corrosion prevention and costs. Our capabilities encompass the full life cycle of our products from research and technology to development, manufacturing, support in service and maintenance.
Within Safran Landing Systems, we are able to cover the full ATA chapter 32 of commercial aircraft landing systems, which allows us to deliver system solutions and integrated landing system packages to our customers. This capability offers airframers a single source for their needs, saving time and cost.

How is Safran adapting to light weighting and reducing fuel costs?
We are meeting today's stringent requirements around weight and fuel consumption through several different strategies, one of them being the use of different materials. The Boeing 787-8 was the first commercial landing gear to have large structural components made from a composite material which is significantly lighter. Safran Landing systems has also leveraged its global demand for titanium to cost effectively incorporate, where appropriate, more of the light weight, corrosion resistant material into some of our designs.

On what other areas is Safran focusing R&D?
Safran Landing Systems is at the leading edge of developing an electric taxiing system. A green taxiing system can significantly improve airline operational efficiency by reducing fuel burn and other taxi related costs, as well as providing environmental benefits by cutting the carbon emissions. Using the Auxiliary Power Unit (APU) generator to power motors installed on the main landing gear wheels, electric taxiing allows aircraft to push-back from the gate without requiring the use of the engines.

What is your expectation for the company going towards the future, after the rebranding?
The aim is to generate a wider understanding of who Safran is. We are not individual pieces of a puzzle, but rather a large group with a shared culture of leading edge technology and innovation. This change should provide our market place with a clearer view of Safran's capabilities and allow us to leverage each of the group companies' specific strengths to provide our customers more complete and competitive offerings.

Frank Karakas & Tim Whittier

FK

FK: Vice President Airbus Business Unit
TW: Director Government Relations
UTC AEROSPACE SYSTEMS

Could you introduce UTC Aerospace Systems with a brief overview of the company's presence in Ontario?

TW: UTC Aerospace Systems has annual sales of $14 billion, and we are part of the landing systems business unit comprising landing gear systems, wheels, and brakes. In Ontario, we design, test, and manufacture landing gear for a variety of commercial aircraft. In Oakville we have about 840 employees. We also have an MRO shop in Burlington with 140 employees.

Airbus and Boeing are two of our key customers for whom we produce landing gear for a number of their aircraft programs. Although the production of large landing gear represents the bulk of our manufacturing activity in Oakville, we also supply landing gear systems for Bombardier's Q-400 and CRJ regional aircraft. For the business jet market, we manufacture landing gear for Gulfstream's large-cabin aircraft. Within the Oakville site, there is also a small team that manufactures and overhauls flight control systems.

FK: Some of our areas of specific focus are advanced materials and coatings, manufacturing and electrical technologies, simulation and modeling. An emerging focus area is digital strategy. UTC Aerospace Systems currently collects a vast amount of engineering, business and SAP data within the business. Our digital strategy is focused on utilising this data to provide further value to our customers.

What steps have you taken to improve productivity in Ontario?

FK: Our Ontario operations have seen a significant gain in productivity over time. This has partly been done through the introduction of automated equipment and multitasking, implementation of LEAN initiatives that have reduced travel distance and flowtimes, and improvements in engineering technology and design tools. Our people philosophy and culture are crucial as well in order to promote productivity, creativity and innovation. As manufacturing and engineering capability becomes more commoditized, a key differentiator will be our people.

How are you using advanced materials and coatings to optimize cost and weight as well as reduce noise?

FK: Weight is a key factor in landing gear design. Landing gears are primarily metallic, with little current use of composites. Our R&D programs are developing composites, as well as metallic variants, to reduce weight, cost and improve reliability. From an environmental perspective, it is believed that landing gears generate as much as 25% of an aircraft's noise during landing, and noise mitigation is an emerging area of focus.

There is increased pressure from the OEMs to consolidate the value chain. What should Ontario suppliers do to remain competitive?

TW: In terms of consolidation, we will partner with companies with the potential to grow with us, broadening their capabilities and taking on more responsibilities, such as design and testing. UTC Aerospace Systems has a supplier development organization which shares best practices with key suppliers and helps to advance their internal processes. Additionally, we are committed to implementing long-term agreements with many of our key suppliers.

FK: We want suppliers which are willing to take on greater risk-sharing responsibilities. A competitive supply chain should be mature enough to accept greater program risks and have the capability to manage these risks.

Landing gear is expected to be a $5.3 billion industry by 2020. How can Ontario best take advantages of the available opportunities?

FK: Ontario needs to keep moving vertically up the value chain. It will be increasingly difficult to compete at the lower levels of machining, which are increasingly being offshored. The government, industry, and academic institutions, should work in close collaboration on research initiatives as well as workforce development.

TW: While some of Ontario's aerospace companies do have established relationships with leading academic institutions, the government can play a more proactive role in helping to formalize linkages and to foster collaborative research. The Downsview Aerospace Innovation and Research (DAIR) initiative is an excellent example of industry, academia and government all working together to create an aerospace hub at Downsview Park in Toronto. It is expected that the co-location of industry and academia will create synergies that will increase the level of collaborative research, improve the relevance of aerospace-related education and training, and fundamentally strengthen Ontario's aerospace sector.

Image courtesy of Bombardier

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duce landing gears for various aircraft, including the largest commercial aircraft in the world, the Airbus A380. UTC Aerospace Systems is a $14 billion business worldwide, yet they see growth potential within their Ontario landing gear operations. “Since 1985, the site has roughly doubled in employees but tripled or quadrupled in revenue, so our labor productivity has almost doubled,” said Frank Karakas, vice president of UTC's Airbus Business Unit.

UTC Aerospace Systems draws from the highly qualified workers in the region, and stresses the importance of a people culture in operations to increase productivity.

Although Safran and UTC together make up 80% of the world’s commercial landing gear business in revenue figures, Héroux-Devtek and SPP Canada are also important contenders in the market, attaining significant international contracts.

Héroux-Devtek has been present in Ontario since the 1970s. Recently, it invested $50 million in a new 110,000 square foot facility in Cambridge, Ontario to accommodate larger contracts. The expansion shows a commitment to growth and development of its landing gear sector in Ontario and is an example of a company leveraging the region through capital investments. “Almost all the major players in the landing gear industry are located in Ontario, and thus there is significant competition in the market,” said Jack Curley, vice president for Central Region at Héroux-Devtek.

Even though landing gear contracts are long-term, competition is strong in Ontario, and recently Héroux-Devtek became the new sole supplier of landing gears on the Boeing 777 and its eventual replacement 777x, in a contract beginning in 2017.

Sumitomo Precision Products Canada (SPPCA) is the most recent landing gear company to enter the Canadian market. With a long heritage in Japan, SPP moved their global operations for landing gear systems into Ontario in 2012 to take advantage of the landing gear expertise and the closer proximity to American and European customers. SPPCA showcases how the landing gear industry in Ontario attracts foreign direct investment into the region. With companies such as SPP joining Ontario’s aerospace industry, the sector is diversifying its capabilities. “We are not competing with the major players in the market such as UTAS and Safran, who work with larger aircrafts, while our focus is mainly small to medium sized landing gears,” said Eli Brigler, CEO of SPP Canada.

The four landing gear titans are able to gain global competitive advantages by leveraging Ontario’s established supply chain and the expertise in the region. “Ontario’s supply chain has grown to support the industry, making manufacturing capacity and skills available, and allowing us to locally source items for landing gear production,” commented Tim Whittier, director of government relations at UTC Aerospace Systems.

Companies such as Nu-tech Precision Metals developed unique processes to supply titanium extrusions for landing gears. Brotech Precision CNC, Koss Aerospace, Magellan Aerospace, Noranco, Universal Precision Technology, and VAC Aero are all examples of companies feeding into landing gear companies’ supply chains. These aerospace SMEs create the necessary efficiencies in their operations, enabling the local landing gear ecosystem to reduce costs and enhance competitiveness.

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Indeed, more companies are refocusing their manufacturing capabilities to feed into landing gear supply chains. For example, Exactatherm has identified the increased demand for landing gears, and its president, Peter Lidster, said: “Since 2008, there was a tremendous push for expanding landing gear facilities here in Southern Ontario, and companies were looking for suppliers. We have now increased our capacity by between 200% and 300% in the last three years to be able to handle landing gear components, investing quite heavily in machinery and technology.”

With regards to R&D, cutting fuel costs has driven companies to invest in developing new materials for landing gears resulting in the recent trend to light weighting. Titanium is a metal with the strength of steel but only 70% of its weight, and is therefore increasingly appearing on new landing gears. Companies are also placing R&D efforts to developing composite materials. For example, Safran Landing Systems produced the landing gears for the the Boeing 787-8, the first commercial landing gear to have large structural components made from a composite material, and the only aircraft flying today with composite structural landing gear components. All companies and their suppliers are looking to light weighting landing gear systems to remain competitive in the market. Landing gear systems’ design has not significantly changed, but Ontario has the ability to lead innovation, incorporating new materials and processing.

The landing gear market is projected to increase in the coming years, and it is estimated that by 2020, landing gear will become a $5.3 billion industry. Ontario needs to take advantage of this increased global demand and grow its aerospace capabilities from the large landing gear companies across the supply chain. —

Jack Curley & John Miller

JC: Vice President for Central Region
JM: Plant Manager for Cambridge
HÉROUX-DEVTEK LANDING GEAR DIVISION

JC

Can you give a brief overview of Héroux-Devtek's presence in Ontario?
JC: Originally owned by Bombardier, Héroux-Devtek started in Longueuil in 1942 as a general machine shop. The company was bought out by management in 1985, and in 2000, Devtek merged with Héroux forming the current company. The Ontario facility in Kitchener is a legacy of the Devtek side of the business, in operation in the region since the early 1970s. In 2015, we inaugurated a new state-of-the-art manufacturing facility for landing gear in Cambridge, as our operations in Ontario focus on landing systems.

What are the capabilities of the Cambridge facility?
JC: When we won the Boeing 777 contract, Héroux-Devtek bought the Cambridge site, mainly for manufacturing larger parts that could not fit in any of our other facilities. The Cambridge facility is approximately 100,000 square feet and houses 12 CNC machines, with some space to expand our operations. In Cambridge we employ about 35 people working on two shifts, and along with our Kitchener facility, we employ just under 200 people in Ontario.

What new technologies has Héroux-Devtek set up at the Cambridge facility?
JC: Héroux-Devtek has invested in programming and developing our machines as well as implementing more automation into our equipment. We moved away from one operator per machine to one operator for every two or three machines, reducing our labor costs and assisting us in staying competitive in the market. By continuously improving our efficiency through implementing new technologies such as automation, Héroux-Devtek is a leading industry example in terms of productivity. We also have virtual software allowing us to eliminate mistakes before they happen on the shop floor.
JM: In all Héroux-Devtek sites, continuous improvement is engrained in our culture. We constantly review our processes and aim to challenge the norm. We always test new tooling and train our programmers to utilize our machines to the best of their abilities. With our new five axis machine, we ensure the efficiency of our operations.

What are Héroux-Devtek's products and services in terms of landing gear?
JC: Héroux-Devtek grew up as a Tier 2 company to our customers, and our different divisions have supplied landing gear to manufacturing partners such as Boeing, Goodrich, Messier-Dowty, and the U.S. military. Our Ontario operations predominantly service Boeing and the military. Our products and services include landing gear, repairs, spare parts, new parts, and we also conduct engineering in Québec and in the U.K.

As a world leader in landing systems, what gives Héroux-Devtek competitive edge in the market?
JC: Our flexibility is a great advantage and we provide innovative solutions to our customers. When we won the Boeing 777 contract, we significantly expanded our sites and operations as to fully support the contract. By quickly accommodating the demands of our contracts and implementing innovative technologies into our processes, we gain competitive advantage in the market.

What is the competitive landscape for landing systems in Ontario?
JC: Almost all the major players in the landing gear industry are located in Ontario. Our strategy was to focus on the military and business jet sector as to reduce our amount of competition, but we still jumped at the opportunity to attain the Boeing 777 contract. Ontario has a substantial amount of capabilities such as machining, and the government is also supportive of the industry. There is a cross over between the aerospace and automotive industries. The expertise transfer allows for the region to have enough skilled labor available for the aerospace.

What are Héroux-Devtek's goals for the next three to five years?
JC: Our aim is to keep expanding our business and facilities and continue delivering large contracts. We want to expand our Kitchener and Cambridge facilities and maintain them at full capacity. Ontario has a good basis, and we want to be involved in growing the Ontario aerospace industry further.
JM: The Boeing 777 contract raised our company to become a world leader in the landing gear industry and we would like to remain a preferred partner and leader in the sector. We aim to always be flexible and deliver good quality products, at competitive prices.

Eli Brigler

CEO
SPP CANADA AIRCRAFT (SPPCA)

Can you give a brief overview of SPP Canada and the company's evolution since 2012?
Established over a century ago, Sumitomo Precision Products (SPP) has a long heritage in Japan. In 2012, the company opened a facility in Canada (SPPCA) which is specializing in landing gear for commercial and business aircraft. At SPPCA we operate as both a Tier 1 and Tier 2 supplier in the Canadian aerospace sector and we have strong business connections with the larger Tier 1 landing gear companies. Our primary focus is design, assembly, and testing of landing gears, but we are also vertically integrated through our wholly-owned subsidiaries. For example, we acquired CFN Precision, specializing in the sophisticated machining of complex components, as well as Tecnickrome Aeronautique, which focuses on surface plating and processing to ourselves and our extended supply chain.

What is the strategic advantage of SPP's Canadian operations in the context of the global company?
SPP Canada's primary markets are North America and Europe, and from a time zone perspective, it is beneficial to be located in Canada, rather than in Japan. The capabilities in Canada are also an advantage, as the Toronto area has deep roots in the aerospace industry and a highly skilled technical workforce.

What are SPP's capabilities in Mississauga in terms of space, workforce, and equipment?
Our primary facility is over 100,000 square feet and we have responsibility for marketing, design, assembly, testing and shipping of final products to our customers. SPPCA has in-house design engineering capabilities and we outsource the manufacture of components to our subsidiaries and global supply chain.

Can you outline SPP's key products and expertise in landing gear?
SPP is currently working closely with UTAS on the CRJ700, CRJ900, and CRJ1000 platforms for Bombardier. We are also working on products for Gulfstream, Safran, and a FAR 23 Business Aircraft manufacturer. Since our inception, the assembly and Engineering support for these products has been transitioning from Japan to our facility in Ontario. SPPCA also recently started working on a new product for the Dornier Seawing CD-2, which is an amphibious aircraft. To satisfy the requirement for the aircraft to land on a runway and in both fresh and salt water, we designed a unique landing gear system made from stainless steel, which will be able to withstand these challenging environmental conditions. SPP in Japan also manufactures the landing gear for the Mitsubishi MRJ.

Ontario is home to 40% of the world's commercial landing gear systems. What is the competitive landscape in the province?
We are not competing with the major players in the market such as UTAS and Safran, who primarily work on larger aircraft. Our focus is mostly on small to medium sized landing gear systems. In this way, we are quite unique.

In what areas is SPP focusing its R&D?
SPPCA's R&D focuses on several areas including weight reduction of landing gear products. We are looking into innovative means of reducing weight while meeting the design requirements of landing gear systems. Another focus area for SPPCA is environmentally friendly coating technologies, where we are developing alternative coatings for landing gears. In addition, since landing gears tests are expensive and time consuming, we are developing analytical approaches to reduce costs and time associated with testing.
Being in Ontario, we take advantage of certain programs as well as collaborate with academic institutions on R&D activities. We have joint programs with universities, and we also give opportunities to young engineers to come and work in our facility and be part of our R&D programs.

What are SPP's goals for the next three to five years?
We are interested in growing the company with both airframe OEMs as well as the large Tier-1 players in the market, and we anticipate significant growth over the next five years. At the same time, we constantly have cost reduction pressures from the OEMs and our goal is to continually improve our efficiency and productivity in design, manufacturing and logistics infrastructure. I expect that Ontario's aerospace industry will continue to grow as Government, industry, and academia work together to develop educational programs to attract people to the aerospace industry.

Image courtesy of Airbus

ADVANCED MANUFACTURING

"In the long term, innovation will be the key global differentiator for manufacturing in Ontario. Therefore, a significant portion of our R&D investment is in advanced manufacturing technologies. These investments are key enablers in our overall strategy to deliver high performance, highly reliable and sustainable engines."

- Edward Hoskin,
Vice President,
Pratt & Whitney Canada

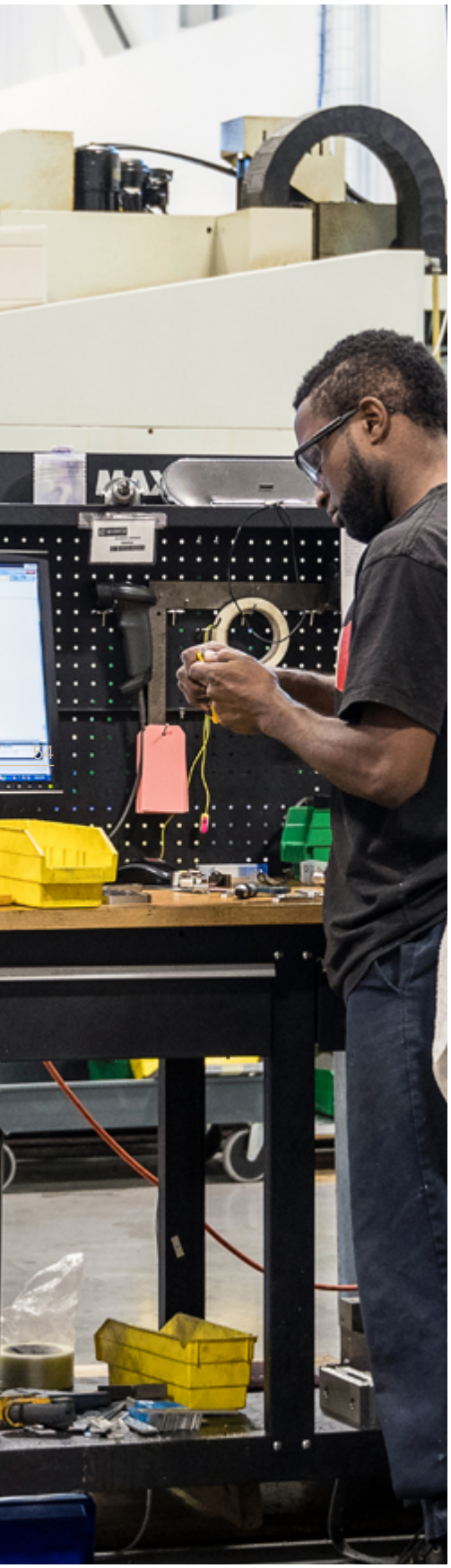


Image Shimco

The Advanced **Manufacturing Core**

From SMEs to large multinationals

The driving force behind Ontario's aerospace activity is the network of advanced manufacturing companies. Ontario generates 37% of the national GDP, and while the services industry is the province's driving force, manufacturing also plays an important role. Indeed, advanced materials and manufacturing are an integral component of the aerospace industry in Ontario. Its strong manufacturing legacy has allowed small and medium sized enterprises (SMEs) to grow and develop unique capabilities for the aerospace industry. "Our strengths lie in developing and utilizing complex processes which are not easily repeatable," highlighted Michael Iacovelli, CEO of Ben Machine Products & Co. SMEs are the backbone of the aerospace sector in the region and together they form an integral part of the ecosystem attracting 14 out of the world's top 25 aerospace companies, who have established themselves in Ontario and utilize the supply chain. Minister of Economic Growth and Development, Brad Duguid, said: "Ontario has the distinguished capabilities of producing advanced technological products, permeating from our long history of a strong manufacturing sector."

Historically, the chief manufacturing industry in Ontario has been the fabrication of automotive vehicle parts, and this trend has shifted to encompass the aerospace sector and the production of aircraft components. The shift from automotive to aerospace has been a necessity for many SMEs in Ontario.

St. Clair Technologies is an example of an SME with roots in the automotive industry that diversified into aerospace. Its President, Charlie Hess, said: "We are looking to reduce our reliance on the automotive industry, which is cyclical and mitigate risk by attaining more business in aerospace. We have a great opportunity to apply our automotive knowledge to the aerospace marketplace."

Additionally, SMEs such as CAN-ENG Furnaces International expanded into aerospace from supplying other industries. "CAN-ENG Furnaces can capitalize on our legacy and we are able to provide systems and equipment to the growing market place," said Michael Klauck, president and CEO.

Advanced manufacturing companies in Ontario have diversified into aerospace to avoid economic hits in cyclical trends. Established aerospace companies handle international contracts, and SMEs attract OEMs from other areas in Canada and across the world into Ontario as a result of their strong capabilities. The fact that Bombardier's supply chain for its Downsview facility relies on a network of more than 300 Ontario-based suppliers proves that many SMEs in the area profit from capital intensive contracts with OEMs. For example, under the Avcorp umbrella—a company that recently landed a $579 million contract with Boeing—Comtek Advanced Structures provides the floor panels for

Bombardier and feeds engineering solutions to OEMs. President Brent Collver said: "Comtek has the onsite capability to design, qualify, certify and release a part for air worthy production. The advantage of this is that we do not have to rely on approval from OEMs. Within our scope we have the ability to receive parts, perform an analysis, design solutions and prove they work."

Other examples are SMEs such as Brotech Precision CNC and Universal Precision Technology who both also handle contracts from OEMs by being niche players and carving out unique capabilities in the industry.

Beyond SMEs, the Ontario Aerospace sector is an ecosystem offering attractive capabilities to international companies. World leading aerospace companies such as Mitsubishi Heavy Industries (MHI) established operations in Ontario and take advantages of the local supply chain.

Ontario's aerospace manufacturers are part of the global supply chain for virtually every passenger aircraft in the world. Within this, advanced manufacturing has allowed aerospace to flourish in Ontario and become an industry with a myriad of companies across the value chain. International companies establishing operations in the region have also diversified the sector and bolstered growth.

However, aerospace in Ontario also faces some challenges, such as a productivity gap as compared to their international competitors, and pressures to consolidate the supply chain and decrease the number of suppliers. In order for Ontario's long-standing aerospace manufacturing to ensure a healthy future, companies need to incorporate new technologies, increase productivity and create partnerships with other companies to keep up with market trends. —

> "Ontario has advanced manufacturing capabilities to capitalize on. From a manufacturing perspective, automotive is ahead of the curve in terms of lean manufacturing and Industry 4.0. As a result of the low volumes in aerospace, the industry is behind. Aerospace companies fear that they do not have sufficient volumes to justify investment in new technologies."
>
> - Mark Makoukji, Managing Partner, P3 Group Canada

Brent Collver

President
COMTEK ADVANCED STRUCTURES

Could you give us a brief overview of Comtek Advanced Structures?

Comtek was established in 1994 as a composite repair facility for the regional aerospace industry. At that time, composites were new to the market and a significant amount of composite repair work was still undefined. The founders of the company, both engineers, had a long history in the aerospace industry, and their aim was to develop solutions for ailing problems on aircraft. Based on operator feedback, they designed and approved a replacement for floor panel with the objective of improving performance while retaining cost-effectiveness. This design was met with such strong results that Bombardier approached Comtek to participate on their Q400 aircraft program. This was the first point of entry into the manufacturing side of our business.

In 2008, Avcorp Industries acquired Comtek to add composite capabilities to their portfolio. Our repair capabilities also provided a strong balance to long-term manufacturing, as it can balance economic uncertainty. Comtek is currently a wholly owned subsidiary of Avcorp, and despite being an SME, we have a global customer base, actively serving between 250 to 300 customers per year.

What are some of Comtek's key products and services?

Comtek can be seen as two different companies working in harmony, as we have both a manufacturing and a repair side to the business. Comtek exclusively manufactures out-of-autoclave composites, which requires understanding the engineering and chemistry of how the materials work. We are a design-to-build company, which means that we design and analyze the components we manufacture and certify to the requirements of the customer. The repair business provides a very unique view of the full life-cycle of components and enables us to provide new and interesting engineering solutions to customers for future programs. A significant amount of our business is floor panels for OEMs such as Bombardier. We also supply floor panels directly to airline operators as aftermarket upgrades. For example, when an operator was experiencing an issue with its floor panels on a particular airplane, we evolved the design and added different constituent materials to solve the issue. The challenge was to improve durability while making the panel lighter and improving its long-term performance. Comtek's engineering solution was eventually fed back to the OEM as an improvement and incorporated into new aircraft designs.

What is the importance of "in-house" certification?

Comtek has the onsite capability to design, qualify, certify, and release a part for air worthy production. The advantage of this is that we do not have to rely on approval from OEMs. Within our scope we have the ability to receive parts, perform an analysis, design solutions and prove they work. Once the designs are certified by Transport Canada, we can repair components independently. We are therefore able to work quickly through challenges, cater to our customers' needs and offer solutions for a fraction of the cost of a new part. Comtek has more than 800 repair capabilities already designed, certified, and qualified.

Where are you focusing your R&D activities?

Under the Avcorp umbrella, Comtek carries out product and process innovation. Our R&D budget is split between product innovation and manufacturing efficiency. We also work closely with research institutions and universities. We have a technical lead who is responsible for marshaling different resources such as funding and university collaborations. He stands in the middle of academia, the industry, and the government to create as much leverage as possible.

What are Comtek's goals for the next three to five years?

Our goal is to create shareholder value and strive to continue to grow as we have for the past four years. About 85% to 90% of our business is exports and we aim to further grow our North American and international customer base. The aerospace industry has changed more over the last several years than it has over the last 20 years, and it will continue to do so with the entry into service of high composite aircraft (i.e. C-Series). There is an intense pressure to be cost competitive with top rate quality and the OEMs are aggressively pursuing cost reductions. We will therefore continue offering innovative, efficient and cost effective solutions to the aerospace industry.

Peter Voss

President and CEO
SHIMCO

Could you briefly introduce Shimco?
Shimco is a manufacturer of high precision parts, laminated and edge-bonded shims, tapers, and spacers. We are the only company in Canada supplying laminated shims to the aerospace, defense and space industries, with the people and equipment to make parts from start to finish. We can manufacture solid and peelable shims from as thin as .001" all the way up to any thickness required for a customer. All the materials we use are aerospace-approved and include aluminum, many types of steel, titanium, fiberglass and almost any polymer.
We rebranded in 2011 and decided to focus on the aerospace related industries, allowing us to more effectively utilize our world-class processes and quality systems. We are now a high precision company focused on aerospace, defense and space applications and have tripled our production over the last five years with that focus.

What was the strategy behind moving Shimco's facility to Cambridge, Ontario?
As the company grew over the years in Markham, additional rental units were added but the layout of the facility became unpractical for further growth. We chose to relocate in Cambridge for its large supply of skilled laborers, proximity to the high technology hub in Waterloo and lower operating costs.

With increased pressures from OEMs to lower costs, how do you remain competitive?
Shimco is automating its processes and has implemented a paper-less shop floor, maximizing the effectiveness of its MRP system. Automation is becoming a trend in the aerospace industry in Ontario, and we are minimizing the labor content in our operations. For example, we have a flexible machining cell that is able to process 32 work orders at once, with only one operator. We are also focused on attaining better cutting tools and reducing touch time on parts.

In what other areas are you focusing R&D?
One of our new offerings is an evolutionary metal coating, using an environmentally friendly form of anodizing called Plasma Electrolytic Oxidation (PEO). PEO offers a superior form of coating designed for high wear applications and high corrosion environments.

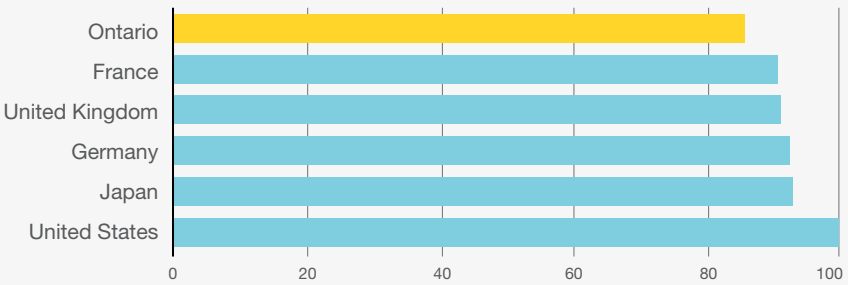
Can you outline some of the goals of your Centre of Excellence?
Shimco's Centre of Excellence will help advance specific research in advanced manufacturing processes and will allow us to incorporate some of those new technologies into our own products and processes. Consequently, we will be able to deliver improved and lower cost products to our customers. We recently received approval for a CARIC project, the first one in Ontario. We are taking the value available from local world-leading research institutions and applying it to real world products.
Ontario's R&D landscape is excellent and there is significant support from the government. Shimco is very focused on R&D and it helps that we get about 43% of our investment back from the government, which we then reinvest back into further R&D activities.

What are Shimco's goals for the future?
We want to be seen as a thought leader and the preferred partner for OEMs and Tier 1 companies. Technology is a big part of our strategy for growth and we want to offer unique technologies that the aerospace, defense and space industries cannot live without.

ONTARIO'S COST COMPETITIVENESS

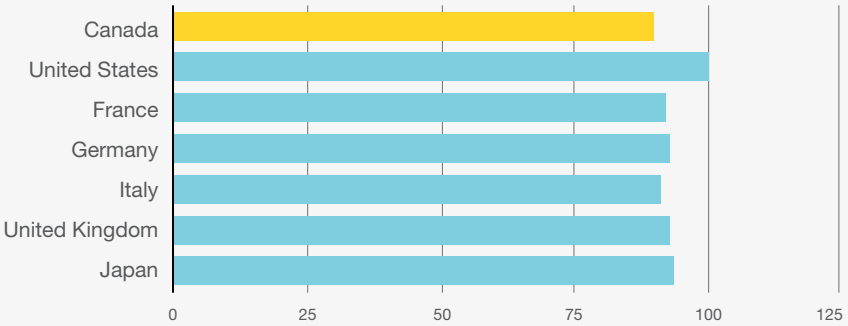
OVERALL BUSINESS COSTS IN ONTARIO ARE LOWER THAN IN ANY OTHER G7 NATION

Source: Invest in Ontario



OVERALL CANADA AEROSPACE COSTS AS COMPARED TO OTHER COUNTRIES

Source: KPMG Competitive Alternative 2016 Report



ECONOMIC INCENTIVES IN PLACE

Source: Invest in Ontario

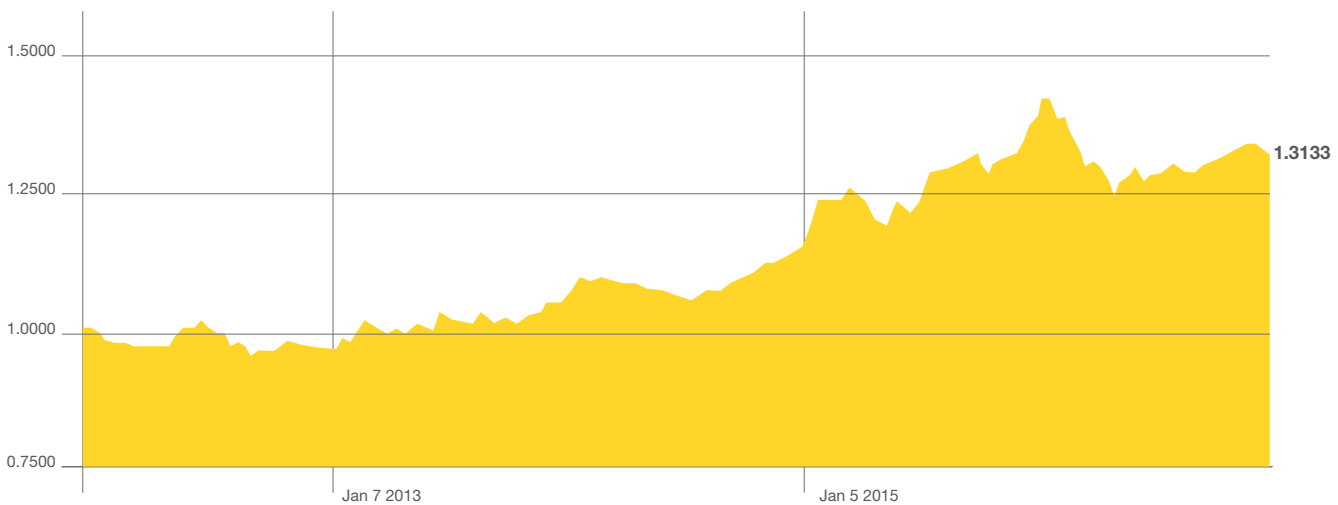
Jobs and Prosperity Fund:
$2.7 billion over 10 years

Strategic Aerospace and Defence Initiative (SADI):
$1 billion over 5 years

Technology Demonstration Program:
$50 million annually.

FAVORABLE USD/CAD EXCHANGE RATES

Source: Yahoo Finance. 5 years up to Dec 12th, 2016



Peter Lidster

President
EXACTATHERM

Exactatherm was established in 1979. Could you give a brief background of the company?

Exactatherm, originally part of the Exacta Group, started as a vacuum heat treatment company. Our focus was originally on the automotive, tool die, and plastic mould industries, as well as providing heat treatment services for the Exacta Group itself. We decided to diversify into energy and aerospace in the 1990s. The aerospace share of our business increased from 5% to 30%, and today accounts for 60% of our total business portfolio. As a small company we can respond to needs very quickly, as we do not have a long chain of command that needs to be consulted in order to make an investment. We have now increased our capacity by between 200% and 300% in the last three years to be able to handle landing gear components, investing quite heavily in machinery and technology. We currently have parts in our furnaces being processed for Airbus and Boeing's 787, for example, and we are on most major platforms including Bombardier.

What attributes do your clients appreciate the most?

We are highly technical and well qualified, but also nimble on our feet. Furthermore, we are very focused, which gives us the chance to be highly specialized. Although we are a small company, we have four graduate metallurgists on board, two of which are PhDs, and we have been focused on specializing and developing our more advanced technologies. At the same time, as a small company, we see ourselves as part of the innovation chain.

Our roots in the automotive industry, in which there is a strong emphasis on delivery time, have made us more customer-oriented than many of our competitors. Requests come in daily for on-the-ground aircraft services, which we always prioritize, and the parts will leave here the following morning.

Exactatherm has established a relationship with a number of universities. Could you give some further insight into these ventures?

There are many centers of excellence in Southern Ontario, and the various institutes present in the region offer a great advantage. We work closely with them to develop new technologies including plasma processing, such as ion nitriding and advanced coatings. We are Canada's largest processor of ion nitride and we will continue to develop this process.

We invest at least 10% in R&D annually, allowing us to remain on the cutting edge of technology. Although our facilities include a metallurgical lab, this is primarily for meeting specifications, and we therefore rely on the university facilities. We have recently completed an R&D project with a student at the University of Windsor working on her PhD to develop plasma ion nitriding of titanium alloys, which are currently at the very forefront in aerospace.

What are your key objectives leading up to Exactatherm's 40th anniversary?

Our first objective is to consolidate our position as a supplier of choice of heat treatment services to the aerospace industry in Ontario. We will support our customers in their growth by supplying services which are highly qualified, expeditiously delivered at the best possible price.

Our second objective is to remain a leader of R&D, both in heat treatment as well as surface enhancement processes, by having the most highly qualified metallurgical staff in the industry. This way Exactatherm will be at the forefront for future platforms.

Alex Cajic

Vice President
KOSS AEROSPACE

Could you walk us through Koss Aerospace's main milestones?
In 1975, Koss Aerospace started manufacturing components for De Havilland's DH-7 and McDonnell Douglas' MD-80 and DC-10. Although we still manufacture for these same customers—now Bombardier and Boeing—we have significantly grown in size. We originally serviced local customers, but have evolved to more international markets, and now export the majority of our sales.
We manufacture structural aircraft components comprising of high-speed, multi-axis machining found on commercial aircraft wings, doors, and the bones of the aircraft. We are also involved in sub-assemblies and metal finishing, so we are able to provide surface treatments. In Mississauga we do three, four, and five-axis machining, primarily aluminium and high-speed raw materials. We are vertically integrated to offer our customers complete machining, sub-assembly, and metal finishing without relying on third-party customers.

What makes Koss Aerospace a trustworthy partner for large OEMs?
OEMs are pressuring companies across the value chain to increase productivity and lower costs. Automation provides us an opportunity to compete efficiently and profitably in the market, and it enhances our performance and our ability to provide on-time delivery. Additionally, our machining capabilities are unique in the industry.
Our sourcing of raw materials is customer-driven. For example, Boeing dictates for us where to source the materials. Similarly, Bombardier has their umbrella of preferred local sources.

What is the strategic advantage of being based in Ontario and Mississauga specifically?
Ontario has a good infrastructure for world-class manufacturers. Over the years, companies have grown and their capabilities have become more sophisticated. There is a broad spectrum of SMEs in Ontario with advanced capabilities. The competitive landscape in Ontario is strong, but the market is broad enough for everyone to prosper. Therefore, our niche focus is aluminium, and there are few players as strong as us in this regard.
Mississauga has a strong pool of skilled workers for the aerospace industry, which is crucial for our business. On our processing side, we source surface treatment and other services from local companies. We are also strategically located close to Pearson Airport.
Moreover, we have taken advantage of Federal Funds such as TPC, propelling us to the next level. The funds have allowed us to implement new technologies and grow our business. There are not many companies with our equipment, which has opened the doors for us to undertake larger components and parts manufacturing, creating a vacuum of business. FedDev Ontario has also recently provided us with funds that have allowed us to acquire automated technologies to accommodate the Airbus project and capitalize on new business.

What are some of the challenges aerospace companies are facing in Ontario?
The industry is struggling with involving the younger generation in aerospace. Aerospace has an aging workforce, and Ontario needs to work on developing their young workforce for the coming generation. The growth in skilled development is the main challenge in the region.

What are some changing trends in the aerospace industry and how is Koss Aerospace adapting?
There are increased market pressures for low-cost solutions. Our clients are looking for a low-cost footprint, and we have adapted by incorporating automation into our processes and decreasing labor costs. Our automated machines allow us to manufacturing in one third of the time compared to standard machines. Automation allows us to compete internationally, without outsourcing and driving business out of the country to Mexico or China. In terms of pressures to being more environmentally sustainable, we recycle all of our aluminium and have also installed pucking machines to recover fluid to be recycled.

What is your strategy for growth going towards the future?
We are on every major platform for Bombardier, and there is growth in these activities. There are also development opportunities in our Airbus and Boeing platforms. With the right programs and the best technology in place, we will sustain growth in the future and remain competitive. We have had growth every year and are looking at sustainable growth in the future.

What is your final message to our international readership?
Ontario has world-class infrastructure and the stronger our companies get, the more we will attract international business. Koss Aerospace supports the growth of the sector.

Nick Dobrea

President and CEO
UNIVERSAL PRECISION TECHNOLOGY

What has been Universal Precision Technology's evolution since 1992?
Universal Precision Technology began as a small garage-based shop, and after years of growing the business the company expanded to our newly renovated 45,000 square foot building. What started as a tool & die shop has grown to a significant custom CNC, EDM, and Manual machine shop. We are capable of providing prototypes to full production runs utilizing all the different types of materials essential to the aerospace industry. We are currently manufacturing parts for landing gear systems as well as parts for control panels in aircrafts.

What is the competitive landscape in Ontario?
Competition for production in Ontario is high, the best and most progressive companies are winning the bids for the majority of the work. Companies that are able to maintain short lead times and provide excellent quality and price while using the newest technology will come out on top. At Universal, we maintain state of the art machines and software to provide our customers with exactly that.

What is your focus on innovation?
We focus on the evolving landscape of manufacturing with machines that have the ability to multi-task to reduce time, scrap and risk. Our EDM capacity is second to none in the area, and we are able to commit to increasing volumes of production with our dedication to advanced manufacturing and cutting edge technology.
Since we are a custom precision machine shop and build to print, we need to create new fixtures and jigs to accommodate the designs our customers require. The Ontario government is particularly supportive of these efforts.

How is Universal Precision Technology adapting to new demands?
Aerospace is moving toward lower weight, lower cost and more stable materials with increases in production and growth of the industry in Ontario. Universal is poised to take on projects utilizing the newest materials and components and our machining capacity can be matched with increase in demand.

What makes Ontario a global aerospace hub?
Ontario has a skilled workforce with education focusing on the trades. Ontario's strategic location allows for shipping to different markets with ease. Although Ontario does not have as many OEMs as Montreal, Tier 2 and Tier 3 suppliers for major aerospace companies are all in the region. Ontario has a strong supply chain with companies such as ours, able to take on large contracts. Ontario has the infrastructure of advanced manufacturing, that is easily applied to aerospace. From manufacturing companies to processing facilities and assembly operations, the potential for business in Ontario is huge.

Next year marks the company's 25th year anniversary. What is your strategy for growth going forward?
Our goals are steady growth, the addition of new clients, and maintaining the high level of quality and satisfaction our current customers enjoy. Within the next five years, we plan to double our sales. Having the ability to expand our machining capacity, invest in new technology and the possibility of joint ventures, we are ready to take on new partnerships.

Daniel Zanatta

Vice President of Business Development
MAGELLAN AEROSPACE

What is Magellan Aerospace's reach in the international market?
Magellan Aerospace is a global corporation with a long presence in Ontario. The company grew substantially through acquisition, much of which occurred in the late 1990s and early 2000s. Today Magellan is a consolidated organization, operating under a common Magellan Operating System (MOS), and has rebranded all of our divisions under the Magellan name. Our global company today has facilities in the United States, United Kingdom, Poland, and India. There are 19 Magellan operating facilities employing over 3,500 people, and our sales revenue is about $1 billion per year. Magellan's products and services are organized into commodity structures including aero structures, aero engines, castings, repair and overhaul, and space propulsion and proprietary products.

How does Magellan provide supply chain integration?
Integration at the corporate level allows Magellan to leverage our commodity purchasing. At the division level, we follow a very sound and common supply chain management system. Vertical integration is an important cost control element in the aerospace industry. All Magellan's facilities are interconnected and integrated, which is key to remaining competitive in the current business environment.

Your clients include world's leading OEMs. What are your competitive advantages?
Our relationships with our customers and our continuous quality performance differentiate Magellan in the industry. Our legacy aircraft customers, Airbus and Boeing, represent about 45% of our business base. Magellan's aero engine operations serve all of the major OEMs including Rolls-Royce, General Electric, and Pratt & Whitney Canada. To ensure quality and cost competitiveness, we invest strategically in technology and focus on the utilization of our equipment. To be globally competitive, we operate our equipment six to seven days a week, and maximize our investment in our resources. Our facilities in Poland and India serve as lower cost centers.

Could you summarize Magellan's strategic plan for growth?
Magellan expects strong organic growth for the next five years, and is in a position to acquire companies to complement our work and add critical mass to our capabilities. We recently invested in a processing facility, which is integral to our supply chain and supports all of our divisions. Although we aim to acquire new customers, we are also focused on strengthening strategic relationships with our existing customer base. Over the next three to five years, our goal is to substantially grow our revenue and maintain our profitability.

Stewart Cramer

CEO
VERTEX PRECISION MANUFACTURING

What are Vertex Precision Manufacturing's core capabilities?
Founded only last year, Vertex Precision Manufacturing is a group of Canadian manufacturers specializing in turnkey solutions. We manufacture components for commercial aircraft companies such as Bombardier and Boeing, components for spacecraft, primarily focusing on communications satellites, and components for defense companies. We buy and integrate small manufacturing companies and now own three facilities in Ontario.

Our first operation, Dellcom Aerospace in Concord, was founded in 1983 and employs 60 people. We mill, turn, and assemble aerospace products. There is a rapid turnaround of parts at Dellcom, which specializes in a high-mix, low-volume manufacturing and rapid response blue streak services. Our second operation, Aero-Safe Technologies in Fort Erie, was founded in 1981 and employs 35 people. AST specializes in precise machining, and performs microscopic deburring in support of applications requiring ultra-tight tolerances and precise surface finishes. Our third operation, Aero-safe Processing, founded in 2004, is a 20-person Nadcap approved process shop in Fort Erie that provides finishing services such as passivation, painting, priming, and cadmium plating. Around 70 to 80% of our manufacturing products are exported to China, the United Kingdom, and the United States. We directly ship about 20% of our products, and the rest of our exports are through our customers.

How do you ensure that this model works?
Our management team is comprised of former Tier 1 and OEM employees including Northrop Grumman, the Boeing Company, Messier Dowty and Bombardier. We draw business management and engineering practices from this strong background. Essentially, we buy small companies and teach them how to execute like a Tier 1 company. We create integrated tools and processing systems to work seamlessly between our acquired companies, without relocating them, creating economy of scale with high affordability.

What are Vertex Precision Manufacturing's growth targets?
In the short term we have a target set for 20% organic growth. Our strategy is to continue buying companies and building our capabilities to match those of larger, consolidated Tier 1 suppliers. We are projecting growth of 50% through acquisitions, and are looking for aerospace companies with strong technical capabilities and quality systems. They must all be AS 9100 certified and have a culture of continuous improvement. There are many opportunities for us in in North America because of the abundance of small, entrepreneurial, family-run companies that are reaching a point of generational transition.

Brian Wetherall & Jerome Horowitz

BW: President
JH: Vice President
BROTECH PRECISION CNC

JH

What are the key milestones in Brotech Precision CNC's development?
BW: Brotech Precision CNC is a manufacturer, serving the aerospace, nuclear, defence, medical and automotive industries. I established the company 21 years ago, and ran the company for 15 years as a job shop. During the last six years, we have moved to a model with longer-term partners. The company therefore invested in aerospace quality systems and high tech equipment. Aerospace today makes up about 20% of business and will continue to grow. The company is not focused on targeting a particular sector or subsector, but around developing our core skills in complex machining challenges.

What are your capabilities in the new facility?
JH: Brotech Precision CNC is a specialist in hard and tough metals: stainless steel, titanium, carbon steel and exotic steel. Our new facility in Barrie is three times the size of the old one, and in the last year and a half, we have increased our machines from 13 to 21. We also recently made a deal to double our space in the next year. We are investing in the latest and greatest equipment, including robotics, which we see as the next trend in global cost-competitiveness. By adding robotics, we will be able to produce almost 24/7, reducing costs between 15 and 20%.

Could you provide a case study demonstrating the success of your products?
JH: Triumph Group were looking for a company to make smaller parts, up to the same level of machining difficulty as larger parts, and we succeeded in this regard. We are only interested in partnering with companies who view us as strategic partners.

How would you characterize the competitive landscape for manufacturing in Ontario?
JH: There is enough work for companies in Ontario, and we will grow by focusing on our machining and productivity. We benefit from being a member of the Ontario Aerospace Council (OAC), particularly from networking, exposure and introductions to bigger companies. However, there is a lack of focus on industry cluster work, and there needs to be increased partnerships between large companies and SMEs. The industry needs to respond to pressures from the OEMs to consolidate the supply chain, instead of acting in self-interest.

Is there an availability of highly skilled workers in Barrie?
JH: We have a constant-improvement, progressive, young culture for hiring workers. The average age at our company is around 30, and our recent growth is partially due to this culture. We are involved with two local school boards with apprenticeship programs, and also with Georgian College. One of our goals is maintaining our attractiveness to machinists interested in developing their skills. To engage them, we use profit-sharing and the vision of employee-ownership.

How do you take advantage of government funds?
JH: Brotech Precision CNC identified the Southwestern Ontario Development Fund as an opportunity to support our long-term plans. We applied for funding with a good business plan and well-documented financial projections. We have also applied for the CME SMART grant three times, and for a digital technology grant. When correctly directed, government programs significantly help industries. They have supported our business and employment expansion, and we are still projecting annual growth of 20 to 40% for the next three years.

What are some of your overarching goals going towards the future?
JH: We want to continue fostering our engaging culture with our employees to ensure increased productivity and growth. We see immense growth potential on the aerospace side of our business, and have the ability to be world class in quality and productivity.

ADVANCED MANUFACTURING
Food for thought from industry leaders

"Fleet Canada is in the process of implementing a new ERP system which will be in full operation in January 2017. The ability to track data in real time will allow us to address needs and challenges as they arise. We do not rely on automation to remain competitive, but rather on our ability to know what suits our company and our continuous delivery of quality work. Our target market does not require that we implement automation as we are manufacturing low volume, high mix products. To stay cost competitive, we implement lean methods and continuously improve our efficiency."

- Marika Kozachenko,
Business Development Manager,
Fleet Canada

"There are significant opportunities in Canada not only in providing steel for various applications, but also in additive manufacturing. We are seeing an additive manufacturing trend in the Ontario region [...] In Canada, there are few players in the heat treatment business. The challenge to enter the Canadian market is the approval process, and OEMs have a limited ability to resource new entrance to the supply chain. We have already achieved all the required heat treatment approvals to operate in the aerospace industry."

- Martin Beaton,
President,
Böhler Uddeholm

"There is interest in switching things which were made of aluminum or steel into advanced composites. This introduces a whole host of challenges in terms of understanding the damage mechanisms and being able to properly predict component lifetimes. Of course, there are now composite aircraft in operation, such as the Dreamliner, but there is still work to be done in understanding repairs and maintenance, and ways to optimize their structures."

- Ronald Miller,
Chair of Mechanical and Aerospace Engineering,
Carleton University

"In manufacturing low-volume, high-mix products technology plays a crucial role in ensuring high quality. Therefore, we rely on robotic and computer technologies to enhance our processes. Through developing unique processes of manufacturing for low-volume parts, we also ensure the on-time delivery of our high quality products. Our strengths lie in developing and utilizing complex processes which are not easily repeatable."

- Michael Iacovelli,
CEO,
Ben Machine Products

"There is a healthy collaborative culture within the manufacturing companies in Ontario and even extended to the other provinces. Manufacturing companies typically have particular niches or approvals that others do not have and we work together to complete projects as cost-effective as possible. The close proximity of the Quebec and Ontario aerospace clusters allows for a significant amount of sub-contracting compared to other provinces. There is a good synergy between the two clusters, enhanced by the relationship between the Ontario Aerospace Council and Aéro Montréal."

- Kofi Bannerman-Maxwell,
President,
Trinity Aerospace

"The government needs to invest and encourage Ontario companies to improve their manufacturing competitiveness. Aerospace is growing and parts do not seem to get moved quickly. It helps that the new machines are excellent and nowadays a machinist can operate three machines at the same time. For Ontario to stay competitive, we have to invest in technology and be increasingly process-driven."

- Valerie Wilson,
Vice President,
Dishon

"Titanium is 70% the weight of steel but offers the same strength, so it is very useful for products which need to be strong but light. Nu-tech Precision Metals has been attempting to deliver customers more titanium parts these days. There is still a question over whether it is cheaper than steel: titanium is expensive, but suppliers receive a dollar credit for producing lighter parts. Some new aircraft have to be light for fuel efficiency. Nu-tech Precision Metals has just won a contract on the 777X."

- George Legate,
President,
Nu-Tech Precision Metals

"Access to the talent of local universities is absolutely key, and there are also a number of local colleges from which we hire technologists directly [...] Our sites in Canada have strong relationships with academia, and many of our science instruments are the result of academic concepts, which form the basis of contracts with the Canadian Space Agency. Universities also provide some advanced manufacturing and proof-of-concept work for us."

- Marina Mississian,
Senior Director, COM DEV Canada,
Honeywell Aerospace

Image courtesy of Air Canada

SERVICE PROVIDERS

"Competition is becoming increasingly fierce, and supply chains are consolidating. The major global manufacturers are shifting their focus from aircraft development to delivery. Therefore, there are increasing pressures on suppliers to deliver cost-effective, timely and scalable products and services."

- Jim Quick,
President,
Aerospace Industries Association of Canada (AIAC)

Image: Com Dev

Beyond Manufacturing

Service providers complete the value chain

Although Ontario has an impressive capacity in advanced manufacturing, the region's aerospace cluster goes beyond these capabilities, boasting a range of services including maintenance, repair, and overhaul (MRO) and avionics. Avionics and Electronics encompass approximately 36% of aerospace activity in Ontario, and MRO comprises 13%.

Avionics

The electronic systems applied to aircraft, or avionics, is a niche capability Ontario carved out in recent years. Within Ontario, the Kitchener-Waterloo corridor is a technology hub, arguably comparable to the Silicon Valley in California. Ontario academic institutions graduate high numbers of engineers, many of whom move on to working in the aerospace industry for companies offering avionics such as Amphenol, Aversan, and Cleeve Technology. These companies offer a wide range of products and services including rack and panel connectors, interconnect solutions, turnkey embedded systems, and other specialized electrical components. "The offering of the Ontario aerospace industry goes well beyond the composites and machine shops that are readily advertised. There is a tremendous amount of avionics experience, engineering capability and knowledge," said Scott Moses, director of engineering at Aversan.

Ottawa is also a hub with high-tech expertise, and has a strong competitive landscape for satellite communications technology. TrueNorth Avionics, with an expertise in advanced communications systems for business aircraft, has caught the attention of international connectivity provider, Satcom Direct, and were recently acquired. "There is a significant amount of technical skill in Ottawa and that is why we have operations in that region," highlighted Scott Hamilton, chief strategy officer of Satcom Direct.

Avionics and MRO services are two areas where Ontario has the best potential to grow. Whereas manufacturing in the region has to overcome the legacy curse in order to innovate, technological innovation in avionics is constant. Many Ontario avionics companies are investing in R&D and have extremely disruptive technologies in the pipeline.

MRO

Ontario's network of 11 airports enhance the region's MRO capabilities, and Ontar-

71►

Nolan Kiely

Marketing Specialist
NEW UNITED GODERICH

Can you introduce New United Goderich and highlight the impact of your recent merger?

New United Goderich is located in Huron Park, Ontario, and offers heavy maintenance, interior and exterior refurbishment and aircraft painting. Our services include avionics, replacement and troubleshooting, STC writing, and modifications. Over the past seven months, the company has been involved in an ongoing 10 aircraft refurbishment and recertification for Jet Suite, which is starting an airline in California. We also have completed a contract with Jiangsu Jet for complete interior and exterior refurbishment as well as STC conversions on their CRJ 200 aircraft.

New United Goderich has recently been bought out by an international conglomerate. The result is that we now have significantly more funding and support. We are currently in the transition between a family-run operation with profits of $5 million a year, to a larger corporation with revenue of over $20 million a year. We changed a significant amount of our processes and supply chain issues, and we are now building up the relationship with our vendors to attain parts faster and more efficiently.

What are New United Goderich's facility capabilities in Huron Park?

New United Goderich has a two-building facility, and a total of four hangars. Three hangars accommodate a regional jet-sized aircraft and the larger hangar can hold a Boeing 727 or two to three regional/business jets depending on their size. We also have two paint bays with the capability of turning our larger facility into a paint bay for larger aircrafts, such as the Boeing 727. We also own the airport that we operate out of, giving us a competitive advantage in terms of costs.

What are the unique advantages of working in Ontario?

Ontario's aerospace supply chain is world-class and has a significant amount of parts available, especially with Bombardier being located in the region. New United Goderich takes significant advantage of the local supply chain. As we grow, we are developing stronger relationships with our vendors as to make the process more efficient and make international parts more attainable.

What is New United Goderich's growth strategy and goals for the next three to five years?

New United Goderich is currently in transition and the aim is to streamline all our processes and consolidate relationships with our customers. We are taking an internal look at our company as to change and progress towards the future. We want to grow our business through marketing and ensure that we are in a good position to take on additional workload. Our target is to achieve revenues of over $20 million a year in the near future. We have our sights set on entering into the Commercial Airline market to gain new clients as soon as 2017.

Do you have a final message for international companies looking to Ontario for aerospace business?

The Canadian dollar is currently not as strong as the US dollar or the euro. By making use of services in Canada, companies can save almost a significant amount on their costs. We have all the aerospace certifications required worldwide, and we work with most aircraft manufacturers. Also, international companies can save money by moving their operations to Canada. Ontario has many aerospace capabilities beyond manufacturing and is definitely a cost competitive region.

John Gillespie

President
FLYING COLOURS CORPORATION

> Primarily, we are a Tier 1 supplier to Bombardier and they represent about one third of our business [...] We are also a Tier 2 supplier providing customer modification for aircraft, and all of our employees are trained in maintenance and avionics.

Flying Colours Corporation started off in 1975. Could you highlight the key services you offer your clients?

Flying Colours Corporation is a privately owned and operated aviation services company with over 25 years of business aviation experience. We started out in refurbishment of airplane interiors and from there we branched out into maintenance services and external paintwork, hence our name. Our dedicated team of trained technicians now provides comprehensive maintenance, repair and overhaul services, completions and modification services for business aircraft. We have offices in Peterborough, in St. Louis, Missouri, and in Singapore.

Primarily, we are a Tier 1 supplier to Bombardier and they represent about one third of our business. We are a fully authorized facility for Bombardier at all of our facilities, and we have the capability to maintain and service their whole fleet. We have a good record with Bombardier that has been growing over the years and from there we branch out to other customer-owned aircraft for full interior refurbishment, modification, or contractual work that comes through Bombardier for third parties. We are also a Tier 2 supplier providing customer modification for aircraft, and all of our employees are trained in maintenance and avionics. Our credo here is service, and our clients stay with us long-term.

Could you provide a case study of the services you offer Bombardier?

With Bombardier we take a "green aircraft," with nothing inside, and we design, build, upholster, and certify the interior before delivering it to the customer. We work with both the commercial and the business side of Bombardier. On the business side, we design the whole interior. On the avionics side, we provide surveillance modifications on the aircraft. The aircraft comes to us with a certification of airworthiness, but we amend that and change it, so we provide supplemental type certificates. We attain certifications from around the world including the Middle Eastern countries, China, and Russia.

What are your capabilities here in Peterborough?

Our facility in Peterborough was the first one for Flying Colours and it has grown due to the size of the airplanes our customers are bringing in. We have about 225 employees in Peterborough. Our Missouri facility is about half the size, and they provide complementary capabilities specializing in maintenance, repair, and overhaul (MRO) work, whereas here in Peterborough we mostly focus on refurbishing airplane interiors. In Singapore, our sole customer is Bombardier and we work out of their facility, focusing on the airplane interiors.

You are currently undergoing a $20 million expansion. How will this strengthen the sector in Peterborough?

We are driven by our customer base, and these expansions have reflected the growth of our business and the demand to service larger aircraft. The city of Peterborough has been very responsive and they have expanded the Peterborough airport to accommodate the larger aircraft. Now we have a higher level of capabilities to service our customers. We are currently undergoing a new expansion that will be finished next year to accommodate the next size up of aircraft.

What are some of the challenges of operating in Ontario, and Peterborough specifically?

The aerospace sector in Peterborough lacks skilled workers, therefore our engineering group is based in St. Louis and we have a sub-engineering group in Peterborough. However, we are increasingly attracting more skilled workers from Toronto and other areas in Ontario into Peterborough as the aerospace hub grows. Another way we attract skilled workers is through our own established program in collaboration with Fleming College. Along with Peterborough Airport, we also recently reached out to the local high schools. In terms of training employees, we work with FedDev Ontario and the Ontario government in all facets of instruction.

In three to five years, where do you see the company positioned in the market?

We started off as a small family-run business, and have grown exponentially throughout the years. We want to continue growing our company internationally and attract more customers from around the world. Foreign country special modifications are our specialty so we want to grow in this area. International companies should look to Ontario and Peterborough specifically for aerospace business.

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io now accounts for 29% of the Canadian MRO industry direct GDP. However, most of the MRO activity is centered around Pearson International Airport, which accounts for 95% of scheduled passenger service in Ontario. Hope Aero Propellers and Components are aircraft maintenance specialists with clients in the Caribbean and Africa. Through the Pearson airport gateway, maintenance services companies attract international business into the region and showcase the range of capabilities. In terms of parts distributors, Airstart is a leading company stocking parts for nearly all commercial aircraft landing in Pearson International Airport as well as Billy Bishop. They leverage their presence close to the airport and president Robert Wills commented: "If an aircraft requires a spare part, we deliver it anywhere in the world within 22 hours so it may fly wherever it needs to be."

However, up and coming airports such as Peterborough are experiencing increased MRO presence in their vicinity. For example, Flying Colours Corporation started off as a small, family-owned business and has grown exponentially into a multi-million-dollar company specializing in MRO service as well as aircraft interiors in Peterborough. Additionally, Kadex Aero Supply is an aviation-focused supplier with technical expertise that recently became the Canadian parts distributor for the U.S. company, Aeroshell.

Air travel is projected to increase in Ontario in the next years, allowing opportunity to grow the region's MRO sector. As Toronto Pearson is expected to reach capacity, other Ontario airports will have to take on some of that workload, with the chance to expand their MRO services. Bruce Simpson, senior partner for McKinsey, commented: "The smaller regional airports in Ontario have an opportunity to establish or expand air services for origin to destination passengers, and increase other aviation activity." —

Andrew Toffelmire

General Manager
AMPHENOL CANADA CORPORATION

You have been operating in Canada for over 50 years. What are your key lines of business?

Amphenol Canada is a leading manufacturer of EMI filtered connectors, rectangular IO Rack & Panel connectors, as well as custom-made connectors. We primarily serve the commercial air and military industries, which encompasses about 75% of our business. Today, Amphenol Corporation is a conglomerate of approximately $6 billion of which $1 billion can be contributed to the Mil-Aero operations of the company.

In Ontario, we have a 55,000 square foot facility acting as the brain of our operations, including engineering, fabrication, assembly, and testing operations. The facility is primarily dedicated to the aerospace industry and employs about 100 people. Our other facility in Belleville employs 40 people and focuses on manufacturing specialty capacitors.

How do you address interconnection for the industry?

Rack and panel connectors can interconnect using high speed RF, fiber optics, signal, and power contracts. Incorporating capacitors and transient suppression devices addresses the growing need to filter against EMI and to suppress power surges in the systems. Amphenol systems attachments and interconnect solutions power light jets as well as large commercial aircraft. With our products, we are able to significantly save money, space, and weight for our customers, while improving their system design and performance.

What is the competitive landscape in Ontario with regards to avionics?

Amphenol is the only company in the Canadian market with the type of products and services we offer, and our competitors are primarily located in the U.S. Here, we can offer fast and local service, along with Canadian content. Abroad, we are effective in the military sector because our competitors are subject to their bureaucratic International Traffic in Arms Regulations (ITAR) on connectors, often negatively impacting overseas customers. We export 80 to 90% of our products.

What is Amphenol Canada's strategic growth plan?

We aim to double our business in the next three to four years. Currently, both the commercial and military aerospace sectors are growing much slower than we would like, but there is still an increasing demand for EMI solutions. The military and aerospace sectors are conservative, which poses as a development challenge for our business timeline goals. We are addressing these challenges through our R&D activities.

Phil D'Eon

CEO
CASEBANK TECHNOLOGIES

What are CaseBank Technologies' key products and services?

I co-founded CaseBank Technologies Inc. in 1998, starting with a primary product called SpotLight, which replaced fault isolation manuals as a better way to troubleshoot. Building on artificial intelligence technology, we introduced case-based reasoning software. We expanded our business and now have an ecosystem of three products: SpotLight, Chronicx, and Diagnostic Data Analyzer. These interact with each other in the differential diagnostic method that we call hybrid reasoning.

SpotLight is a software that provides differential diagnosis. When an aircraft encounters a problem, SpotLight detects symptoms, asks effective diagnostic questions, and generates potential causes resulting in that symptom, which is essentially troubleshooting. Our other service, Chronicx for airlines, analyzes aircraft maintenance records and determines repeating faults. Our third main product, Diagnostic Data Analyzer, processes, records, and stores fault message history. The analyzer detects the fault codes in the equipment and sends it to a repository to determine if there is an issue, in which case fault codes trigger a troubleshooting response.

How do your products benefit your aerospace and defense clients?

There are thousands of ways aircrafts can fail, and any one mechanic will not know all the possibilities. Our software has the collective experience of every recorded malfunction, creating an extensive database. Our technology enables rapid, accurate, and consistent troubleshooting. Also, by capturing knowledge and solutions to problems, we forego the loss of experience with labor mobility and retirement of technicians. Commercial aerospace clients adopt new technologies quicker than the defense clients, who tend to be more conservative. Defense customers have particular aspects of confidentiality, and budget cycles are also longer in the military.

What is the impact of your technology and new R&D efforts?

Our technology is the bridge between engineers and mechanics. Engineers make built-in test fault codes and they try to predict what will go wrong with their design, but there is a lot of unanticipated challenges in the field. As technicians troubleshoot with our software, they identify failure modes that can in turn be used by engineers to improve their design.

We spend about 40% of our revenues on R&D, focusing our efforts on technology development and applicable artificial intelligence. Specifically, a large portion of our research focuses on machine learning, which has a small role in the Chronicx tool.

Terry Hope

President
HOPE AERO PROPELLER AND COMPONENTS

Could you provide a brief introduction to Hope Aero Propeller & Components?
Hope Aero Propeller & Components is a family-run business that has been operating for 47 years. We primarily provide maintenance, repair, and overhaul (MRO) services. Small companies also require our services for non-destructive testing (NDT). We inspect engine and airframe parts. We also go to the aircraft and inspect something specific, such as the live-TV antennas for WestJet to make sure none of the fittings are cracked. However, our main focus is internal. We can do almost any propeller, wheel, or brake on the commercial side. About 95% of our business is commercial aerospace but we also work with the Department of Defence and supply them with propeller repair and overhaul service. Our customers are typically domestic in Canada, though we have a few clients in the Caribbean and in Africa.

What is a case study of the services you provide your clients?
As an example, we carry out the maintenance on all of Air Canada's wheels and brakes, so their inventory is in our system. We track their parts removals on a daily basis, and we resupply the bases from our facility here. We reduce the amount of inventory required by our customer because we supply them with the adequate parts.

What are Hope's key competitive advantages in front of other MRO companies?
Hope Aero Propeller and Components strives to provide world class products and services. We have long-standing relationships with our customers, and we work on fostering communication to provide the best services. Also, the Hope Aero way is doing it right the first time.

Additionally, we were the first overhaul company in Canada to purchase and use the Aeroscan machine, and we strive to always have the most specialized technology. This allows us to save manpower as well as improve productivity and quality in our products. New equipment also allows us to adapt to the current pressures in the market to be more cost effective.

What are the strategic advantages of operating in Ontario and Mississauga specifically?
Firstly, we are strategically positioned close to Pearson International Airport, which means proximity to our customers. Also, the variety of different aerospace companies in Mississauga creates a significant hub in the industry. Most maintenance, repair, and overhaul companies are based in the Toronto area, which is advantageous for us, as there is a pool of capabilities elevating our business. Furthermore, there are many technicians, engineers, and highly skilled workers in the area. Having said all this, the GTAA needs to address the issue of lack of public transportation in the area.

What is your strategic growth plan in the next three to five years?
We are looking to acquire additional customers as well as take on new projects with different models of propellers. Our primary goal is to prepare the company for the next generation in terms of technology and innovation. For example, environmentally sustainable technologies will be important in going towards the future. We will also keep looking for ways to improve productivity and efficiency for our processes.

Mark Van Berkel

President
TRUENORTH AVIONICS

Could you briefly introduce TrueNorth?
I founded TrueNorth Avionics in 2006 with the idea that there was a lot of innovation happening on the ground but not in the air, particularly around voice over IP technology. The genesis of TrueNorth was to bring voice over IP-type handsets on the aircraft. We also developed a complete voice over IP system.
In 2007, we shipped our first product and from there we continue to bring new products to market every year. Today we have approximately 30 products with a team of 40 people. We sell products worldwide and are the premier solution provider for communications on head of state and Fortune 50 aircraft. We address a niche market with bespoke customized communication systems for these business jets.

On what areas is TrueNorth focusing R&D efforts?
It goes back to communication, information, and entertainment. Aircraft had no connectivity 15 years ago when we started. In the next 15 years, 90%+ of all aircraft will have some kind of connectivity. At TrueNorth we develop novel ways to bring connectivity to the aircraft, beyond using the internet on a plane. Similar to the Internet of Things, the internet of aviation is also happening, and there is increased connectivity associated with aircraft engines, being able to upload their log files without humans having to intervene. The next big thing that will happen in aviation will be empowered by connectivity. For example, a self-flying airplane would only be possible by connectivity. We will have real time data to see what is happening in the aircraft, even from a maintenance perspective.

In light of your recent acquisition by Satcom Direct, what are TrueNorth's opportunities for growth?
We are a hardware manufacturer, and Satcom Direct is a service provider. We manufacture the SD Router, so there is already a synergistic way we have been working together. We will have new and exciting opportunities with the growth in the connected aircraft. One of the advantages for us is Satcom Direct's complete data security solution. TrueNorth will benefit from a more secure network because of our acquisition by Satcom Direct.

Scott Hamilton

Chief Strategy Officer
SATCOM DIRECT

What key services does Satcom Direct offer?
Satcom Direct, also known as SD, is a global connectivity provider primarily serving the business aviation and military markets. Over the years we enhanced our service portfolio to provide customers with a full solution, nose to tail, in terms of connectivity. The company now offers a variety of cabin and cockpit services, including internet and telephone connectivity on aircraft. Historically Satcom Direct has focused on making connectivity simple for the flight deck and cabin and, in 2013, we introduced our first avionics product to the market called the Satcom Direct Router (SDR). The system has been very successful and has led to other products such as our recently introduced WiFi Hub and our LTE Hub, which will be introduced in 2017.

How will the acquisition of TrueNorth Avionics advance your operations in Canada?
Our recent acquisition of TrueNorth Avionics allows us to grow our product line and develop more advanced products. Our existing engineering and technical team in Canada consists of ten people, and TrueNorth offers more engineering talent that we can pull from, as well as manufacturing capabilities. SD's router was designed by our team of engineers, but is manufactured by TrueNorth. TrueNorth builds additional products serving business aviation and heads-of-state aircraft, which are more advanced, or parallel, with our router product. TrueNorth's product line is a great opportunity for growth for SD.

What trends do you see moving towards the future?
Over the past two years, the majority of our R&D has been focused on flight information and streamlining flight operations for our customers. Particularly in business aviation, our customers use many suppliers to track data on the aircraft. With our Satcom Direct Router and some of our other products, we are able to pull a significant amount of operational data from the aircraft, and then feed the information off to the different suppliers on an automated basis.

How receptive is the business aviation sector to new technologies?
The business aviation sector accepts automation and new technologies faster than both the military and commercial aviation sectors. The commercial sector is still very slow in technology adoption. As an example, global flight tracking has been in the business aviation sector for a significant amount of time, whereas the commercial sector is only now starting to implement global flight tracking technologies.

Michael Klauck

President
CAN-ENG FURNACES INTERNATIONAL

Could you briefly introduce CAN-ENG Furnaces?
CAN-ENG Furnaces has operated for 52 years, and we focus on industrial furnaces and automation for industrial furnaces. We are diversified amongst many industries, including automotive, iron and steel, oil and gas, mining and aerospace. Our aerospace contracts are for large open die forgings for titanium and aluminum components in the USA. The aerospace sector is large with many opportunities for business, and we have a targeted market in terms of what we offer to the industry.

What various batch and thermal processing systems do you offer?
CAN-ENG Furnaces' batch processing systems are large automated systems with specific requirements on temperature uniformity. Our products exclusively serve the large component industry and we have a reduced focus on the small component needs. We are currently building two batch systems for a client in California: one is a large rotary hearth furnace for titanium components, and the other system is a continuous chain conveyer for aluminum components. We are also working on other aerospace components, employing large batch and continuous furnaces.
In the past, we completed projects involving extrusions, including projects for the U.S. Military and the Canadian Military. With regards to current contracts, we have roughly $5 million worth of business in house. We anticipate another $5 million worth of contracts over the coming months.

What gives CAN-ENG Furnaces a competitive advantage?
Many companies build furnaces, but CAN-ENG Furnaces' focus is the automation of furnaces. Our clients want a solution to the problem of providing parts with certain mechanical properties. To achieve these properties, the parts have to be heat-treated. Our value proposition is the automation, providing a turnkey solution. There is an increasing demand for automated technologies across all sectors, and definitely in the aerospace industry. The main drivers for automation in the aerospace industry are reliability, consistency, and tight temperature uniformity. The requirements expected from an automotive system are exponentially greater in an aerospace system.

How does CAN-ENG Furnaces ensure the quality of these automated technologies?
CAN-ENG Furnaces has an excellent design team of about 50 engineers. Preliminary engineering is conducted at the sales stage; then, detailed engineering ensures the satisfaction of the customer's requirements. We sometimes spend 6 to 18 months engineering the system properly. In addition, we have an in-house R&D facility where we can trial test parts. We are also undergoing development work for a U.S. aerospace contract, and they approached us for our unique technologies for quenching and cooling parts.

Does CAN-ENG Furnaces have any partnerships for R&D?
CAN-ENG Furnaces does have some cooperation with the universities, but this has not been leveraged significantly over the last few years. We have developed our staff and in house capabilities to a point where we do not have to go out and find partners for projects. There is a landscape for R&D in the Ontario area, but there is still a disconnect between the needs of the industry, the needs to find commercially viable solutions, and the R&D world at the university level.

What is your growth strategy for the future?
Since 2009, CAN-ENG Furnaces has experienced significant growth. Due to a drop in demand from the steel, oil and gas and mining industries, our 2015 revenue has fallen back, but 2016 has shaped up very well and our business has rebounded significantly, partially on the strength of the aerospace market segment. We also aim to leverage international markets to grow our business further. The forecast for new investments into the aerospace industry is very strong for the next 15 to 20 years.

INSIGHTS FROM THE SERVICES SEGMENT

"The current process used to remove aircraft coatings is antiquated and not environmentally friendly. Laser ablation is a low risk, low cost technology that we are developing as an alternative process. Although it is an existing and proven technology, we are looking to automate it and make it cost effective by marrying with other technologies such as sensors, cameras, programming contour following, automation and robotics."

- Paul Church,
President,
Cleeve Technology

"For aerospace parts, everything is going digital, so we are selling electronic devices to be included in the aircraft. We are also seeing an increasing amount of on-line ordering instead of over-the-phone. Although many of our customers have been with us for over 20 years, a new generation wants to do everything on-line."

- Jordan Lavery,
Outside Sales Representative,
Kadex Aero Supply

"We focus our R&D in laser and ultrasonic machines as well as additive manufacturing. DMG MORI has unique additive machines and we integrated a significant amount of technologies on our standard machines."

- Daniel Medrea,
Managing Director,
DMG MORI Canada

"One of the main adversaries to automation is lack of standardization. For more robust and higher quality systems that are also low volume, the challenge is not being able to standardize. Therefore, the more OEMs can standardize, the more their suppliers can automate."

- Charlie Hess,
President,
St. Clair Technologies

Robert Wills

President
AIRSTART

Could you give us an introduction to AirStart and outline your key products and services?
AirStart was founded in 2000, and we now support over 75 airlines, maintenance, repair and overhaul, and leasing companies. Our world headquarters are across the street from Pearson International Airport, which gives us proximity to not only Canadian airlines, but also international airlines such as Lufthansa and British Airways. Exports account for 80% of our business.
A grounded aircraft incurs in a large financial loss when they are out of service (about $350,000 per day), so they need to be relaunched immediately. We offer a qualified team and 24-hour service to swiftly put planes back into service. We were one of the first companies in the world to have smartphones to be more accessible to our customers, as everything can happen quickly in the aviation industry and our services are required from one moment to the next. If an aircraft requires a spare part, we deliver it anywhere in the world within 22 hours. Using our own analytics, we have compiled an inventory with 20,000 components and at least 150 parts for each aircraft. We are thus an ideal provider for any airline should a plane need a new part.

Besides Ontario, where are your other operations located?
Besides Ontario, we have a presence at JFK International Airport in New York and also have critical inventory stocked at other major gateway airports worldwide. Our inventory locations are no more than four hours' flight from major customers. We will continue building our inventory as clients' demands increase. We are pursuing more density, looking at high growth areas worldwide.

What gives you competitive advantage?
In 2015, Deloitte voted AirStart as Canada's best managed company, and we are also on the Profit 500 list of fastest growing companies for three consecutive years. Although we are a small company, our sales numbers are continually growing. We are a capital-focused business so we have a prudent approach to investment. Every day we buy between $50,000 to $200,000 in inventory. We use Canadian vendors wherever possible, and offer our customers unique cost and time savings solutions, such as our Exchange Model.
We are unique in our capabilities, and in many cases, we are the only company in Canada that stock parts for many commercial aircraft such as Bombardier, Boeing and Airbus. On one occasion, a U.S. company offered to sell one of our local customers a new part for $150,000, while we offered to exchange their part for $5,000. We acquired the asset and repaired it. They took advantage of our stock, and we delivered the part in 11 minutes and no passenger realized there was a service fault. Had they ordered the part from the United States, it would have taken 36 hours to be delivered. The advantages of our service in terms of cost are apparent.

Looking to the future, what will be the key market trends?
Big data is infiltrating every industry, and the aerospace aftermarket is no exception. There is a tremendous drive towards data-driven solutions. There is also a trend towards consolidation, with big companies acquiring smaller companies like ours. We do not want to be bought, and instead we want to grow, so we are constantly seeking new customers. Every year we attend tradeshows and conferences where we learn about industry and market trends and realize opportunities with customers, trading partners and even competitors. We always ask prospective customers about what can we do for them that no one else has done. With our partnership with EDC (Export Development Canada) customers often talk about extending credit, having access to local inventory, and getting airplane parts transported faster, so this is where we come in.

Next year marks your 15th anniversary. What are your plans for growth?
We are looking to double in sales every two years for the next few years. I want to grow through mergers and acquisitions and through improving our current services. We are looking to expand our business to airplane and engine leasing and also airplane sales and contracts with bigger airlines such as Air Canada. As we grow, we want to maintain our existing flexibility as a company. Besides growth in terms of figures, our main goal is to be known as the best partner an airline can work with.

Image courtesy of Conestoga College

ONTARIO'S INNOVATION ECOSYSTEM

"Manufacturing is complex; subtle changes in materials and processes are having a big impact on cost, quality and product performance. Safety in aerospace is paramount as there is no opportunity to pull over to the curb to fix something when flying; this impacts how new ideas and technologies are developed and implemented."

- Stephen C. Veldhuis,
Director,
McMaster Manufacturing Research Institute,
McMaster University

Ontario's R&D Capabilities

At the crossroads between a conservative industry and the fourth industrial revolution

> It is increasingly important to invest in R&D to develop and de-risk technologies before they can be included in a new program. Technologies can be de-risked through targeted collaborative research and technology demonstration activities. The recent introduction of a Technology Demonstration Program (TDP) by the government of Canada is a very positive development for the industry.
>
> - Fassi Kafyeke,
> Senior Director, Advanced Technologies and Innovation,
> Bombardier Product Development Engineering, Aerospace.

Although Ontario's legacy of advanced manufacturing has carried the aerospace industry into the 21st century, the sector can no longer rest its weight on history. The aerospace industry is at a crossroads, and companies need to steer away from their traditional mindset to embrace disruptive technologies and lead the world in innovation. "To elevate the aerospace industry and become globally competitive, the region should adapt new technologies available," said Joris Myny, senior vice president for Process Industries & Drives division at Siemens.

Ontario has the capabilities in place to adopt innovative technologies and break away from the legacy aerospace industry. The region has a high concentration of assets including incubators and accelerators, contributing to the innovation ecosystem. Ontario also hosts approximately 18 universities and colleges offering 40 aerospace-specific programs. For example, McMaster University's Manufacturing Research Institute (MMRI) collaborates closely with OEMs, engine providers and the aero parts supply base through a range of research programs. Additionally, the University of Ontario Institute of Technology's (UOIT) ACE allows for aerospace companies to test and validate their research in a unique facility. The University of Waterloo, Carleton University, and Conestoga College all work with industry partners on aerospace-related research from blade coatings to aircraft design.

The Downsview Park Aerospace Campus is a unique collaborative project between academic institutions, industry players and government institutions. Key stakeholders are part of the Downsview Aerospace Innovation and Research (DAIR) working group, and contribute to the efforts of building the aerospace campus that will be the hub for integrated research, industry-leading innovation, and entrepreneurial business development. The University of Toronto Institute for Aerospace Studies (UTIAS) and Centennial College are both relocating aerospace programs to Downsview to further collaborate with the industry in research. The Downsview hub will be an avenue for the aerospace industry to stay at the global forefront for R&D and innovation. "We need to create this beacon to the world where they can come to Ontario and access the newest R&D projects and be at the cutting edge of innovation," said Andrew Petrou, director for DAIR.

Associations play a role in bridging the gap between industry and academia. For example, Consortium of Aerospace Research and Innovation in Canada (CARIC) has 14 projects in Ontario establishing collaboration between the aerospace industry and academic research centers and helps the region strengthen its aerospace network while innovating to better compete globally. Marlene Conway-Diels, CARIC regional director for Ontario, said: "We create awareness of R&D processes and opportunities to help companies understand how they can benefit from these types of programs. The basis of our program is to connect the industry and academia to collaboratively work on R&D projects."

Even with strong academic institution and associations supporting collaborative research initiatives, government support is imperative to increase R&D and innovation in Ontario as well as the adoption of new technology. "Strategic investments by our government partners heavily leverage industry investments both in terms of accessing existing infrastructure and talent and also by providing matching funding on research performed at the MMRI and through generous R&D tax credits," said Stephen Veldhuis, director of MMRI. Both the federal and provincial governments provide programs and incentives supporting the aerospace industry in Ontario, allowing companies to invest in innovation. FedDev Ontario's mandate since 2009 is to support the innovation ecosystem.

To some extent, government programs also facilitate SMEs access to funds, allowing them to incorporate the latest technology to remain globally competitive. For example, Brotech Precision CNC has leveraged opportunities such as the South-

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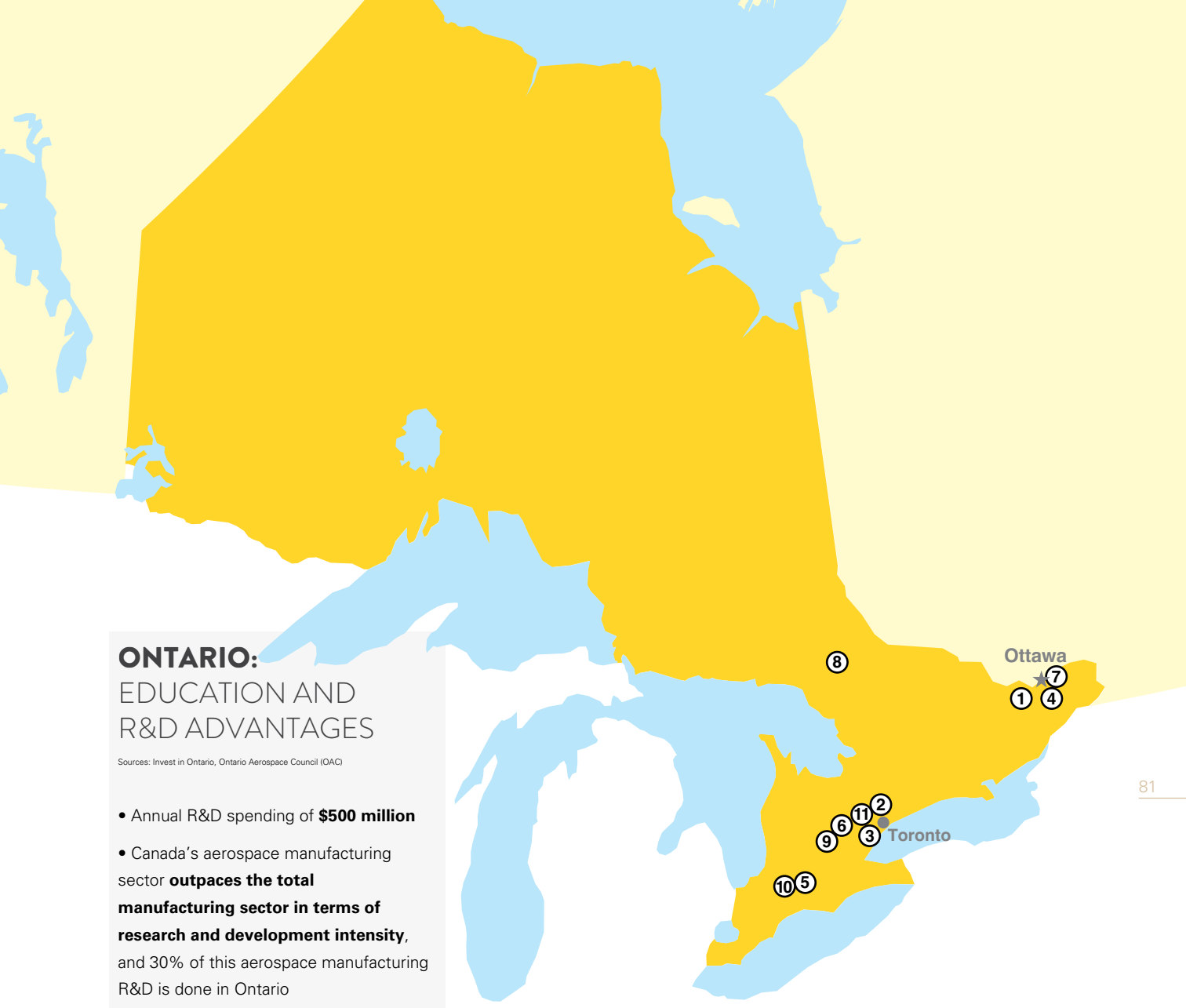

ONTARIO: EDUCATION AND R&D ADVANTAGES

Sources: Invest in Ontario, Ontario Aerospace Council (OAC)

- Annual R&D spending of **$500 million**
- Canada's aerospace manufacturing sector **outpaces the total manufacturing sector in terms of research and development intensity**, and 30% of this aerospace manufacturing R&D is done in Ontario
- Approximately **18 universities** and colleges offering **over 40 aerospace-specific programs**
- 14 universities with **engineering programs**
- **PhD and Masters Programs in aerospace engineering** offered at University of Toronto, Ryerson University (Toronto) and Carleton University (Ottawa).
- Nearly **40,000** Science, Technology, Engineering and Mathematics (STEM) **graduates** per year.
- **67%** of Ontario adults have **completed post-secondary education**, more than in any OECD country.

MAP OF R&D LOCATIONS

1. David Florida Laboratory - Ottawa
2. UTIAS Spaceflight Laboratory (University of Toronto) – Toronto
3. NRC CANMET Materials – Hamilton
4. NRC Aerospace – Ottawa
5. Fraunhofer Project Centre for Composites Research – London
6. Institute for Quantum Computing (University of Waterloo) – Waterloo
7. Defence Research and Development Canada – Ottawa, Toronto
8. Innovation Centre for Advanced Manufacturing and Production – North Bay
9. Catalyst 137 – Waterloo
10. Canadian Centre for Product Validation – London
11. Downsview Park

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western Ontario Development Fund to incorporate cutting-edge technology. However, government institutions still need to play a stronger role to ensure SMEs invest in innovation and new technology. SMEs continue having difficulty financing the capital investment required to incorporate new technology and grow. "Reducing costs goes hand in hand with R&D and technological development, and therefore smaller companies require financial support from the government," said Daniel Zanatta, vice president of Magellan Aerospace.

Industry 4.0

As manufacturing sectors have taken a hit in recent years, there is the necessity to increase productivity and efficiencies, transitioning into the fourth industrial revolution, or Industry 4.0. "Assembling a plane is still manually intensive, and fully leveraging advanced operations, advanced analytics, and the Internet of Things will be important. Aerospace should be a leader in looking at new automated technologies for manufacturing," said Bruce Simpson, senior partner at McKinsey.

An important part of Industry 4.0 is automation. With the high mix, low volume nature of aerospace manufacturing, SMEs in Ontario have been slow in implementing automation. However, there needs to be an understanding that automation can still enhance productivity and help lowering costs for aerospace companies, even with the low-volume quantities of manufacturing. Automation for aerospace manufacturing will still require labor, but can increase quality and precision of production. Koss Aerospace, located in Mississauga, has incorporated automation technologies into its manufacturing processes in order to achieve faster cycle times and reduce costs, and other companies need to follow suit to increase productivity.

The Internet of Things (IoT) is another important facet of Industry 4.0. The next generation of aircraft will arguably be powered by IoT. However, big data and smart data can also be incorporated into manufacturing processes. Companies such as UTC Aerospace Systems are investing into a digital strategy to guide their operations into the future with Industry 4.0. Aerospace companies need to invest in new technologies now to not be left behind in the rising storm of the fourth industrial revolution. Jeff Gazidis, business development for aerospace at Siemens, highlights: "Industry 4.0 is a journey and change will not happen overnight."

Environmental initiatives

The outlook for R&D in Canada will include trends relating to environmental sustainability. In regards to the increasing emphasis on carbon credits and jet engines' effects on the atmosphere, Nathan Cheifetz, partner at Blakes, comments: "Soon there will be a new world-wide system, with pressure all the way down the manufacturing chain to OEMs and suppliers of different components to meet these new standards."

Environmental sustainability is an area for collaborative research between universities and aerospace companies. For example, UTIAS collaborated with Bombardier and Pratt & Whitney on a project dedicated to developing an environmentally sustainable aircraft.

Fortunately, sustainable technologies often go hand in hand with cost reduction. For example, aerospace parts with new materials, such as composites or titanium not only reduce weight, resulting in lower fuel consumption, but also ensure cost optimization. Therefore, beyond the pressure to increase environmental sustainability, aerospace companies are seeing the aggregate benefit in doing so. "Going towards the future, it is important to support innovation in the aerospace industry, and to support those looking for more green technology with faster and more ecologically-friendly methods," said Heidi Clark, senior partner at Dentons.

Emerging markets such as Mexico or China are heavily investing to create the aerospace capabilities Ontario already has in place. These countries are developing their infrastructure both in manufacturing as well as in academic institutions. In these regards, Ontario already benefits from having a strong foundation, therefore the region needs to leverage the R&D ecosystem comprising of academic institutions, associations and industry players to elevate the aerospace sector. In other words, Ontario needs to stay ahead of the game and lead the industry at the forefront of innovation and into the fourth industrial revolution. In the words of Denis Faubert, president of CARIC, "Ontario's aerospace industry continues making capital investments and we expect long-term growth for the sector."

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Ontario's Aerospace Advantage

The Southern Ontario Innovation Ecosystem

By Alain Beaudoin,
Vice President Policy, Partnership and Performance Management, Federal Economic Development Agency (FedDev) for Southern Ontario

> "As a technology leader, Canada's aerospace sector can play a key role in the achievement of government priorities such as the development of clean technologies."

Southern Ontario is home to the most complex innovation ecosystem in Canada and ranks as one of the most sophisticated innovation ecosystems in the world. It consists of a large concentration of high technology firms, post-secondary institutions, research centers and government agencies, working together to support the development, adoption and commercialization of new products and services. Approximately $14 billion of R&D is performed in southern Ontario each year by businesses, universities and colleges, non-profit organizations, and governments. Not only is there a growing realization amongst key partners that innovation is the foundation of our region's future prosperity, but also that collaboration will be key to succeed and be globally competitive.

The Government of Canada has launched an Innovation Agenda focused on making Canada a global center for innovation. As a technology leader, Canada's aerospace sector can play a key role in the implementation of this agenda and the achievement of other government priorities, such as encouraging the development of clean technologies.

Southern Ontario is world renowned for its Information and Communications Technology (ICT) clusters, as well as its automotive, financial and life-sciences sectors. The Toronto-Waterloo corridor alone is home to more than 15,000 technology companies, and more than 200,000 technology workers.

Alongside well established industries, the innovation ecosystem is also supporting the growth of emerging clusters including big data, digital media, Internet of things, artificial intelligence, quantum computing, cyber security, autonomous vehicles, 3D printing and Telecom/next generation networking. The development and adoption of these types of transformative and potentially disruptive technologies are changing business models in aerospace and other industries, giving firms that successfully adopt and integrate these technologies a competitive advantage.

Thanks in large part to its 44 universities and colleges, southern Ontario has one of the world's most highly skilled workforces. College and university graduates come from a broad spectrum of technology disciplines, including aerospace. Collectively, post-secondary institutions offer more than 40 aviation-related programs, and are actively collaborating with industry. For example, a new aerospace innovation and research hub is in development at Downsview Park in Toronto. This hub will group together aerospace campuses next to aerospace firms and collaborative R&D facilities to support collaboration and innovation.

To accelerate commercialization, federal, provincial and local governments are working together with the private sector, post-secondary institutions, and other partners, to support a dedicated network of accelerators and incubators, research, testing and certification infrastructure, venture capital networks, as well as industry-academic research partnerships. One example of such infrastructure and asset available to the aerospace sector is the Fraunhofer Project Centre for Composites Research in London, Ontario, where firms can work with the Centre to develop, test, and validate new lightweight materials and advanced manufacturing processes at industrial scale.

Southern Ontario's innovative firms also benefit from a competitive business climate and good access to global markets. Market access is critical to southern Ontario's innovation ecosystem. Our technology intensive firms typically depend on global markets for most of their sales. The Canadian aerospace sector is a good example as 80% of its production is exported.

We know that technological change continues to accelerate and that it will continue to affect the competitive landscape for aerospace and other technology intensive industries. To maintain the prosperity of southern Ontario, the various partners within our innovation ecosystem must continue to collaborate so that our firms are able to commercialize leading edge innovation and successfully compete globally.

Denis Faubert & Marlene Conway-Diels

DF: President

MCD: Regional Director for Ontario

CONSORTIUM FOR AEROSPACE RESEARCH AND INNOVATION IN CANADA (CARIC)

DF

MCD

Could you provide an overview of the evolution of CARIC since its inception in 2014?

DF: CARIC was established in 2014 with the financial support of the federal government. The consortium establishes collaboration between the aerospace industry, academia research centers, and even other industry players, by providing financial support for R&D projects. The Montreal team managing CRIAQ, started managing CARIC as well, allowing us to quickly establish our operations and benefit from CRIAQ's operational framework to advance to success. In 2015, CARIC established regional offices, and we currently have approved over 30 projects with a total value of about $40 million. Ontario is involved in 14 of the projects.

MCD: CARIC projects span in areas such as diagnostics, prognostics & health monitoring (DPHM), operations, avionics, manufacturing and assembly processes. Ontario has various projects of Expressions of Interest in these domains, and one has recently been approved to formally submit for funding.

What services does CARIC offer the aerospace industry in term of innovation strategy?

DF: We create awareness of R&D processes and opportunities to help companies understand how they can benefit from these types of programs. CARIC ensures the implementation of projects for improving and developing innovative products. Another aim is building a network within the aerospace industry and creating linkages between industry players. The basis of our program is to connect the industry and academia to collaboratively work on R&D projects.

MCD: CARIC also plays a strategic advisory role for OEMs, Tier 1, and Tier 2 companies. Larger companies often have identified technology domains, which are specific areas of interest. We have 11 research areas under which projects can be submitted. We also have discussions with companies of all sizes about their long and short-term goals, allowing us to match partners from a strategic perspective.

What industry players are involved in the Aero-Connect program?

DF: The Aero-Connect program develops new relationships between the aerospace industry and academia through new research collaborations. The program builds on the Engage Grants program of the Natural Sciences and Engineering Research Council of Canada (NSERC), supporting new collaborations between academia and industry. Universities and colleges are eligible to receive funding from this program. Industry partners often make a direct contribution and CARIC supplies $10,000, while NSERC supplies $25,000.

How does CARIC collaborate with the Ontario Aerospace Council as well as the Ontario Centres of Excellence (OCE)?

MCD: CARIC actively collaborates with the provincial and regional aerospace organizations, and there is a natural partnership between us and the Ontario Aerospace Council (OAC). In Ontario, we work closely with the OAC's Research and Technology Committee as well as with the OCE and several other funders. In collaboration, we sponsor events and activities to increase awareness of opportunities in the sector. We also host workshops to educate SMEs on how innovation may grow their business.

What are the major trends in the aerospace industry, and how is CARIC supporting these trends?

MCD: CARIC mainly sees research projects in the areas of manufacturing processes, materials, IT, data, avionics, operations, and autonomous systems. We support these projects by directly engaging with industry and academia, building awareness, and facilitating a linkage between possible partners.

DF: One of the current trends in the aerospace industry is building on ITC (Information, Technology and Communication) to improve their operations and offer novel services. Another trend in the market is advanced manufacturing.

What are some of the key challenges aerospace companies are currently facing in Ontario?

MCD: CARIC's main objective is increasing Canada's competitiveness and sustainable market share growth globally. The main challenge is for aerospace companies to innovate and improve their operations and products creating competitive advantage to facilitate further market penetration on an international level. In Ontario, there is also the concern for the availability of a talented workforce.

What are your objectives at CARIC in terms of supporting the industry going forward?

DF: Ontario's aerospace industry continues making capital investments and we expect long-term growth for the sector. CARIC programs are based around three outcomes: innovation, building a network, and human capital sustainability. Our program also supports protecting the environment.

Stephen C. Veldhuis

Director
MCMASTER MANUFACTURING RESEARCH INSTITUTE, MCMASTER UNIVERSITY

Could you briefly introduce the McMaster Manufacturing Research Institute?
The McMaster Manufacturing Research Institute (MMRI) works collaboratively with its industry partners to solve advanced manufacturing challenges. Our focus is on enhancing productivity, quality and cost competitiveness while supporting product innovation and sustainability. My specific area of research is on surface engineering; utilizing adaptive surfaces with self-protecting properties to improve tool life and process performance.
Academic programs at McMaster are closely linked to research through our unique problem-based learning approach which was developed at the McMaster medical school in 1969. This approach to engaged learning has become an international standard for student-centered pedagogy. Our close collaboration with our aerospace partners' strengthens this by exposing our students to meaningful research challenges making them job ready upon graduation.

How important is aerospace for the institute?
Aerospace encompasses 30% to 40% of our activity in the MMRI and directly complements our automotive, energy, mold/die and biomedical manufacturing research. The MMRI works closely with OEMs, engine providers and the aero parts supply base through a range of research programs. We see our role as leveraging Ontario's natural strengths in advanced manufacturing to develop competitive processes which ensure that the innovative products coming out of R&D programs are competitively manufactured here in Ontario and supplied globally.

What challenges are aerospace companies in Ontario currently facing?
Aerospace companies are facing a host of challenges including: increasing production volumes with tight price pressure, rising customer performance expectations, stringent energy and environmental regulations and continuously tightening quality targets. Addressing these involves manufacturing, but manufacturing is complex; subtle changes in materials and manufacturing processes are having a big impact on cost, quality and product performance. Safety in aerospace is paramount as there is no opportunity to pull over to the curb to fix something when flying, this impacts how new ideas and technologies are developed and implemented.
For these reasons manufacturing research at the MMRI takes a highly collaborative and integrated approach to problem solving bringing together industry, academic and government lab researchers spanning material science, design, manufacturing and inspection/test. Within this context the MMRI plays an important role in de-risking technology investments by validating and demonstrating new processes and technology.

The automotive industry has been quick to implement automation technologies. How valuable would investment in automation be for aerospace companies?
Automation needs to be different in aerospace. By nature of their production volumes, cars are designed to facilitate automation while aircraft have tighter design restrictions and involve materials and structures which do not lend themselves to the same levels of automation. In aerospace people are integral to the job and need to be accommodated. Thus for aerospace we are recommending collaborative automation, which is specifically designed to empower Ontario's highly trained and skilled workers to enhance their productivity, not replace them.

How strong are your links with partner companies?
Manufacturing is a hands on exercise with industry needing to see technology working before gaining buy in. However, it is also complicated enough to require the level of analysis that academics can provide. At the MMRI we combine these by performing the detailed science based research, then validate and demonstrate the technology on our industry scale equipment. Our staff also work closely with our industry partners to support full scale implementation at the industry partner's site.

What makes Ontario a global aerospace hub?
Talent and critical mass are the main factors. Aerospace is a priority in Ontario and the MMRI has benefited greatly from related industry, government and university investment in advanced manufacturing R&D infrastructure and talent development. Strategic investments by our government partners heavily leverage industry investments. This strategic thinking has allowed Ontario aerospace activity to reach critical mass making it very easy for a new company to come and fit into the ecosystem.

What are MMRI's goals for the next three to five years?
Over the next three to five years the MMRI aims to continue to grow its interactions with the industry, implementing our research results to benefit companies operating in Ontario. Through this focused initiative my goal is to meaningfully contribute to a highly collaborative, engaged and globally competitive aerospace industry in Ontario.

Joris Myny

Sr VP Digital Factory
PROCESS INDUSTRIES & DRIVES DIVISION
SIEMENS CANADA

What is Siemens' history in Ontario?
Siemens is a global technology company that has been part of Canada for more than 100 years and has a substantial footprint in Canada and in Ontario specifically. The province is home to 29 locations including our LEED Gold certified head office in Oakville and seven manufacturing facilities. We employ hundreds of people in manufacturing operations including a significant R&D team. In Concord, Ontario at Siemens Ruggedcom for example, we perform research and development for global product lines of communications equipment built to endure extreme climatic surroundings and sustain demanding environments. At our Trench Canada locations in Scarborough and Pickering, R&D teams look at improvements in coils and instrument transformer products lines which are part of specialized high voltage electrical equipment serving customers worldwide in the utility and industrial markets. Our operation in Peterborough is a global center of competence for manufacturing of level and weighing instrumentation for the global market.

Could you address the importance for manufacturing companies in Ontario to increase their productivity?
There is tremendous potential in the Canadian advanced manufacturing sector. The key to remaining competitive is to increase productivity and this is where *Industrie 4.0*, what some people call the fourth industrial revolution, comes into play. *Industrie 4.0* allows manufacturers to be increasingly oriented toward individual customers' wishes. Customers are increasingly able to tell their manufacturers directly what exactly they want and when. Alternatives can often be found easily and potential business can be quickly lost which is why productivity is key.
We aim to introduce new technologies to the complete supply chain, from OEMs to suppliers, to increase the productivity of the entire aerospace industry. The performance of the entire supply chain makes the production of a product successful, and aerospace companies are only as strong as the weakest supplier in the chain. We do not limit our focus on large OEMs, but also look at the important aerospace supplier base which has quite a strong presence in Ontario.

How does Siemens help implement digital factories?
To realize *Industrie 4.0* companies need to set up digital enterprises and implement innovative technologies into their manufacturing process to increase productivity, efficiency, and time-to-market. Siemens provides technology to create a digital enterprise. The digital enterprise allows manufacturers to design and test their entire manufacturing process and products in a virtual world, which is more cost effective and brings a game-changing transformation.
Our Industry Software also enables suppliers to work on the same data backbone as the companies they are supplying to and key design, manufacturing, and service data is exchanged in real time. Many of our customers already have real time open communication with their suppliers, allowing them to more easily address productivity and innovation challenges together and quickly.

How far along is Ontario's aerospace sector in implementing *Industrie 4.0*?
Ontario's aerospace sector is open to *Industrie 4.0*, as the industry is competitive and innovative. The large global companies have the resources to implement new and innovative technologies on their own and assume the associated risks, and Siemens supports these global manufacturing companies in Ontario. We also however want and need to support SMEs who often do not have the resources to experiment with implementing *Industrie 4.0* technology. To accomplish this we need cooperation between the government, the education sector and leading technology providers. Also, to achieve *Industrie 4.0* we need a workforce with knowledge and expertise of these new technologies and systems. Siemens is taking a lead role in the collaboration between academic institutions and government.

What are Siemens' strategy and goals for the next three to five years?
Our goal is to demonstrate to our customers how our technologies improve efficiency, innovation, and cost competitiveness. Our technology allows manufacturing companies to realize the Digital Enterprise, and our strategy is to partner with our customers and guide them through this change together. I am optimistic about Ontario's aerospace industry, as the power is in the quality of our people and innovative mindset. Ontario has a very promising aerospace industry with opportunity to become a global leader.

David Zingg

Professor

THE UNIVERSITY OF TORONTO'S INSTITUTE FOR AEROSPACE STUDIES (UTIAS)

UTIAS was the first institute in Canada dedicated to Aeronautical engineering. How has the program developed since the institution's establishment?

UTIAS was established in 1949 and in the last 10 years our graduate student population has more than doubled in size. Since the institution's establishment, we have moved away from defense related research to almost exclusively civil related research. The evolution of the program is driven by the constantly changing trends and technologies. UTIAS is now a critical component of Canada's aerospace ecosystem.

What are some of the main areas of study that UTIAS offers?

In terms of undergraduate education, UTIAS offers the undergraduate Aerospace Option within the Engineering Science Program in the Faculty of Applied Science and Engineering and also contributes significantly to the delivery of the Robotics Option.

In terms of graduate education, we now have approximately 180 graduate students supervised by 19 professors. The research groups operate in various areas including combustion, autonomous robotics, fluid dynamics, unmanned aerial vehicles (UAVs), and flight simulation, among others. In terms of space research, we are mainly focused on satellites and rovers, and we have a Space Flight Laboratory which designs, builds and operates micro satellites.

UTIAS has two centers reflecting important strategic research priorities: The Centre for Research and Sustainable Aviation (CRSA), focusing on developing technologies to reduce the environmental effect of aviation and The Centre for Aerial Robotics Research and Education (CARRE), focusing on UAVs and robotics.

How has UTIAS assisted in the development of the aerospace industry in Ontario?

UTIAS conducts a significant amount of collaborative research with the aerospace industry, but our biggest contribution to the sector is through education and the development of highly qualified graduates. Our graduates play a critical role in Ontario's aerospace sector. In terms of research, we have been collaborating with major OEMs, such as Bombardier and Pratt & Whitney Canada, and MDA, for more than 30 years. For example, the flaps on the Bombardier Q400 aircraft were designed based on software developed at UTIAS. We also collaborate with smaller aerospace companies, such as Solar Ship and UAV companies.

Could you elaborate on UTIAS' collaborative R&D efforts?

Improving the environmental sustainability is a major focus of our collaborative research. This includes research on topics such as combustion for reduced emissions, biofuels, multifunctional materials, active flow control for drag reduction, low-drag unconventional aircraft configurations, and technologies to tackle noise reduction. UTIAS collaborated with Bombardier and Pratt & Whitney on a project dedicated to developing an environmentally sustainable aircraft. The project ran for four years and we studied alternative aircraft configurations for regional jets that would have better fuel efficiency and lower CO2 emissions than the conventional configuration.

What is UTIAS's involvement in the Downsview Park Aerospace Campus project?

Along with Bombardier and Centennial College, UTIAS is one of the leaders of the Downsview Park Aerospace project. Initially, the hub will consist of UTIAS, Centennial's aerospace department, an Innovation Centre, Bombardier, and Flight Safety International. The innovation center will include academic institutions such as Ryerson University and York University as well as facilities for conferences, short courses, and workshops as well as shared research facilities, all of which will bring the entire sector together.

What is your vision for UTIAS going into the future?

UTIAS's vision is that Ontario, Canada, and the global community will benefit scientifically, socially, and economically from research and education in aerospace science and engineering performed at UTIAS. Our mission is the pursuit of excellence in the education and training of students for research and leadership positions, discovery and dissemination of new knowledge, and application of knowledge to the benefit of society.

There are enormous opportunities for the aerospace sector in Ontario in partnership with the entire Canadian industry. One goal is to attract more foreign companies to the region and for more of their research to be conducted in Canada. Similarly, we would like to see Ontario's aerospace sector attract talented individuals through attending academic institutions, such as UTIAS, and then working in the sector. Retention is equally important, so we need to create more opportunities for post-doctoral students in aerospace within Ontario and Canada.

Julia Biedermann

Executive Dean, Engineering-IT-Trades
CONESTOGA COLLEGE

Justin Gammage

Industry Liaison Manager
UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY (UOIT)

Could you introduce Conestoga College with an overview of your areas of study?
We provide a full breadth of programs and credentials. We offer engineering technology, which includes mechanical, electrical, civil, environmental, architecture and construction, software engineering and welding. As a full-service polytechnic institution, we also encompass the full suite of automotive, industrial and construction trades. Our division also has applied research capabilities. We offer co-op programs and are one of the largest trainers of apprentices in Ontario. Conestoga College does not offer any courses specific to aerospace, but a lot of the knowledge we impart is applicable to that area.

The average age amongst aerospace workers in Ontario is high. How is Conestoga College helping build a new workforce?
We can produce skilled graduates in all the areas we cover, including aerospace, but in some cases we cannot get the students in, because they are not being directed into the skilled trades or engineering. A huge demographic we are missing out on is women, who make up about 15% of the intake across my division. Machining and welding are trades we cannot fill. Conestoga College is fortunate that this region receives a lot of immigration, so our overall numbers have increased, but this will not go on forever unless we see different types of students coming in. Only 40% of our students come directly from high school, and the average age of an apprentice is 28.
There is a problem with the Canadian apprenticeship system, where each apprentice needs to find an employer before they can begin their training. Conestoga offers pre-apprenticeship programs providing students with the skills needed to secure that industrial sponsor. On the other hand, the aerospace industry complains that it lacks skilled trades, but if it does not come to us to post positions or look for co-op students, it is missing out on a fantastic opportunity to find good people.

What is your strategic growth plan for Conestoga College?
This year the college grew by about 2%, while our division grew by more than 11%. By continuing to expand, we can take advantage of economies of scale. Other objectives are to use our space more efficiently and to ensure our students are employed, with both co-op and graduate opportunities. Good employment statistics are key to attracting students – currently we are doing very well, with about 90% graduate employment.

How does the University of Ontario Institute of Technology prepare students to work in the aerospace industry?
Through experiential learning opportunities, we focus on training students to ensure they are well-rounded, well-educated and prepared for successful careers in the aerospace or any other industry. Through internships and co-ops, we have specific training modules encouraging hands-on learning in the real world.

Could you provide an overview of ACE, its history as well as its capabilities?
Operating for more than four years, ACE is a hundred-million-dollar facility founded on an industry/public sector partnership with the federal and provincial government. ACE was developed with industry research needs in mind. Companies can rent ACE by the hour, and we can develop a test program with our engineers to test a product at a much lower cost than it would be for organizations to build a brand new research facility. Although OEMs may have their own testing facilities, it is difficult for smaller companies to access these, so we open that door for them.

Ronald Miller

Chair of Mechanical and Aerospace Engineering
CARLETON UNIVERSITY

What are the different mechanical and aerospace engineering programs at Carleton University?
Established in 1998, we have the oldest and largest aerospace engineering program in Canada. At the undergraduate level we have four aerospace streams: one focused on aerodynamics and propulsion, one on aircraft structures, one on avionics, and the other on space vehicles. Our undergraduate program offers a 16 month co-op option. 30% of our students maintain the B average necessary to participate in the co-op program. Of these, the placement rate is virtually 100%. Many of the placements are in government, such as with the National Research Council and the Canadian Space Agency, while many others are in companies in Montreal, Toronto, and other parts of Canada. We have connections with Bell Helicopters, Pratt & Whitney and Bombardier, among others. At the graduate level, we have a full MASc and PhD program.

Could you describe the faculty and its research focus on aerospace engineering?
We have 38 faculty members between aerospace and mechanical engineering programs. Carleton University focuses on aerospace-related research, including gas-turbine technology, blade coatings, fundamental aerodynamics, aircraft design and optimization, aero-acoustics, rotor blade design, unmanned aerial vehicles, and guidance and control systems.

Will automation be increasingly incorporated in Ontario's aerospace industry?
There are trends toward automation in all areas. However, automation is more easily incorporated in the automotive industry than in aerospace, due primarily to the greater economies of scale. With research going into making automation easier and more efficient, it will eventually expand into aerospace as well.

How interested is your department in innovative, lightweight products for aerospace?
The big push is in composites. There is interest in switching things which were traditionally made of aluminum or steel into advanced composites. This introduces a whole host of challenges in terms of understanding the damage mechanisms and being able to properly predict component lifetimes. Of course, there are now composite aircraft in operation, such as the Dreamliner, but there is still work to be done in understanding repairs and maintenance, and ways to optimize their structures. These are areas we are interested in. We have a variety of composites manufacturing and testing facilities, some already online and some being commissioned or purchased as we speak.

And how can your capabilities at ACE be applied to aerospace specifically?
Climatic scenarios are applied broadly to aerospace conditions, and ACE can deliver consistent made-to-order weather conditions simulating a range of humidity and temperatures from -40 to +65 Celsius and wind velocities as high as Category 4 hurricane force (in excess of 260 km/h). We can simulate conditions for take-off and landing, and also conduct research on seats and componentry within the aircraft, including landing gear. We can also simulate shaking, cycling of temperature, and icing. With Unmanned Aerial Vehicles (UAVs, or drones), we did a year's worth of landing possibilities in just 30 seconds. UAV manufacturers were able to get their testing answers within a day, rather than waiting a full year in actual real-life testing.

Going forward, what are some of your overarching goals for the UOIT as well as ACE?
Our goal is to fulfill the mandate of our university's strategic research plan and provide the support necessary to our industry clients and partners. Also, we want to grow ACE and expand the sectors we serve. We will continue working with our partners to develop ACE's capabilities and maximize our impact in the regional and provincial economy because ultimately we are here to serve the people of Ontario.

Image courtesy of Bombardier Business Jets

INDUSTRY PROSPECTS

"There are enormous opportunities for the aerospace sector in Ontario in partnership with the entire Canadian industry. Ontario has tremendous academic expertise and a great industrial sector. The goal is to attract more foreign companies to the region and for more revolutionary research to be conducted in Canada."

- David Zingg,
Professor,
University of Toronto's Institute for Aerospace Studies (UTIAS)

Going into **the Future**

The prospects for Ontario's aerospace industry are bright

Aerospace industry leaders in Ontario have reasons to feel optimistic. The sector's history of advanced manufacturing capabilities as well as diverse aerospace offerings set the foundations for an established supply chain. Now, the sector must seize the current opportunity for growth given its capabilities and also the fact that Canada is a current hotspot for international investment. Donald Gray, partner at Blakes, said: "Due to the stability of Canada as a place to invest, and the fact that aerospace is one of the areas where Canada is a world leader, there has been an increasing interest internationally to invest in Ontario, and we have negotiated deals for investments in original equipment manufacturers, parts manufacturers, aviation training units, military procurement projects, airlines and others."

Regardless of the opportunities, however, the development of the aerospace sector will not reach its full potential if the industry is not able to tackle current challenges as well as adapt to changing trends.

Thinking of the Workforce

Although Ontario has an excellent pool of engineers, there is a rising challenge to find highly skilled workers for aerospace manufacturing. Michael Iacovelli, CEO of Ben Machine Products & Co., commented: "The manufacturing industry has experienced a decrease in the skilled labor force as workers move out of the region and out of the manufacturing sector. Ontario's manufacturing capabilities will shrink in the long-term and it will be difficult to find qualified talent."

Especially in areas further removed from Toronto, such as Peterborough, it is difficult to find qualified workers for aerospace jobs.

Additionally, the legacy characteristic of the aerospace industry has resulted in an aging workforce in manufacturing. In various companies throughout Ontario, the average age of employees is 50, and in some cases more. The region needs to leverage its world-class post-secondary academic institutions to create the next generation of the workforce.

Conestoga College is an example of an institution preparing the future highly skilled laborers, many of which work for aerospace companies. However, efforts need to commence at even an earlier stage in order to motivate students from a young age to work in the aerospace sector. Airbus Helicopters is opening its doors in Fort Erie to students from elementary school to spark passion for aerospace from a young age. Other aerospace companies should follow suit. If the province wants to continue attracting international investment in the industry, it needs to strengthen the promotion of new talent.

Consolidation of the Supply Chain

A current trend in the aerospace industry worldwide is the pressure from the OEMs, Tier 1 and Tier 2 companies down to their suppliers to consolidate the supply chain. Ontario has a wide network of SMEs with unique aerospace capabilities, but for these companies to remain relevant, they need to respond to the market demands. Smaller contract manufacturers will need to either scale up or to find partners in order to maintain viability going forward. Romain Trapp, president and CEO of Airbus Helicopters Canada, commented: "We are looking to reduce the number of Tier 1 and Tier 2 suppliers, and thus companies must merge or partner to provide a wide range of capabilities at one shop."

Mergers and Acquisitions (M&A) are increasing in Ontario and SMEs will continue to be acquired by larger companies. As an example, SPP Canada acquired CFN Precision and Tecnickrome to add surface plating, processing, and other services to their capabilities. If SMEs want to survive, they need to develop their offerings such as providing finished solutions as opposed to just manufacturing components.

Another approach towards consolidating the supply chain is for SMEs to collaborate and work together as one supplier to Tier 1 or OEMs. Vertex Precision Manufacturing is a group of Ontario companies that specialize in turnkey solutions. Umbrella companies such as Vertex or other collaborations simplify the supply chain and ensure sustained competitiveness.

Image courtesy of Downsview Park

Additionally, serving the aerospace industry, companies in Ontario such as P3 and Intertek offer supply chain management services that the sector could benefit from to remain efficient and globally competitive.

Productivity

Another big issue is productivity. In this context, it is vital for Ontario's aerospace industry to incorporate new technologies, making processes more productive. "Productivity is the biggest challenge for the aerospace cluster in Ontario," asserted Bruce Simpson, senior partner at McKinsey.

The aerospace industry is conservative and its legacy characteristic has meant resistance to change. Industrial upgrading in emerging economies and the technological revolution around the world have increased pressures on Ontario aerospace companies to keep up. Automation of factories, lean processing, and introduction of new advanced materials in the production processes are all possible ways for companies to increase productivity.

Some companies are confronting the productivity challenge by incorporating additive manufacturing as well as other technologies or by providing productivity solutions. For example, Applied Precision creates 3-D manufacturing technology for aerospace parts as well as digitalizing aircrafts for simulation, all of which decrease labor and production costs. 3-D printing of aerospace parts is increasingly relevant and some companies in Ontario are keeping up to speed with new market trends. Maintenance service companies in Ontario, such as CaseBank Technologies, are also embracing innovative technology. By offering their advanced maintenance software that stores data of all aircraft malfunctions, they nullify traditional aircraft maintenance methods. Laurence Esterhuizen, the director for aerospace and defense business development for CaseBank, said: "In the world of reliable equipment, efficient maintenance is vital, and our products will only become increasingly necessary."

So, the industry needs to incorporate innovative technologies to ramp up productivity in aerospace. A requisite for this is the creation of further linkages between industry and academia. The Emerson Report 2012 in the Aerospace Review stated that the co-location of industry and academia into a single hub is an effective strategy to increase aerospace sector competitiveness, and pointed to Ontario to form the hub to bolster the industry.

Downsview Park Aerospace Campus is a reaction to the Emerson report. The hub will not only bolster R&D in the region but will also incentivize SMEs to collaborate with larger industry players and will attract international business to the region by providing the infrastructure for collaboration. The Downsview Aerospace hub will help to tackle the key challenges in the Ontario aerospace sector; for example, the increased synergy between industry and academia should mitigate the lack of skilled workers. The Downsview hub will be "the heartbeat of aerospace," according to Andrew Petrou, director for DAIR.

Although there are key challenges on the road towards growth for the Ontario aerospace sector, the industry is already taking steps to address these to remain a contender to become a global aerospace powerhouse. David Zingg, Professor at the University of Toronto's Institute for Aerospace Studies (UTIAS) highlighted: "There are enormous opportunities for the aerospace sector in Ontario in partnership with the entire Canadian industry. Ontario has tremendous academic expertise and a great industrial sector. The goal is to attract more foreign companies to the region and for more revolutionary research to be conducted in Canada."

Ontario has a crucial role to play in raising Canada's global aerospace ranking up from fifth place. Ontario's aerospace sector is an unsung hero. It is time for the industry to address pertinent challenges, capitalize on its strength and showcase itself internationally.

COMPANIES	KEY CAPABILITIES			
Company	Components and standard parts	Industrial engineering and engineering services	Systems and software	Subassemblies and structures
Airbus Helicopters Canada	X	X		X
Airstart				
Altair Engineering			X	
Amphenol	X			
AON Risk Solutions				
AV Base Systems			X	
Ben Machine Products	X			
Brotech Precision CNC	X			X
CAN ENG Furnaces				
Casebank Technologies			X	
Cleeve Technology	X	X		X
COM DEV (Honeywell)	X			X
Comtek	X	X		
Exactatherm				
Fleet Canada	X			X
Flying Colours Corporation				
HISS	X		X	X
Hope Aero Propellers and Components				
Kadex Aero	X			
Koss Aerospace	X			X
Magellan Aerospace	X			X
Munro and Associates		X	X	
New United Goderich	X		X	X
Nu-Tech Precision Metals	X			X
P3 Group		X		
Safran Landing Systems	X		X	X
Satcom Direct				
Shimco	X			X
SPP Canada Aircraft	X		X	X
St Clair Technologies	X			X
Trinity Aerospace	X			X
Universal Precision Technology	X			X
Vertex Precision Manufacturing	X			X

This list intends to include just a representative sample of companies operating in Ontario Aerospace sector, and as such it should not be considered a guide to take investment decisions.

KEY CAPABILITIES

Machinery and equipment	Actuation and landing gear	Treatment and processing	Navigation systems and equipment	Communication systems and equipment	Design, interiors and exteriors	Testing and Maintenance	Mapping and Remote sensing	Aerospace Services
X	X	X			X	X		X
						X		X
								X
								X
	X	X						
X								
						X		
	X							X
						X		
						X		
		X						
		X						
			X	X	X	X		X
			X			X	X	X
		X				X		X
	X							
		X						
	X	X				X		
								X
	X		X	X	X	X		
	X	X				X		
					X	X		X
	X	X				X		X
				X				
		X						
	X	X						X
				X				
		X						X
X								X
		X		X				

This list intends to include just a representative sample of companies operating in Ontario Aerospace sector, and as such it should not be considered a guide to take investment decisions.

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3M
300 Tartan Drive London, ON N5V 4M9
Tel: +1 519-451-2500
http://www.3mcanada.ca/

Aerospace Industry Association of Canada (AIAC)
255 Albert St #703, Ottawa, ON K1P 6A9
Tel: +1 613-232-4297
http://aiac.ca/

Aerotek Manufacturing Ltd
1449 Hopkins Street Whitby, ON L1N 2C2
Tel: +1 905-666-3400
http://www.aerotekmfg.com/

Aeryon Labs Inc
575 Kumpf Drive, Waterloo ON N2V 1K3
Tel: +1 519-489-6726
https://www.aeryon.com/

Airbus Helicopters Canada
1100 Gilmore Road, P.O. Box 250 Fort Erie, ON L2A 5M9
Tel: +1 905-871-7772
https://www.airbushelicopters.ca/

Airstart
2680 Skymark Ave, Suite 901
Mississauga, ON L4W5L6
Tel: +1 888-359-2320
http://www.flyairstart.com/

Altair Engineering Canada
170 The Donway West, Suite 215
Toronto ON M3C 2G3
Tel: +1 416-447-6463
http://www.altair.com/

Amphenol Canada
605 Milner Avenue Toronto, ON M1B 5X6
Tel: +1 416-291-4401
https://www.amphenolcanada.com/

AON Risk Solutions
20 Bay St, Toronto, ON M5J 2N9
Tel: +1 416-868-5973
http://www.aon.com/canada/

Arnprior Aerospace
107 Baskin Drive East Arnprior, ON K7S 3M1
Tel: +1 613-623-4267
http://www.arnprioraerospace.com/

ASA Alloys
81 Steinway Blvd Etobicoke, ON M9W 6H6
Tel: +1 416-213-0000
http://www.asaalloys.com/

AV-BASE Systems Inc.
120 Bessemer Road London, Ontario, N6E 1R2
Tel: +1 519-691-0919
https://winair.ca/

Aversan
30 Eglinton Avenue West, Suite 500
Mississauga, ON L5R 3E7
Tel: +1 416-289-1554
http://www.aversan.com/

Avicast
4284 Village Centre Court
Mississauga, ON L4Z 1S2
Tel: +1 905-306-9669
http://avicast.com.md-32.webhostbox.net/131126/index.html

Avion Technologies
1203 Lorimar Drive Mississauga, ON Canada, L5S 1M9
Tel: +1 905-670-1570
http://www.avion-tech.com/

Ben Machine Products Co
1-8065 Huntington Road, Vaughan, ON L4H 3T9
Tel: +1 905-856-7707
http://www.benmachine.com/

Blakes
199 Bay Street, Suite 4000, Toronto, ON M5L 1A9
Tel: +1 416-863-2400
http://www.blakes.com/

Böhler Uddeholm
2595 Meadowvale Blvd. Mississauga, ON L5N 7Y3
Tel: +1 905-812-9440
http://www.bucanada.ca/

Bombardier
124 Garratt Toronto ON M3K 1Y5
Tel: +1 705-476-6468
http://www.bombardier.com/en/worldwide-presence/country.canada.html

Brotech Precision CNC
711 Bayview Drive Barrie, ON L4N 9A5
Tel: +1 705-728-5259
http://www.brotechprecisioncnc.com/

Cabernet Carpets
611 Conrad Place, Waterloo, ON N2V 1C4
Tel: +1 519-725-5182
http://cabernetcarpets.com/

Camatech
20 Commerce Crescent Acton, ON, Canada L7J 2X3
Tel.: +1 519-853-2699
http://www.camatech.ca/

CAN-ENG Furnaces International Ltd.
6800 Montrose Road P.O. Box 628
Niagara Falls, ON, L2E 6V5
Tel: +1 289-292-2040
http://www.can-eng.com/

Consortium for Aerospace Research and Innovation in Canada (CARIC)
740 Notre-Dame West Street, Suite 1515, Montréal, QC H3C 3X6
Tel: +1 514-313-756
http://caric.aero/

Carleton University- Mechanical and Aerospace Engineering
1125 Colonel By Dr, Ottawa, ON K1S 5B6
Tel.: +1 613-520-2600
http://carleton.ca/

Carpenter Technology Corporation
6114 Edwards Boulevard, Missisauga, ON, L5T 2V7
Tel: +1 905-564-5255
https://www.cartech.com/

CaseBank Technologies
6205 Airport Rd Bldg A - 2nd Floor Mississauga, ON L4V 1E1
Tel: +1 905-364-3600
http://www.casebank.com/

Celestica
844 Don Mills Road Toronto, ON M3C 1V7
Tel: +1 416-448-5800
https://www.celestica.com/home

CENTRA Industries
24 Cherry Blossom Rd CAMBRIDGE, ON N3H 4R7
Tel: +1 519-650-2828
http://www.centra-ind.com/Centra.php/home/

City of Mississauga
300 City Centre Drive, 3rd Floor Mississauga, ON L5B 3C1
Tel: +1 905-615-3200
http://www.mississauga.ca/

City of Toronto
100 Queen Street West, East Tower, Toronto, ON M5H 2N2
Tel: +1 416-394-8069
www.toronto.ca

Clark & Company
100 Richmond St. West, Suite 330, Toronto, ON M5H 3K6
Tel: +1 416-681-9900
http://www.yyzlaw.com/

Cleeve Technology International
716 Colonel Sam Drive Oshawa, ON L1H 7Y2
Tel: +1 905-579-9502
http://www.cleevetechnology.ca/

Comtek Advanced Structures
1360 Artisans Crt BURLINGTON, ON L7L 5Y2
Tel: +1 905-331-8121
http://www.comtekadvanced.com/

Conestoga College
850 Fountain Street South, Cambridge, ON
Tel: +1 519-748-5220
www.conestogac.on.ca

CPG Aerospace
265 Pony Drive Newmarket, ON L3Y 7B5
Tel: +1 905-715-7826
http://www.cpgaero.com/

COM DEV Canada (Honeywell Aerospace)
155 Sheldon Drive Cambridge, ON, N1R 7H6
Tel: +1 519-622-2300
https://www.comdev.ca/

Cyclone Manufacturing
7300 Rapistan Court Mississauga, ON L5N5S1
Tel: +1 905-567-5601
http://www.cyclonemfg.com/

Dentons
77 King Street West, Suite 400, Toronto, ON M5K 0A1
Tel: +1 416-863-4511
http://www.dentons.com/en.aspx

Diamond Aircraft Industries
1560 Crumlin Sideroad, London, ON, N5V1S2
Tel: +1 888-359-3220
http://www.diamondaircraft.com/

Dishon Ltd
40 Citation Dr CONCORD, ON L4K 2W9
Tel: +1 416-638-8900
http://www.dishoncnc.com/

DMG MORI Canada
395 Ambassador Drive Mississauga, ON L5T 2J3
Tel: +1 905-795-2891
http://ca-en.dmgmori.com/

Downsview Aerospace Innovation and Research (DAIR) Working Group
P.O. Box 631, Station A, Toronto, ON M1K 5E9
Tel: +1 416-289-5000
http://www.dairhub.com/

Durham Region Economic Development
605 Rossland Road East Whitby, ON L1N 6A3
Tel: +1 905-668-7711
https://www.investdurham.ca/

E Craftsmen Inductors and Transformers
73 Schaefer St WATERLOO, ON N2L 4C4
Tel: +1 (519) 884-2210
http://www.ecraftsmen.com/

Exactatherm
2381 Anson Drive, Mississauga, ON L5S 1G1
Tel: +1 905-677-7822
www.exactatherm.com

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2395 Speakman Dr. MISSISSAUGA, ON L5K 1B3
Tel: +1 905-822-4111
http://www.exova.com/

Firan Technology Group (FTG)
250 Finchdene Square Toronto, ON Canada M1X 1A5
Tel: +1 416-299-4000
www.ftgcorp.com/

Fleet Canada
1011 Gilmore Rd Fort Erie, ON L2A 5M4
Tel: +1 905-871-210
http://www.fleet.ca/site/home

Flying Colours Corporation
901-120 Airport Rd Peterborough, ON Canada, K9J 0E7
Tel: +1 705-742-4688
http://www.flyingcolourscorp.com/

Footage Tools Inc
1-54 Audia Crt Vaughan, ON L4K 3N4
Tel: +1 905-695-9900
http://www.footagetools.com/

General Dynamics
1941 Robertson Rd Ottawa, ON K2H 5B7
Tel: +1 613-596-7000
http://www.gdcanada.com/

Gretear Toronto Airports Authority (GTAA)
311 Convair Drive, Toronto, ON L5P 1B2
Tel: +1 416-776-3344
www.gtaa.com

Héroux-Devtek
1665 Highland Rd W KITCHENER, ON N2N 3K5
Tel: +1 519-576-8910
http://www.herouxdevtek.com/home

Highland Integrated Surveillance Systems (HISS)
385 The West Mall, Suite 259 Toronto, ON M9C 1E7
Tel: +1 416-622-2618

Honeywell
3333 Unity Drive, Mississauga ON, L5L 3S6
Tel: +1 905-607-0300
http://www.honeywell.com/worldwide/north-america/canada-en

Hope Aero Propeller & Components Inc
7605 Bath Rd. Mississauga, ON L4T 3T1
Tel: +1 905-677-8747
http://www.hopeaero.com/

Horizon Aircraft
3187 Highway 35 LINDSAY, ON K9V 4R1
Tel: +1 613-866-1935
http://www.horizonaircraft.com/

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Tel: +1 905-678-7820
http://www.intertek.com/canada/

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http://kadexaero.com/

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150 Elgin Street, Suite 1800, Ottawa, ON K2P 2P8
Tel: +1 613-212-3613
https://home.kpmg.com/ca/en/home.html

Koss Aerospace
7805 Tranmere Drive Mississauga, ON, L5S 1V5
Tel: +1 905-364-5000
http://www.kossaerospace.com/

L-3 Wescam
649 North Service Road West, Burlington, ON L7P 5B9
Tel: +1 905-633-4000
http://www.wescam.com/

Lean Design Canada
10 Queens Quay West, Suite 2505, Toronto, ON M5J2R9
Tel: +1 416 848 1104
leandesign.com

Leonardo-Finmeccanica- Tactical Technologies Inc.
2685 Queensview Dr, Unit 200 Ottawa, ON K2B 8K2
Tel: +1 613-828-0775
http://www.leonardocompany.com/en/-/ttiinc

Magellan Aerospace
3160 Derry Road East Mississauga, ON L4T 1A9
Tel: +1 905 677 1889
http://magellan.aero/

Marsh Brothers Aviation
3225 Mainway Burlington, ON 3225
Tel: +1 905-335-1440
http://www.marshbrothersaviation.com/index.php/contact-us/

McKinsey & Company
110 Charles Street West, Toronto, ON M5S 1K9
Tel:+1 416-313-3700
http://www.mckinsey.com/

McMaster Manufacturing Research Institute (MMRI)
1280 Main Street West, Hamilton, ON L8S 4L7
Tel: +1 905-525-9140
http://mmri.mcmaster.ca/

Memex
3425 Harvester Road, Suite 105
Burlington, ON L7N 3N1
Tel: +1 905-635-1540
http://www.memexoee.com/

Mitsubishi Heavi Industries (MHI)
6390 Northwest Drive, Mississauga, ON L4V 1S1
Tel: +1-905-612-6781
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http://www.newunitedgoderich.com/
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Huron Park, ON N0M 1Y0
Tel: +1 519-228-6052

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Tel.: +1 416-754-2010
http://www.nobleprecision.com/

Noranco Inc
1842 Clements Rd Pickering, ON L1W 3R8
Tel.: +1 905-831-0100
http://www.noranco.com/

Northstar Aerospace
204 East Pike Creek Road Tecumseh, ON N8N 2L9
Tel: +1 519-979-940
nsaero.com

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460 McCartney St. Arnprior, ON K7S 3H2
Tel.: +1 613-623-6544
http://www.nutechpm.com/

Ontario Aerospace Council
1701 Aberfoyle Ct, Pickering, ON L1V 4W4
Tel: +1 905-387-1550
http://theoac.ca/general/

Ontario Ministry of Economic Development and Growth
Mowat Block 900 Bay Street Toronto, ON M7A 1L2
Tel: +1 416-325-6666
https://www.ontario.ca/page/ministry-economic-development-and-growth

P3 Group Canada Ltd
7150 Frederick-Banting, Suite 101, Montreal, QC H4S 2A1
Tel: +1 514-335-3310
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1801 Courtney Park Drive
Mississauga, ON L5T 1J3
Tel.: +1 905-564-7500
www.pwc.ca

QSDM
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Tel.: +1 905-565-1800
http://www.qsdm.com/

Raytheon
360 Albert St #1640, Ottawa, ON K1R 7X7
Tel: +1 613-233-4121
http://www.raytheon.com/

Region of Waterloo International Airport
1-4881 Fountain Street North, Breslau, ON N0B 1M0
Tel: +1 519-648-2256
http://flyalo.com/

Safran Electronics Canada Inc
2000 Fisher Dr, Peterborough, ON K9J 6X6
Tel: +1 705-743-6903
http://www.safran-group.com/country/safran-canada

Safran Landing Systems
574 Monarch Avenue, Ajax, ON L1S 2G8
Tel: +1 905-683-3100
http://www.safran-group.com/country/safran-canada

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2360 Dixie Road Mississauga, ON L4Y 1Z7

Tel.: +1 905-543-8728
http://www.samuel.com/en/Pages/default.aspx

Satcom Direct
350 Palladium Dr. Suite 105, Ottawa, ON K2V 1A1
Tel: +1 613-800-0926
https://www.satcomdirect.com/

Sciens Industries
1901 Fisher Drive, Peterborough, ON K9J 6X6
Tel: +1 705-743-6913
www.sciensindustries.com

Shea Business Solutions
5160 Explorer Drive, Mississauga, ON L4W 4M8
Tel: +1 905-486-2293
http://shea.ca/

Shimco
75 Heroux Devtek Drive, Cambridge, Ontario, N3E 0A7, CANADA
http://www.shimco.com

Siemens
1577 North Service Rd E Oakville, ON L6H 0H6
Tel: +1 905-465-7490
http://www.siemens.com/plm

Southern Ontario Defence Association (SODA)
PO Box 34 Acton, ON L7J 2M2
Tel: +1 519-841-7682
http://southernontariodefence.ca/

SPP Canada Aircraft
2025 Meadowvale Boulevard, Unit 1, Mississauga, ON L5N 5N1
Tel: +1 905-819-6145
http://www.spp-ca.com/

St. Claire Technologies
827 Dufferin Ave, Wallaceburg, ON N8A 2V5
Tel: +1 519-627-1673
http://www.stclairtech.com/

Thermodyne Engineering
3-421 Nugget Ave. Scarborough, ON M1S 4L8
Tel: +1 416-754-8686
http://www.thermodyne.ca

Tradewind Scientific
1181-2720 Queensview Dr. Ottawa, ON K2B 1A5
+1 613-238-1246
http://www.Tradewind.aero

Trinity Aerospace
7017 Fir Tree Dr. Mississauga, ON L5S 1J7
Tel: +1 905-612-0754
http://www.trinityaerocanada.com

Triumph Gear Systems
11 Fenmar Dr, North York, ON, M9L 1L5
Tel: +1 416-743-4417
http://www.triumphgroup.com/companies/triumph-gear-systems-toronto

Universal Precision Technology
350 Dosco Drive, Stoney Creek, ON, L8E 2N5
Tel: +1 905-389-1610
http://universaltoolanddie.com/

University of Ontario Institute of Technology (UOIT)
2000 Simcoe Street North, Oshawa, ON L1H 7K4
Tel: +1 905-721-8668
www.research.uoit.ca

University of Toronto Institute for Aerospace Studies (UTIAS)
4925 Dufferin Street, Toronto, ON M3H 5T6
Tel: +1 416-667-7709
http://www.utias.utoronto.ca/

University of Waterloo
200 University Ave. W., Waterloo, ON N2L 3G1
Tel: +1 519-888-4567
https://uwaterloo.ca/

UTC Aerospace Systems
1400 South Service Road West Oakville, ON, L6L 5Y7
Tel: +1 905-827-7777
http://www.utc.com/

VAC Developments
2270 Bristol Circle, Oakville, ON, L6H 5S3
Tel.: +1 905-855-6855
http://www.vacdev.com

Vertex Precision Manufacturing
60 Marycroft Avenue, Unit 2 Vaughan, ON L4L 5V5
Tel: +1 905-264-0251
http://vertexprecision.com/

Valiant Corporation
6555 Hawthorne Drive Windsor, ON N8T 3G6
Tel: +1 519-974-5200
http://www.valiantcorp.com/

Wainbee Limited
5789 Coopers Avenue, Mississauga, ON L4Z 3S6
Tel: +1 905-568-1700
http://www.wainbee.com/

Waterloo Region Economic Development
260 King Street West, Suite 201 Kitchener, ON N2G 1B6
Tel: +1 519-747-2541
http://www.wredc.ca/en/about-wredc/Contact-Us.asp

Zodiac Aerospace-Cantwell Cullen
1131 South Service Road West Oakville, ON L6L 6K4
Tel: +1 905-825-3255
http://www.zodiacaerospace.com/en/zodiac-interconnect-canada

EDITORIAL AND MANAGEMENT TEAM

Project Director: Ty Jeevaratnam (ty@gbreports.com)
Journalists: Catherine Howe (chowe@gbreports.com), Camila Moscoso Román (cmoscoso@gbreports.com)
Executive Editors: Mungo Smith (mungo@gbreports.com), Alfonso Tejerina (alfonso@gbreports.com)
Operations Director: Miguel Pérez-Solero (mperezsolero@gbreports.com)
Graphic Design: Designa (gdc@gopadesign.com)
Graphic Design (ads): Özgür & Deniz (ozgur@gbreports.com)
General Manager: Katya Koryakovtseva (katya@gbreports.com)

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THANK YOU

We would like to express special gratitude to everybody who has participated in the research process.
We would also like to thank all the governmental bodies, associations and companies that took the time to share their knowledge about the market, with special mention to:

ONTARIO MINISTRY OF ECONOMIC DEVELOPMENT AND GROWTH
ontario.ca/page/ministry-economic-development-and-growth

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