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GLOBAL BUSINESS REPORTS

Ontario Aerospace 2016-2017

PRE-RELEASE EDITION

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.

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Ontario

Paid for by the Government of Ontario

Dear Readers,

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,

Brad Duguid

Honourable Brad Duguid,
Ontario Minister of Economic Development and Growth

ONTARIO
CANADA

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Welcome,

The pre-release of our Ontario Aerospace report, published in partnership with the Ministry of Economic Growth & Development and the Ontario Aerospace Council, is the culmination of eight weeks of research and interviews with some of the sector's top executives across the supply chain who generously donated their time and insights. We look forward to receiving feedback and interviewing more industry leaders for the final version of our report to be released in June 2017 at the International Paris Airshow Le Bourget.

Ty Jeevaratnam, *Project Director*
Camila Moscoso, *Journalist*

Ontario Aerospace
2016-2017

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Global Business Reports

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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 15 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 Bombardier, Boeing, and Airbus. 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 sales 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 home to 40% of the world's

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 Products and UTC Aerospace Systems have opened facilities in the province. These companies can take advantage of the strategic location of Ontario in close proximity to the United States and offering quick and easy access to that market. According to Bruce Simpson, 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 interna-

Photo courtesy of MHI Canada Aerospace

Brad Duguid

Minister of Economic Development and Growth, **Government of Ontario**

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. Our goal is making Ontario the easiest place in the world to conduct business and invest.

How strategically important is Ontario's aerospace sector to the region's economy and how do you support the growth and development of the industry?
Aerospace is important because in today's economy 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. Aerospace is crucial in our efforts to build the new economy in Ontario. 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 academic institutions as well as private sector partners 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, resulting in world-class workers.

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 with 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. 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 ten companies so long to locate to 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.

tional 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, and Brad Duguid, the Minister of Economic Growth and Development, 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

"In Ontario, we have discussions with companies of all sizes about their long and short-term goals, allowing us to match partners from a strategic perspective. The aim is facilitating linkages between companies within the aerospace industry."

Marlene Conway-Diels, Regional Director for Ontario, Consortium for Aerospace Research and Innovation in Canada (CARIC)

for aerospace companies to innovate and improve their operations and products creating competitive advantage to facilitate further market penetration on an international level".

Additionally, the Aerospace Industries Association of Canada (AIAC) support 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 collaborations 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

Source: Ontario Government

14

of the top 25 aerospace firms are in Ontario

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 over the next 20 years, resulting in global forecasts of nearly 40,000 new aircraft worth over $5.9 trillion USD, which presents opportunities for Ontario aerospace companies to capitilize 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.

Moira Harvey

Executive Director,
Ontario Aerospace Council (OAC)

Could you provide a brief introduction to the OAC?
Established in 1993, the Ontario Aerospace Council (OAC) is a not-for-profit organization comprising over 200 member companies representing approximately 70% of the Ontario aerospace industry employment base. These member companies represent the full gamut of a diverse and flourishing industry. The sector in Ontario boasts annual revenues over $6 billion CDN.

OAC has a very diverse membership which includes OEMs, large companies and SMEs in aircraft manufacturing (Tiers 1–4); UAS/UAVs;MROs; ground-based infrastructure; and space.

How does the OAC collaborate with its members to strengthen the aerospace sector in the region?
OAC works with industry stakeholders to gather and share industry intelligence, identify and facilitate funding, and be an active catalyst for industry growth. We work to enhance the recognition of Ontario's aerospace capabilities as a leader in global markets.

What types of programs does the OAC offer Ontario's aerospace industry?
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.

What is your future outlook for Ontario's aerospace industry in terms of growth?
Ontario aerospace companies are growing successfully, both domestically and beyond Canada's borders. We see Ontario companies expanding beyond the province to establish an international presence close to their customers. These new opportunities bring new challenges—but nothing that the Ontario industry cannot meet. These are exciting times because the industry is ramping up production rates and the supply chain has to respond quickly. It is a challenge of the best kind, bringing with it amazing opportunity.

Annual sales of over

Source: Ontario Aerospace Council

$6 billion

Annual GDP impact of

$3.2 billion

Highlighting Key Hubs within Southern Ontario

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, and Peterborough. Each hub has their local nuances, with a unique variety of aerospace companies across the supply chain.

Mississauga is the leading aerospace cluster in Canada in terms of employment. "Mississauga's aerospace industry has long been historically important to the region. Today it comprises of 302 companies and over 26,000 employees,", said Susan Amring, director of economic development of the City of Mississauga.

In particular, Mississauga has historically been known for hosting a large network of manufacturing companies, resulting in a strong aerospace manufacturing hub. "The variety of different aerospace companies in Mississauga create 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, manufacturing companies, and maintenance and support service companies grow in the area. The City helps companies access provincial and federal funds as well as 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 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 and the local government, academic institutions, and industry leaders 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 supply 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 the future.

The Mississauga, Toronto, and Peterborough aerospace hubs owe much of their growth, success, as well as future potential to the airports in their vicinity. According to Bruce Simpson, 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".

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), encompassing both Mississauga and Toronto. 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".

"We want to collaborate with airports in Southern Ontario to meet demands and to ensure that accessibility to the region will continue to support its economic growth. We strive to develop an integrated airports system and attract businesses to Ontario by showcasing our combined linkages and strength as a cluster to be reckoned with internationally."

Howard Eng, CEO, GTAA

Pearson International also has extensive MRO services, and Air Canada is investing $90 million in the construction of a new hangar to develop the location as a main MRO 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 7000 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 centre, 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 of 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.

Mississauga, Toronto, and Peterborough aerospace hubs 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.

Ontario's Aerospace Corridor

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*
- *Approximately a quarter (**25%**) of all Canadian aerospace activity is done in Ontario*
- *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)*

Susan Amring

Director, Economic Development, **City of Mississauga**

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

Comprising 302 companies and over 26,000 employees, Mississauga's aerospace industry has long been important to the region. There are a number of ways in which we support it, 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. We work with our provincial and federal counterparts to support companies accessing particular programs. We often make introductions and raise awareness for the types of programs available. Developing the supply chain is another extremely important factor, and we have worked to support the quality of products and services. Additionally, we recently hired a representative focused solely on the advanced manufacturing sector to bring Industry 4.0 to the region's companies across the supply side, 3D printing and the Internet of Things.

What are some of the factors that make Mississauga a particular 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, and we are located only 90 minutes from the United States border. Furthermore, Mississauga's large concentration of highways and rail links are a great advantage. Our business costs are also ranked some of the lowest across large Canadian cities.

What are Mississauga's key objectives going forward?

Mississauga has a 10-year Economic Development Strategy. We are now focused on building key clusters in both life sciences and advanced manufacturing, including aerospace. Mississauga will continue to attract the aerospace sector based on our highly diverse and integrated business community, our skilled and talented labour force, competitive business costs and our easy access to North America's richest markets.

Rhonda Keenan

CEO, **Peterborough Economic Development**

Could you introduce the Peterborough Economic Development office?

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. The aerospace industry is a key driver for economic development in Peterborough. We invest resources targeted at developing the sector to create more opportunities for economic growth.

In what ways does the Peterborough Economic Development agency assist in the growth of the aerospace industry?

Peterborough Economic Development agency helps connect companies with provincial and federal funds. These funds are available to help companies grow, whether through an investment in training, or by providing access to new manufacturing equipment. 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 to showcase Peterborough's established aerospace companies and the opportunities in the region.

What is your vision for the future of Peterborough's aerospace sector?

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.

Suppliers across the Value Chain

The driving force behind Ontario's aerospace activity is the network of advanced manufacturing companies.

Ontario generates 37% of the national GDP, largely due to the historically thriving manufacturing industry in the region. Ontario's strong manufacturing legacy has allowed small and medium sized enterprises (SME) to grow and develop unique capabilities for the aerospace industry. Advanced materials and manufacturing are an integral component of the industry in the region. "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 industry in the region and together they form an integral part of the ecosystem attracting 15 out of the world's top 25 aerospace companies to establish themselves in Ontario and utilize of 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. Exactatherm is an example of an SME with roots in the automotive industry that diversified into aerospace. President, Peter Lidster, said: "As a small company we can respond to needs very quickly, and we don't have a long chain of command that needs to be consulted in order to make an investment. 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".

CAN-ENG Furnaces International has likewise expanded to apply their industrial furnaces and automation into the aerospace industry by producing thermal processing systems for aerospace metal forgings. "CAN-ENG Furnaces can capitalize on our legacy and we are able to provide systems and equipment to the growing market place. We have the expertise and technologies to provide unique solutions to aerospace industry problems", 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 500 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 Fleet Canada and Vertex Precision Manufacturing who both also handle contracts from OEMs by being niche players and carving out unique capabilities in the industry.

"A significant amount of advanced level manufacturing is undertaken in Ontario. The region is a fantastic location for solving problems, with interconnectivity between academic institutions, government and industry in the research and development of cutting edge technologies."

Michael Iacovelli, CEO
Ben Machine Products

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

Ontario's impressive capacity in advanced manufacturing has created an aerospace cluster and paved the way for the region to develop maintenance, repair, and overhaul (MRO) capabilities. Ontario now accounts for 29% of the Canadian MRO industry's direct GDP. Flying Colours Corporation in Peterborough 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. President, John Gillespie, said: "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".

Hope Aero Propellers and Components are aircraft maintenance specialists with clients in the Caribbean and Africa. Maintenance services companies attract international business into the region and showcase the range of capabilities the Ontario aerospace sector has to offer.

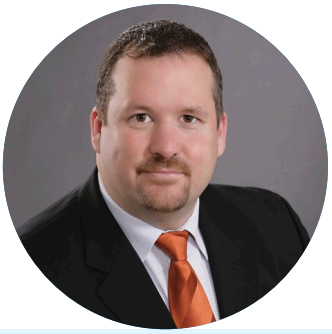
Ontario's aerospace manufacturers are part of the global supply chain for virtually every passenger aircraft in the world. Advanced manufacturing has allowed aerospace to flourish in Ontario and become an industry with a myriad of companies across the value chain offering a wide range of products and services. International companies establishing operations in the region have also diversified the sector and bolstered growth. However, aerospace in Ontario is facing challenges, such as a productivity gap as compared to their international competitors, as well as a lack of highly skilled workers to support the industry. In order for Ontario's long-standing aerospace manufacturing to ensure a healthy future, companies need to incorporate new technologies and increase productivity to keep up with market trends.

"Ontario aerospace companies are able to add to their capacity from an existing legacy supply chain. The region's level of expertise, stability, and quality of life are all attractive for international investors."

Marika Kozachenko, Business Development Manager, Fleet Canada

Brent Collver

President,
Comtek Advanced Structures



"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."

Could you give us a brief overview of Comtek Advanced Structures and its relationship to Avcorp Industries?
Comtek was established in 1994 as a composite repair facility for the regional aerospace industry. The founders of the company, both engineers, aimed to develop solutions for ailing problems on aircrafts. Based on operator feedback, they designed and approved a replacement for floor panels 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.

In 2008, Avcorp Industries acquired Comtek to add composite capabilities to their portfolio. Comtek is currently a wholly owned subsidiary of Avcorp, and despite being a 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 repair side to the business. Comtek exclusively manufactures out-of-autoclave composites. 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. Although the manufacturing and repair areas are operated as two separate businesses, they remain integrated with shared resources that provide mutual benefits to each.

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.

In what areas are you focusing R&D?
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.

What are Comtek's goals for the next three to five 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). Comtek strives to adapt to these trends with equal pace.

Photo courtesy of Comtek Advanced Structures

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, and 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 don't 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 makes Exactatherm the partner of choice?

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 regard 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 also places a strong emphasis on R&D and 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.

Terry Hope

President, **Hope Aero Propeller and Components**

"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."

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. 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 supply propeller repair and overhaul services to the Department of Defence. Our customers are typically domestic in Canada, though we have a few clients in the Caribbean and in Africa. We are always looking to acquire new customers.

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.

What makes Hope the partner of choice and what separates you from other aerospace MRO companies?

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 are the first overhaul company in Canada to purchase and use the Aeroscan machine, and we strive to always have the most specialized technology. Our advanced technology allows us to save manpower as well as improve productivity and the quality of 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 create 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. Also, there are many technicians, engineers, and highly skilled workers in the area where we can source expertise.

Photo courtesy of Centennial College

Going into the Future

Future prospects for Ontario's aerospace industry are bright.

The sector's history of advanced manufacturing capabilities set the foundations for an established supply chain. Aerospace in Ontario must seize the current opportunity for growth given the capacities of the industry and 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 potential if the industry is not able to tackle current challenges as well as adapt to changing trends.

Among the set of challenges that Ontario must address in order for the aerospace sector to grow and remain competitive in the international market is the lack of highly skilled workers for aerospace companies in the region. 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.

Another main issue is productivity and it is vital for Ontario's aerospace industry to evolve the supply chain, incorporate new materials and technologies, and make

"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. "

Michael Klauck, President, CAN-ENG Furnaces International Ltd.

processes more productive. "Productivity is the biggest challenge for the aerospace cluster in Ontario", asserted Bruce Simpson, partner for 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 has increased pressures on Ontario aerospace companies to keep up. Integration of supply chain management, automation of factories and processes, and introduction of new advanced materials in production 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. Koss Aerospace, located in Mississauga, is an example of a company incorporating 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. Also, Applied Precision is creating 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 defence business development for CaseBank, said: "In the world of reliable equipment, efficient maintenance is vital, and our products will only become increasingly necessary".

The industry across the value chain needs to incorporate innovative technologies to ramp up productivity in aerospace and keep up with market demands. A requisite for this is the creation of further linkages between industry and academia. Such collaborations are key for increased innovation in the region. 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 an attempt to do this; a unique project between academic institutions, industry players, and government institutions. These different actors are part of the Downsview Aerospace Innovation and Research (DAIR) consortium 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 hub will also incentivize SMEs to collaborate and will attract international business to the region. The Downsview Aerospace hub will help to tackle the key challenges in the Ontario aerospace sector; for example, increased synergy between industry and academia will address as 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 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 Ontario aerospace industry to address challenges, capitalize on its strength and showcase itself internationally.

Photo courtesy of Safran Landing Systems

David Zingg

Professor, **The University of Toronto's Institute for Aerospace Studies (UTIAS)**

"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."

UTIAS was the first institute in Canada dedicated to Aeronautical engineering. How has the program developed?
UTIAS was established in 1949 and has since grown significantly. In the last 10 years, our graduate student population has more than doubled. 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 Center for Research and Sustainable Aviation (CRSA), focusing on developing technologies to reduce the environmental effect of aviation and The Center for Aerial Robotics Research and Education (CARRE), focusing on UAVs and robotics. Both centers require the trainees to intern at one of our industry partner companies. Through the internships, our students attain practical training and many find jobs for after graduation.

What is UTIAS 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 Center, 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 on a regular basis in order to facilitate communication between academic institutions and the industry to drive more productive research collaboration.

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