EXPLORER
SOLUTIONS

Aerospace Sector Analysis and Action Plan

Final Report

Town of Gravenhurst, ON

(Economic Development Division)



January 22, 2019

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Executive Summary

Introduction

The Town of Gravenhurst has commissioned an aerospace sector analysis looking at bringing additional private investment to the area and attracting investment to Muskoka Airport lands and private lands surrounding it. The analysis meets the Town Strategic Plan which:

- Identifies the Muskoka Airport as an airport primed to grow from both a job creation and a number of aircraft movements perspectives;
- Re-designation of the land surrounding the Muskoka Airport;
- The presence of at least two (2) strong aviation maintenance and modifications companies;
- An increased amount of interest from foreign investors and companies looking to grow in Ontario and in the Town of Gravenhurst; and
- Census and other data for Gravenhurst demonstrate moderate growth and a changing demographic make-up of the community, resulting in a modest increase in demand for employment.

This report consists of two (2) pieces, a sector strategy, followed by the development of an action plan identifying short, medium and long-term actions to be completed. Throughout this project, our team read through and consulted a series of past studies and reports conducted for the airport, the Town and the District of Muskoka over the past 20 years.

In supporting the aerospace sector and sub-sector analysis and assessing the areas with the greatest potential of business investment attraction, a strong understanding of the local assets helped support the recommendations presented throughout this report.

Supply Chain Analysis

There is a very limited aerospace manufacturing presence and supply chain activity in the Muskoka region. A few manufacturers were identified including one (1) Tier-2 as the regional lead. This reality has pushed the manufacturers to become self-sufficient by integrating most activities they require in-house. Looking at the aviation side, Muskoka Airport hosts two (2) fair-sized maintenance and modifications providers and a few small shops offering aviation-related services and products, but a very limited size.

SWOT Competitive Analysis (Obtained from Consultations)

Local-area strengths include the expertise of the airport's two (2) anchor tenants, nearby post-secondary institutions, cottage country-style quality of life, proximity to the GTA and the influence that International Cultural icon Dr. Henry Norman Bethune continues to have on local-area tourism and investment by the Chinese in Gravenhurst.

Weaknesses that the Town must overcome entail workforce and workforce development challenges, the distance to neighbouring post-secondary institutions for businesses to attract and fulfill co-op placements, limited airside lands for development at the airport and addressing airside tenants that do not require airside access.

Summary of Consultations

The consultation process entailed a series of focus groups and one-on-one interviews that provided an opportunity to challenge claims, obstacles and opportunities with local business leaders, influencers and those who are part of the local-area aerospace cluster on a daily basis.

Participants commented on local-area aerospace strengths, assets, skill sets and expertise including limitations, challenges and obstacles needing to be overcome in order to bring structure of a possible aerospace cluster to the airport. Feedback ranged from zoning issues hindering development readiness, to talent attraction and retention and the calibre of local-area talent pools, affordable housing, the Town's proximity to business supports, services and suppliers between Gravenhurst and the GTA, challenges with the location of the airport's parkway and the airports restricted growth areas for development and increased need for Canada Border Services Agency services.

Aerospace Market Analysis

An Aerospace Market Analysis of the Ontario and Canadian markets was performed along with a portrait of the global situation, including the impact that new technology trends and regulations are having on the industry.

The Ontario Aerospace market is comprised of over 350 companies employing more than 22,000 skilled workers, namely highly qualified engineers, technicians and scientists and is home to subsidiaries of over half of the world's top 25 aerospace companies. With a comprehensive supply chain where most of the products and services are being manufactured and offered within the province, a significant percentage of revenues are derived from export markets.

Companies in this sector invest heavily in Research and Development (R&D) which represents more than any other market sector. Canada has R&D incentive programs that help the industry by making it more affordable to innovate and remain competitive. The province is home to several potential partners that can support R&D, prototyping and testing and the evaluation of new products and technologies.

The North American market for aircraft maintenance, repair and overhaul is expecting significant growth into 2028 with repair of components leading MRO demand over that period and engine spends, line maintenance and heavy airframe maintenance round out the prevailing MRO activities.

Other major markets globally are also expected to experience significant growth including the Middle East, China and Asia Pacific, which will all outpace North America. However of the G7 countries, Canada maintains the lowest manufacturing costs.

Market 20-Year Forecast

The market forecast for the next 20 years will depend on the demand for passenger travel. In 2017, the global aviation industry continued to set new records with projections from the International Air Transport Association estimating that the aviation industry will support nearly four (4) billion travellers and almost 56 million tonnes of cargo in 2018. Aircraft are being flown more intensively with 2017 departures exceeding 38 million. Profits, air passenger growth and aircraft manufacturing are all on the rise, which is demanding an increase labour pool. With rising fuel prices and the demand for competitive airfare pricing, ultra-low-cost carriers are becoming more mainstream.

Throughout Canada, passenger traffic has also experienced a significant increase over the past decade both domestically and abroad with a significant amount of transborder and other international traffic being supported by Toronto Pearson and Vancouver International Airports.

Provincially, Ontario remains the highest among all Canadian provinces and territories for air passenger traffic. With strong projected growth rates within the GTA, further capacity pressures at Toronto Pearson and Billy Bishop Toronto City Airport will continue to be experienced. The province as a whole will see a higher demand for aircraft manufacturing, aircraft maintenance and other aircraft related services as a result of its own substantial growth in air passenger traffic over the next five (5) to 25 years.

Technology Serving MRO Service Centres

OEMs are pushing the limits of technology to reduce weight, maintenance and noise while increasing efficiency and autonomy. In parallel, larger organizations involved in the maintenance of aircraft are investigating in new technologies to inspect aircraft for their regular checks. The following are some of the more promising technologies to meet inspection requirements and return the aircraft to service in a minimum amount of time.

Additive manufacturing, otherwise known as 3D printing, has experienced strong growth in the design (prototyping) and production of aircraft components. Another trend sees collaborative inspection tools that directly connect less experienced inspectors to remote experts during an aircraft inspection.

Advanced visual inspections through the use of video inspection endoscopes feature 3D measurement technology and wireless connectivity along with collaboration software to connect field inspectors to analysts via secure Internet connections.

Virtual robotized inspection systems can detect defects that a human eye can't. The use of remotely piloted aerial systems for automated inspections is being used to replace traditional methods that are costly as a result of being labour intensive.

Training is being conducted through augmented reality technology to address the shortage of training personnel both for manufacturing and MRO activities. Lastly, the "Internet of Things" technologies allow electronic devices to communicate with each other without having a host computer. MRO professionals can communicate using tablets connected with aircraft sensors, which allows them to easily scan aircraft systems and identify components that need to be replaced or repaired while communicating with the supply system to determine if required parts are available.

Gravenhurst Sub-Sector Analysis and Identification

The sub-sector analysis and identification process is designed to assess the presence of business and supply chain activity within a larger cluster or industry sector. Throughout the validation process of understanding the local-area aerospace cluster, little aerospace and aviation manufacturing was found to be taking place within the town itself or the surrounding region. As such, we have identified the presence of a unique and emerging sub-sector tied to "aircraft maintenance and modifications" as being the most mature to evolve and generate employment and attract new businesses and investment to Gravenhurst.

Important to forming the basis of this cluster is the presence of aircraft companies such as Muskoka Aircraft Refinishing and Lake Central Air Services. The airport itself attracts a variety of different airline companies and private aircraft. A variety of business support services can also be accessed through the Town, the District, industry associations, funding agencies, among others, that can provide the required services and supports. The cluster development activities will be supported by the Town of Gravenhurst Office of Economic Development in many ways including the development of a business investment attraction strategy.

The value proposition behind the Muskoka Aircraft Maintenance and Modifications cluster will be its cluster members, but will require the direct involvement of local government and its ability to obtain marketing and funding to develop a joint undertaking for both industry and government to move the cluster into a one-stop-shop and a centre of expertise for aircraft maintenance and modifications that can cater to airlines, aircraft owners and operators with shared services, capabilities and talent.

The cluster's brand should be based on elements that already have a global status. As such, Muskoka, more than the Town of Gravenhurst, is a more recognizable name. The branding identifies the location of the cluster (Muskoka Airport), the type of services offered (Maintenance and Modifications) and the notion of cluster testimony of a joint undertaking from various organizations focused on a same goal.

Incubation and Technologies

The development of an incubator is designed to bring an important element to strengthening the cluster's and the Town's value position, while at the same time providing space and services to support MRO and aviation-related technologies. With a positive level of interest expressed from neighbouring post-secondary institutions to further define what their level of support could entail, the objective of a potential incubator is to focus primarily on technologies related to maintenance, repair overhaul, modification and technology integration of aircraft, while hosting a series of aerospace manufacturing and R&D activities.

Business Attraction Strategy

To support the Aviation Maintenance and Modification cluster structure at the Muskoka Airport, the Town of Gravenhurst will be responsible for leading a strategic and targeted business attraction strategy. In doing so, the Town already has a structured Ambassador program in place which could be leveraged to support this cluster development initiative.

As part of the recommended outreach strategy and supporting activities, trade shows and conferences can be an effective way to open doors and generate new investment interest at the Muskoka Airport. Investment attraction and Business Retention and Expansion are key activities of any Economic Development Office and it is important that the Town be "investment ready".

To assist the Town in targeting specific companies for business investment attraction at the airport, and that have the potential to strengthen the Airport's Maintenance and Modifications cluster and related supply chain activity, a detailed list of 500 targeted prospects has to be provided based on identified priority sub-sectors.

Marketing Gravenhurst

The Town must develop eye-catching marketing material and collateral that is to the point yet enticing enough for readers to want to know more and possibility arrange an in-person site visit. It is imperative that a Muskoka Aircraft Maintenance and Modifications Cluster brand be developed and effectively conveyed. The development of a website dedicated to profiling and educating viewers on the cluster and investment attraction will become an effective way to communicate to existing networks and those monitoring the cluster or airport from afar.

Action Plan

A series of short, medium and long-term proposed activities and tasks are required to get the cluster project on its way. These activities include the development of a cluster business plan/business case, cluster funding, the development of a Muskoka Aircraft Maintenance and Modification Cluster Advisory Committee, a commercial office with dedicated staff support, marketing, an official launch of the cluster, updating the Ambassador Program, attending trade shows and events and focusing on Foreign Direct Investment activities.

Regarding the proposed Incubator and Technologies, a series of short, medium and long-term proposed activities and tasks (including an engagement process, finance, marketing, equipment and an official launch) should be done to get the aerospace and aviation incubator project on its way. A business plan should support this action plan, and it is intended that this project will occur following the developed of the Muskoka Aircraft Maintenance and Modifications Cluster and that work on this project may not begin immediately following the approval of this report.

Conclusion

Our team has identified the presence of a unique and emerging sub-sector tied to “aircraft maintenance and modifications” as being the most mature to evolve and generate employment and attract new businesses and investment to Gravenhurst. The successful development of this cluster will provide the basis for a more predominant aerospace supply chain leading to the future aerospace branding for the Town and the region. It is recommended that a business plan should be prepared to support the launch of the cluster and ensure a coordinated effort by all parties involved. MAR and LCAS are the top priority tenants and supporting their growth and expansion by wrapping an aircraft maintenance and modifications cluster around them will be a great incentive for business retention while at the same time generating significant economic benefit for the cluster and community as a whole.

The development of an incubator has the potential to bring an important element to strengthening the cluster’s and the Town’s aerospace/aviation value position while at the same time providing space and services to support MRO-related and aviation-related technologies. The objective of an incubator would be to focus primarily on technologies related to maintenance, repair overhaul, modifications and technology integration of aircraft and host aerospace manufacturing and R&D activities. There continues to be an opportunity to dialogue with neighbouring post-secondary institutions that have expressed a positive level of interest in learning more about participating and to further define level of support. The incubator can also be a catalyst for bringing opportunities between private-sector cluster members and post-secondary academic institutional partners.

1. Introduction

1.1 Project Understanding

The Town of Gravenhurst is looking at bringing additional private investment to the area which is evident in the Town's Strategic Plan, which states that building economic and employment opportunities is one of the municipality's five (5) main goals. As one of the remaining untapped small airports in Ontario, Gravenhurst has seen significant interest from businesses located across the globe as an investment destination.

The Town of Gravenhurst has determined that a sector analysis and corresponding action plan focused on attracting investment to airport lands and private lands surrounding the Muskoka Airport are important due to:

- Identification of the Muskoka Airport as an airport primed to grow from both a job creation and a number of aircraft movements perspectives;
- Re-designation of the land surrounding the Muskoka Airport;
- An increased amount of interest from foreign investors and companies looking to grow in Ontario and in the Town of Gravenhurst; and
- Census and other data for Gravenhurst demonstrate moderate growth and a changing demographic make-up of the community, resulting in a modest increase in demand for employment.

This report consists of two (2) pieces, a sector strategy, followed by the development of an action plan identifying short-, medium- and long-term actions to be completed which includes the following:

- Identification and assessment of aerospace-related sub-sectors with the greatest prospect of:
    - Attracting inward investment to the community from outside of Canada;
    - Increasing the export of local goods and services; and
    - Building on existing infrastructure and services (i.e. the Muskoka Airport).
- An investment readiness and market assessment for the identified sub-sectors;
- An assessment of the most effective way to promote Gravenhurst in the context of the Aerospace and Aerospace-related sectors; and
- Short-, medium- and long-term recommendations for implementing a business attraction strategy related to aerospace, including an action plan.

In the course of this project, our team:

- Worked collaboratively with Economic Development staff and other stakeholders to meet project objectives;

- Identified community infrastructure and assets that are required to support the aerospace and aerospace-related sectors;
- Provided a detailed analysis and assessment, along with recommendations for the aerospace sector and/or sub-sectors, which provide the best opportunities for growth and investment in Gravenhurst;
- Identified Gravenhurst's competitive strengths, expertise and existing competitive advantages;
- Identified current and potential business capacity, opportunities for clustering and partnerships or investment available in the aerospace sector in Gravenhurst; and
- Provided detailed short-, medium- and long-term recommendations for implementing a Business Attraction Strategy to target the key sectors identified.

The following report identifies the proposed sectors with support through a series of recommendations from the performed research and analysis. The report also includes short-, medium- and long-term recommendations for implementing a business attraction strategy.

1.2 Summary of Past Studies

Throughout this project, our team has read through and consulted these documents to be more knowledgeable of what happens in the region and how they come to as a result of actions that have transpired over time. The following summary represents the key elements extracted from the provided past documents that provided insightful and/or meaningful information in the assessment of this project.

Muskoka Airport - Business and Marketing Plan – 1996

- On May 6, 1995, The District Municipality of Muskoka signed a Letter of Intent with Transport Canada to enter into negotiations for the transfer of Muskoka Airport to local interests on the basis that a Business and Marketing Plan for the airport was created.
- The long-term vision for Muskoka Airport is that it should continue to be a local commercial airport which promotes and supports the social and economic needs of the District Municipality of Muskoka. The short-term objectives for the airport are: that it should continue its operation; that the airport's financial performance should be improved; and that it should continue to foster local economic activity and development.
- Several ownership scenarios were investigated as part of the study. The most appropriate form of ownership was considered to be direct ownership by the District Municipality of Muskoka.
- Placing responsibility for the airport with the Planning and Economic Development Department will signify the important role the airport will play in the future of the District.
- The airport may be acquired from Transport Canada for the price of $1.00. The transfer will include the airport land parcel of 198 hectares containing runways, taxiway, apron, infrastructure and six (6) buildings.

- Activity levels have fallen substantially at Muskoka Airport from the levels achieved five (5) years ago. A major decline has been observed in light aircraft operations, especially recreational flying, which accounts for more than 70% of all traffic. Corporate and commercial traffic, on the other hand, has declined only slightly by comparison and appears to have achieved stability in recent years.
- Land management strategies recommended for the airport include: equalization of land rental rates for all tenants; simplification of the rate structure; gradual increase in land rental rates to levels prevailing at other comparable airports; and provision of a one-time land purchase option to all existing and new airport tenants.
- Providing an opportunity for tenants to purchase their properties would provide long-term stability to airport lands, facilitate financing of commercial developments, and provide a marketing advantage to Muskoka Airport over similar competitive airports.
- Muskoka Airport has a value to the local economy of approximately $11,185,128 annually according to the "Economic Impact Report for the Muskoka Airport" prepared by the Planning and Economic Development Department of the District of Muskoka.
- At this time, demand for non-aviation industrial land is considered to be very weak. Once the airport lands have been integrated into the District's inventory of land available for economic development, a more accurate picture of the relative attractiveness of these airport lands may emerge. At this point, a potential non-aviation use of airport land could be for the expansion of the Beaver Creek Institution or for the development of an industry, in close cooperation with the Institution, where residents could receive training or employment.

<u>Muskoka Airport Master Plan – 1999 4.1, 7.1, 8.1</u>

- Recommended Development and Land Use Plan
    - Commercial development related to aviation should be developed on the east side of Runway 18/36.
    - The identified land areas and lots should be rationalized and similar activities should be concentrated in the following locations:
    - The northwest and southwest end should be developed for larger aircraft and air cargo facilities.
    - The central area should be developed for light aircraft storage facilities.
    - The northeast, south and southwest areas should be developed for non-aviation use.
    - Airport reserve lands should be maintained at the north and east side of the airport for later use in response to specific development initiatives unsuited to the west side of the airport.
    - Land west of the air terminal building and northeast of Runway 18 threshold should be marketed for non-aviation use.
    - Access to non-aviation lands should be developed as the demand warrants.
- Implementation Plan: Short Term (1 - 5 years)

    - Commercial lot layout, survey and development.
    - Closure of fixed refuelling facilities; introduction of mobile fuel tankers and supply infrastructure.
    - Encouragement of development of an expanded charter air service for industry.
    - Encouragement of development of a scheduled airline service.
    - Encouragement of development of a full-service FBO facility.
    - Construction of access to non-aviation lots.
    - Development of a pavement management plan.
    - Development of GPS approach procedures.
    - Development of a Wildlife Management Plan and related facilities if required.
- Implementation Plan: Longer Term (as the airport develops and expands)
    - 1st phase construction of taxiway parallel to Runway 18/36.
    - Southerly extension of air terminal building (if scheduled air service is successfully developed).
    - Expansion of public apron.
- Implementation Plan: Longer Term (due to continued development of the airport)
    - 2nd phase construction of taxiway parallel to runway 18-36.
    - Other airside and groundside developments identified in the Plan as warranted by growth in demand and activity levels.

<u>Muskoka Airport Economic Impact Study – 2001</u>

- The study update followed very closely the approach taken in the original analysis done in 1994.
- The Muskoka Airport has a value of almost $19 million on the Muskoka economy annually. This figure is derived from the sum of the Direct ($2,500,000), Indirect ($4,136,256) and Induced Impacts ($12,272,512).
- By comparison, the 1994 study revealed that the total economic impact of the Airport at that time was $11,185,128. This represents a 69% increase over the past seven (7) years.
- The 1999 Airport Master Plan recommended that the taxiway be expanded along the full length of the paved runway to provide additional airside access. This would also influence the ability to attract additional commercial development and perhaps stimulate additional land sales or increased annual land lease revenues.

<u>Muskoka Airport Marketing and Business Development Strategy – 2003</u>

- The District Municipality of Muskoka owns and operates the airport. The Muskoka Airport Implementation Committee provides oversight and recommends policy direction for the airport to Muskoka District Council. The airport is managed through the Planning and Economic Development Department.

- The business development strategy has two (2) important elements. The first element is focused on opening up the eastern side of the airport lands to development. The second element is the stimulation of existing businesses. The attractiveness of the east development land, east of Runway 18/36, is its spaciousness and generally level terrain. These attributes permit the airport to offer any size lot to potential aviation businesses and good access to the main runway. An initial layout of the east development lands has been done. The layout contains provision for a roadway, a taxiway and 10 lots of varying size.
- Provision of capital funding for the development area, its taxiway and roadway access has been discussed in detail with FedNor and the Northern Ontario Heritage Fund offices. The project as envisaged will meet the guidelines for such projects on a shared financing basis. Nothing in the east development area compromises the development options defined in the Master Plan prepared by LPS Aviation in 1999.
- The employment base and capacity for growth at the existing businesses with some exceptions is limited to some degree. Growth of these businesses will tend to reflect the overall aviation economy, competitive forces and the skill of the entrepreneur operating the business. However, there may be some opportunity for business expansion and growth into the proposed East Development Lands. Existing businesses should be used to assist in marketing the airport.
- The resulting target markets can be divided into two (2) segments. They are the land development market and the tourism market. The primary land development market should be focused on attracting new or expanding existing aviation-related businesses including: aircraft manufacturing; aircraft servicing; aircraft repair and overhaul; and, aircraft painting. The tourism market is a natural fit for the airport and it is already involved in a large way with that industry. However, there could be closer coordination between the tourist market providers, the tourist agencies and any others involved with the industry.
- The marketing tactics developed include the creation or enhancement of the Muskoka identity or brand, having the airport properly listed and promoted in all economic development and tourist material and the coordination of airport brochure material with other promotional materials.
- The sales strategy recommends that the Airport Manager direct all "sales" or business development activity. Ideally, 20% of his time should be devoted to marketing-related activity. The Airport Manager will require some administrative assistance in order to more effectively take on this function. The brand strategy suggests that the successful Muskoka brand should be more directly integrated into the brand and marketing of the airport. To support the objective of building awareness of the Muskoka Airport as a viable business location, awareness advertisements in key trade publications and the Internet are recommended as well as undertaking a direct mail campaign.
- The primary land development market should be focused on attracting new or expanding existing aviation-related businesses including: aircraft manufacturing; aircraft servicing; aircraft repair and overhaul and aircraft painting.

- All of the companies presently located at Oshawa, Markham and Buttonville airports should be considered as marketing targets for relocation to Muskoka Airport.

Muskoka Airport Economic Impact Study - 2005

- The Muskoka Airport contributes approximately $31,318,305 to the Muskoka economy annually, compared with $18,908,768 in 2001. This represents a 65.6% increase over the 2001 total impact (or $12,409,537). When considering inflation, $31,318,305 represents $28,577,953 in 2001 dollars, so in fact, a direct comparison indicates that the total impact has significantly increased since 2001.
- This figure is derived from the sum of the Direct ($5,401,305), Indirect ($50,358,130) and Induced Impacts ($20,878,305).

Strategic Business Plan for The Muskoka Airport - 2006

- The Muskoka Airport was one of many airports transferred to local interests between 1995 and 1997 as a result of the 1994 National Airports Policy. The District Municipality of Muskoka assumed responsibility for the Airport in November 1996 in recognition of its importance to Muskoka's economy and that it formed an essential link in Muskoka's transportation infrastructure.
- Over the past nine (9) years, Muskoka has focused primarily on providing excellent customer service and ensuring the facilities were maintained in order to continue operation as a certified aerodrome.
- Over this time, the following has been achieved:
    - A master plan (1999) and a Marketing and Business Strategy (2003), have been prepared;
    - An Economic Impact Study (1994, 2001 and 2005), has been updated;
    - The Air Terminal Building (ATB) has been improved and the Airport Manager's office and administration has been relocated to the ATB from the maintenance garage;
    - Pilot facilities have been added;
    - Airport service has been provided 7 days a week and customer service has been improved;
    - Concession revenue has been provided;
    - Ongoing preventative runway maintenance has been undertaken;
    - Taxiway access has been improved;
    - The airfield lighting system has been upgraded;
    - A land sale policy was introduced;
    - The Imperial Oil Fixed Fuel dealership has been operated by Muskoka since 1999;
    - Snow removal vehicles have been upgraded and included in the District fleet program;
    - A new website for the Airport has been designed;

- A Global Positioning System (GPS) approach for runway 18/36 has been established; and
- An Environmental Impact Study for the wetland on the east side of the Airport has been completed.

- The primary objective for business development is to increase aviation industry and business at the Muskoka Airport. Increased land utilization will ensure the long-lasting viability and importance of a Community-based Airport facility. Increasing the development area will have a direct impact on the economic impact of the Airport.
- Airport Development Implementation Plan:
  - Promote good tenant relations;
  - Encourage business development; and
  - Plan for future development of the Airport.

Muskoka Airport Business Plan and Master Plan - 2013

- Land development at the airport over the next 20 or so years should be per Plan B-R. Key features of this plan are:
  - Relocate the grass runway;
  - Carry out additional surveys to determine what length of runway might be possible without the need to purchase additional lands to the east, with the intent of achieving a runway of between 2,000 and 2,200 ft.;
  - If necessary, purchase land to the east of the grass runway to accommodate a length at least as long as the grass runway is today;
  - Develop the west part of the area vacated by the grass runway into a 9-10 acre subdivision with a mix of large, medium and smaller lots;
  - Develop the east lands to the south of the new grass runway into a new 25 acre +/- subdivision providing a mix of large, medium sized and smaller lots;
  - Develop a number of lots along the north side of Beaver Creek Road for aviation or even non-aviation related landside type uses (those not requiring access to taxiways);
  - Develop lands in the area east of the threshold of Runway 18 for covered tie downs using Quonset hut type construction;
  - Develop some area between the parallel taxiway and the north end of Runway 18 for low-cost, uncovered tie downs; and
  - Phase the land development so as to meet the anticipated demand in a just in time manner.
- Over the very long term, the airport should consider mixed use of the lands located west of the airport between the Gravenhurst Parkway and Highway 11. The key features of this very long-term plan would include the following:
  - Relocation of the Gravenhurst Parkway to the west to provide the primary means of access to the industrial lands located there;
  - Designating the lands to the west for mixed industrial and aviation-related uses;

- Closing portions of the current Gravenhurst Parkway and re-purposing other portions to provide land access to both existing and new developments areas;
- Relocating the abandoned north portion of the current Gravenhurst Parkway alignment further west to accommodate future development all along a future parallel taxiway along the west side of the main runway (18-36);
- Making provision for the potential extension of the crosswind runway (12-30) further to the east, permitting a total length of some 4,500 ft. +/-; and
- This long-term plan should be revisited and better defined in the next ten (10) year update to this Master Plan or at such a time that any development proposals are brought forward to develop the lands to the west.

- Infrastructure Plan
  - Reserve sufficient space for a terminal building expansion and associated car parking area;
  - Develop a more detailed major maintenance and repairs plan; and
  - Test alternative airport café/restaurant concepts.
- Financial Plan
  - The airport should aggressively pursue land sales as a means of attracting additional tenants and to raise the necessary funds to pay for the various expansions.
- Future Opportunities
  - We used an investment attraction model developed in consultation with FedNor and used by airports and communities. This model includes a two-step process that first evaluates the community's strengths in the aerospace sector; and then assesses a community's readiness to attract new investment.
    - The District's aerospace strengths or assets were broken into four (4) main categories (aerospace product and services; airport infrastructure; aerospace training and education supply and location / access); each with its own set of criterion. While each criterion within the main categories is scored equally on a scale of 0-5, the number of criterion in each main category determines the importance of the category in the overall score. Airport infrastructure represents 41% of the total. For this step of the assessment, Muskoka Airport was compared to Parry Sound, Peterborough, Lake Simcoe, Oshawa, Kingston, Niagara District, and Haliburton/Stanhope. Muskoka ranked 5th out of 8 as shown in the summary table below.

Table 1 - Aerospace Strength Comparison

	Muskoka	Parry Sound	Peterborough	Lake Simcoe (Barrie)	Oshawa	Kingston	Niagara District	Haliburton / Stanhope
Aerospace Products and Services	15	12	18	13	17	11	9	4
Airport Infrastructure	25	19	27	25	22	25	22	11
Aerospace / Aviation Training and Education	3	4	5	6	6	4	4	3
Location / Access	3	3	4	5	6	7	5	4
Score	46	38	54	49	51	47	40	22
Rank	**5**	**7**	**1**	**3**	**2**	**4**	**6**	**8**

- The investment readiness component of the model uses the criteria/investment factors found in Ontario's Local Economies in Transition Initiative (LETI) combined with a series of aerospace and aviation opportunities. As shown in the summary table below, the top five (5) opportunities for Muskoka are: Hangars, FBO, MRO services, Flight Training, and Aircraft Sales.

Table 2 - Investment Readiness Analysis

INVESTMENT FACTORS (from Ontario's Local Economies in Tarnsition Initiative (LETI)	Aircraft Manufacturing &/or Assembly	Expanded Post Seconday Specialty / Technical	Base for Public Services (medevac, firefighting,	MRO Services (incl. a/c conversions,	Flight Training	Maintenance Base for Scheduled Carriers	Aviation Equipment Manufacturing	Air Cargo Base / Logistics Centre	Cold Weather Testing	Test Flights	Aircraft Sales	FBO (incl. aviation fuel)	Aeronautical R&D	Aerospace Supply Chain Entry	Aeronautical Recreational	Hangars (private / corporate)	[OTHER]	WEIGHT
LABOUR FORCE	6.7	7.1	9.0	10.7	10.8	3.9	8.7	1.8	7.2	1.1	8.4	11.1	6.6	4.5	2.7	12.0		12
LOCAL INDUSTRY	8.0	4.8	10.2	6.0	8.0	4.4	9.8	6.0	4.8	1.8	10.8	11.4	2.6	5.4	8.0	9.4		12
TRANSPORTATION / DISTRIBUTION	10.5	12.0	12.0	8.4	12.0	8.4	2.2	8.0	11.6	12.0	12.0	12.0	12.0	10.4	12.0	12.0		12
TAXES	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12
UTILITIES	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12
LOCAL BUSINESS ENVIRONMENT	9.9	10.5	10.4	10.8	10.5	10.8	10.8	9.9	10.8	10.8	9.8	9.0	10.1	10.1	11.3	10.1		12
PROPERTY AVAILABILITY AND COST	9.6	9.7	7.3	8.1	7.3	8.1	9.4	9.6	11.0	8.5	12.0	7.5	9.4	9.4	12.0	7.5		12
INCENTIVES / BUSINESS SUPPORT PROGRAMS		9.6		9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6		7.3	12.0		12
EDUCATION & TRAINING	8.0	8.0	10.0	10.0	7.8	10.0	10.0	8.4	7.8	8.0	11.6	11.0	9.0	10.0	7.5	12.0		12
QUALITY OF LIFE	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12
	88.7	97.7	94.9	99.6	102.0	91.2	96.4	89.3	98.8	87.9	110.2	107.6	95.3	85.8	96.8	111.0	0.0	120
	14	7	11	5	4	12	9	13	6	15	2	3	10	16	8	1	17	rank

- We assessed investments, expansions and related activities at competing airports in the broader region to see what they were undertaking, such as:
    - Peterborough has extended their runway to attract larger corporate jets to meet the demands of their corporate and industrial businesses, and they are also planning to pave their crosswind runway to attract Seneca College flight training;
    - Lake Simcoe has been investing heavily in additional land to satisfy anticipated aviation-related industries locating there and is also planning to extend their runway to be able to accommodate larger aircraft; and
    - Parry Sound has been developing large areas of additional land to accommodate more aircraft hangars and as well they hope to accommodate a range of aviation-related industries.
- We considered general trends in the broader aviation industry and more specifically in the general aviation component;
    - Here we know that with the baby boom generation retiring, there will be lots of shortages for jobs like pilots, mechanics, sales, management, etc.; and
    - Decline in private and small piston aircraft usage and increase in corporate, share ownership and charter turboprop and jet aircraft usage.
- We held discussions with key airport stakeholders. Opportunities arising from these discussions indicated:
    - There is a keen interest to expand the existing maintenance, repair and overhaul activities at the airport, mainly on the painting-related side, but in other related areas as well;
    - There is a lot of demand for additional hangars and T-hangars to store private aircraft; and
    - There are additional opportunities for flight training activities.
- We reviewed activities and trends at Southern Ontario Airports in general to identify that:
    - The closing of Buttonville Airport will provide opportunities for Muskoka to provide land for hangars for private and possibly some corporate aircraft;
    - Capacity constraints at the Billy Bishop Toronto City Airport, will force some private and corporate customers to relocate their aircraft and associated hangars;
    - Policies at Toronto Pearson favouring big commercial traffic will lead to continued relocation of corporate and other traffic to outlying airports; and
    - Some airports in the region have been expanding and actively pursuing the displaced traffic (e.g., Peterborough and Lake Simcoe), while other airports are not (e.g., Oshawa).
- Enhanced Maintenance Repair and Overhaul (MRO)
    - At Muskoka, there is significant opportunity to work with MAR and LCAS to expand their MRO services and facilities as there is a great interest on the part of these companies to expand at the Muskoka Airport. But in addition, other local

businesses such as Grassroots Aviation and Freedon Flite might also be interested in expanded opportunities, especially if their larger counterparts succeed and provide opportunities for synergistic investments. Known demand from MAR and LCAS is for probably in the range of about 5 acres +/- adjacent to their existing facilities.

- These known developments from MAR and LCAS would lead to:
    - Retention of existing anchor tenants who could otherwise move elsewhere if they cannot expand at Muskoka Airport;
    - Additional land development, and therefore additional land rents or land sales;
    - Incremental fuel sales and associated revenues, as well as additional landing fee revenues and possibly parking revenues; and
    - More jobs at the airport and within the community and the associated economic spin-offs from these jobs.
- As part of our assessment, we looked at other opportunities that were deemed to probably not be feasible over the short term. These were as follows:
    - Base for aircraft manufacturing and/or assembly – Typically such activity would require a higher population base (year-round) than available at Muskoka and the availability of skilled labour. This would be true for larger manufacturing/assembly operations, however smaller operations such as the activities currently being undertaken by Grass Roots and Aztec/Nomad10 may be viable.
    - Post-Secondary Aviation / Aerospace Training (incl. MRO, engineering, airport management) – We feel that based on our experience at other airports and during other work, that this area is already generally well served in Ontario. However, this does not necessarily rule out all activities in this sector. For instance, MAR's proposal for an aircraft painting course at its proposed facilities tends to be unique and seems to be a good niche to explore.
    - Maintenance base for scheduled carriers – Similar to the manufacturing point above, the low year-round population and access to pools of skilled labour works against the Muskoka area. However, the proposed MAR investment at the airport is a niche and is NOT the kind of maintenance requiring larger pools of skilled workers. This is a matter of scale.
- Action Plan: Short-Term (2013)
    - Approve development plan B-R;
    - Increase land lease and sales rates as well as the AMC;
    - Confirm development intent of existing tenants and negotiate agreements; and
    - Acquire land to the east to permit grass runway relocation.
- Action Plan: Medium Term (2014-2018)
    - Move to an Airport Commission operating structure;
    - Reduce landing fee exemptions from 5 tonnes to 3 tonnes for based aircraft, and from 3 tonnes to 1 tonne for visiting aircraft;

- Approve a new one-time development service fee similar to (but slightly less than) Lake Simcoe's (waived for Phase 1 i.e., implement before 2019;
- Approve a new one-time airport development permit fee similar to (but slightly less than) Lake Simcoe's (waived for Phase 1 i.e., implement before 2019);
- Approve a new one-time airport development levy similar to (but slightly less than) Lake Simcoe's (waive for Phase 1 i.e., implement before 2019);
- Develop comprehensive marketing program, including marketing materials (brand message, logo, print materials, etc.), key messages, advertising plan; and
- Implement land development program on a phased approach i.e., line up customers prior to developing the land.

2. Regional Assets and Supply Chain Analysis

2.1 Assets

In supporting the aerospace sector and sub-sector analysis and assessing the areas with the greatest potential of business investment attraction, a strong understanding of the local assets helped support the recommendations presented throughout this report.

2.1.1 Transportation Networks

Running north-south through the centre of Gravenhurst is Highway 11, a provincially maintained highway. At 1,784.9 kilometres, it is the second longest highway in the province, following Highway 17. Highway 11 begins at Highway 400 in Barrie and arches through northern Ontario to the Ontario–Minnesota border at Rainy River via Thunder Bay.

Traffic counts tracked by the Ministry of Transportation of Ontario (MTO) provide a glimpse of the southbound passenger vehicle and truck activity along Highway 11 through Gravenhurst. The results revealed a 21% increase of passenger vehicle traffic and a 113% increase in truck traffic between 2001 and 2012. However, the period between 2001 and 2006 experienced a passenger vehicle increase of 50%, followed by a decrease of 19% between 2006 and 2012. This is compared to a 102% increase in truck traffic between 2001 – 2006, followed by a subsequent increase of 5% between 2006 and 2012.

Table 3 - Hwy 11 Average Weekly Volumes Through Gravenhurst

Highway 11 (Southeast to Northwest)	2001 Average Weekly Volumes			2006 Average Weekly Volumes			2012 Average Weekly Volumes		
	Passenger Vehicle	Total Truck	Total	Passenger Vehicle	Total Truck	Total	Passenger Vehicle	Total Truck	Total
ON0126 Gravenhurst - SB	72,983	3,935	76,918	109,658	7,974	117,632	88,307	8,398	96,705

Table 4 - Percent Change in Hwy 11 Average Weekly Volumes Through Gravenhurst

Highway 11 (Southeast to Northwest)	2001-2012 Growth (%)			2001-2006 Growth (%)			2006-2012 Growth (%)		
	Passenger Vehicle	Total Truck	Total	Passenger Vehicle	Total Truck	Total	Passenger Vehicle	Total Truck	Total
ON0126 Gravenhurst - SB	21%	113%	26%	50%	102%	53%	-19%	5%	17%

The Ontario Northland Transportation Commission (Ontario Northland) is an Agency of the Province of Ontario that provides efficient and vital transportation services to Northeastern Ontario including stops in Gravenhurst at the old Gravenhurst Train Station.

Metrolinx and Ontario Northland have recently completed a five-week GO ON Muskoka pilot project (August 3 to September 3, 2018) that offered a combined GO train and Ontario Northland bus route from Toronto to North Bay with stops in Gravenhurst, Bracebridge and Huntsville. Details of the next phase of this project have not yet been disclosed at the time of writing this report.

In-town transportation initiative the Loop was a pilot bus project throughout 2017, however due to lack of demand the pilot was not continued. The Town of Gravenhurst may consider additional transportation pilots in the future.

Northern Ontario Passenger Service offers two (2) buses per day departing from and arriving to points between Gravenhurst and North Bay to/from Toronto Pearson International Airport or an airport hotel.

2.1.2 Post-Secondary Institutions

The Town of Gravenhurst benefits from its close proximity to nearby post-secondary institutions and satellite campuses.

Georgian College

Established in 1967, Georgian College offers 125+ market-driven diplomas, certificate and graduate certificate programs. Students also have access to four (4) combined degree-diplomas with Lakehead University that include:[1]

- Bachelor of Engineering (Electrical) degree with Electrical Engineering Technology advanced diploma;

[1] Georgian College, https://www.georgiancollege.ca/about-georgian/

- Honours Bachelor of Arts and Science – Environmental Sustainability (Specialization in Ecosystem Management) degree with Environmental Technician diploma;
- Honours Bachelor of Science in Applied Life Sciences degree with Biotechnology – Health diploma; and
- Honours Bachelor of Science in Computer Science degree with Computer Programmer diploma.

With its seven (7) campuses and recognized as Ontario's number one (1) co-op college and leader in student work experience, the college:

- Emphasizes practical, hands-on learning;
- Maintains the highest percentage of students enrolled in a co-op program (52%);
- Reports the highest percentage of students enrolled in a mandatory co-op program;
- Benefits from 6,200 employer partners; and
- Was the first Ontario college with programs accredited by the Canadian Association for Co-operative Education.

Full-time programs available through the college (that have the potential to support a Muskoka Airport aerospace cluster) include:

- Aviation Management;
- Bachelor of Engineering (Electrical) Degree with Electrical Engineering Technology Advanced Diploma;
- Business;
- Business - Entrepreneurship;
- Business - Marketing;
- Business Administration;
- Electrical Engineering Technician;
- Mechanical Engineering Technology; and
- Mechanical Technician - Precision Skills.

Apprenticeship programs available through the college (that have the potential to support a Muskoka Airport aerospace cluster) include:

- Electrician – Construction and Maintenance/Domestic and Rural/Industrial;
- General Carpenter;
- General Machinist;
- Mould Maker;
- Small Engine Mechanic; and
- Tool and Die Maker.

Lakehead University

Lakehead University was established in 1965 in the City of Thunder Bay and opened two (2) Orillia satellite campuses in 2006 and 2010. The Orillia campus offers degree level programing in the areas of Business, Education, Interdisciplinary Studies, Social Work and Sustainability Sciences. In 2008, Lakehead University and Georgian College signed an agreement formalizing their partnership to bring increased degree options to central Ontario with the commencement of two (2) new combined programs that began in September 2018.

Lakehead-Georgian programs allow students to complete a university degree and college credential in only four (4) years, combining academic and applied learning to be graduate job-ready.

Lakehead-Georgian

Situated at Georgian College's Barrie campus, students have access to four-year programs in the fields of Bachelor of Engineering (Electrical) with Electrical Engineering Technology advanced diploma, and Honours Bachelor of Arts and Science – Environmental Sustainability (Ecosystem Management) degree with Environmental Technician diploma.

Canadore College

Established in 1967, Canadore College offers more than 65 full-time post-secondary programs spread over four (4) campuses: Aviation Technology Campus, Commerce Court Campus, and the Education Centre (College Drive Campus) in North Bay, Ontario, and one (1) campus in Parry Sound, Ontario.

Apprenticeship programs available through the college (that have the potential to support a Muskoka Airport aerospace cluster) include:

- Automotive Service Technician;
- General Carpenter;
- General Machinist;
- Information Technology Technician;
- Marine and Small Engine Technician;
- Metal Fabricator;
- Railway Car Technician; and
- Truck and Coach Technician.

Full-time programs available through the college (that have the potential to support a Muskoka Airport aerospace cluster) include:

- Aircraft Structural Repair Technician;
- Aircraft Structural Repair Technician – Manufacturing and Inspection;
- Aviation Fundamentals;

- Aviation Fundamentals Dual Credit;
- Aviation Technician – Aircraft Maintenance;
- Aviation Technician – Avionics Maintenance;
- Aviation Technology – Aircraft Maintenance and Avionics;
- Aviation Technology – Aircraft Maintenance and Structures;
- Manufacturing Dual Credit;
- Mechanical Engineering - Technician;
- Mechanical Engineering - Technology;
- Mechanical Technician – Machinist;
- Mechanical Technician – Welder Fitter;
- Mechanical Techniques – Machinist;
- Mechanical Techniques – Plumbing;
- Mechanical Techniques – Welder Fitter;
- Metal Fabricator Apprenticeship; and
- Motive Power Technician.

Simcoe Muskoka Workforce Development Board

The Simcoe Muskoka Workforce Development Board (SMWDB)[2] helps address questions associated with local-area labour/skill shortages by providing workforce information and labour market planning. They regularly conduct research and release an Annual Report concerning the labour force in Simcoe County and the District of Muskoka, which helps to guide stakeholders as they develop plans that help address these issues proactively.

While the SMWDB does not directly assist job seekers in finding employment, or offer training programs, they are a source for connecting them to local employment agencies, Government agencies and career information to help them attain their ideal career. SMWDB and Job Central websites are gateways to connect job seekers to a network of people and resources in their search for employment.

SMWDB partners with local-area organizations to address high-priority workforce development issues at the local level. On any specific partnership project or event, it may act as lead partner, co-lead partner or be involved in a steering or advisory committee role. SMWDB can also provide information and support to proposals for new initiatives and programs where a need has been identified.

[2] Simcoe Muskoka Workforce Development Board, https://www.smwdb.com/untitled-sitepage_6

Table 5 - Distance Between Muskoka Airport and Nearby Post-Secondary Instructions

	Georgian College (Barrie Campus)	Georgian College (Bracebridge Campus)	Georgian College (Orillia Campus)	Lakehead University (Orillia Campus)	Canadore College (West Parry Sound Campus)	Lakehead University (North Bay 'Aviation' Campus)	Simcoe Muskoka Workforce Development Board (Barrie)
Muskoka Airport	80kms	10kms	55kms	52kms	93kms	52kms	80kms

2.1.3 Research and Development

The Centre for Applied Research and Innovation at Georgian College's Barrie campus focuses on product design, prototyping, market research, analysis, testing and the development e-business solutions. They can help business or industry bring ideas to life by connecting with their faculty, student and staff researchers who have the expertise, skills and knowledge required to address industry research and development needs. Their state-of-the art facilities, labs and equipment are available to help industry partners better serve current and/or prospective markets.[3]

The Advanced Technology, Innovation and Research Centre also housed at Georgian College's Barrie campus is home to their Competitive Smart Manufacturing (CSM) program. This program supports regional manufacturers with implementation of advanced technologies and information strategies that improve traditional approaches to manufacturing and boost competitiveness. Over ten (10) faculty members are engaged in projects with up to eight (8) regional industry partners. The companies participating in the program with Georgian College must match the funding through a combination of cash and in-kind contribution. The college was recently awarded $150,000 in the College Voucher for Technology Adoption (CVTA) program. This will allow Georgian College to work with 15+ small- and medium-sized enterprises (SMEs) on projects related to product development, process optimization, technology evaluation, integration and adoption, and data analytics. Participating companies will receive $10,000 of grant funding from the Colleges Applied Research and Development Fund (CARDF) program, which must also be matched through a combination of cash and in-kind contribution. CARDF is administered by Ontario Centres of Excellence (OCE) for the Ministry of Research, Innovation and Science in partnership with Colleges Ontario. The key aspects of the CSM program focus primarily on automation, computer control, robotics, customization, and adaptability in product and process improvement. This will help businesses address the needs of just-in-time manufacturing in a global market.[4]

[3] Georgian College, https://www.georgiancollege.ca/community-alumni/applied-research-and-innovation/
[4] Georgian College, https://www.georgiancollege.ca/news/featured-news/georgian-receives-550000-grant-funding-support-industry-applied-research-projects/

2.1.4 Muskoka Airport

The Airport sits on about an approximate 550-acre site, a significant portion of which is consumed by runways, taxiways and aprons. Only about 22-acres of serviced land is currently available for commercial/revenue purposes. This land is currently all leased or sold (except for 2 remaining small lots). The Airport has additional land to service and develop, probably in the order of 40-50 acres, depending on how it is developed and how facilities are allocated on the site. Large portions of the airport's lands are environmentally sensitive wetlands, focused primarily on the east side, but with some similar but much smaller, environmental areas on the west side as well.

The Airport has a 6,000 ft. x 150 ft. asphalt runway. This runway is oriented North-South with GPS approach limits of 500 ft. and 1.5-mile visibility to both ends, as well as NDB approaches with similar limits. Weather data indicates these limits are exceeded some 5% of the time, so that the airport is not available due to weather during these periods. The airport's second runway is a 2,180 ft. x 100 ft. grass runway-oriented East-West that is available only during summer daylight conditions.

The airport is open 24 hours per day year-round, though traffic is very seasonal with low volumes during the winter. It has fuelling facilities, including jet fuel and avgas. The airport is also a Customs port of entry, allowing it to cater to U.S. and International traffic. In some cases, aircraft may have to land here to clear before heading to another airport in the region that does not have Customs, such as Parry Sound. The airport also has a fleet of vehicles that it operates and maintains in support of its airport operations.

The existing small passenger terminal is located at the south end of the field. While there are areas dedicated for parking, the airport currently does not charge for vehicle parking. Arriving passengers can arrange for taxi pick up at the terminal and rental cars can also be arranged through airport staff.

Compared to the three (3) competing airports (Peterborough Municipal Airport, Lake Simcoe Regional Airport and Parry Sound Area Municipal Airport), Muskoka appears to have the following advantages:[5]

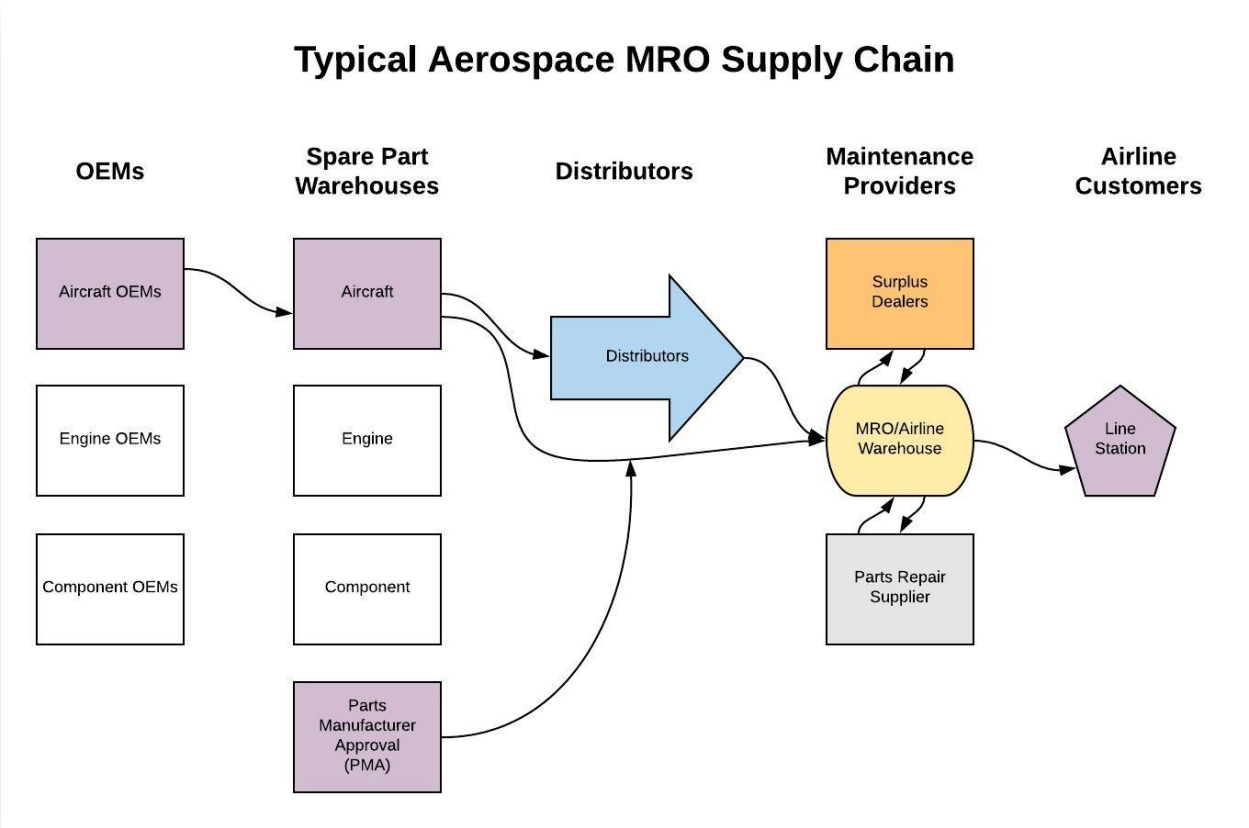
- It has a high concentration of based aircraft servicing firms: full-service;
- Its provision of specialty services is a plus;
- It has a competitive runway length and width, and good accessibility due to weather;
- It is a year-round base for public services;
- It is a Customs port of entry (though all but Parry Sound have this);

[5] Business Plan and Master Plan Muskoka Airport, SNC Lavalin, May 10, 2013

- It has branded fuel (which is important to attract commercial/corporate sector and especially turbos and jets (though all but Parry Sound have this); and
- It has a good base of turbo and jet traffic to use as a spring board for additional growth and for revenue purposes.

2.2 Supply Chain Analysis

There is a very limited aerospace manufacturing presence and supply chain activity in the Muskoka region. A few manufacturers were identified and one Tier-2 as the regional lead. This reality has pushed the manufacturers to become self-sufficient by integrating most activities they require in-house. Looking at the aviation side, Muskoka Airport host two (2) fair-sized maintenance and modifications providers and a few small shops offering aviation-related services and products but a very limited size.



In evaluating the supply chain activities that exist at the Muskoka Airport, the airport's two (2) anchor tenants were consulted, Muskoka Aircraft Refinishing (MAR) and Lake Central Air Services (LCAS). As such, we identified the following supply chain activities that exist at the airport:

- Aeronautical Engineer (available when needed);
- Aircraft maintenance (structural repairs, component overhauls, avionics and auto flight installations, parts manufacturing);
- Avionics;
- Cabinet making shop;
- Cargo conversions;
- Composite shop;
- Heavy maintenance shop;
- Machinable plastics;
- Maintenance facility (servicing both private and commercial piston, turbine, light jet, and rotary wing aircraft);
- Paint shop;
- Part repair and overhaul;
- Prototyping;
- Sheet metal shop;
- Tooling; and
- Weld shop.

2.3 SWOT Competitive Analysis

The Strengths, Weaknesses, Opportunities and Threats (SWOT) Competitive Analysis takes a critical look at the community, its infrastructure, workforce and related skill sets or lack thereof, local companies in or supporting the industry, proximity to post-secondary institutions among other variables that can play a supporting role in this report's cluster recommendation.

2.3.1 Strengths

As detailed in article 2.2 of the supply chain analysis, the assets and expertise that are held within Muskoka Airport's two (2) anchor tenants Muskoka Aircraft Refinishing and Lake Central Air Services are strong attributes for which to build a cluster concept around.

The somewhat close proximity that Gravenhurst can benefit from the nearby post-secondary institutions strengthens the value proposition of a newly explored potential aerospace supply chain with their many skilled trades apprenticeship programs, particularly in aviation structural repair, maintenance, inspection, and avionics, including full-time programs in aviation management, business and engineering.

Known as the Gateway to Muskoka, residents and those familiar with the area enjoy a great cottage country-style quality of life. Residents of the area generally want to be situated there and those who move to the community primarily come for a job, but stay for everything else the community has to offer. Being situated 90 minutes (by vehicle) from the Greater Toronto Area (GTA), it's not hard to access the business opportunities and services available from Canada's largest city or for those who commute to the GTA for their careers.

The Town of Gravenhurst is the birthplace of International Cultural icon Dr. Henry Norman Bethune. The Bethune Memorial House is a National Historic Site of Canada and celebrates the life of Dr. Bethune. His achievements include his research on tuberculosis and a mobile blood transfusion service. He is most famous for the last two (2) years of his life, which were spent in China, where he served as a surgeon and teacher. Decades after his death, Dr. Bethune's story continues to be taught as an example of selfless humanitarianism to millions of Chinese students. This has led to a significant increase of tourism activity and investment interest by the Chinese in Gravenhurst.

2.3.2 Weaknesses

Related to workforce and workforce development, businesses often struggle with finding the right individuals with the specific skill sets being sought after. This is particularly true for Aircraft Maintenance Engineers (AME's) in support of the businesses located at the Muskoka Airport.

Situated 45 minutes from Georgian College's Barrie campus and 30 minutes from Orillia's campus, it is difficult for Gravenhurst-based businesses to attract students during their co-op placements due to the distance from either campus. Additionally, Georgian College has a great aviation program, but it is more about aviation management, when there is a more pressing need for aviation technicians.

Regarding the airport, there are limited airside lands for development (as not all airside tenants require airside access).

2.3.3 Opportunities (Obtained from Consultations)

Given the interest and demand for commercial pilots and flight training centres worldwide (especially from China), the Muskoka Airport could be a strategic location to house an international flight school. Coupled with the influence from the Bethune Memorial House, an international flight training centre would be of particular interest to both Chinese investors and prospective Chinese pilots.

The Muskoka Airport should consider an onsite restaurant similar to what the Parry Sound Area Municipal Airport offers. It would not only serve the airport users and onsite tenants, but it also draws people from within the community out to the airport itself.

It is believed that a bakery-type establishment will have a larger chance of success, so it is recommended to begin with a bakery and then later introduce a restaurant-type establishment.

There is plenty of land available for businesses to develop and establish themselves on the east side of the runway. Additionally, other airports are putting up hangars that house private and corporate owners, many of whom could potentially establish a business in the community. Orillia saw the potential benefit of additional hangar space and installed groups of T-Hangers per building. Having the hangar brings the people and the people bring the economic benefit. Orillia is focused on interprovincial tours locally and associates them with activities in the area. This is an opportunity to tie Muskoka activities at the Muskoka Airport with access to the airport.

The airport should further investigate the financial benefit associated with the rising interest of float planes. A water runway only needs to be 36” deep and would be inexpensive to develop and operate. A Montreal-based airport invested in a water runway and their business quadrupled. Currently, float planes are serviced by Parry Sound or Orillia Airports.

There is a large untapped labour force at the Beaver Creek Institution located at the airport. The institution has and continues to work with local businesses by offering work releases for night shifts that entail floor moping to construction-related activities. There is an interest and willingness by the Warden to explore other employment opportunities with inmates to support onsite businesses at the airport.

Georgian College offers a year-round mechanical engineering co-op program based on rotating co-op start dates. More awareness of this opportunity may be enticing to local companies as a single 3-4-month semester work placement is often just enough time to get students up to speed.

There is an office building at the airport that is not in operation yet owned by the airport. Perhaps an incubator-type enterprise centre could be situated there to spur R&D and innovation at the airport.

If local businesses and airport tenants are struggling to attract talent, perhaps a commuter bus from Barrie or Orillia to Gravenhurst could be organized to pick up staff from these areas with designated drop-off locations in/around Gravenhurst (including at the airport).

There may be an emphasis on focusing more on aviation services rather than enhancing the manufacturing scene at the airport. It is reported that there is some growth in general aviation and globally in the commercial aviation sector. The US FAA forecasts a slow decline in piston (-0.1%/yr) and growth in turbine (jet and turboprop) of 4%/yr for the next 20 years, with overall GA growth 1.7%/yr. In the U.S., 2/3rd of GA activity is related to business activity.

2.3.4 Threats (Obtained from Consultations)

There is such a shortage of mechanics that some skilled trades are jumping from job to job based on who pays the most. Some are even living/working out of their vehicles. It makes it difficult to attract and retain these skilled trades when they are in such demand.

It is speculated that the Greater Sudbury Airport is considering building a hanger to support line maintenance. This has the potential to take away business opportunities at the Muskoka Airport.

The new governance board does not want to sell land and many leases older than 30 years are grandfathered and not in the district's hands.

There are ongoing housing and labour issues in Gravenhurst. Additionally, most houses and rental units are sold by word-of-mouth as opposed to online – this is becoming an issue especially for those wanting to relocate to the area.

Three (3) primary companies situated at the Muskoka Airport are becoming more fully integrated because of not being able to find the needed services locally. For example, Muskoka Aircraft Refinishing began with maintenance and painting, but is exploring the potential of incorporating cargo conversions, a composite shop and a welding shop into their facility.

3. Summary of Consultations

The consultation process provided an opportunity to challenge claims, obstacles and opportunities with local business leaders, influencers and those who are part of the local-area aerospace cluster on a daily basis. Throughout a two-day consultation process, 12 individuals participated in the two (2) focus group discussions – some of whom were involved in both focus groups and 11 conversations were held on an individual basis to collect information specific to their business activities.

3.1 Focus Groups

The two (2) focus group discussions allowed for open conversations wrapped around a targeted set of questions with a goal of stimulating additional thoughts, ideas, feedback and input from those in attendance. When the group was asked to comment on the local-area aerospace strengths, assets, skill sets and expertise, the following feedback was provided:

<u>Gravenhurst Strengths</u>

- Muskoka Airport already has land zoned for development to accommodate new investment interest;
- There is ample land at the Muskoka Airport to support new business development marked out on the east part of the runway;

- There is a large captured labour force at the Beaver Creek Institution with available work releases for midnight shifts ranging from floor moppers to construction;
- Contrary to popular belief, Gravenhurst is closer to business supports, services and suppliers between Gravenhurst and Toronto; and
- When 25 countries realized that LCAS has companies here, it sets a bar for what can be achieved.

The following comments were collected when the group was asked about local-area limitations, challenges and obstacles that must be overcome in order to bring structure to a possible aerospace cluster:

Workforce Development

- Staffing issues tied to size, availability and calibre of local-area talent pools (i.e.: mechanics, engineers, aircraft maintenance engineers and other apprentices);
- Retaining the youth, where many of them are leaving due to lack of available positions and seasonal work;
- Missed business opportunities due to not having sufficient numbers of employees to take on larger projects;
- Lack of affordable housing in the area to attract new talent; and
- It is becoming more difficult to attract qualified mechanics when many are becoming self-employed and able to charge higher rates.

Muskoka Airport

- The parkway is too close to the airport and growth at the south-end of the airport is restricted due to overcrowding;
- Muskoka Airport is weak in light aircraft. Other airports are putting up hangars with private and corporate owners - many of whom have established a business in the community; and
- Some airport tenants do not experience any transient business from the busy weekend traffic flying in/out of the Muskoka Airport.

Other

- “Hotel pricing” for pilots is an issue as it can be very expensive in the summer months.

In disclosing the types of aerospace/aviation opportunities/activities that have the potential to work well in Gravenhurst, participants responded with:

Research and Development

- Researchers (from Lakehead University) often require industry partners (with matching private-sector funding or in-kind support) to obtain grants in support of industry-academic collaborative and/or R&D projects; and
- Create an aerospace incubator at the airport. There is a program that provides funding for incubators to help get them started along with grants to attract researchers and entrepreneurs. There is an airport-owned office building onsite that could be converted to an incubator.

Business Segment Opportunity at the Airport

- The creation of an international flight school to accommodate the increasing requirement for commercial pilots and flight training programs; and
- An onsite restaurant will draw people into the airport and service employees of existing tenants. For example, the Orillia airport established a full-service restaurant and bar, which is very well attended and they have found that less than 20% of its customers are pilots. The restaurant is a big draw for people from within the community.

Airport Asset Requirement

- Airports in the general area and to the further north represent important transportation hubs for people. Many of these individuals fly float planes as a result of the many rivers and lakes that exist in these areas. With a growing market for float planes, a control tower is required to better manage the growing number of these types of movements;
- Establish an onsite water runway which can be inexpensive to install and operate. Some airport tenants could benefit as a result (such as LCAS). An airport in Montreal installed a similar option and airport movements quadrupled. Currently, float planes are handled by airports in Orillia and Parry Sound;
- Construct a number of T-Hangars per building over a number of hangars. Orillia saw the benefit of hangar space and installed groups of T-hangars per building over several hangars. Both Stanhope and Parry Sound Area Municipal Airports also have these in place. Having the hangar brings the people and the people bring the economic benefit;
- Additional Canada Border Services Agency (CBSA) services have the potential to increase the number of international flights.

Skills Development

- The new degree-diploma programs offered by Lakehead University and Georgian College need to be leveraged by local airport tenants.

Tourism Activity that Engages Airport

- Gravenhurst should develop interprovincial tours and associate them with local activities in the area. While they are economic benefits, but small in nature, the opportunity is to tie in Muskoka-based activities with access to/from the Muskoka Airport.

Community Development Opportunity

- Develop community housing around the airport to support local-area housing requirements.

Final comments collected from focus group participants included:

- An important benefit that can't be forgotten about Gravenhurst and the surrounding area is its quality of life;
- Very little interest in the 3D printing of planes as the return-on-investment does not yet outweigh the efforts of obtaining approval from Transport Canada;
- It is important to continue promoting the available airport lands for development and to ensure prospective developers/investors know how close the airport is to the highway;
- There are a number of support businesses (at the airport) that do not require airside access. Consider relocating them to groundside to open up new airside opportunities to attract new tenants;
- The airport needs a professional ambassador to travel the world and properly represent the airport. Everybody knows about the Muskoka Region (to some degree), but no one knows about its airport;
- Settlement services – if a business is bringing/attracting a new employee to the area, the town will help find that person a place to live. This has been done 25 times;
- People will move to a community for a job, but will stay for everything else the community has to offer. This is very evident in Gravenhurst; and
- It is important to leverage the influence of Dr. Bethune to the Chinese people and related investment opportunities.

3.2 One-on-One Interviews

From a scheduling perspective, our one-on-one meetings were held with individuals representing aerospace companies, private hangar owners, post-secondary institutions, workforce development boards and local/provincial government offices. As such, it is more difficult to aggregate information for the purposes of summarizing common trends. That said, the more meaningful observations noted during the many conversations are included below:

- Many Gravenhurst-based businesses being vertically integrated due to their isolation;
- Have had to grow engineering in-house;
- Outsourcing avionics, painting and propeller work;
- No in-house R&D or proprietary products;
- Challenged to grow the business with the talent they have and the limited timeframes;
- Seeking a “like cluster” to offer some business growth opportunities;
- Would like to see more commercial-based aviation, FBO and flight school at the airport;
- Want to expand engineering capabilities;
- Trouble finding AMEs;
- Work with young professionals through local high schools and co-op programs;
- More Canadian Border Security Agency (CBSA) would be good by increasing custom service staff during the heavy season;
- Runway length for a challenger 605 can be tight to land;
- High prices for hotels are an issue for pilots during the summer months – perhaps a concierge service with preferred rates could be established; and
- Aircraft interiors can be done out of Goderich, Kitchener has full FBO capabilities, Peterborough is strong in painting, Hamilton does cargo, and flight safety is taken care of in Dallas.

4. Aerospace Market Analysis

The Town of Gravenhurst is looking at bringing additional private investment to the area. Gravenhurst's Strategic Plan clearly states that building economic and employment opportunities are one of the five (5) main goals of the municipality. In addition to being home to one of the remaining untapped small airports, Gravenhurst has seen significant interest from businesses located across the globe as an investment destination.

In supporting those efforts, we have undertaken to perform an Aerospace Market Analysis of the Ontario and Canadian markets along with a portrait of the world situation. Additionally, we have examined the impact that new technology trends and regulations are having on the industry. Finally, we are provided some insight into the market forecast for the next 20 years.

4.1 Portrait of the Market

4.1.1 Ontario Market

4.1.1.1 Market Size

The Ontario Aerospace market is comprised of over 350 companies employing over 22,000 skilled workers, namely highly qualified engineers, technicians and scientists. Ontario is home to over half of the world's top 25 aerospace companies which are involved in the following sub-sectors: Ontario aerospace industries contribute to 25% of the Canadian aerospace activities.

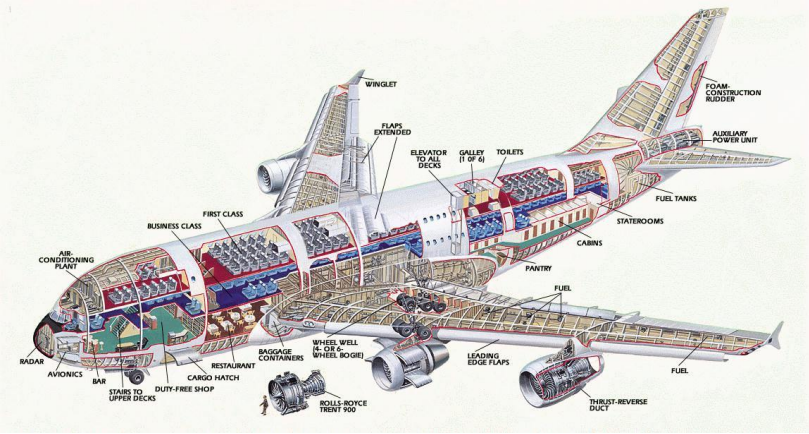
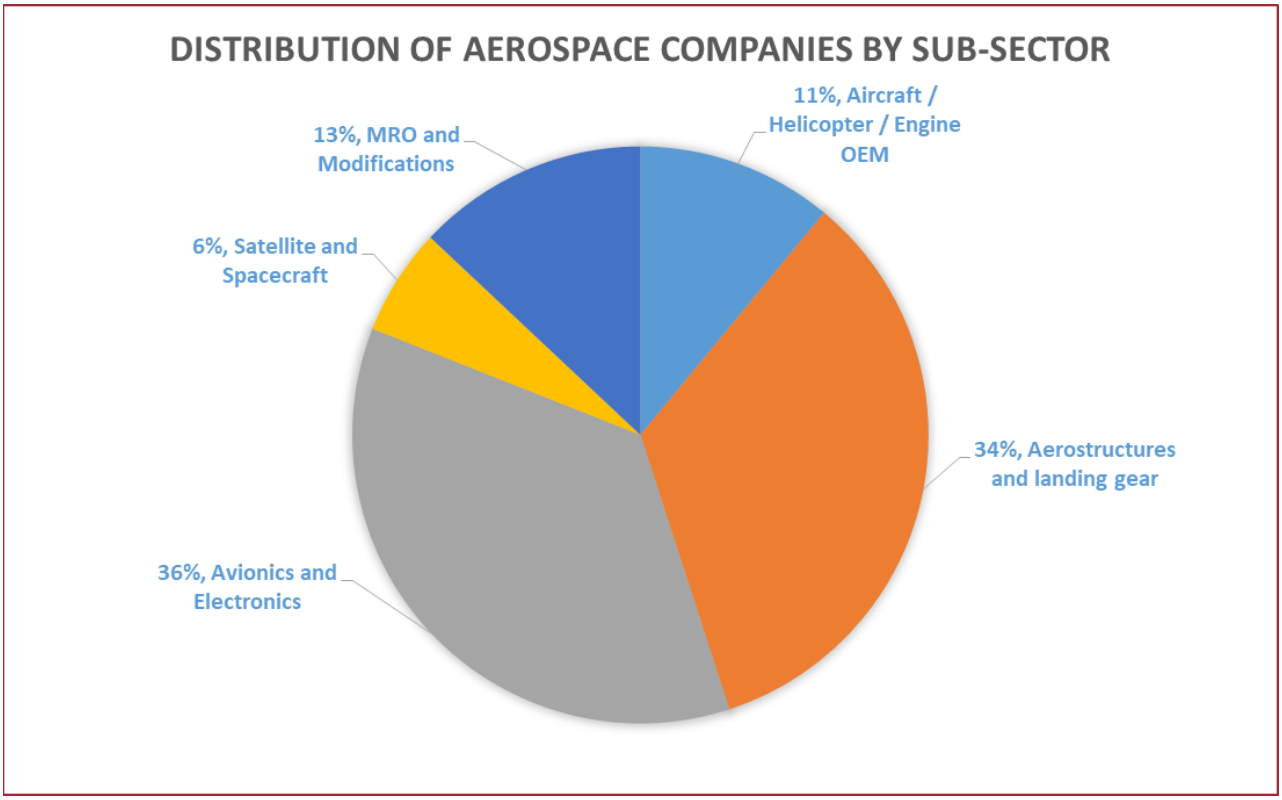


Table 6 - Ontario Aerospace Sub-Sectors

Aerostructures	Composites
Satellites	Engines
UAVs	Landing Gear
Space	Software
Avionics	Robotics
MRO	Testing

The aerospace market in Ontario is very solid and offers a complete supply chain from OEMs through Tier1, Tier 2 and Tier 3. It generates revenues of $6.4 billion in annual sales with 80% of revenue derived from export markets. Figure 1 provides a breakdown of the larger companies (OEM, Tier 1 and Large Tier 2) by sub-sector.

Figure 1 - Distribution of Ontario Aerospace Companies by Sub-Sector (OEM, Tier 1 and Large Tier 2)



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.

Although there are over 200 companies involved in the sector, many are small and medium enterprises (SMEs). They contribute significantly to the economy and to the aerospace supply chain, but they are somewhat dependent on the larger companies. Table 7 provides a list of the top 16 aerospace sector companies in Ontario.

Table 7 - List of some of the key players in the industry

Airbus	Northrup Grumman
Bombardier	POC Aerostructures
Leonardo	Raytheon
L3	Safran
General Dynamics	Thales
Alcoa	United Technologies
Zodiac Aerospace	Honeywell
Mitsubishi Heavy Industries	Goodrich

4.1.2 Main Products and Services

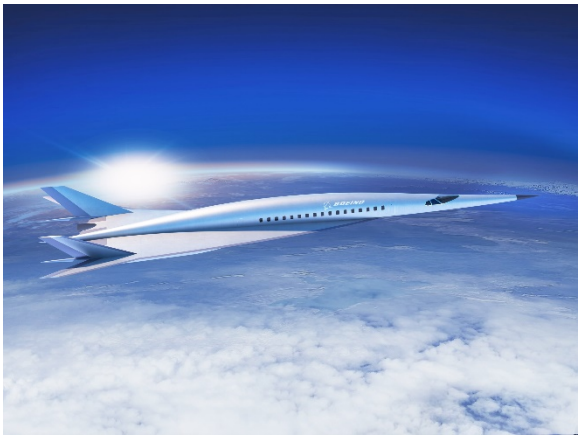
Ontario's aerospace sector is a complete supply chain with most of the products and services being manufactured and offered within the province. The list of those products and services are presented in Table 8 along with the companies involved in providing the products or services.

Table 8 - Ontario Aerospace Products and Services

Product/Service	Company
Aircraft integration and assembly	Bombardier
Aircraft customization and simulation	Flying Colours, Flight Safety
Helicopters and components	Airbus Helicopters Canada, Dart Aerospace
Engines, hardware and testing	Pratt and Whitney Canada, MDS Aero Support, GasTops, Triumph Gears
Structural components	Arnprior Aerospace, Mitsubishi Heavy Industries Canada Aerospace, Magellan Aerospace, Noranco, Centra, Cyclone Manufacturing
Landing gear systems	Héroux Devtek, Messier-Bugatti-Dowty, UTC Aerospace Systems, Sumitomo Precision Products, Canada Aircraft
Avionics / electronic systems and components	Raytheon, Honeywell, CMC Electronics, L-3, Safran Electronics Canada, Nexeya, Celestica, Thales, General Dynamics, Zodiac Interconnect Canada, DRS Technologies.
Composite component manufacturing	Apex Composites, Fleet Canada, Comtek Advanced Structures, Diamond Aircraft, Shimco
Maintenance, Repair and Overhaul (MRO)	KF Aerospace, Premier Aviation, Chorus Aviation
Satellites and services	COM DEV, ExactEarth, Sinclair Interplanetary
Space robotics and systems	Neptec, MDA, Teledyne Dalsa, Canadensys
Unmanned aerial vehicles (UAV) platforms	Aeryon Labs, Brican Flight Systems, MMIST, ING Robotics, Northrop Grumman

4.1.3 Research and Development

Companies in this sector invest heavily in Research and Development (R&D). It represents more than any other market sector. In Ontario, R&D in aerospace accounts for over 30% ($500 million) of all aerospace R&D in Canada.



Testing and Partnership Opportunities

The province is home to a number of potential partners that can support R&D, prototyping and testing and evaluation of new products and technologies. A list of the major test and evaluation and R&D support organizations is presented in Table 9.

Table 9 - List of R&D Support and Testing Organizations

Organization	Location	Logo
Canadian Space Agency – David Florida Laboratory Satellite and space system assembly and environmental testing.	Ottawa	
UTIAS Spaceflight Laboratory (University of Toronto) Microsatellite design, production, launch and control.	Toronto	
NRC CANMET Materials – Hamilton Research, fabrication, processing and evaluation of metals and materials. **NRC Aerospace – Ottawa** Conducting research, performing technical services and developing technology solutions to support the Canadian aerospace industry.	Hamilton Ottawa	
Fraunhofer Project Centre for Composites Research Develops, tests, validates and characterizes new lightweight materials and advanced manufacturing processes at industrial scale.	London	

Organization	Location	Logo
Institute for Quantum Computing (University of Waterloo) Quantum information research.	Waterloo	
Defense Research and Development Canada Scientific and technical information exchange, shared materials and facilities, jointly developed frameworks, trials, exercises and advanced concept technology demonstrations.	Ottawa - Toronto	
Innovation Centre for Advanced Manufacturing and Production Allows companies to access the technologies and resources for the development of new products and processes or the refining of existing products and processes.	North Bay	
Catalyst 137 Provides centralized funding, consulting, engineering and other services, consolidated under in one location.	Waterloo	
Canadian Centre for Product Validation Prototyping and testing in one central location – with full developmental multimodal capabilities.	London	

4.1.4 Ontario Main Aerospace Cluster – Downsview Aerospace Innovation and Research Consortium (DAIR)



The aerospace sector around the world has worked at creating strong close proximity clusters to provide a compelling offer ready to compete and attract the best talents in the industry. In Ontario, located at the Downsview airport and greatly supported by Bombardier, the DAIR was established.

The Downsview Aerospace Innovation and Research Consortium (DAIR) is an association of all major aerospace companies and major post-secondary institutions in the Toronto area. It has the mandate to create an aerospace hub in the Greater Toronto Area at the Downsview Park. At the heart of the cluster, an aerospace research and innovation center will create industry, academia and government partnerships. This will catalyze new research and development initiatives, primarily by providing a shared space to house offices of various industries, academic and government organizations, small and medium-sized enterprises (SMEs), experimental and testing facilities, and space for technological development.

DAIR has been created to help bring the right players to a centralized location to enable more effective collaboration and better position Ontario and Canada in this increasingly competitive global marketplace. Key sectors include turboprops and business jets, engines, landing gear, electronics, satellites and space robotics. The center is expected to create up to 14,400 sustainable jobs and provide direct, indirect and induced benefits of up to $ 2.3 billion over the next 20 years.

4.1.5 Training Organizations and Main Programs

The province has many universities that train engineers and scientists along with several community colleges that provide aviation training and training of technicians for the aerospace sector. In total, there are over 40 degree and diploma programs in applied aerospace, aviation and space disciplines at colleges and universities across Ontario.

There are 16 universities with engineering programs (disciplines range from aerospace, physics, nuclear, mechanical, industrial, software, computer systems, etc.). Many universities also offer postgraduate training. Aerospace engineering PhD and Masters Programs are offered at the University of Toronto, Ryerson University (Toronto) and Carleton University (Ottawa).

Ontario has a number of colleges (Table 10) that offer aircraft maintenance technician training.

Table 10 - Ontario Colleges Offering Aviation Training

College Name	Location	Programs
Algonquin College	Ottawa	• Aircraft Maintenance Technician
Canadore College	North Bay	• Aircraft Structural Repair Technician • Aviation Technician - Aircraft Maintenance • Aviation Technician – Avionics Maintenance • Aviation Technology – Aircraft Maintenance and Avionics • Aviation Technology – Aircraft Maintenance and Structures
Centennial College	Toronto	• Aviation Technician – Aircraft Maintenance • Aviation Technician – Avionics Maintenance • Aviation Technology – Aircraft Maintenance and Management
Confederation College	Thunder Bay	• Aviation Technician – Aircraft Maintenance
Fanshawe College	London	• Aviation Technician – Aircraft Maintenance • Aviation Technician – Avionics Maintenance • Aviation Technology – Aircraft Maintenance and Avionics
Mohawk College	Hamilton	• Aviation Technician – Aircraft Maintenance
Sault College	London (Partnership with Fanshawe)	• Aviation Technician – Aircraft structural Repair Technician

Georgian College with a campus in Muskoka does not currently have an aviation or aerospace-related program.

4.1.6 Financial Programs and Incentives

There are a number of Federal and Provincial Funding programs to support the industry.

Provincial Programs

At the provincial level, the Ministry of Economic Development, Job Creation and Trade offers most of the programs available. Table 11 provides a sample of the programs available through the ministry or other organizations. This is sensibly the same in all the provinces. As programs change on a regular basis, it is recommended to review the ministry's web site when the need arises.

Table 11 - Sample of Provincial Funding Programs

Program Name	Eligibility Criteria	Funding Available
Consortium for Aerospace Research and Innovation in Canada (CARIC)	Minimum of 2 industrial partners and 2 academic partners. Provide 25% of the project cost.	Depending on the project and available program funds.
Export Market Access Program	• Been in business for at least 2 years • More than 5 employees • Annual sales of more than $500,000	50% of direct costs
Ontario Exporters Fund	Cover the cost of hiring an experienced export manager in: advanced manufacturing and aerospace. • Been in business for at least 2 years • 5 to 500 employees • Annual sales of $3 to $20 million (10%-50% in export sales)	Up to $80,000
Eastern Ontario Development Fund – Business Stream	To be eligible for the business stream, businesses need to: • Employ at least 10 people • Commit to creating at least 10 new jobs • Be able to provide 3 years of operations/financial statements • Be located in, or plan to locate in, a community in eastern Ontario • Invest at least $500,000 in their project	• 15% of eligible costs • Max $1.5 million For projects in excess of $10M and creating over 50 jobs. • 50% in loan
Eastern Ontario Development Fund – Regional Stream	Contribution of at least 35% of the company's own resources. • Focus on economic and business development and job creation in the community or region; • Align with provincial and regional priorities, e.g., introducing new forms of innovation, taking part in province-led economic development initiatives; • Invest more than $100,000; • Have private sector support; and • Be used for activities that are new to the organization.	• 50% of eligible project costs • Maximum grant of up to $1.5 million.

Federal Programs

For Northern Ontario, businesses have access to FedNor funding and to a number of other programs available through the National Research Council (NRC). As for provincial programs, the federal programs do also vary and it is better to look for specific programs as the need arises. Table 12 provides a sample of the most commonly used programs.

Table 12 – Sample of Federal Funding Programs

Program Name	Eligibility Criteria	Funding Available
FedNor Targeted Manufacturing Initiative for Northern Ontario – Productivity Improvements	Established manufacturers located in Northern Ontario, with 500 or fewer employees. Activities that aim at improving and modernizing the manufacturing process, leading to increased productivity and competitiveness.	FedNor will contribute up to 33% of eligible capital costs and up to 50% of eligible non-capital costs.
Industrial Research Assistive Program (IRAP) (NRC)	1-500 people on payroll, 2 years incorporated with internal technical R&D expertise	$50k non-repayable grant with 80% of direct labour and 50% of subcontractor expenses
NSERC Collaborative Research and Development (NRC)	Company must operate from a Canadian base. IP ownership to be agreed on by both partners.	25-75% of project expenses covered through NSERC grant funding
Invest Canada-Community Initiatives (ICCI)	Eligible recipients are Canadian communities and non-profit, locally based organizations that are seeking assistance, for example: • To offset costs associated with developing marketing tools aimed at foreign investors; • For specific FDI training; • To identify potential investors and/or coordinate interactions with them; or • To develop and implement multi-year international investment attraction and retention strategies.	Consult the following Web Site: http://tradecommissioner.gc.ca/funding-financement/icci-icic/eligibility-document.aspx?lang=eng

4.1.7 Events

Most of the events that take place in this sector are happening around the globe. The following are the main events for aerospace manufacturing and Maintenance Repair and Overhaul (MRO). A partial list is provided in Table 13.

Table 13 - List of the Main Aerospace Events

Event	Location	Approximate Dates
HAI Heli Expo	Major US City	Annual event in March (next one in Atlanta, GA)
Aerospace Innovation Forum	Montreal, QC	Annual event in April.
MRO Americas	Major US City	Annual event in April (next one in Atlanta, GA)
Aeromart Montreal	Montreal, QC	Every other year in April (next one in 2019)
Aircraft Interiors Expo	Hamburg, Germany	Annual event in April
Canadian Association of Defense and Security Industry (CADSI) – CANSEC Convention	Ottawa, ON	Annual event in May
Salon International de l'aéronautique et de l'espace (SIAE) (Le Bourget)	Paris, France	Every other year in June (next one in 2019)
Farnborough Air Show	Farnborough, UK	Every other year in July (next one in 2020)
Regional Airline Association (RAA) Annual Convention	Major US City	Annual event in September (next one in Nashville, TN)
MRO Convention Europe	Major European City	Annual event in October (next one in Amsterdam, Netherlands)
National Business Aviation Association – Business Aviation Convention (BAA-BACE)	Major US City	Annual event in October (next one in Orlando)
Doing MRO in Canada Conference	Toronto, ON	Annual event in October
Canadian Aerospace Summit (Aerospace Industries Association of Canada)	Ottawa, ON	Annual event in November
Aeromart Toulouse	Toulouse, France	Every other year in December (next one in 2018)

4.2 Canadian Market

4.2.1 Market Size

Aerospace products made in Canada are primarily for commercial use, while military sales make up a smaller but still important segment. Canada's main trading partner, the United States, is the primary destination for Canadian-made aerospace products. In 2015, for example, the United States purchased $7.7 billion of the $12.3 billion worth of civilian and military planes, components and other items the Canadian industry produced.

The tight integration between the Canadian and American aerospace industries is reflected in trade as well as the partnerships between the companies themselves. As a result of global economic trends, many American firms continue to operate subsidiaries in Canada, benefiting from a cheaper Canadian dollar and government incentives.

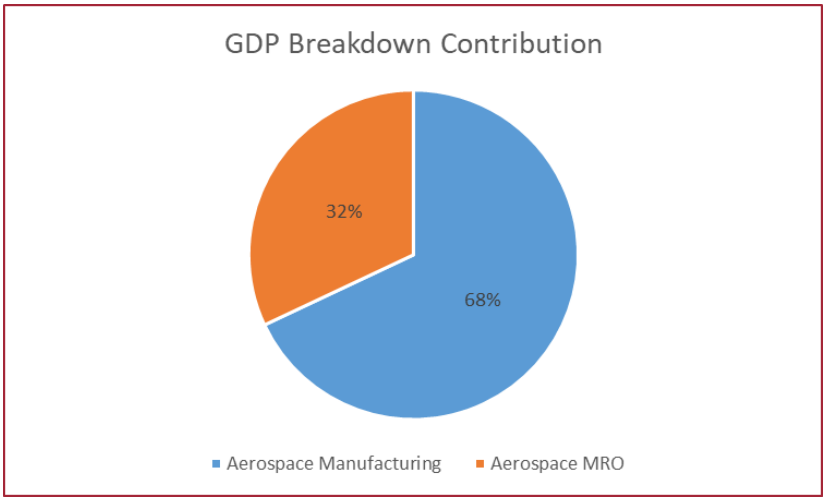
The Canadian aerospace sector is composed of over 700 companies throughout the country. Its ecosystem is interlinked with the defense and space industries. Consequently, the Canadian aerospace industry sales were composed of a combination of these three (3) industry sectors. Table 14 provides the breakdown. The Space Systems manufacturing sector requires a highly skilled labour force and is oriented toward civil applications. Additionally, among defense activities, aerospace captured more than 30% of sales and close to 50% of research and development (R&D) budgets.

Table 14 - Distribution of Sales per Aerospace Industry Sector

Industry Sector	Breakdown in % of Sales
Commercial Aerospace	86%
Defense Aerospace	12%
Space Systems	2%

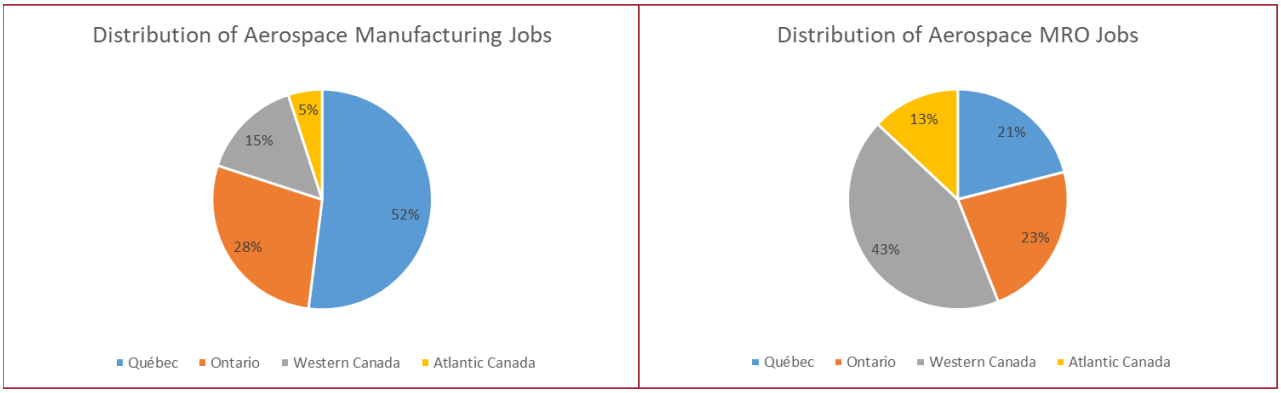
The contribution of the aerospace sector to the Canadian Gross Domestic Products (GDP) is substantial. In 2017, the industry contributed close to $25 billion to the Canadian GDP resulting in over 6% increase over the previous five (5) years. It also created almost 190,000 jobs (with direct employment of 85,600 Canadian), an increase of 2% over the previous five (5) years. Of the total GDP contribution, it is possible to provide a breakdown by the two (2) main sub-sectors as per Figure 2. 75% of the production and services are for the export market.

Figure 2 - Sub-Sector GDP Breakdown Contributions



The number of jobs created that are associated with aerospace in Canada is 190,000. This number can be further broken down per region. Figure 3 provides the distribution of workers per region.

Figure 3 - Distribution of Employees per Major Sub-Sector



Canada ranks in the top three (3) countries in terms of civil aircraft, engines, and flight simulator production. The actual ranking for each of the sub-sectors is presented in Table 15.

Table 15 - World Production Ranking per Sub-Sector

Overall Ranking	Sub-Sector	Specific Productions
#1	Civil Flight Simulator Production	#1 – Civil Flight Simulator Production
#3	Civil aircraft production	#2 - Business aircraft production
		#2 - Regional aircraft production
		#4 - Large jet production
		#4 - General aviation production
		#5 - Helicopter production
#3	Civil engine production	#1 - Turboprop engine production
		#1 - Helicopter engine production
		#4 - Turbofan engine production

Canada offers the lowest overall business cost of all G7 countries. This makes Canada an interesting target for aerospace investments.

4.2.2 Research and Development

Canada has R&D incentive programs that help industry by making it more affordable to innovate and stay competitive in the market. In many cases, they help reduce the R&D costs by more than 50%. More than 20% of the Canadian aerospace manufacturing activity is dedicated to R&D. The Canadian aerospace manufacturing sector outpaced key industrial sectors, the total manufacturing average, and the total of all industries in terms of R&D intensity.

R&D performed by aerospace manufacturing totalled $1.7 billion in 2017. The aerospace manufacturing industry contributed close to a quarter (Figure 4) of total manufacturing R&D in Canada and was over seven (7) times as R&D intensive as the manufacturing average (Figure 5). The R&D intensity is generally defined as expenditures by a firm on its research and development (R&D) divided by the firm's sales.

Figure 4 - R&D Canadian Manufacturing Industry Comparison - 2017

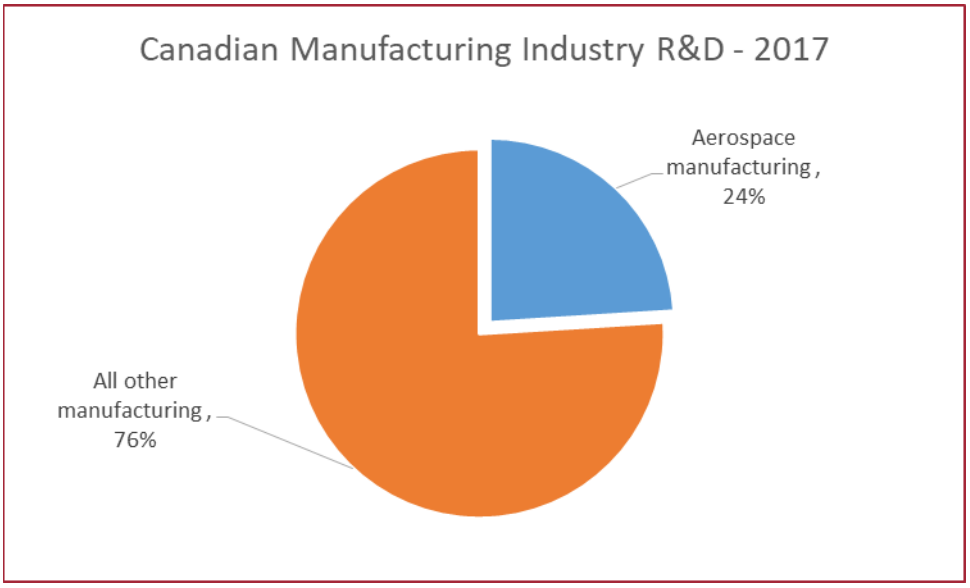
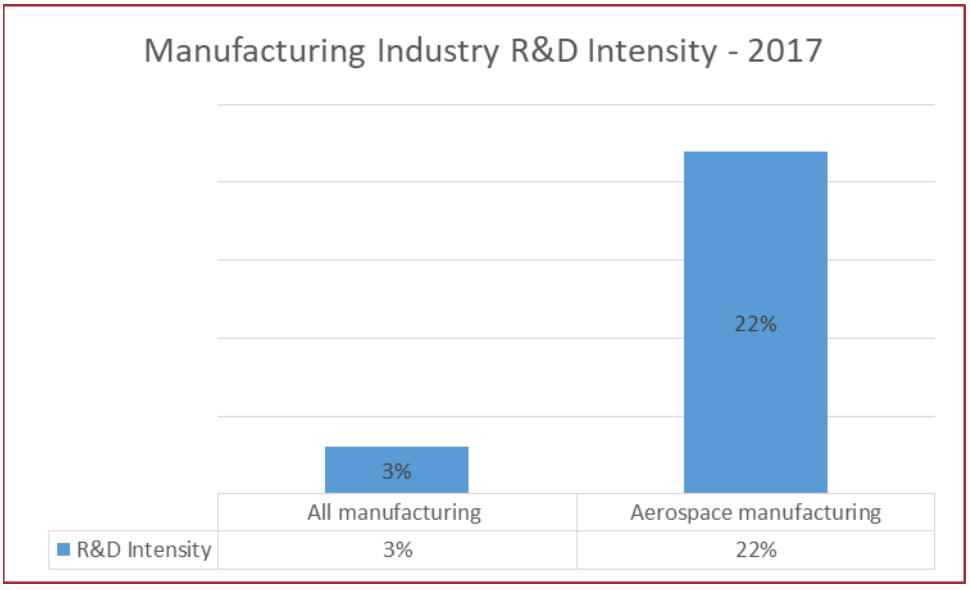


Figure 5 - Manufacturing Industry R&D Intensity - 2017



4.2.3 Unique Projects



Bombardier has just completed two (2) major projects, the CSeries and the Global 7500 (received Transport Canada certification in September 2018). Although there is probably a supply chain already in place, there are probably opportunities to have other companies involved in their supply chain.



Viking acquired the rights to the CL215 and CL415 in the last few years. They are presently assessing the market to start the manufacturing of a new model, the CL515. In the meantime, they have started to re-engine and modify used CL415 for delivery to the Chilean government.

4.3 World Market

4.3.1 Aerospace Market Outlook

The global Aerospace and Defense (A&D) industry will strengthen in 2018 as revenues were forecasted to increase by 4.1%, doubling the 2.1% growth in 2017. The recovery of global gross domestic product (GDP), stable commodity prices and heightened passengers travel demand are likely to ramp up growth in the commercial aircraft sector in 2018. On the defense sector side, heightened global security threats as well as higher defense spending from other major regional powers such as India, China, and Japan are likely to drive global defense sector revenue growth in 2018 and beyond.

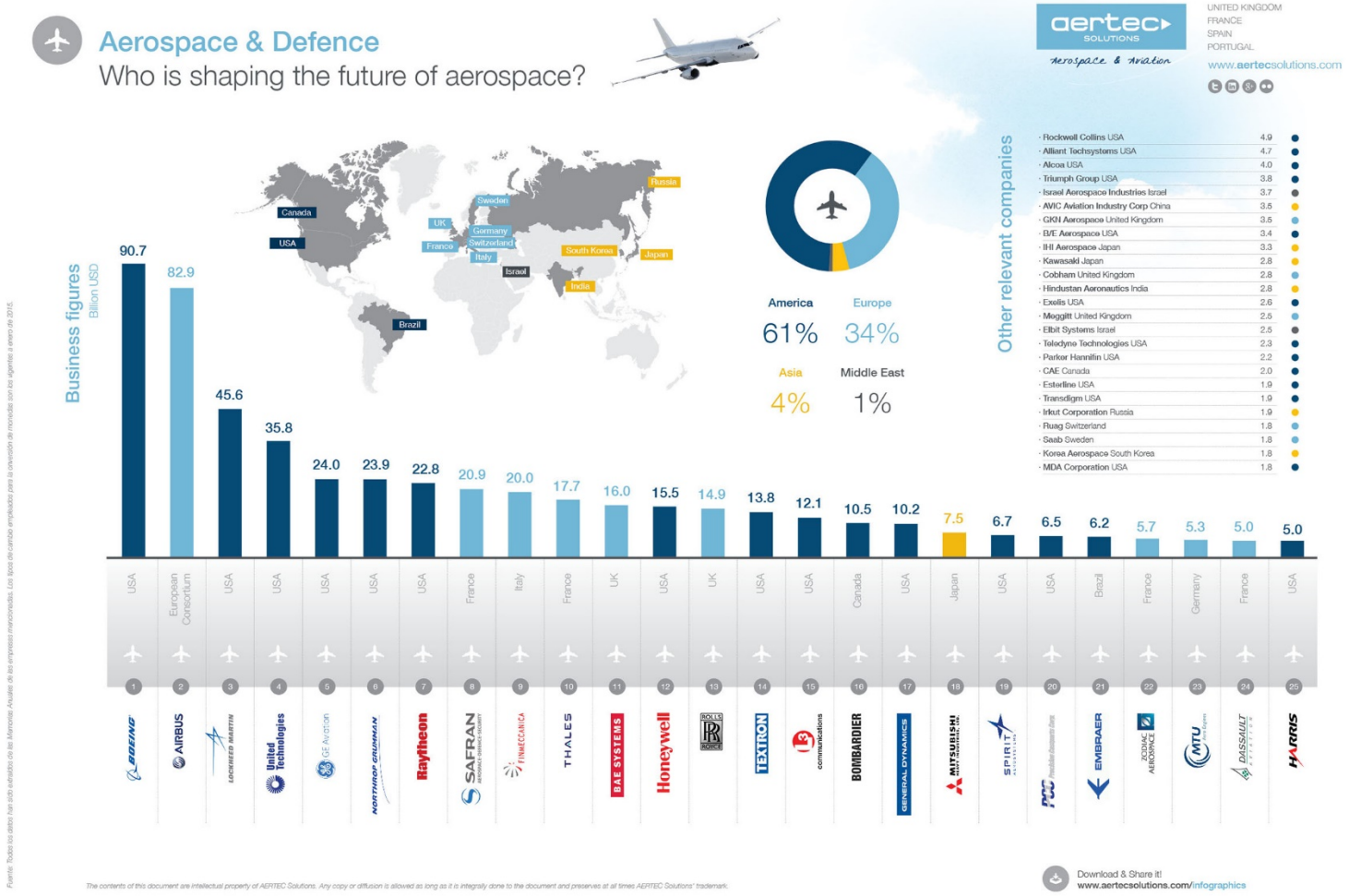
Commercial aircraft sector revenues expected to grow 4.8% as production levels are likely to be robust while the defense sector revenues are likely to record 3.6% growth as the US defense budget returns to growth after experiencing multi-year declines.

The spiraling demand for passenger travel is driving commercial aircraft production and is responsible for the record high backlog of 14,215 units at the end of 2017. During the same period, the global defense spending is anticipated to grow at a CAGR of about 3.0% over the 2017–2022 period, crossing US$2 trillion by 2022.

4.3.2 World Leading Companies in Aerospace and Defense

In most of the literature, the Aerospace and Defence Industry is combined making it difficult to separate both. This discussion will address both. The Americas and especially North America (61%) possesses the strongest A&D market in the world followed by Europe (34%) and some companies in emerging markets in Asia and the Middle East. Figure 6, has been prepared by Aertec Solutions and provides the breakdown of the size of the A&D market around the world. It also provides the leading companies and their contribution to Aerospace and Defense.

Figure 6 - Distribution of Global Aerospace and Defense Companies Leading the Industry



4.3.3 The US Market

Figure 6 depicts the importance of the North American Market on the world stage. In addition to the Canadian analysis in the previous section, we need to discuss separately the largest Aerospace Market in the world, the USA.

U.S. aerospace manufacturers are very competitive internationally. In 2017, the industry contributed $143 billion in export sales to the U.S. economy. Its positive trade balance of nearly $85 billion that year was the largest trade surplus of any manufacturing industry, supporting high-wage jobs for hundreds of thousands of American workers. At the end of 2017, inward stock of foreign direct investment (FDI) into the U.S. aerospace manufacturing industry totaled more than $21 billion.

Foreign firms are attracted to the U.S. aerospace market because it is the largest in the world and has a skilled and educated workforce, extensive distribution systems, diverse offerings, and strong support at the local and national level for policy and promotion. The U.S. aerospace industry directly employs about 485,000 workers in scientific and technical jobs across the nation and supports more than 700,000 jobs in related fields. Investment in the U.S. aerospace industry is facilitated by a large pool of well-trained machinists, aerospace engineers, and other highly-skilled workers with experience in the aerospace industry.

Large Civil Aircraft (LCA): The United States is a global leader in LCA production and has a complete LCA supply chain.

Rotorcraft: The U.S. rotorcraft industry is diverse with the bulk of new deliveries arriving from mature production lines. The market encompasses military, emergency medical service (EMS) providers, offshore oil and gas exploration, and law enforcement applications.

Commercial Space: The companies in the U.S. commercial space market are major suppliers to U.S. Government programs, where demand has remained stable during the commercial aerospace and global economic downturns.

General Aviation (GA): The United States is the world's largest market for GA aircraft. U.S. manufacturers produce a wide range of GA products including piston aircraft, turboprops, jets, balloons, dirigibles, and experimental aircraft.

Engines: Major engine and power plant manufacturers are typically part of diversified corporations producing engines for both civil and military aircraft, either alone or as part of one or more joint ventures. Engines and power plant sales also provide maintenance, repair and overhaul.

Unmanned Aircraft Systems (UAS): Given the rapid growth of military and civil governmental UAS operations, there is tremendous potential for the U.S. industry in the evolving commercial UAS sector. The establishment of the FAA's six (6) UAS test sites, the creation of the FAA's Center of Excellence for Unmanned Aircraft Systems, and the partnership with industry through the Focus Area Pathfinder initiative demonstrate the U.S. Government's commitment to supporting civil UAS development. The over-one million registrations that the FAA has processed (163,000 of which are for commercial users) exemplify the expanding level of demand for UAS in the United States.

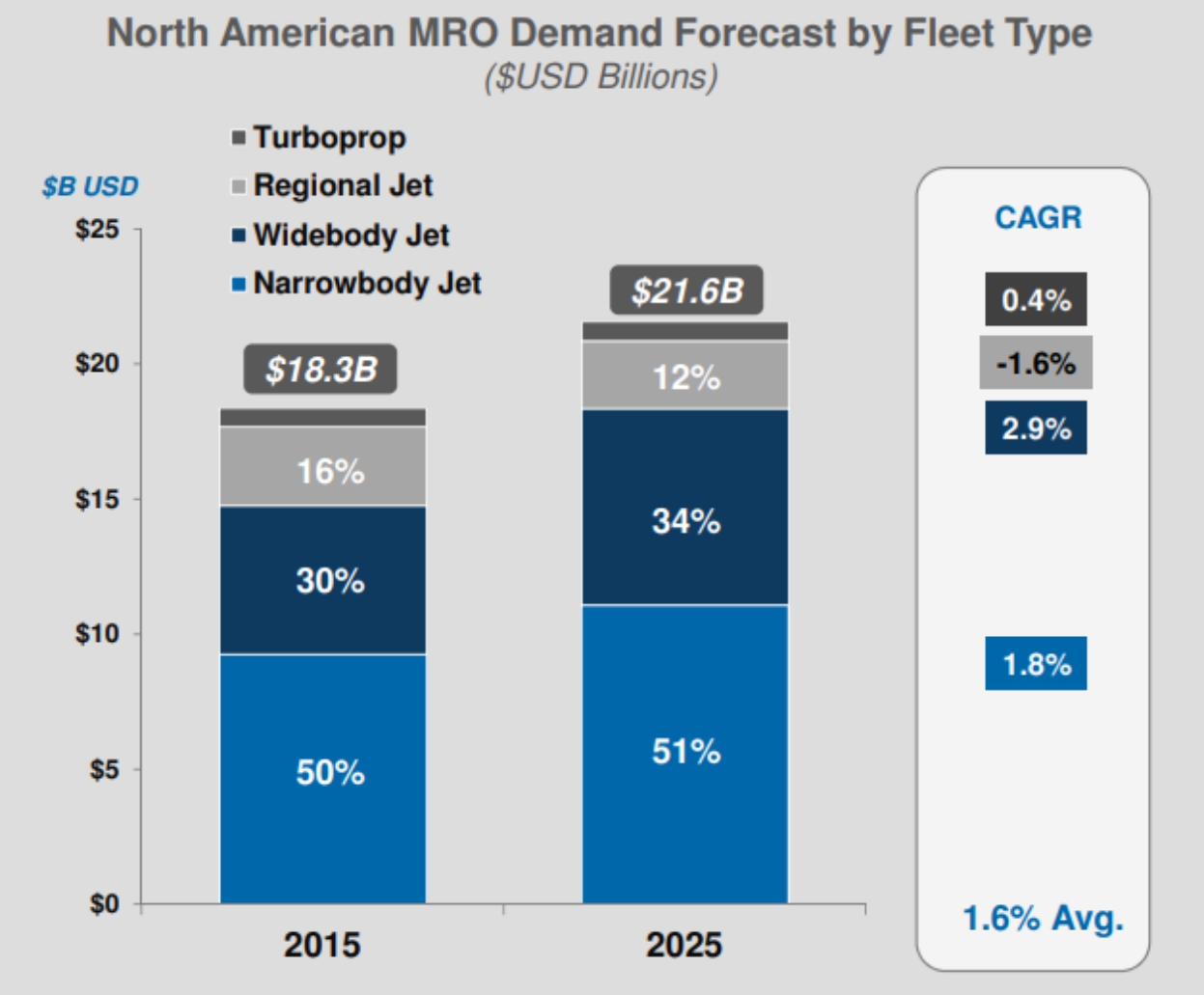
4.3.4 The North American MRO Market Outlook

The present section focuses on the MRO segment of the Aerospace industry. The North American (for which the US has the most significant contribution) market for aircraft maintenance, repair and overhaul (MRO) is estimated to reach around $23.8 billion U.S. dollars by 2028. Between 2018 and 2028, the aircraft MRO market in North America is expected to show a compound annual growth rate of 1.8%. On the longer terms, between 2023 and 2028, the aircraft MRO market in North America is expected to grow at a faster pace with a compound annual growth rate of 4.2% due to forecast aircraft demand and the need to renew aging fleets.

The total North American revenue for the next decade (2018-2027) is expected to be more than $209 billion with repair of components leading MRO demand over that period. From now until 2027, it will generate in excess of $82 billion, which accounts for 36% of the regional market. Engine spends between 2018 and 2027 will generate more than $70 billion in MRO demand. This figure accounts for 31% of the overall North American commercial maintenance market. Line maintenance will account for 21% during the same period. Heavy airframe maintenance work will account for 7% of MRO demand over the next decade. With spending expected to be in excess of $15 billion, aircraft such as the 737 MAX will become increasingly prominent in the North American fleet as more enter into service. With more providers looking to take advantage of the global surge in aircraft modifications, the segment will account for 6% of MRO demand in North America.

The most accurate and up-to-date data that were available for the North American MRO Demand Forecast by Fleet Type is presented in Figure 7.

Figure 7 - North American MRO Demand Forecast by Fleet Type Until 2025



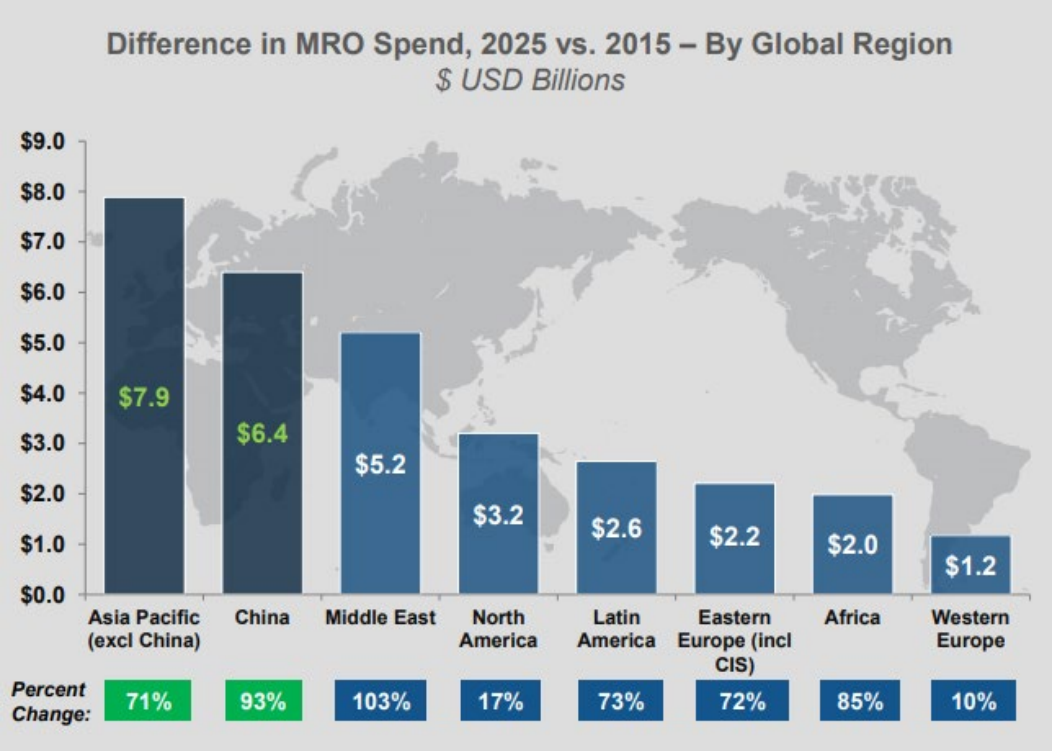
The 2017 distribution of aircraft by type is presented in Figure 8.

Figure 8 - Distribution of aircraft by type in the U.S. - 2017

Top 10 Models	# in Fleet	% of Total
Boeing 737-800	794	10.9%
Boeing 737-700	585	8.0%
Airbus A320 (ceo)	505	6.9%
Boeing 757-200	456	6.2%
Bombardier CRJ200	393	5.4%
Airbus A321 (ceo)	350	4.8%
Airbus A319 (ceo)	342	4.7%
Boeing 737-900ER	292	4.0%
Bombardier CRJ700	282	3.9%
Bombardier CRJ900	270	3.7%

The US MRO market will not be the only market to observe growth until 2025. Figure 9 provides the total MRO spend growth by region. China and Asia Pacific are expected to drive that growth.

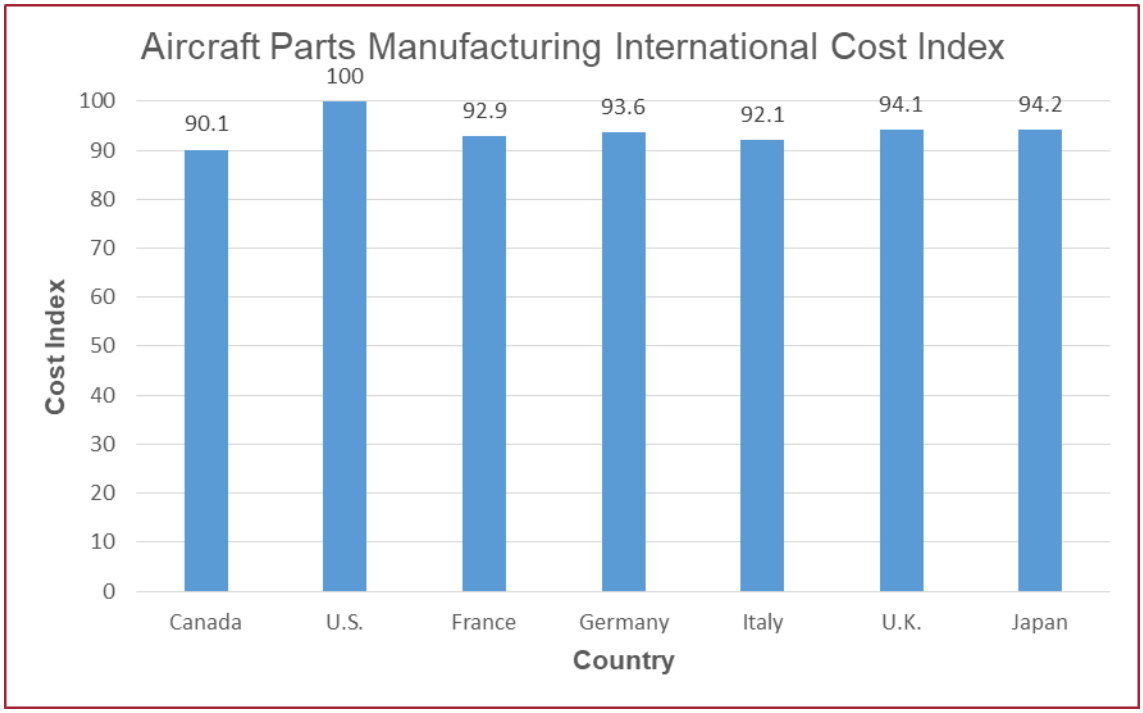
Figure 9 - MRO Increased Spending Comparison (2015 vs 2025) by Global Region



4.3.5 Countries Competitiveness

Of the G7 countries, Canada maintains the lowest manufacturing cost. Using the US as the reference, Canada represents 90% of the cost index behind Japan and other European countries. Figure 10 provides the breakdown.

Figure 10- Aircraft Parts Manufacturing International Cost Index



5. Trends and Technologies Impact

5.1 New Technological Environment

The aviation and aerospace industry is constantly evolving. Several recent innovations have had a direct impact on MRO service centers that must adapt to these changes in order to remain competitive and efficient. In addition, new components and technological innovations from Original Equipment Manufacturers (OEMs) must be considered by service centers to define strategies to facilitate Maintenance and Repair. With a focus on efficiency and process improvement, some service centres are beginning to implement cutting-edge technologies to improve inspection, resource management and logistics.



Newer aircraft like the A220 (CSeries), A320neo, 737Max, 737NG, A350 and B787, as well as a new generation of helicopters, have been or will be designed and manufactured with advanced state-of-the-art technologies. These new technologies present a challenge for maintenance centers accustomed to more traditional technologies. The technologies that will have an impact on the maintenance of these aircraft include: advanced aluminum panels (Aluminum-Lithium), advanced composite materials, digital control systems of the aircraft "Fly -by-Wire ", as well as more efficient and quieter engines. These technologies will require a slightly different approach than traditional maintenance centers, but at the same time offer new opportunities.

This section presents an analysis of the technological environment of aircraft maintenance. Not all the described technologies are currently used in more recent aircraft, but a number have been.

5.2 State-of-the-Art Technologies

These new aircraft have used extensively new technologies. Among the leaders in that field, a Canadian designed and built A220, which includes many technological advances that are not found in older fleets. It is important to understand the nature of these new technologies to understand the challenges facing the MRO centres, but also to understand any potential opportunities.

5.2.1 Advanced Composites

Notwithstanding weight considerations, one of the reasons for adopting composite materials for airliners is to reduce maintenance tasks due to corrosion. For example, Airbus anticipates a 60% reduction in these maintenance tasks for the A350. This reduces the time required for maintenance checks throughout the life of the aircraft. Although it is difficult to anticipate future (10-15 years) issues with advance composite materials, it is expected they will reduce overall maintenance costs and reduce aircraft downtime.

The industry has also introduced hybrid composite material in the construction of their aircraft. For instance, an advanced composite material called “GLARE” (Glass Reinforced Aluminum) (refer to Figure 11) has been used for the construction of the fuselage on the A350 and A380 (Figure 12). Glare is a layup combination of aluminum and fibreglass. It is used as it has the light weight property of fibreglass while having the durability of aluminum.

Figure 11 - Glare Laminate Composition

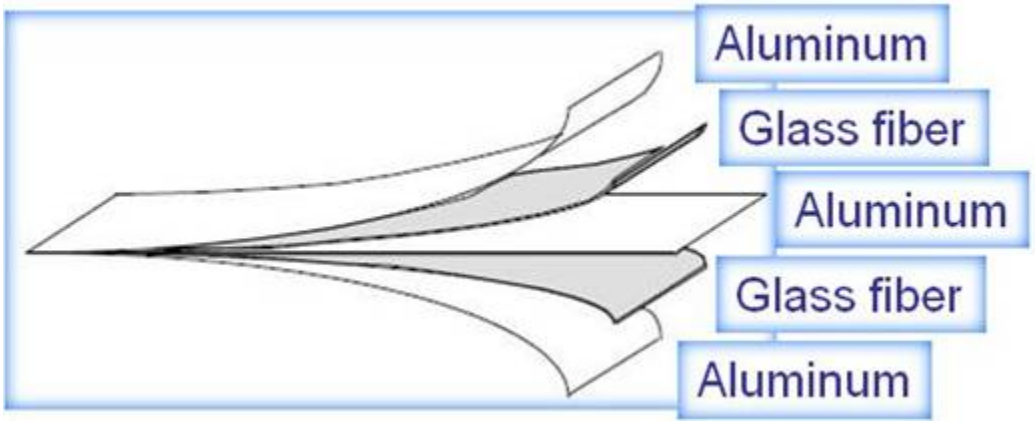
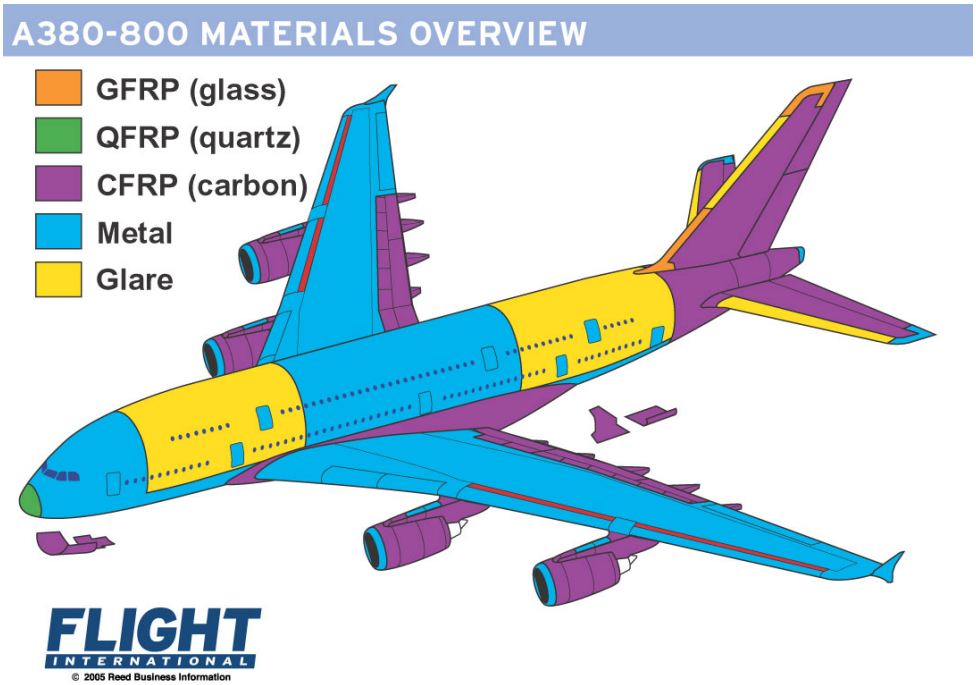


Figure 12 - A380 Advanced Manufacturing Material



By working with complex composite aircraft, major airlines and MRO service providers anticipate three (3) major challenges:

a. The need to carry out an increasing number of repairs directly on the aircraft as compared to doing them in the workshop;
b. Reducing repair processes without neglecting quality; and

c. Aircraft inspections of composite structures will require some technological advances to improve access to components and reduce inspection time while maintaining a high level of reliability.

From 2012 to 2015, some major players in the industry such as Lufthansa Technik, Airbus Air & Defense and AGI have worked on the project CAIRE ("Composite Adaptation Inspection and Repair") to address this situation that has been looming for a number of years already. A prototype mobile robot was built and tested on aircraft, demonstrating the ability to perform composite repairs for repair areas up to one (1) square meter. The mobile robotic unit is easily movable around and on the aircraft, hoisted using a forklift and mounted with suction cups. The challenge is to ensure that any development will allow these tasks to be performed by a single person. The robot can scan the damaged surface and render it as a 3D geometric image.

Bombardier, in collaboration with Swiss Air, has also been working with some research centres to develop robotized inspection techniques that will ensure a high level of reliability.

5.2.2 Aluminum-Lithium Material

An aircraft like the A220 fuselage is made of third generation aluminum-lithium (Al-Li), one of the most technologically advanced aluminum alloys on the market. Al-Li has been around for a number of years, but it has gone through three (3) cycles of improvements and has now been developed to a point that makes it a very strong competitor against any other material for the fabrication of aircraft structures. It is much lighter than any other aluminum alloy. It is also 40% more resistant to fatigue and 250% more resistant to corrosion than traditional aluminum alloys. The use of advanced materials increases maintenance intervals and reduces in-service costs, allowing those aircraft using this material like the A220 to offer a 25% reduction in the direct cost of maintenance compared to their competitors.

5.2.3 Fly-by-Wire

Fly-by-Wire (FBW) systems replace conventional mechanical flight controls with an electronic interface. The movements of the pilot's flight controls are converted into electrical signals that are interpreted by the flight computers. In turn, these determine how to move the actuators to each control surface for the aircraft in response to the pilot’s intent. In comparison to the traditional mechanical systems, the Fly-by-Wire concept (FBW) offers the following advantages:

a. Improved aircraft efficiency through the constant analysis of thousands of sensor information in addition to numerous flight parameters;
d. Weight reduction in comparison to heavy hydraulic systems;
e. Fewer moving parts;
f. Reduced wear and therefore less maintenance;
g. Greater control surfaces accuracy (via a digital input / output) and;

h. Better interface with other aircraft (and engine) systems, including automatic flight control systems.

This will be a challenge to the MRO centres as they learn to maintain these systems that are much closer to solving software issues than actual hydraulic (mechanical) systems.

5.2.4 Strategic Partnerships

MRO Service Centres have been used to work closely with components' manufacturers to support maintenance activities on these new technologies. More in-depth information will need to be shared to perform the right level of inspection and repair on these highly complex systems.

5.3 Technology Serving MRO Service Centres

OEMs are pushing the limits of the technology to reduce weight, maintenance and noise while increasing efficiency and autonomy. In parallel, larger organizations involved in the maintenance of aircraft are investigating in new technologies to inspect aircraft for their regular checks. The following describes some of the more promising technologies to meet inspection requirements and return the aircraft to service in a minimum amount of time.

5.3.1 Additive Manufacturing

In recent years, additive manufacturing, otherwise known as 3D printing, has experienced strong growth in the design (prototyping) and production of aircraft components. Today, these technologies are also being investigated to perform some on and off aircraft repairs.

The use of these components requires the manufacturer of these parts to demonstrate that they are of equal or superior quality to the original part. As with any other components, these parts will require the same level of certification as the parts they replace.

Recently, a European consortium, that after a three-year development period, has succeeded in improving maintenance and repair processes by integrating additive manufacturing. A total of 12 partners, including Boeing and Lufthansa Technik, participated in the RepAIR project. The fully tested RepAIR system is now seeking industrial partners to continue the development and application in operational environments.

5.3.2 Collaborative Inspection Tools

When qualified and experienced inspectors retire, bringing with them their extensive knowledge of industry imperfections, cracks and maintenance regulations, then less experienced inspectors need to be more aware of the critical maintenance process and supported by more experienced employees.

In the past, experts had to physically travel to the aircraft site to assess and resolve problems. Now, mobile collaboration tools can directly connect less experienced inspectors to remote experts during an aircraft maintenance. This provides apprentices with high value-added coaching and online training. They can also check the actions taken and make decisions or ask questions to the team that supports them. New collaboration software simplifies the process of sharing, analyzing and reporting data and helps inspectors make better decisions, save time and share best practices.

5.3.3 Advanced Visual Inspection - Video Inspection Endoscope (3D)

Today's advanced video endoscopes feature three-dimensional measurement technology and wireless connectivity along with collaboration software to connect field inspectors to analysts via secure Internet connections. The three-dimensional surface maps produced with current endoscope systems generate a 3D point cloud view. These data points provide actual measurements that calculate defects as the cursor moves on the 3D surface. This allows the inspector to perform several critical accuracy checks, difficult or impossible to perform using only the 2D image.

5.3.4 3D Computed Tomography (CT)

3D Computed Tomography allows for the effective inspection of metals, composites, plastics and manufactured additives or 3D printed parts with intricate internal structures. Advances in scanning time, parts handling, workflows and software now allow for several analyses in a short period of time. This makes CT technology a viable online inspection solution for processes previously dominated by visual, ultrasonic or 2D radiography techniques.

CT scanners and high quality 3D metrology allow manufacturers to compare finished parts to specifications and tolerances with a high degree of accuracy. Automated Defect Recognition software can speed up and simplify the decision for success or failure for operators.

CT scanning also ensures product quality by enabling process optimization in real time and consolidating inspection steps. Increasing speed and CT production capacity now allow manufacturers to sample a larger percentage of parts and process results quickly, improving yields, speed of change and reducing waste generation.

5.3.5 Virtual Robotized Inspection Systems

Robotic visual inspection systems can detect defects that a human eye can’t see such as handling defects (bumps, nicks, scratches, etc.) or process defects (polishing marks, grinding marks, coating chip, etc.). These inspection systems can also recognize 2D imperfections and ensure that a specific feature of an aircraft is positioned correctly or has the required size. This robotic inspection may also include analysis of the surface profile in addition to tools for precision calibration and morphological analysis.

Some organizations, such as AV & R Aerospace, have also designed systems that can validate an assembly through its ability to archive images of a given assembly or specific components and perform optical characteristic recognition to validate that a specific component is present and compliant.

Several big names in aerospace engineering already offer such solutions. The main advantages of these technologies are:

a. Elimination of human subjectivity related to visual inspection;
b. 100% complete inspection;
c. Feedback on process quality; and
d. Elimination of shipping non-compliant parts.

5.3.6 Use of Remotely Piloted Aerial Systems (RPAS) for Automated Inspections

80% of inspections conducted by MRO Service Centres or by airlines are done visually. They are carried out using flashlights to visually look at the structure under inspection. The use of scaffolding may be required to access hard to reach areas. This is time consuming and costly. Some organizations have started using RPAS to perform a number of inspections when it makes sense. The use of RPAS for aircraft inspections allows the following:

a. An inspection of the aircraft that is 20 times faster than traditional manual inspection;
b. A safer environment for the technicians; and
c. An increased traceability of the results. Results that can be archived and used for ulterior validation if required.

For example, the French company Donecle, and the British company RAPID, offer this type of solution. Their technologies include 360-degree coverage of all external components of aircraft, automatic image analysis, automatic reporting and remote consultation via a cloud platform.





Another technology that has been developed uses a ground-based automated vehicle to carry out inspections of the structure. AKKA Technologies is currently working on a project called the AIR-COBOT. The project aims at designing and developing a collaborative mobile robot to inspect aircraft structures. The robot is able to navigate safely around the aircraft in an autonomous fashion to perform non-destructive inspections (visual inspection and 3D analysis). It maintains communication with a human operator through a control system while communicating information that is used to maintain aircraft.

5.3.7 Use of Radio Frequency Identification in the Inspection Process

The Futjitsu's "GlobeRanger" system offers an FAA approved (Federal Aviation Administration) automated inspection process for aircraft emergency equipment including lifejackets, O2 generators and fire extinguishers.

GlobeRanger uses Radio Frequency Identification (RFID) technology to reduce the four-hour inspection time to just five (5) minutes for life jackets. Complete inspections of O2 generators can be done in minutes, reducing time by 99%.

These technologies consist of putting transmitters in each of the life-support equipment and track their movement to ensure their presence on each seat on board the aircraft.

5.3.8 Training Through Augmented Reality Technology

The industry is facing a shortage of training personnel for both for manufacturing and MRO activities. A shortage due to many factors including the rapid expansion of airlines in the Middle East and Asia-Pacific, the lack of training structure in many of these countries, limited places for training, the many barriers to rapid certification and the limitations imposed by this highly regulated industry. Airbus and Boeing predict that with the expanding demands, there is a need for 224,000 new technicians. The Boeing Market Outlook for the 2016-35-period indicates that the MRO market alone will need a total of 679,000 new aircraft maintenance technicians by 2035.



With the introduction of augmented reality (AR), MROs are now able to get the necessary training and support from anywhere in the world without having to wait for openings at training centers. This offers more versatility and availability for training of technicians. To date, AR is mostly used for on-type training and not so much for ab initio training. There are advances in that direction for the coming years. Augmented reality technologies do not, in themselves, reduce the hours required to obtain certifications, but eliminate delays and improve access to trainers, which indirectly reduces the duration of training.

This is not yet a widely used approach, however, companies like TAE, an Australian MRO, and XMReality, an augmented reality trainer for MRO professionals, are using it to fill the void in training, improve the quality and the efficiency of the training processes.

5.3.9 Internet of Things (IoT) and Aircraft Installed Sensors

Internet of Things ("Internet of Things") technologies allow electronic devices to communicate with each other without having a host computer. Even before the airlines knew what to do with information, they had already started collecting large amounts of data using sensors placed inside and outside the aircraft.

Today, maintenance, repair and overhaul (MRO) professionals can communicate using tablets connected with aircraft sensors. This allows them to easily scan aircraft systems and identify components that need to be replaced or repaired. These sensors also have the ability to communicate with the supply system to determine if required parts are available.



It also allows to track life limited components and have the appropriate replacement ready when it is needed hence reducing aircraft downtime.

5.4 Aerospace Industry Clusters – A Developing Trend

To increase competitiveness, regions around the world have realized that pooling businesses in a centralized area provides the synergy to further leverage R&D and offer complete services. The Downsview Park in Toronto being an example already discussed. The following provides two (2) other such clusters with their background and advantages.

5.4.1 Hamburg Aviation

Hamburg Aviation is the Greater Hamburg aviation industry cluster. It is located in one of the world's largest concentration of civil aerospace companies. In total, more than 40,000 highly qualified specialists are working on the future of aviation.

Their skills cover the entire lifecycle of an aircraft, from design, manufacturing and equipment to the overall system of transportation, maintenance, repair and overhaul, and finally recycling. This makes Hamburg one of the largest sites in the civil aviation industry in the world.

Two (2) industry giants, Airbus and Lufthansa Technik, are located at the Hamburg Airport in addition to 300 small and medium-sized enterprises, as well as various scientific and technological institutions. Each of them brings its know-how and expertise to the group.

Companies, universities, associations, local economic authorities and other partners came together to form Hamburg Aviation, a group dedicated to the advancement of aviation. The cluster pursues the following common objectives:

a. Facilitate and improve research and development, thereby bringing high quality products and services to the aviation of tomorrow;
b. Create products that are good for passengers; and
c. Set standards for resource protection.

5.4.2 Mobile Aeroplex (Alabama)

Mobile Aeroplex is the expansion center of the aerospace industry of Mobile. This cluster includes the manufacturing facilities of Airbus in the United States, Airbus Engineering, SAFRAN, Continental Motors, VT MAE, MAAS Aviation and many other global companies. Mobile provides aviation leaders with a combination of low operating costs, skilled labour, excellent airport capacity and extensive intermodal access to domestic and international markets.

Aerospace companies in the region employ approximately 3,500 engineers, mechanics, welders and other skilled workers, forming a growing market. Workers are recruited across the Gulf Coast region and trained by the Alabama Nationally Recognized Training Program (AIDT) or one of the region's many educational programs. Regional universities also offer an impressive number of engineers and other professionals.

6. Regulations Impacting the Industry

Aircraft Manufacturing and Maintenance is heavily regulated by Transport Canada. This has been the case for many years and it is not expected to change over the coming years. For commercial aircraft, there are no real major changes that would have an impact on the growth of this type of aircraft. On the other hand, the FAA in the US has approved a weight limit increase to 3,600 lbs for the Light Sports Aircraft (LSA) category. Transport Canada has not made any announcement in this direction yet but as there is normally some kind of harmonization between our two (2) countries, this might also occurs only in Canada. This may have an impact on the number of GA aircraft manufactured in the coming years as the LSA rules are less restrictive than the rest of the GA aircraft manufacturing.

In Canada, a new ultra-low-cost carrier (ULCC) market is beginning to emerge. Due to regulation, the tax and border fee regime, and capital constraints, Canada has been, until 2018, the only G7 country without ULCC service. Swoop and Flair are two (2) low-cost carriers that started operations in 2018 while Canada Jetlines Ltd is also expected to start operations in early 2019. ULCCs in the United States (US) have taken advantage of this by attracting Canadian travellers with discounted fares at US border airports.

On the environmental front, the Canadian Government has developed an action plan to reduce Greenhouse Gas Emissions (GHGE) from Aviation. The goal is to improve fuel efficiency by 1.5% annually by 2020 in comparison to the 2008 baseline or the equivalent of an annual average reduction of 2% GHGE. The proposed measures to achieve this target are: to renew the fleets; upgrade engines with more fuel-efficient engines; improve air traffic management (in progress); and to carry out more efficient operations. It is also for that reason that the aviation industry is investigating alternative fuels.

7. Market 20-Year Forecast

The market forecast for the next 20 years will depend on the demand for passenger travel. The following provides a picture of the anticipated forecast in the coming years.

7.1 Global Outlook

In 2017, the aviation industry continued to set new records. Projections from the International Air Transport Association (IATA) estimate that the aviation industry will support nearly four (4) billion travellers and almost 56 million tonnes of cargo in the coming year[6]. Passenger load factors on average are expected to be just under 80%. Aircraft are being flown more intensively with 2017 departures exceeding 38 million (73 aircraft per minute). This growth is the result of increasingly affordable passenger airfare.

Almost 1% or $769 billion of global Gross Domestic Product (GDP) is spent on air transport. Profits are expected to be $35 billion and airlines and their customers will generate approximately $123 billion in taxes next year. The North American airline industry has seen its largest profits in 2017. Air passengers' growth over the past four (4) years has been in excess of 7% annually. This leads to an increased demand on the labour force. This is compounded by the demand associated by many economic sectors that also continue to rely heavily on the air transportation network to sustain global value chains.

New aircraft have continued to be in high demand in 2017. Commercial airlines have taken ownership of 1,700 new aircraft. Higher fuel prices and the demand to retain competitive prices are leading airlines to upgrade existing fleet to larger aircraft that are more fuel efficient. This trend is expected to continue over the next 20 years. Commercial and cargo aircraft demand is projected at more than 33,000 aircraft.

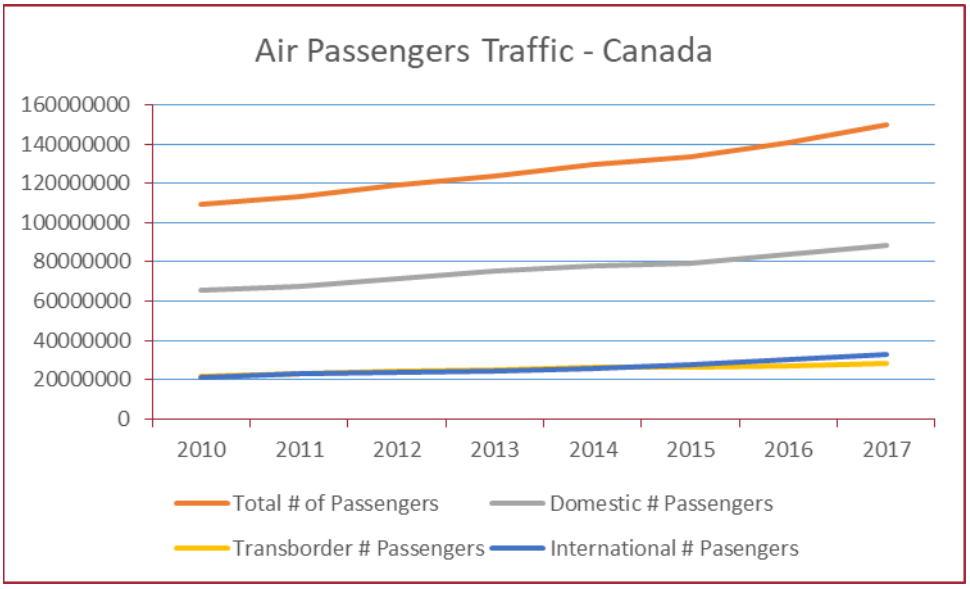
The continued growth of ultra-low-cost carriers (ULCCs) across the industry is a contributing factor to this demand for new aircraft. Growth in recent years by airlines such as Spirit Airlines, Ryanair, and Indigo Airlines are providing secondary market airports around the world with new opportunities for air service. The ULCC business model is based strictly around low fares and point-to-point service[9].

ULCCs have found success by serving underserved destinations that have been overlooked by legacy carriers due to passenger traffic volumes or proximity to hub airports. In order to take advantage of this growing opportunity, secondary market airports have been forced to review their air service development strategies including keeping airport fees at competitive rates. For smaller airports, which are likely to be served by smaller aircraft either Turboprop or single aisle aircraft, there is an opportunity to provide space for MRO or manufacturing associated with these aircraft types.

7.2 Canadian Outlook

Between 2009 and 2017, the total number of passengers enplaned and deplaned in Canada increased approximately 37% to 150 million as per Figure 13. Domestic travel accounted for almost 88 million passengers while transborder traffic and other international traffic made up the remaining 62 million. Transborder and other international traffic have seen the largest growth in traffic (42%), which has been in large part supported by Toronto Pearson and Vancouver International Airports. This growth has resulted in an average annual growth of 5% in passenger traffic at Canadian airports for the past seven (7) years.

Figure 13 - Air Passengers Traffic - Canada - 2010 to 2018



In 2013, the air transport industry as a whole contributed $34.9 billion to Canada's GDP. The industry supported approximately 405,000 jobs including 141,000 direct jobs. This has provided various levels of government with approximately $12 billion through fees and taxes.

7.3 Ontario Outlook

In 2017, approximately 56.3 million passengers enplaned and deplaned at Ontario airports. This is the highest among all provinces and territories in the country. In the long term, Ontario's population is projected to grow by 30.1%, or almost 4.2 million over the next 26 years. The Greater Toronto Area (GTA) is projected to be the fastest-growing region with its population increasing by over 2.8 million. This translates to further capacity pressures at Toronto Pearson and Billy Bishop Toronto City Airport. By 2025, southern Ontario is projected to have approximately 50 million passengers travelling by air and approximately 90 million passengers by 2043 which exceeds the current 70 million passenger capacity at existing airports. This demand will translate into higher demand for aircraft manufacturing, aircraft maintenance and other aircraft-related services.

8. Sub-Sector Analysis and Identification

The sub-sector analysis and identification process is designed to assess the presence of business and supply chain activity within a larger cluster or industry sector. Throughout the validation process of understanding the local-area aerospace cluster, little aerospace and aviation manufacturing was found to be taking place within the town itself or the surrounding region. As such, we have identified the presence of a unique and emerging sub-sector tied to "aircraft maintenance and modifications" as being the most mature to evolve and generate employment and attract new businesses and investment to Gravenhurst.

8.1 Aviation Maintenance and Modifications Cluster

There are quite often a number of important elements of a cluster that should be present in order to properly call it a cluster. In this case, in Gravenhurst and situated at the Muskoka Airport, there is a sufficient presence of the necessary elements to warrant calling this a cluster. As the cluster continues to mature and attract new cluster members and supply chain strengths, this infographic will expand appropriately.

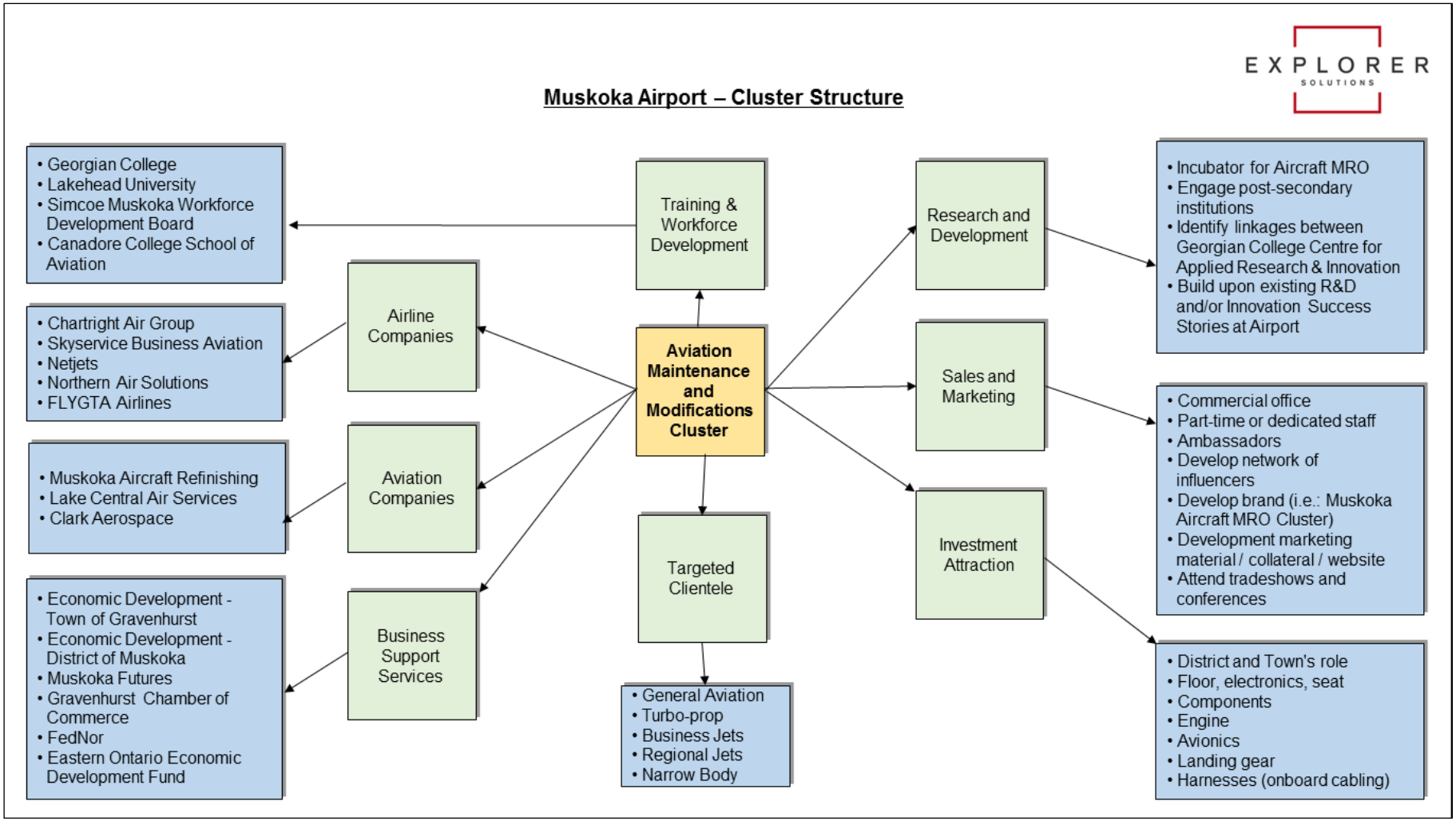
Important to forming the basis of this cluster and in this study is the presence of a) aircraft companies, such as MAR and LCAS. While their b) target clientele (combined) represent general aviation, turbo-prop, business jets, regional jets and narrow body, the airport itself attracts a variety of different c) airline companies. In order for cluster members to attract the right mix of talent, the cluster requires defined d) training and workforce development partners and programming in place. When the cluster partners with post-secondary institutions, the cluster not only benefits from accessing co-op student placements and recent graduates to meet their staffing needs, but cluster members can also take advantage of e) research and development opportunities in the form of industry-academic collaborations. This as a result forms part of the basis for incubation space and programming.

To ensure the long-term success of the cluster, a variety of f) business support services can be accessed through the Town, the District, industry associations, funding agencies, among others, that can provide the required services and supports. This support in turn will help in the creation of a commercial office (and the hiring of a dedicated staff personnel) to assist in the g) sales and marketing requirements of cluster members. The cluster development activities will be supported by the Town of Gravenhurst Office of Economic Development in many ways including the development of a h) business investment attraction strategy.

To move the cluster model forward, we recommend a business case/plan be prepared to best define the legal and operational structure, tasks and responsibilities of each party, financial implication for cluster members and partners, marketing activities and strategy along the cluster growth and action plan.

Initial leader could be a joint undertaking from MAR, LCAS and the Town of Gravenhurst Office of Economic Development.

Table 16 - Muskoka Airport - Cluster Structure



8.1.1 Value Proposition

The value proposition behind the Muskoka Aircraft Maintenance and Modifications cluster will be its cluster members. However, until such a stage exists where the cluster safely has the appropriate mix of members, the value proposition for MAR, LCAS and others contemplating participation in the cluster will be the direct involvement of local government and its ability to obtain marketing and funding to develop a joint undertaking for both industry and government to move the cluster into a one-stop-shop and a centre of expertise for aircraft maintenance and modifications catering to airlines, aircraft owners and operators with shared services, capabilities and talent.

Other components of the value proposition include the creation of a commercial office to support sales of cluster services including joint marketing activities like trade shows attendance, commercial mission, client networking, hosting and the ambassador program. The cluster members would also benefit from the business support services and associated funding that the Town's Economic Development Office and its various partners can provide. In the context of comments provided from MAR and LCAS through the validation workshop, the proposed cluster would contribute to expanding the multiplier effect of the cluster's economic impact throughout the community and each cluster member.

The value proposition also entails the Town role of investment attraction of national and foreign direct investment for the airport in order to expand the number of cluster members.

8.1.2 Key Messaging

To support the brand development and marketing efforts of building and maintaining the cluster, it will be essential to start incorporating the right "messaging" into the various marketing vehicles. To provide a basis for which to expand upon, the following "key messages" are believed to offer the level of expertise the cluster is seeking:

- Maintenance;
- Modifications;
- Certified service provider;
- Approved service provider;
- Quality of facilities and work;
- Fully integrated services; and
- Turnkey services and solutions.

8.1.3 Cluster Branding

For those in relatively close proximity to the Town of Gravenhurst, are all typically aware of the town's brand reputation. For the purposes of growing the proposed cluster, we need to be mindful of developing and associating the cluster's brand with elements that already have a global status. As such, Muskoka when compared to the Town of Gravenhurst is a more recognizable name, and a location that many aviation and aerospace stakeholders will know. In trying to leverage the Airport notoriety in the aviation sector, we recommend branding the cluster "the Muskoka Aircraft Maintenance and Modifications cluster".

The branding carries three (3) messages: first the location of the cluster (Muskoka Airport), the type of services offered (Maintenance and Modifications) and the notion of cluster testimony of a joint undertaking from various organizations focused on a same goal.

8.1.4 Cluster Advisory Committee

Open lines of communication and transparency will be an essential requirement for the long-term success of the cluster model, as such, a Muskoka Aircraft Maintenance and Modification Cluster Advisory Committee (MAMM-CAC) should be established and meetings held on a quarterly basis. This is an opportunity that would bring together strategic partners of the local-area Aircraft Maintenance and Modifications Cluster, the Town of Gravenhurst, the Town of Bracebridge, the District Municipality of Muskoka, the Gravenhurst Chamber of Commerce and others to convene on a regular basis to share industry insights, intelligence, opportunities and threats for the benefit of the cluster and its members. It is appropriate that a NDA is signed by all participating members in order to protect the privacy of the discussions held and to ensure that meaningful information is shared. These types of groups should remain informal in nature until such time that there is increased participation and new members being added. Once this occurs, a Chair to lead the group should be assigned along with a Secretary to plan the agenda and take minutes. The MAMM-CAC can also agree to meet at a centralized location or even rotate with each quarterly meeting taking place at a member of the committee's office.

8.1.5 Commercial Office

8.1.5.1 Commercial Office

A commercial office with assigned staff personnel will be accountable for day-to-day administrative activities and responsible for supporting: sales and marketing efforts; business retention and expansion (BR+E) requests; and overall requirements and opportunities tied to the cluster. This office, led by a staff member (with time dedicated to growing the MAMM cluster) will act as the primary contact and be responsible for the day-to-day activities and operations of the cluster.

The following entails a breakdown of the various duties within the commercial office:

Sales Support

- Facilitate introductions with airport tenants/cluster members (where appropriate) to stimulate business development opportunities;
- Coordinate trade missions to support marketing cluster member services and expertise;
- Coordinate events and trade shows participation;
- Develop and manage a network of potential clients for the cluster; and
- Prepare and coordinate cluster marketing activities and outreach campaign.

Sales Channels

- Foster and strengthen relationships with strategic influencers/referral partners (i.e.: airlines, aircraft owners and operators but also commercial/industrial real estate agents, site selectors, provincial and federal ministries of economic development, Canadian Consulate Offices abroad, Senior Economic Officers (abroad), etc.

Growing Airport Client (Tenant) Base

- It will be essential that the staff personnel maintain strong relationships with existing airport tenants and cluster members in understanding what is missing from their local and international supply chains for the purposes of identifying new opportunities to grow the airport tenant base.

8.1.5.2 Dedicated Staff

The best way forward would be to dedicate an individual to be assigned the role of overseeing all aspects of building and maintaining the Aviation Maintenance and Modifications cluster. Until the cluster is at full capacity and requires a full-time commitment from a dedicated individual, it may be best that this individual have shared responsibilities between growing this cluster and other economic development priorities under the umbrella of the Town of Gravenhurst Office of Economic Development.

This individual will be responsible for overseeing the proposed elements of the commercial office as defined in the section above and coordinate when to engage the appropriate local stakeholders to participate in key activities.

8.1.6 Workforce

As the demand for aircraft maintenance engineers (AME's) continues to grow, it will become increasingly important for cluster members to develop creative solutions that attract and retain top talent. Cluster members themselves have the responsibility of ensuring they are recognized as a good company, a safe and positive place to work and that all employees are well-respected with opportunities for growth. Employers will have to adapt to ensure that their company is not perceived as a rotating door or simply training grounds for the larger, higher-paying companies.

Companies also have the opportunity to participate in a Program Advisory Committee (PAC) at a partnering post-secondary institution. A PAC allows companies to have a voice at the table and help influence and shape the future academic programming to ensure students are graduating with the right skill sets that industry so desperately seeks.

8.1.7 Validation Workshop

The Aircraft Maintenance and Modifications cluster concept was derived as an outcome that stemmed from the consultation process. The notion entails leveraging the expertise and capabilities of the two (2) largest tenants currently situated at Muskoka Airport and building an "aircraft maintenance and modifications" cluster around them.

A first step in validating this potential cluster development opportunity entailed an inaugural meeting with both Lake Central Air Services (LCAS), Muskoka Aircraft Refinishing (MAR), the Town of Gravenhurst and organized by Explorer Solutions. The cluster opportunity was introduced, the expertise and capabilities of both companies were verified and the notion of building this type of cluster was challenged amongst the participants.

While both companies left with a willingness to further consider and discuss the cluster potential and their own company's role and investment within the cluster, the following elements were captured to assist in ongoing efforts to validate the potential strengths and synergies of progressing this cluster model concept:

- The Town of Gravenhurst Council sees the economic potential that the Muskoka Airport has to offer;
- For LCAS, participating in this cluster represents a pivot in their business model, not just an expansion. Currently, they focus on General Aviation aircraft;
- For MAR, participating in this cluster represents more of an expansion of existing services. Currently, they are focused on regional aircraft and larger, capable of handling Cessna 170's to 747's; and
- Workforce:
    - Nearby post-secondary institutions are graduating students every year and represent the cluster's future workforce; and
    - Since LCAS and MAR work on different aircraft models, there is the potential that they could share talent between the cluster members (as required).

8.2 Incubation and Technologies

To support the cluster, but as well with the objective of creating the foundation of a larger aerospace and aviation footprint in the Town of Gravenhurst, we recommend the Office of Economic Development supports the creation and start-up activities of an Aviation and Aerospace Incubator.

Feedback from the consultation process suggested that an incubator-type facility be explored as one way of supporting the notion of a Muskoka Airport Aircraft Maintenance and Modifications cluster. The development of an incubator is designed to bring an important element to strengthening the cluster's and the Town's value position while at the same time providing space and services to support MRO-related and aviation-related technologies.

The objective of the incubator concept is to explore areas that support:

- Robotic system sensor development, prototyping and testing for MRO purposes;
- MRO training using Augmented Reality / Virtual Reality;
- MRO ERP and management;
- Aerospace manufacturing;
- Aviation-related technologies;
- Collaboration, partnership and programming with post-secondary academic institutions;
- Collaboration, partnership, innovation and R&D with private-sector companies (and airport tenants); and
- Business start-ups and the entrepreneurial ecosystem.

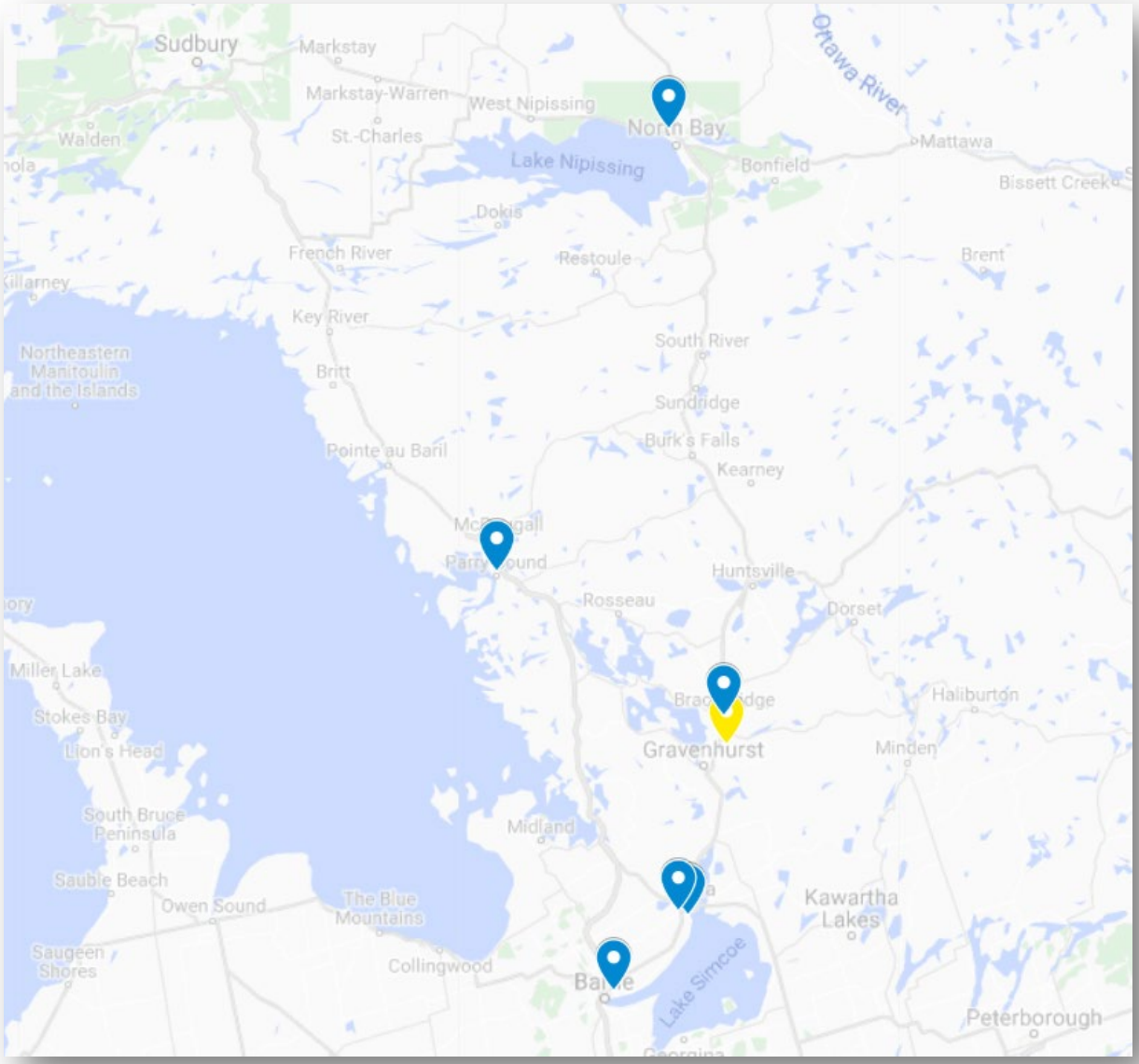
The objective of a potential incubator is to focus mainly on technologies related to maintenance, repair overhaul, modification and technology integration of aircraft. The incubator will also host aerospace manufacturing and R&D activities. There is an increasing trend within the aerospace industry where the use of robotic systems on aircraft is utilized to identify needed repairs.

Successful incubators are being more commonly viewed and leveraged as economic hubs and creating significant economic benefit on the local community around them. Not only are incubators great for creating an entrepreneurial and start-up ecosystem, they often have the facilities, equipment and the means by which to inspire innovative research and development for both new and established companies. A focus for this incubator concept is to help facilitate technology development and/or to engage companies already involved in this type of work and looking for a technology-type environment to work with skilled talent and test technologies with participating post-secondary institutions.

The possible location for the incubator is at the Muskoka Airport which would provide ease of access to onsite cluster members and partners by way of its close proximity. The airport also acts as a centralized location to neighbouring post-secondary institutions such as Georgian College, Lakehead University and Canadore College as potential academic partners. These partners will be key to moving forward certain aspects of this study. Without buy-in and support from these organizations, some aspects may not be achievable.

These institutions have been interviewed to evaluate their receptiveness to such a project and how they might be involved. Initial reaction were positive, but all parties suggested a business case or plan would be required to bring an official request to senior management, but also to apply for funding to support the development and launch of the incubator. A similar request was raised by MAR and LCAS.

Table 17 - Muskoka Airport Relative to Nearby Post-Secondary Institutions



Neighbouring post-secondary institutions expressed a positive level of interest in learning more about participating and to further define what that level of support could entail. Georgian College's Henry Bernick Entrepreneurship Centre (HBEC) in Barrie could possibly incorporate its strengths in supporting the start-up community with extending mentorship, funding training, trademark advice, strategic introductions, market research, and access to angel network. The Centre of Applied Research and Innovation (CARI) also situated at Georgian College's Barrie campus along with HBEC are focused on supporting projects with regional appeal and that offer a regional impact.

The incubator can also be a catalyst for bringing opportunities between private-sector cluster members and potential post-secondary academic institutional partners. There are many ongoing opportunities for private-sector companies to connect and speak with students at each of the schools while highlighting employment opportunities that could be available with various types of aircraft including business and regional jets.

Open house days at the post-secondary institutions (which could also take place at the incubator) are a great way for businesses to educate students about the types of careers that await them – both during their academic careers in the form of a co-op placement and once they have graduated. Other opportunities for consideration include student sponsorship opportunities whereby a cluster member commits to sponsoring the academic costs of a graduating high school student who is enrolled in a relevant post-secondary academic program on the basis the student commits to working a predetermined amount of time at the sponsoring company following the completion of their academic studies. In addition to employer sponsored scholarships, there are a number of local organizations that offer scholarships for potential students from the Gravenhurst area.

9. Business Attraction Strategy

To support the Aviation Maintenance and Modification cluster structure at the Muskoka Airport, the Town of Gravenhurst will be responsible for leading a strategic and targeted business attraction strategy. In doing so, the following sections outline the required activities needed to move this initiative forward and to ensure success by achieving both short- and long-term milestones.

The Muskoka Aviation Maintenance and Modification cluster will require a coordinated approach not only from a starting point, but to ensure its long-term success. In doing so, it is recommended that the following elements are in place.

9.1 Ambassadors

The Town of Gravenhurst already has a structured Ambassador program in place which could be leveraged to support this cluster development initiative. It may be required to provide training to strengthen group members' knowledge of how an aviation cluster (tied to this initiative) operates.

In additional, it may prove helpful to also attract senior-level representatives, Muskoka Airport tenants, other influencers and/or partners such as post-secondary academic institutions and regular users of the Muskoka Airport to also participate as official ambassadors. The day-to-day operations of the ambassador group program should be led by the dedicated staff personnel.

The role of the Ambassador group is to assist in developing leads as well as to assist in representing the town and the Muskoka Airport when prospective investors visit/tour the Muskoka Airport and surrounding privately-owned lands for development. The most appropriate time and location for Ambassadors to become involved is often in an informal setting – perhaps over coffee or if there is a networking reception of sorts.

Investors often rely on and expect non-sales type conversations with Ambassadors. It is an opportunity for the Investor and Ambassador to build their own relationship and for the Ambassador to talk openly about their own experiences in establishing themselves at/around the Muskoka Airport and how the airport, the town and others rallied behind them to ensure their short- and long-term success.

Ambassadors should be armed with the appropriate verbiage and marketing collateral (both hardcopy and in electronic format) on how to articulate and sell the value proposition including latest facts and figures of the Muskoka Aircraft Maintenance and Modification cluster when travelling outside the Muskoka District. It is important to develop a loosely-defined protocol that Ambassadors can follow (and adapt to their specific situation) for when they find themselves in the presence of a possible investor or influencer. In addition to holding a conversation, Ambassadors should be prepared to either leave an Ambassador-branded business card, any hard copy material (on hand) or a USB drive containing appropriate marketing collateral and extending an invitation to visit the Muskoka Airport in the near future. It is also appropriate for Ambassadors to express a willingness to facilitate an introduction with the cluster's dedicated staff member to assist in providing more detailed and customized information and material.

It is important for any discussion notes that transpire between the Ambassador and a prospective investor to be relayed back to the dedicated staff member for tracking purposes and entered into a CRM system.

9.2 Outreach Strategy

9.2.1 Tradeshows, Conferences and Key Events

Trade shows and conferences can be an effective way to open doors and generate new investment interest at the Muskoka Airport. With the number of trade shows and conferences that take place globally throughout the year, it is important that the staff member understand not only which shows may be of interest to existing tenants, but also to target shows that showcase companies that offer the specific business activities, products and/or services that the cluster may be in need of.

The first priority should be to provide opportunities for private aerospace related businesses to participate in the appropriate shows with support from government and research partners. This support could include training, collateral provisions, and funding to attend specific shows as the MAMM Cluster. A few examples of relevant tradeshows and conferences include:

General Aviation

- SUN n' FUN Int'l Fly-In Expo (April 2-7, 2019) in Lakeland, Florida
  - As the second largest event of its kind in the world, SUN 'n FUN offers, jet teams, aerospace related exhibits; educational forums, aircraft static displays, professional gatherings of aviation and economic development groups; daily and evening airshows that include adrenaline pumping aerobatics, a veterans plaza and women in aviation arenas.
- EAA AirVenture Oshkosh (July 22-28, 2019) in Oshkosh, Wisconsin
  - EAA AirVenture Oshkosh is the largest general aviation annual gathering of aviation enthusiasts in the world. It is held each summer at Wittman Regional Airport in Oshkosh, Wisconsin, United States and attract an average of 500 000 visitors over a 7-day period.

Business Aviation

- Canadian Business Aviation Association Convention & Exhibition (July 9-11, 2019) in Calgary, Alberta
  - Canada's largest static display of private and corporate aircraft.
- National Business Aviation Association Convention & Exhibition (October 22-24, 2019) in Las Vegas, Nevada
  - The largest business aviation event in the world designed for aircraft owners, flight department personnel; aircraft manufacturers or service providers.

Maintenance, Repair & Overhaul (MRO)

- MRO Americas (April 9-11, 2019) in Atlanta, Georgia
  - MRO Americas — where airlines, MROs, suppliers, OEMs, regulators and industry experts converge to define the aviation maintenance industry.
- MRO Southeast Asia (March 6-7, 2019) in Kuala Lumpur, Malaysia

    - MRO Southeast Asia is a two-day conference exploring the key issues and concerns in the Southeast Asia region, examining how airlines and their suppliers can optimise maintenance planning to effectively manage expanding fleets.
- MRO Europe (October 16-17, 2019) in London, England
    - MRO Europe is the premier event in this region for the commercial air transport maintenance, repair and overhaul industry
- MRO Latin America (January 16-17, 2019) in Cancun, Mexico
    - The Latin American region is growing in terms of fleet growth and modernization. As aircraft equipped with the latest technology enters into service, maintenance organizations are facing the need to upgrade capabilities to support and accommodate these new technologies.
- Aeroxchange Annual Conference (March 6-8, 2019) in Lake Buena Vista, Florida
    - The Aeroxchange Conference provides brings together leading operators, MROs, OEMs, airlines and service providers from around the world actively engage and focus on driving improvement across supply chain activities.
- Airline Purchasing & Maintenance (AP&M) Europe (June 4-6, 2019) in Frankfurt, Germany
    - The leading networking event for the commercial aviation aftermarket
- Aircraft Interiors Expo (September 10-12, 2019) in Los Angeles, California
    - The only global fall event dedicated to the passenger experience and cabin interiors industry.

A discussion is recommended between the staff resource, the airport tenants, local post-secondary institutions and other partners and/or businesses to garner interest and assess the benefits of structuring a formal outbound mission and wrapping a day or two on either side of the conference for individual meetings between the delegates and the companies in close proximity to the conference location. Grant opportunities exist for this type of project, and it should be considered in the long-term. Additionally, third-party professional expertise may be required to assist with coordination and scheduling of B2B meetings, both on the trade show floor and externally if a side program is organized as part of the outbound mission.

9.2.2 Foreign Direct Investment (FDI) and Business Retention + Expansion (BR+E)

Investment attraction and Business Retention and Expansion are key activities of any Economic Development Office. Below we have listed a series of activities/tools the Town of Gravenhurst can undertake to generate more activities with the aerospace and aviation sectors. The key word is “Be investment ready” by:

1. **Take inventory of your local foreign-owned manufacturers** and identify which countries their parent companies are situated. Understand their local supply chain needs and determine if they carry enough weight to influence their suppliers (large and small) to establish themselves near the local foreign-owned company. This helps the local foreign-owned company save time and money by reducing or eliminating a transportation leg in the supply chain, while also

allowing opportunities for their suppliers to develop new business opportunities in/around their newly established facility.

2. **Add a group of aerospace Ambassadors to the Community Ambassador Program:** This group should be comprised of professionals from within the local manufacturing sector. Offer a half-day workshop to ensure they are properly trained on the local manufacturing scene and the overall competitive assets of the community and how they support the local manufacturing industry. Ensure that at least one (1) member of the local Ambassador Group participates in each manufacturing business delegation and depending on the culture of the visiting delegation, let the ambassador have private time with the investment prospect while the Town's representative pays for lunch or these individuals could meet privately in the Town's boardroom.

Investors are looking for more than just the selling points of the local community. They want to hear firsthand (from an ambassador) what it may be like to live in the community (from those who may have immigrated to Canada for their own job). Not only should matching community-based solutions with the investor's business challenges be a top priority, but having the investor feel that he/she is investing in a community that has their short- and long-term success in mind is also very important.

Ambassadors can also be a great resource when travelling abroad for business and/or pleasure when it comes to promoting the airport and its cluster. Leverage the fact that people naturally like to talk up where they are from. Consider providing these ambassadors with a few loaded USB drives that contain brochures and other relevant documents that profile your community. If done correctly, you will be surprised just how many of your local citizens are abroad at any given time from your community.

3. **Organize an annual familiarization tour**. It can often be more advantageous if the local office of economic development can organize a two-day site visit program or familiarization tour of your community and extend invites to all the most promising investment prospects. Having strategic influencers participate can also pay dividends in the future. Ensuring that individuals such as provincial or federal levels of government, site selectors and others are able to articulate your community's key value propositions are paramount for when they are discussing strategic locations with their own clients. You also want to ensure that your community is always top of mind. A familiarization tour is a great exercise for a community to demonstrate its willingness and ability to not only cooperate, but collaborate with internal and external partners (such as industry, academia, government and industry association).

4. **Develop a series of funding opportunities and incentives that are tailored to the needs of aerospace and aviation companies**. This could take the form of helping with the financing of new equipment, tax increment financing, talent attraction and recruitment and expedited service handling of zoning changes to name a few. Grants and loans that are offered by

external agencies and any incentives available in conformance with the Municipal Bonusing Act should be considered.

5. **A benchmarking exercise** that compares your community and the state of the local manufacturing sector with others has multiple benefits. It not only provides your community with insights into why other competing municipalities are more successful in terms of attracting manufacturing investment, but it saves your prospective investors time from having to conduct their own research. You may have to include three (3) to four (4) common communities based on similar size, assets and state of the manufacturing sector, but if you are successful in learning which other communities your prospective investor is considering, you may want to also include them into your benchmarking. This benchmarking exercise should also be done with nearby airports to understand and leverage the competitive advantages that the Muskoka Airport provides.

6. **Have a focal point or department within your office of economic development that is made aware of all inbound missions taking place in your municipality**. Depending on the size and complexity of your municipality, you may be surprised how many annual business delegations are organized by your local post-secondary institution(s), local regional innovation centres, lower- or upper-tier government offices, local businesses themselves (such as a visit to their head office), local chambers of commerce and your own local office of economic development. This is also a great time to also partner with your local tourism office as they may be assisting small-to-large groups of tourists from other parts of the world preparing for travel to your community in the near future. By better understanding who, from where and their intentions for visiting your municipality, you will be in a better position to engage the appropriate stakeholders and ambassadors from within your community. This prevents burnout and people having to reshuffle schedules with unexpected delegations arrive with a request to participate in the form of a meeting, presentation or building tour.

7. **Industry-specific tradeshows** can be an excellent way to meet, entice and qualify a large number of investment prospects at a single location over a short period of one (1) to five (5) days. The size of the tradeshow will often influence the amount of time needed to prepare, and it can also be advantageous to leverage the expertise of a professional lead generation firm to assist in the preparation of your meeting schedule. Consideration should also be made for identifying a lead generation firm that is based in the county which is playing host to the conference. This way, your office can leverage their native language to also help in organizing a series of one-on-one meetings with prospective targets at their actual offices.

8. **Outbound missions** can often be wrapped around an industry trade show or organized on their own. They are a great opportunity to engage select and strategic stakeholders from the local government (such as a mayor), the local post-secondary institution (such as a Dean of Engineering or University President), local businesses considering expansion or export opportunities in the target countries and members of your local office of economic development.

Depending on the size of the outbound delegation, it is important to be mindful of the cost to participate, everyone will have a list of demands (such as strategic business meetings) they will want to achieve during the mission. This may present a unique opportunity for the outbound delegation to be strategically split up into small groups of two (2) to four (4) individuals with their own program and where all members may meet at certain key areas throughout the duration of the mission for larger gathering, investment presentations and networking opportunities.

9. **Consider approaching and partnering with Georgian College's Department of Alumni Affairs** to work with their office to gain access to key alumni of theirs that may reside in a target country or city. Be mindful that most post-secondary institutions keep this list under lock and key, but if done correctly and without a threat of losing the relationship, this could be mutually beneficial for both post-secondary institutions and your office of economic development. The importance of relationships with alumni are becoming more important as more post-secondary institutions are becoming more dependent on the annual giving campaigns of their alumni to support infrastructure, scholarship and other financial obligations. Successful alumni who have moved on to become respected business leaders could also be enticed to relocate back to the municipality where they studied and/or consider establishing a local presence of their business in your community if your office of economic development can demonstrate how the local assets can give them a competitive advantage or increase profits.

10. **Leverage realtors, site selectors and broker relationships**. Realtors are your "front line of defense" in the business community and often know just as much or more about what's occurring with a business looking to grow, consolidate or close their operations. Most realtors are aware that resources are available to bring in new businesses, but may not be fully aware of resources available to retain and expand existing businesses.

11. **Have marketing material** targeted to aerospace manufacturers and aviation service providers showcasing key assets (supply chain, labor data, airport technical data, incentives and others) and your value proposition.

12. **Get involve with the aerospace and aviation organization** at the provincial and national level – in Ontario, the Ontario Aerospace Council and the "Doing MRO in Canada" event (mid-October) – in Canada, the Aerospace Industry Association of Canada, the Canadian Business Aviation Association and the Canadian Owners and Pilots Association. This can help drive additional clientele to existing cluster members and is part of the continuous learning for those responsible for the commercial office.

13. **Have a mapping of buildings and lands available airside and groundside** at the Airport and in the various commercial and industrial spaces in Town including a mapping of infrastructure capacity and assessment to support investors. Ensure that this is up to date at all times.

14. **Have partner organizations involved** (academia, workforce, municipal leaders, government agencies).

In supporting FDI and BR+E opportunities, partnerships could provide the following services:

- Assisting with B2B introductions between FDI or BR+E company and local chamber of commerce members; and
- Present features, benefits, programs and networking opportunities that chamber of commerce offers in supporting the local business community and which can benefit specific FDI or BR+E companies.

In supporting FDI and BR+E opportunities, a partnership with the local funding agencies could provide the following services:

- Ensuring alignment with target funding programs;
- Review eligibility;
- Pre-qualification; and
- Assist with application completion.

9.2.3 Prioritized List

To assist the Town in targeting specific companies for business investment attraction at the airport, the following list of 74 sub-sectors brings together a combined total of 18,070 U.S.-and Canadian based companies that have the potential to strengthen and augment the level of the Airport Maintenance and Modifications cluster and related supply chain activity. In consultation with the Town's Manager of Economic Development, a detailed list of 500 target prospects has been provided based on identified priority sub-sectors.

The following company and contact information will be provided as part of this target list:

- Company Name
- Trade style (Operating Name)
- Address Line 1
- Address Line 2
- City
- State Or Province
- Postal Code
- Country/Region
- Phone
- URL
- Employees (All Offices)
- Employees (Target Office)
- Revenue (USD)
- Assets (USD)
- Owns/Rents
- Square Footage
- Year Founded
- Business Description
- Parent Company
- Parent Country/Region
- US SIC 1987 Code
- US SIC 1987 Description
- NAICS 2012 Code
- NAICS 2012 Description

Table 18 - Prioritized List of Prospects Based on US 8-Digit SIC Codes

US 8-Digit SIC	Description	# of Companies
76992200	AIRCRAFT AND HEAVY EQUIPMENT REPAIR SERVICES	3364
45810200	AIRCRAFT MAINTENANCE AND REPAIR SERVICES	3116
37280000	AIRCRAFT PARTS AND EQUIPMENT, NEC	2915
45810202	AIRCRAFT SERVICING AND REPAIRING	1649
50880302	AIRCRAFT AND PARTS, NEC	1430
37240000	AIRCRAFT ENGINES AND ENGINE PARTS	1406
55990104	AIRCRAFT INSTRUMENTS, EQUIPMENT OR PARTS	523
51720201	AIRCRAFT FUELING SERVICES	471
37289901	AIRCRAFT ASSEMBLIES, SUBASSEMBLIES, AND PARTS, NEC	341
50880303	AIRCRAFT ENGINES AND ENGINE PARTS	291
37219902	RESEARCH AND DEVELOPMENT ON AIRCRAFT BY THE MANUFACTURER	229
76992201	AIRCRAFT FLIGHT INSTRUMENT REPAIR	222
76299901	AIRCRAFT ELECTRICAL EQUIPMENT REPAIR	215
37249912	RESEARCH AND DEVELOPMENT ON AIRCRAFT ENGINES AND PARTS	128
17210301	AIRCRAFT PAINTING	119
37289909	AIRCRAFT PARTS AND AUXILIARY EQUIPMENT, NEC	115
37280102	AIRCRAFT BODY ASSEMBLIES AND PARTS	110
76220101	AIRCRAFT RADIO EQUIPMENT REPAIR	96
45810203	AIRCRAFT UPHOLSTERY REPAIR	91
17999943	RENOVATION OF AIRCRAFT INTERIORS	88
38120201	AIRCRAFT CONTROL SYSTEMS, ELECTRONIC	87
37280100	AIRCRAFT BODY AND WING ASSEMBLIES AND PARTS	86
38290100	AIRCRAFT AND MOTOR VEHICLE MEASUREMENT EQUIPMENT	78
25310302	SEATS, AIRCRAFT	65
37249915	TURBINES, AIRCRAFT TYPE	63
38120102	AIRCRAFT FLIGHT INSTRUMENTS	62
36479901	AIRCRAFT LIGHTING FIXTURES	48
37280205	GEARS, AIRCRAFT POWER TRANSMISSION	42
37280200	AIRCRAFT PROPELLERS AND ASSOCIATED EQUIPMENT	41
38120200	AIRCRAFT CONTROL INSTRUMENTS	39
37249905	ENGINE MOUNT PARTS, AIRCRAFT	34
37280115	WING ASSEMBLIES AND PARTS, AIRCRAFT	29
38120202	AUTOMATIC PILOTS, AIRCRAFT	29
37280109	FUEL TANKS, AIRCRAFT	28

33579901	AIRCRAFT WIRE AND CABLE, NONFERROUS	27
37280300	AIRCRAFT LANDING ASSEMBLIES AND BRAKES	26
35920101	VALVES, AIRCRAFT	24
37280303	ALIGHTING (LANDING GEAR) ASSEMBLIES, AIRCRAFT	24
37280304	BRAKES, AIRCRAFT	24
37249902	AIRFOILS, AIRCRAFT ENGINE	21
34920102	VALVES, HYDRAULIC, AIRCRAFT	20
37280103	AIRFRAME ASSEMBLIES, EXCEPT FOR GUIDED MISSILES	19
37249916	TURBO-SUPERCHARGERS, AIRCRAFT	17
37249901	AIR SCOOPS, AIRCRAFT	16
35940102	PUMPS, HYDRAULIC, AIRCRAFT	14
37249903	COOLING SYSTEMS, AIRCRAFT ENGINE	14
37280204	BLADES, AIRCRAFT PROPELLER: METAL OR WOOD	14
37249911	PUMPS, AIRCRAFT ENGINE	12
38290104	FUEL SYSTEM INSTRUMENTS, AIRCRAFT	12
37280101	AILERONS, AIRCRAFT	11
37280201	ACCUMULATORS, AIRCRAFT PROPELLER	11
37280203	AIRCRAFT POWER TRANSMISSION EQUIPMENT	11
37249906	EXHAUST SYSTEMS, AIRCRAFT	10
22730100	AIRCRAFT AND AUTOMOBILE FLOOR COVERINGS	9
38290110	PRESSURE AND VACUUM INDICATORS, AIRCRAFT ENGINE	9
37249904	ENGINE HEATERS, AIRCRAFT	7
38120124	POSITION INDICATORS FOR AIRCRAFT EQUIPMENT	7
22730101	AIRCRAFT FLOOR COVERINGS, EXCEPT RUBBER OR PLASTIC	6
37249909	LUBRICATING SYSTEMS, AIRCRAFT	6
37249910	NONELECTRIC STARTERS, AIRCRAFT	6
37280111	NACELLAS, AIRCRAFT	6
38290105	FUEL TOTALIZERS, AIRCRAFT ENGINE	5
37280108	FLAPS, AIRCRAFT WING	4
37280307	WHEELS, AIRCRAFT	4
37280106	EMPENNAGE (TAIL) ASSEMBLIES AND PARTS, AIRCRAFT	3
37280107	FINE, AIRCRAFT	3
37280110	FUSELAGE ASSEMBLY, AIRCRAFT	3
37280113	RUDDERS, AIRCRAFT	3
37280114	STABILIZERS, AIRCRAFT	3
38290113	THRUST POWER INDICATORS, AIRCRAFT ENGINE	3
37280211	SPINNERS, AIRCRAFT PROPELLER	2
38290111	SYNCHRONIZERS, AIRCRAFT ENGINE	2
37289906	OLEO STRUTS, AIRCRAFT	1
38290103	FUEL MIXTURE INDICATORS, AIRCRAFT ENGINE	1

9.3 Marketing Gravenhurst

In today's fast-paced society and business climate, businesses only have seconds to make a meaningful impact on their prospective and existing customers. That is why it is important to ensure that production of marketing material is done in conjunction with a skilled graphic design studio to develop eye-catching marketing material and collateral that is to the point yet enticing enough for readers who want to know more and possibility arrange an in-person site visit.

9.3.1 Development of the "Muskoka Aircraft MRO and Modifications Cluster" Brand

At the rate the aerospace and aviation industries are growing and the number of municipalities and airports worldwide that are trying to garner some of that activity, it is vital that Muskoka Airport and the Cluster not only develop a strategic and niche brand for itself, but also ensure that the agreed upon message and value propositions speak to potential clients and investors and properly conveyed and marketed to target jurisdictions and/or businesses from an investment attraction perspective.

In the process of developing the cluster brand, the staff member must remain aware of the varies activities and developments taking place at the various airport hubs (in close proximity or throughout Ontario) and their corresponding brands and areas of speciality to ensure that the Muskoka Airport continues to adapt or position itself as a strategic location above other competing jurisdictions or airport business parks for future investment attraction. Leveraging existing Muskoka Airport staff and the governance board will help ensure that this information is relevant and timely.

9.3.2 Cluster Website

The development of a website dedicated to profiling and educating viewers on the cluster and investment attraction is an effective way to communicate to existing networks, but also to a more passive group of investors who may be monitoring the cluster or airport from afar. An updated website is a great way to highlight specific information, provide details about cluster tenants, disclose real estate opportunities of land and/or buildings for lease or for sale, promote success stories, introduce new cluster members, advertise procurement opportunities, among others.

9.3.3 Brochure

In addition to an online presence, it is equally important to ensure that a review of the different ways to reach the target audience is taken into consideration. Hard copy pamphlets or brochures are very appropriate when hosting prospective investors or strategic influencers (such as Ontario's Ministry of Economic Development, Job Creation and Trade or site selectors). These marketing materials can be easily converted to electronic file format and presented on a USB Drive or sent via email.

9.3.4 Social Media

In addition to an online presence, it is equally important to ensure that the appropriate social media channels are utilized. Understanding which social media platforms investors typically favour can give the cluster an advantage of visibility. Traditionally, LinkedIn, Twitter and Facebook may be the three (3) more commonly used mediums, but the staff member must remain abreast of the other emerging platforms to ensure that a key channel is not overlooked. It may also be a good idea to liaise with each the Town's and District's in-house marketing and communications departments to understand changing social media trends. For aviation and aerospace brands, the top five (5) social media platforms include:[6]

- Twitter (for customer service and news updates);
- Instagram (for showing off amazing visuals);
- LinkedIn (for recruiting and reaching C-suite leads);
- YouTube (for telling a story with video); and
- Facebook (for building an online community).

Aerospace marketers running the top aerospace manufacturers do rely heavily on social media and they use it in very interesting ways that one might not expect from the industry.[7]

In additional to their latest news, partnerships and products, a brand's social media pages need to be interactive and engaging, but they also need to be a hub for the latest news and statements from the company. Additionally, more aerospace and defense CEO's are "liking" social media on account of:[8]

- Good way to share company news and information;
- Positively impacts the company's reputation;
- Demonstrates company innovation;
- Puts a human face on the company;
- Employee communication;
- Helps with media relations;
- Makes for a better place to work;
- Builds market credibility; and
- Helps find/attract new customers.

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[6] Aly J. Yale, What Social Platforms Should Your Aviation Brand Be on? Haley Aerospace Advertising and Marketing Agency. October 27, 2015. http://haleyaerospace.com/what-social-platforms-should-your-aviation-brand-be-on/

[7] Adam Dalezman, Why Aerospace Marketing Needs Social Media. Synthesio Social Media Intelligence Suite, https://www.synthesio.com/blog/aerospace-marketing/

[8] Douglas Burdett, 15 Reasons Why More Aerospace & Defense CEOs are "Liking" Social Media. Artillery Marketing, https://www.artillerymarketing.com/fs/15-reasons-why-more-aerospace-defense-ceos-are-liking-social-media

While the planning and implantation of a strong social media strategy is an important step, it should be secondary to a robust and informative website as social media posts often link viewers back to a dedicated website for additional information.

It has been shown that digital marketing will continue to be widely used on a variety of platforms into the future. Tweets with images receive 150% more response in the form of a retweet. Facebook posts with images get 2 to 3 times more response. And with the emergence of 3-D augmented technology, who knows how impressive and dazzling visual content is about to become![9]

There is a chatbot revolution going on and its being fueled by major social media and messaging platforms like Facebook, Messenger, Google, Microsoft Skype, Salesforce, Slack, Twitter DM, WeChat, Kik and Line." Marketers utilizing these apps can easily start conversations with their target audiences.[10]

The best way to strengthen your messaging is to use visuals as well as words. Infographics make a huge impact on digital consumers because they display information easily for people who have neither the time nor the attention span to read lengthy articles and blogs (like this one!).[11]

In the Web 2.0 world, audiences do not want static content and they certainly don't want brands delivering their messages through passive media like television ads. They want visual engagement and immediate interaction. Viewers want to stop, see, click and connect![12]

[9] Aviation Marketing Consulting, "Back to the Digital Future: 2018 Digital Marketing Trends", January 1, 2018. https://aviationmarketing.aero/digital-marketing-trends-2018
[10] Aviation Marketing Consulting, "Back to the Digital Future: 2018 Digital Marketing Trends", January 1, 2018. https://aviationmarketing.aero/digital-marketing-trends-2018
[11] Aviation Marketing Consulting, "Back to the Digital Future: 2018 Digital Marketing Trends", January 1, 2018. https://aviationmarketing.aero/digital-marketing-trends-2018
[12] Aviation Marketing Consulting, "Back to the Digital Future: 2018 Digital Marketing Trends", January 1, 2018. https://aviationmarketing.aero/digital-marketing-trends-2018

10. Action Plan

10.1 Cluster Development Action Plan

The following chart presents the main objective and tasks that should be done to get the cluster project on its way. As previously stated a business plan should support this action plan.

Objective	Task / Activity	Lead	Participants Involved	Budget required	Timeline
Cluster Business Plan/Case	Prepare the cluster business plan	Local Government Rep	MAMM-CAC	YES	Short-Term
Cluster Funding	Research and apply to grant program as they relate to the Business Plan model	Local Government Rep	MAMM-CAC		Short Term
Muskoka Airport Aircraft Maintenance and Modification Cluster Advisory Committee (MAMM-CAC)	Plan and develop the framework for the MAMM-CAC	Local Government Rep	MAMM-CAC		Short Term
	Recruit strategic partners to participate within the cluster advisory committee and sign NDA	Local Government Rep	MAMM-CAC		Short-Term
	Hold quarterly MRO-CAC meeting	Local Government Rep	MAMM-CAC		Short-Term/Ongoing
Commercial Office	MAMM-CAC to approve roles and responsibilities of Commercial Office	Local Government Rep	MAMM-CAC		Short-Term
	Secure and furnish commercial office location	Local Government Rep		YES	Long-Term
Hire Dedicated Staff	Prepare job description for dedicated staff personnel responsible for the cluster	Local Government Rep	MAMM-CAC		Long-Term

	Post, interview and hire dedicated staff personnel	Local Government Rep	MAMM-CAC	YES	Long-Term
Marketing	Establish CRM system and bridge connection with cluster members, local businesses, key influencers and update interactions in CRM system	MAMM Staff/Local Gov't Rep	• YQA tenants • MAMM-CAC • Funding Agencies	YES	Mid-Term
	Affirm and update "Muskoka Airport Aircraft Maintenance and Modifications Cluster" brand	MAMM Staff/Local Gov't Rep	MAMM-CAC		Mid-Term
	Cluster website and marketing material development	MAMM Staff/Local Gov't Rep	MAMM-CAC	YES	Mid-Term
	Social media	MAMM Staff/Local Gov't Rep	MAMM-CAC	YES	Long-Term
Cluster Official Launch	Coordinate official launch of the cluster	Local Government Rep	MAMM-CAC	YES	Mid-Term
Ambassador Program	Develop/update Ambassador training manual and update value propositions and other essential messaging required for Ambassadors to articulate	Local Government Rep	MAMM Staff/MAMM-CAC	YES	Mid-Term
	Prepare Ambassador sales and marketing kits (hard and soft copy)	Local Government Rep	MAMM Staff/MAMM-CAC	YES	Mid-Term
	Organize Ambassador welcome presentation and complete marketing, promotion and recruitment of new Ambassadors leading up to event	Local Government Rep	MAMM Staff/MAMM-CAC	YES	Mid-Term
Trade shows, Conferences and Key Events	Develop draft list of proposed industry trade shows worth attending and cross reference with cluster members, and other businesses to gauge interest and	Cluster Staff Representative	MAMM-CAC		Mid-Term

	willingness to attend				
	Organize trade missions to various shows and targeted airlines/prospects	MAMM Staff/Local Government Rep	MAMM-CAC	YES	Mid-Term
	Coordinate and launch activities to host clients and prospects	Local Government Rep/MAMM Staff	MAMM-CAC	YES	Mid-Term
Foreign Direct Investment Attraction	Develop prioritized list of business activities, manufacturers and business support services to target for investment attraction into the cluster	Local Government Rep			Short-Term
	Prepare updated value propositions and key messaging to support investment attraction into the cluster	Local Government Rep	MAMM-CAC		Short-Term
	Develop industry business case for each target business segment including “Why Canada”. Consider starting with top 2-3 business segments.	Local Government Rep			Short-Term
	Develop outreach campaign and frequency and execute. Professional lead generation services may be required to assist in the outreach, qualification and promotion.	Local Government Rep			Mid-Term
	Participate in cluster-attended trade shows and outbound missions.	Local Government Rep		YES	On-going
	Move opportunities forward and work towards hosting individual site visits/FAM tours	Local Government Rep			Mid-Term

10.2 Incubator and Technologies

The following chart presents the main objective and tasks that should be done to get the aerospace and aviation incubator project on its way. As previously stated, a business plan should support this action plan. It is intended that this project will occur following the developed of the MAMM Cluster and that work on this project may not begin immediately following the approval of this report.

Objective	Task / Activity	Lead	Participants Involved	Budget	Timeline
Engagement process	Continue to work with the post-secondary institutions (towards a letter of intent) to identify synergies and support (both funding and in-kind) that will push incubator model forward	Local Government	• Georgian College • Canadore College • Lakehead University		Short-Term
	Discuss engagement opportunities with cluster members, airport tenants and nearby businesses	Local Government	• MAR • LCAS • Airport tenants • Nearby businesses		Short-Term
	Develop business case and funding requirements for years 1-3 (outside professional support may be required)	Local Government		Yes	Short/Mid-Term
	Present business case to Town and District Councils in addition to target private-sector companies to support application funding request as matching partners (subject to approval)	Local Government	• Town of Gravenhurst • Muskoka District • Targeted private sector companies		Mid-Term
Finance	With funding application approval, develop steering committee to establish roles and responsibilities of Executive Director and hire this individual	Local Government	• Georgian College • Canadore College • Lakehead University • Cluster members		Long-Term
	Firm up on previously agreed upon financial, in-kind and engagement commitments from the Town, District and private-sector companies	Executive Director	• MAR • LCAS • Airport tenants • Nearby businesses • Local Government		Long-Term

	Complete lease agreement for space (i.e.: proposed vacant commercial office at airport terminal)	Executive Director	Local Government		Long-Term
Marketing	Develop website and marketing material and begin promoting engagement opportunities	Executive Director	Local Government	Yes	Long-Term
Equipment	Furnish office with required furniture, equipment, etc.	Executive Director	Local Government	Yes	Long-Term
Official Launch	Hold official ribbon-cutting ceremony	Executive Director	Local Government	Yes	Long-Term

11. Conclusion

An extensive consultation process along with thorough research on the market and its trends and demands was used to support this project and reach meaningful and accurate conclusions. Our team has identified the presence of a unique and emerging sub-sector tied to “aircraft maintenance and modifications” as being the most mature to evolve and generate employment and attract new businesses and investment to Gravenhurst. The successful development of this sub-sector will provide the basis for a more predominant aerospace supply chain leading to the future aerospace branding for the Town and the region.

The various economic studies that have transpired over the years in Gravenhurst reveal that some economic development opportunities and trends have remained consistent over time and were again identified throughout this study.

Our independent research and community consultation process identified the primary land development market should be focused on attracting new or expanding existing aviation-related businesses including aircraft manufacturing, aircraft servicing, aircraft repair and overhaul, and aircraft painting.

The development and growth of an aviation maintenance and modifications cluster and brand will require a number of initiatives that have been included in the action plan. For instance, it is recommended that a business plan should be prepared to support the launch of the cluster and ensure a coordinated effort by all parties involved.

The basis of our study was to undertake a sector analysis and corresponding action plan focused on attracting investment to airport lands and private lands surrounding the Muskoka Airport. Our analysis has concluded that MAR and LCAS are the top-priority tenants and supporting their growth, through the expansion of their MRO services and facilities, provides a great opportunity for the airport while being great incentives for business retention.

The results of our present study show that the top investment opportunities for the development of the aviation maintenance and modifications cluster includes related activities tied to floors, electronics, seats, components, engine, avionics, landing gear and harnesses (onboard cabling). Furthermore, enhanced Maintenance Repair and Overhaul (MRO) and Modifications was identified as a strength including significant opportunity to work with MAR and LCAS who are looking at expanding their MRO and Modifications services and facilities at the Muskoka Airport.

Furthermore, the development of an incubator has the potential to bring an important element to strengthening the cluster's and the Town's aerospace/aviation value position, while at the same time providing space and services to support MRO-related and aviation-related technologies. The objective of a potential incubator is to focus mainly on technologies related to maintenance, repair overhaul, modifications and technology integration of aircraft and host aerospace manufacturing and R&D activities. Neighbouring post-secondary institutions expressed a positive level of interest in learning more about participating and to further define what that level of support could entail. The incubator can also be a catalyst for bringing opportunities between private-sector cluster members and potential post-secondary academic institutional partners.

The growth of the MAMM cluster will be heavily dependent upon strategic partners in ensuring that their interests are aligned with the Town and in sync for moving certain aspects of this study forward. Without buy-in from these organizations (including post-secondary institutions), some aspects may not be achievable. The cluster and its members would also benefit from the leadership and business support services and associated funding that the Town's Economic Development Office and its various partners can provide.

12. Appendix

12.1 Focus Group Participants

- Brian Didone, Dura-Line
- David Dunk, Beaver Creek Institution
- David Rodwell, Private Hangar Owner
- Earle Robinson, Muskoka Flying Club
- Elton Townsend, Muskoka Aeronautics
- Florence MacLean, Lakehead University
- Grant Elliot, Muskoka Flying Club Member
- Jim Hodgson, Lake Central Air Services
- John Cooper, Frequent Users and Aviation Interested Residents of Muskoka
- Mac Greaves, Georgian College
- Martin Galvin, Canadore College School of Aviation
- Mike Goudie, Muskoka Aircraft Refinishing
- Rebecca Heffernan, Lakehead University
- Roy Davies, Bracebridge Machine & Mechanical Services
- Sruli Weinreb, Lake Central Air Services
- Susan Laycock, Simcoe Muskoka Workforce Development Board
- Trent McCabe, Frequent Users and Aviation Interested Resident of Muskoka

12.2 One-on-One Meeting Participants

- Brian Didone, Dura-Line
- Catherine Oosterbaan, Ministry of Agriculture, Food and Rural Affairs
- Cheryl Kelley, Town of Bracebridge
- Graham Nierop, Chartright Air Inc.
- Jill Harris, Town of Bracebridge
- Jim Hodgson, Lake Central Air Services
- Mark Stirling, Muskoka Airport
- Mike Goudie, Muskoka Aircraft Refinishing
- Paul Heide, Paradigm Precision
- Scott Weeres, District of Muskoka
- Sruli Weinreb, Lake Central Air Services
- Susan Laycock, Simcoe Muskoka Workforce Development Board

13. Bibliography

1. Innovation Science and Economic Development (ISED) Aerospace Economic Model Estimates - 2018. (Based on Statistics Canada, Canada Revenue Agency, Canadian Space Agency, Canadian Defense, Aerospace and Marine Industries Survey), 2018.
2. Ontario Aerospace, Space Defense, UAV and MRO 2018 Capabilities Directory.
3. Forecast International and Teal Group, Civil aircraft and engine production rankings based on final assembly production data, 2018.
4. Flight simulation: Frost & Sullivan, Commercial Flight Training and Simulation Market, 2016.
5. The Canadian Encyclopedia, Canadian Aerospace Industry 2017, https://www.thecanadianencyclopedia.ca/en/article/aerospace-industry, 2017.
6. Government of Ontario, Incentive Programs and Services, https://www.investinontario.com/incentive-programs-and-services.
7. KPMG, *Competitive Alternatives* 2016 Report, 2016.
8. Deloitte, Report on 2018 Global aerospace and defense industry outlook, 2018.
9. Airbus, Global Market Forecast 2016-2035.
10. Aviation Industry Trends, InterVistas, 2012.
11. Statistics Canada, Air Carrier Traffic at Canadian Airports, 2015.
12. Transport Canada, Minister Garneau presents his strategy for the future of transportation in Canada: Transportation 2030, 2016.
13. McKinsey & Company, Regional Airport and Ground Transportation strategy, December 2015.
14. Conference Board of Canada, Growing Canada's Economy: A New National Air Transportation Policy, 2013.
15. Centreforaviation.com, Canada's Airline Market Duopoly, 2016.
16. Financial Post, NewLeaf drops more routes, down to five destinations for the summer season, February 2017.
17. Oliver Wyman, Global Fleet MRO Market Forecast, 2018, https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2018/January/2018-2028_Global_Fleet_MRO_Market_Forecast_Commentary_Public_Final_web.pdf
18. Select USA, Aerospace Spotlight – The Aerospace Industry in the United States, 2017.