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QUÉBEC AEROSPACE 2015

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Landing Gear - Interiors - Avionics - Automation - Clusters*



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Québec 

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MONTREAL
Québec's Aerospace Cluster

Dear Readers,



On the strength of the vitality and spirit of initiative of its businesses, the Québec aerospace industry is recognized for its considerable capacity to reinvent itself. What is more, the expertise of more than 200 efficient, innovative firms, including 15 principal contractors and equipment manufacturers, now ranks Québec as a leader among the world's biggest aerospace centers.

Aerospace is a veritable driving force in the Québec economy and accounts for nearly 42,000 specialized jobs. We are relying on this skilled labor and on the constantly changing sector's other undeniable advantages in order to bolster our competitiveness and further promote investments in Québec.

More than ever, our industry possesses the strengths necessary to carry out innovative projects that serve as catalysts for the sector. Québec firms offer complementary, diversified products in addition to investing in research and development that enables them to consolidate their reputation for excellence from the standpoint of innovation.

Québec also offers investors an attractive business environment, one that is particularly renowned for its specialized training establishments and state-of-the-art research centers.

Numerous possibilities await companies that undertake promising projects in this flourishing sector. We therefore invite investors from the world over to opt for Québec talent and to discover the rewarding business opportunities that Québec and its aerospace industry have to offer.

We are indeed proud to present in the pages that follow entrepreneurs who are keenly interested in this industry, which is a veritable economic linchpin and a source of wealth for Québec.

Jacques Daoust
Minister of the Economy,
Innovation and Exports

Suzanne M. Benoît
President and CEO,
Aéro Montréal



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Big Four



Aerostructures



Engines



Landing Gears



Aircraft Interiors



Avionics



Service & Equipment



Automation



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The future is being built with the decisions of today, as Quebec looks to grow its importance and influence in the global aerospace community.





INTRODUCING QUEBEC AND ITS AEROSPACE INDUSTRY



“Bearing in mind federal tax credits, Quebec’s fiscal policy is among the most generous in the world.”

- Jacques Daoust
Minister,
Ministry of Economic Development,
Innovation and Export Trade (MEIE),
Government of Québec



QUEBEC'S AEROSPACE CLUSTER

A Diversified Ecosystem

- The field of aerospace is a pinnacle of high-technology achievement. While many regions of the world wish to develop a toehold in the aerospace sector, few have been able to accomplish this feat as successfully as the Canadian province of Quebec. Canada's aerospace industry has a history of over 100 years, and Quebec has emerged as its epicenter; the province drives 55% of the country's total aerospace activity. A defining feature of Quebec's aerospace industry is its concentration: 98% of its activity stems from the region of Greater Montreal, which renders it the third largest hub for aerospace activity in the world behind only Seattle in the United States and Toulouse in France. The Quebec aerospace cluster is comprised of 41,750 highly skilled employees, four prime-contractors (OEMs), roughly 15 tier-one suppliers (integrators), and over 190 small to medium-sized enterprises (SMEs). Due to its extensive composition, Quebec is recognized to contain, within a 30-kilometer radius, enough companies with ample capabilities to build an entire aircraft. Dedication to research and development (R&D) further reinforces Quebec's impressive position amongst the global aerospace com-



Image: CAE

munity. Greater Montreal accounts for 70% of Canada's total investment in aerospace R&D initiatives, a figure which amounts to C\$700 annually. Continual R&D investment has been key to sustaining the industry's growth, which has averaged 5.9% annual growth over the last 25 years. In 2014, growth jumped to 14.9%, elevating annual revenues to C\$13.8 billion. As one of Quebec's most successful industries, aerospace is also its most highly exported sector, with 80% of its activity targeted at international markets.

The driving force behind Quebec's aerospace activity is the presence of four OEMs: Bombardier, Bell Helicopter, Pratt & Whitney Canada (P&WC), and CAE. Quebec is the only Canadian province to benefit from such a strong concentration of OEMs. Supporting the OEMs is a host of roughly 15 local and multinational integrators, including Héroux-Devtek, L-3 Communications MAS, Mecachrome Canada, Rolls-Royce Canada, Sonaca Montreal, and Thales Canada. While integrators supply OEMs with comprehensive end-to-end solutions, they rely upon an extensive network of SMEs to deliver their end products.

A distinguishing quality of Quebec's aerospace cluster is the extent of its base of uniquely specialized SMEs. In addition to its exhaustive base of industrial companies, Quebec has roughly 20 public and private research centers entrenched in the field of aerospace, which play a critical role in supporting the industry's activity and development. Quebec is also home to international aviation organizations such as the International Air Transport Association (IATA), the International Business Aviation Council (IBAC), and the International Civil Aviation Organization (ICAO). Due to the variety of its stakeholders and its tightly-knit composition, Quebec's aerospace cluster has garnered worldwide acclaim for its culture of collaboration and capacity to innovate, dynamic qualities which have affirmed its position as a world-leading aerospace hub. The link that binds Quebec's aerospace industry together is Aero Montreal, an inclusive association of industry members, which serves as a think-tank and sounding board for enhancing industry collaboration and competitiveness. Aero Montreal champions working groups and cluster-wide initiatives to realize its mission of driving growth within the industry. Its working groups focus



COMPANIES IN THE AEROSPACE INDUSTRY OF GREATER MONTRÉAL

Source: Montréal International

- BIG FOUR
- COMPANIES
- ◆ RESEARCH CENTERS
- ◆ GOVERNMENT BODIES AND ASSOCIATIONS
- AIRPORT

1. Bombardier Inc.
2. Mecachrome
3. Avianor Inc.
4. CanRep Group
5. Bell Helicopter Textron Canada
6. Héroux-Devtek
7. Electro-Kut
8. Avior
9. Ministry of Economic Development, Innovation and Export Trade (MEIE)
10. CEL Aerospace Group
11. Beel Technologies Inc.
12. AV&R
13. ICAM Technologies
14. AKKA Technologies
15. CAE Inc.
16. Jabez Technologies
17. CS Canada
18. AAA Canada
19. GGI International
20. CMC Electronics
21. DELASTEK inc.
22. L-3 MAS
23. Turbomeca Canada
24. Pratt & Whitney Canada Inc.
25. Sonaca Montréal
26. RTI-Claro Inc.
27. Tekalia Aeronautik
28. Tecnickrome Aeronautique Inc.
29. Techfab
30. Hutchinson
31. Zodiac Aerospace
32. Nétur
33. NSE Automatech Industrielle Inc.
34. Rolls-Royce Canada
35. Innotech-Execaire
36. Thales Canada
37. ThyssenKrupp Aerospace
38. MDA
39. Mecaer America
40. AERO MONTREAL
41. Conseil national de recherches Canada (CNRC)
42. CAMAQ
43. Centre de recherche industrielle du Québec (CRIQ)
44. Granby Industriel
45. ATLAS
46. GE Aviation
47. Adetel Canada
48. Altitude Aerospace
49. Assystem Canada Inc
50. Desjardins
51. Fonds de solidarité FTQ
52. Consortium Recherche et Innovation synergétiques en Aérospatiale au Québec (CRIAQ)
53. JMJ Aero
54. Techno Aero Services
55. Alta Precision
56. Safran Group
57. Techniprodec
58. Norton Rose Fulbright
59. Sinters America
60. Aerosphere
61. CP Tech
62. PCM Innovation
63. TNM
64. Verdun Anodizing
65. Alphacasting
66. Avitec
67. Initial Aviation
68. Meloche Group
69. SOMR
70. Genius Solutions

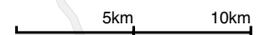


Saint-Bruno-de-Montarville

Saint-Hubert
Leu Airport

Chambly

Granby



on themes such as supply chain development, branding and promotion, and innovation, while its initiatives tackle topics such as developing the next-generation of environmentally friendly aircraft (Greener Aircraft Catalyst Project, also known as SA2GE) and optimizing the competitiveness of Quebec’s aerospace supply chain (MACH Initiative). The overarching goal of these programs is to promote industry collaboration, while strengthening its capabilities on a global scale.

The Greener Aircraft Catalyst Project is another avenue through which the Quebec aerospace cluster showcases its capacity to innovate. The government of Quebec recognizes the significance of R&D in driving the aerospace sector’s competitiveness and has consequently installed a framework that is conducive to aerospace innovation. While Quebec’s aerospace cluster benefits from a supportive business environment and favorable fiscal policies, the provincial government also encourages industrial partnerships with consortiums and research and development centers in Quebec.

The Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), is one such organization formed to support R&D initiatives within Quebec’s aerospace industry. CRIAQ is an industry led organization charged with bridging the academic and industrial sectors. Through applying university research to practical industry situations, CRIAQ has overseen 110 aerospace oriented R&D projects with a cumulative worth of CAD \$107.6 million, which have resulted in substantial cost savings for industry members.

Another organization that supports Quebec’s aerospace cluster is the Centre de Recherche Industrielle du Québec (CRIQ), which assists aerospace companies with certification, testing, and R&D. According to Denis Hardy, president and CEO of CRIQ, it is currently undertaking a program that will result in “reduction of aircraft engine-emissions for cleaner air,” while it also has a mandate from the government to develop a 3-D printing network in Quebec, which “will come to the forefront of supporting manufacturing profitability in the future.”

A combination of expertise, collaboration and innovation has made Quebec’s aerospace cluster renowned in the global aerospace industry; however, with the emergence of strong international competition within the aerospace sector, the cluster will need to take steps to further develop and differentiate its capabilities. Speculating on the future prospects of Quebec’s aerospace industry, the Honorable Jacques Daoust, Minister of Quebec’s Ministry of Economic Development, Innovation and Export Trade (MEIE), said: “The aerospace industry’s future hinges on four key factors. First, we must promote the development of principal contractors in the sector. Second, we must round out the Quebec supply chain by attracting new first-tier equipment manufacturers and integrators. Third, we must foster broader competitiveness and productivity in Québec SMEs. To this end, we must promote their consolidation and the automation of manufacturing processes. Lastly, the Quebec aerospace sector must remain at the forefront of technology by making innovation a genuine priority.” •

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In collaboration with **CRIAQ**



Jacques Daoust

Minister of the Economy,
Innovation and Exports,
GOVERNMENT OF QUÉBEC

●●● **Québec's Aerospace Cluster is composed of over 205 companies, 41,750 workers, and \$13.8 billion in annual sales. What is the strategic importance to Québec's economy?**

The aerospace industry is of very strategic importance to the Québec economy overall for several reasons. First, mention should be made of the significant number of jobs in the sector and the quality of such jobs, which require high qualification, are highly technological and foster innovation. In Québec, it is estimated that one worker in 97 possesses an aerospace diploma, 1.5 times higher than the proportion in France and 2.5 times higher than in the United States.

Moreover, the aerospace industry affords Québec a veritable window on the world. In 2013, it ranked first among manufacturing industries and accounted for 11.6% of total exports. Furthermore, 80% of output in the aerospace sector is exported outside Canada. To fully grasp its importance, it should be

noted that Québec's aerospace sector accounts for 1.35% of its GDP. The Canadian aerospace sector accounts for only 0.42% of Canada's GDP.

What is MEIE's role supporting Québec's aerospace industry?

The MEIE plays a twofold role with respect to the aerospace sector in that it maintains a favorable business environment and supports the industry's growth.

What do we mean by a favorable environment? Among other things, this means competitive taxation, an extensive pool of highly qualified manpower (semi-skilled workers, technicians, engineers and scientists) and the presence of universities and research centers at the forefront of worldwide innovation. According to a 2012 KPMG study that evaluates the competitiveness of total operating costs, Greater Montréal ranked second among the major metropolitan areas in North America specializing in aerospace.

Our support for the aerospace industry takes several forms. For example, we offer financial support for private investment projects, investment or research and development tax credits, and a tax holiday for major investment projects.

In terms of revenue, Québec's aerospace sector has fallen in rank from 3rd to 5th globally. What steps will MEIE take to reverse this trend and to ensure the sector's long-term international competitiveness?

As a matter of fact, the Québec aerospace sector has never ranked third in the world. The four key players are the United States, France, the United Kingdom and Germany, all of which have a significant history in aerospace and invest heavily in the defense sector.

Thus, there is no trend to be reversed. On the other hand, Québec wishes to maintain or even improve its position among the front-runners so it must remain vigilant in light of strong international competition, including that from the emerging countries, and ensure that our manufacturing SMEs adapt to changes in the worldwide supply chain.

It is also important to maintain support for the industry by enhancing risk sharing and through financial support for principal contractors, SMEs and research centers. I am thinking in particular of Aéro Montréal's MACH initiative, which seeks to bolster our supply chains, and the ecojet catalyst

project, which is promoting collaboration and innovation.

What is MEIE's policy for granting tax credits and similar concessions to aerospace companies?

The R&D tax credit policy is not specific to the aerospace sector, although it is one of Québec's industrial sectors that benefit the most. Bearing in mind federal tax credits, Québec's fiscal policy is among the most generous in the world. Furthermore, enhancements are possible if the R&D is conducted under industrial partnerships, by a consortium or R&D center in Québec.

Lastly, I recently launched the Créativité Québec program, which targets businesses in all sectors that have innovative projects and are seeking financing to acquire new technologies or to develop or enhance products or processes.

Québec has earned international acclaim for the quality of its aerospace human capital, but many companies have voiced concern over potential shortages of technically trained employees. How will MEIE support the development of its base of human capital?

The Québec government supports manpower development by funding training establishments at the secondary, CEGEP and university levels. It also supports organizations that work directly with businesses to ascertain their qualitative and quantitative manpower needs. In this way, the MEIE supports the Comité sectoriel de main-d'œuvre en aérospatial (CAMAQ), which takes stock each year of manpower and training needs. Lastly, through Aéro Montréal, the MEIE promotes the aerospace sector to young people.

What is MEIE's vision for the future of Québec's aerospace industry?

The industry's future hinges on four key factors. First, we must promote the development of principal contractors in the sector. Second, we must round out the Québec supply chain by attracting new first-tier equipment manufacturers and integrators. Third, we must foster broader competitiveness and productivity in Québec SMEs. To this end, we must promote their consolidation and the automation of manufacturing processes. Lastly, the industry must remain at the forefront of technology by making innovation a genuine. •



Suzanne Benoit

●●●
President
AÉRO MONTRÉAL

●●● **Please describe the rationale for Aéro Montréal's formation in Quebec in 2006 and some of its key milestones.**

The greater Montreal Region has long been home to a concentration of major aerospace companies, including four original equipment manufacturers or OEMs, as well as a significant network of smaller related companies and other stakeholders. In 2006, the industry and the three levels of government (federal, provincial and municipal) jointly put forth the concept of an industry cluster. The primary objective of Aéro Montréal was to establish a dynamic mechanism for consultation among its members so that the industry could develop to its full potential, continuously improve productivity and remain competitive globally. In 2012, Aero Montreal merged with the Association québécoise de l'aérospatiale (AQA), a kindred industry group. Today, Aéro Montréal boasts a broad membership of larger companies such as OMEs, as well as small and

medium-sized enterprises (SMEs), universities, colleges, trade schools, associations, and unions.

Aéro Montréal's strategic committee on Supply Chain Development produced the MACH Initiative. Walk us through the emergence and development of this program.

Aéro Montréal's Supply Chain Development Working Group mobilized more than 80 supply chain industry professionals between 2009 and 2011 to launch the MACH initiative, which is designed to accelerate the transformation of Québec's aerospace supply chain and enhance its performance in a constantly evolving and globalized business context where OEM's are now mostly working with first-tier integrators.

There are roughly 15 first-tier suppliers in Quebec and some 200 aerospace subcontractors whose activities are largely determined by larger companies. Therefore, the MACH Initiative aims at intervening directly with suppliers to improve their performance while fostering collaboration and innovation and to develop a base of SME subcontractors with distinctive competencies that are better aligned with OEMs and Tier 1 suppliers.

At the heart of the initiative lies the MACH Excellence Framework, which is a management system and maturity matrix to help suppliers assess their performance, identify performance gaps, and determine the actions necessary to improve and better position themselves within the supply chain. The MACH Excellence Framework also has a maturity scale of five levels, MACH 1 to MACH 5, which help evaluate to what extent a supplier masters the 15 key business processes of the framework.

Supply chains are never static; they form and reform according to the demands of each customer. That's why effective collaboration is so critical. The MACH initiative therefore encourages the establishment of special collaborative relationships between customers and suppliers that focus on the sharing of expertise and strategic information to increase pro-activity and innovation. A better alignment between customers and suppliers will inevitably result in the enhanced performance of the Québec aerospace supply chain. As a result, each supplier that participates in the MACH initiative is accompanied in its efforts by one of its customer, which takes the role of sponsor. The sponsor agrees to support its supplier through a fixed num-

ber of pro-bono initiatives, something made possible because of a good client/supplier relationship.

To correct gaps identified via the audit process, a team of experts prioritizes and identifies specific solutions, which are then implemented by the supplier with help from consultants chosen by the very same supplier. One of the factors that has made the success of the MACH Initiative on the administrative level is that Aéro Montréal manages the various projects and disbursements to the participating companies. This approach contributes to the reduction of the paper burden (red tape) for the SMEs.

The MACH Initiative will devote \$15 million over 5 years to help 70 suppliers better understand the needs and expectations of OEMs and Tier 1 integrators and to acquire the necessary internal capability to operate at this level.

What is the significance of R&D to Québec's aerospace cluster and what steps does Aéro Montréal take to promote innovation within the industry?

The most telling figure is that 70 per cent of Canada's total R&D is performed in Quebec, with Quebec's aerospace cluster and its four OEMs having triggered substantial R&D. Companies within the cluster have developed strong research capabilities, in collaboration with universities and other stakeholders, an asset that has enhanced our ability to attract research projects.

A great example of R&D is the Coalition for Greener Aircraft catalyst project, SA2GE. This project was conceived by the Innovation strategic committee of Aéro Montréal, in conjunction with the Quebec government in 2009. In order to retain our strengths in Quebec, we needed to develop greener technologies meeting the new environmental regulations. In 2010, a budget \$150 million of private and public funding was allocated to the first phase of the project. More than 25 SMEs are currently working with OEMs on new technologies under the banner of SA2GE.

In its 2015-2016 budget, the Québec government announced \$40 million of funding over four years for the SA2GE project. The industry is adding \$40 million of its own, bringing the total to \$80 million. This investment will allow our industry to maintain its leadership and build on existing collaboration among large companies, SMEs, research centres and educational institutions. •



Raymond Bachand



Strategic Advisor

NORTON ROSE FULBRIGHT

●●● Can you provide a brief introduction to your professional background and involvement in the development of Quebec's aerospace cluster?

I am a lawyer by training, and I also have an MBA and DBA from Harvard. Most of my career has been spent in the private sector in corporate development. I was CEO of both the Quebec Solidarity Fund and Secor. For seven years, I served as Minister of Industry and Minister of Finance for Quebec. During my tenure, I helped companies grow not only individually but also as clusters. For example, in 2006 I was responsible for putting in place the first aerospace strategy and major innovation and research policy for the Quebec government to keep the province at the forefront of research and development (R&D). In 2013, I left the political arena to join Norton Rose Fulbright as a strategic advisor. I am Chair of the Board of Tourisme Montréal and President of the

Institute of Quebec, a Conference Board of Canada - HEC Montréal partnership. I currently sit on the boards of National Bank of Canada and Transat A.T. Inc.

What is the nature of Norton Rose Fulbright's involvement in the aerospace industry?

Norton Rose Fulbright consistently ranks as one of Canada's top law firms and in 2015 earned its recognition as the number one law firm by the client-driven Acritas' Canadian Brand Index. With that said, the aerospace industry is very important for our Montreal office and we are heavily involved with major players in the industry. For example, we worked with Bombardier on their recapitalization and equity issue. Norton Rose Fulbright has a broad practice in the areas of financing, corporate law, labor relations, intellectual property and litigation. We help aerospace companies with various aspects of their development. I act as a strategic advisor to our clients and partners on business development and governmental matters. I am registered as a lobbyist for Bombardier for specific fiscal matters.

What role should government play in supporting the aerospace industry?

First of all, the labor force is very important. The government can help by setting up training schools and facilitating workforce mobility as well as new, skilled immigration, so that when highly qualified technicians are needed they can be readily hired. The taxation or fiscal aspect is also important and was reviewed in the past year. The government can also make sure the financing chain is complete, including venture capital and within that, angel investing. The Government of Quebec invested in Teralys Capital, a fund of funds, so that capital could be made available for larger high-tech projects. Today, 150 entrepreneurs are equipped with the capital they need to boost their innovative capacity.

Automation, robotics, advanced manufacturing practices, and vertical integration are all capital-intensive endeavors. Is Quebec's financing climate adequately equipped to support the growth of the aerospace cluster?

I believe so, yes. Aéro Montréal has initiatives like MACH to match large companies

with suppliers in an organized, systematic manner in order to boost productivity and help players in the industry.

Generally, the basic challenge is for companies to be competitive and to therefore invest in plant equipment. Macroeconomic policies are in place, including the removal of tax on capital and the existence of special tax credits for R&D investments that are refundable, which is not the case in other Canadian provinces. However, companies in North America have been hesitant to invest. Once the U.S. economy is clearly in growth mode, they will start investing.

The years ahead are promising for the aerospace industry, given what is going to happen in tourism and travel, where growth is expected at 5% per year.

Bombardier has recently come under a bit of distress with the delay in the release of the C Series and the outsourcing of jobs to Mexico. What is your outlook for the company?

I am totally confident in Bombardier's future because it has been through these challenges in the past. A new plane is a bold move, but the market is there and there is competition. They have had some financing challenges, but have also secured their cash flows through large equity and debt issues. The investments in Mexico were made with the approval of the trade unions, which realize that lowering costs is important for job security.

What does Quebec need to do to remain the world's third largest aerospace hub?

People like Quebec because of its talented young people and great R&D, universities and special colleges, which are required to build and run the plants of the future. If companies have all these factors present and work together to engage in research projects and become more agile, they will remain competitive in the long run.

How can Norton Rose Fulbright support the industry's development?

There are two things good lawyers can do besides legal work. First, they can follow and serve clients' needs wherever they are. At Norton Rose Fulbright, we have 350 lawyers working worldwide within the transport industry. Second, they can stay close to the executives, follow industry trends and provide support to companies. ●



Denis Faubert

●●● President and CEO
CONSORTIUM FOR RESEARCH AND INNOVATION IN AEROSPACE IN QUEBEC (CRIAQ)

●●● **The Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ) was founded in 2002 with financial support from the Quebec government. Could you please provide us with an overview of the evolution of this organization from its inception?**

CRIAQ is a sectorial research cluster meant to support eight of our most important sectors. Among its industrial members, CRIAQ has four original equipment manufacturers (OEMs): Bombardier, Bell Helicopter, CAE, and Pratt & Whitney Canada. Being complementary aerospace companies, they drive the network without competing against each other.

One of the key requirements of our initiative was to integrate different sectors by bringing companies and people to work together. The launch of CRIAQ as a network was vital to create a robust and functional system, which had industry at its base and where research was an integral

part. A vibrant and diverse community was built. One of the valued outcomes of this network is the production of highly qualified personnel. CRIAQ enables projects in universities and allows students access to an important resource that will impact their careers. CRIAQ's success is due to its exceptional leadership and the key decisions that were made in its development.

What is CRIAQ's mission in supporting Quebec's Aerospace Cluster?

CRIAQ is industry led, and its primary goal is to stimulate innovation, collaboration and provide companies large and small with these benefits. We support and finance projects which explore problems that the industry is facing and hold activities to bring people together to solve these problems collectively. Last year, our open innovation forum gathered over 1,000 people to discuss these issues.

The CRIAQ system was originally designed to transfer university research into industry practice. Most of the work has been done in universities under the guidance of professors and industry leaders. CRIAQ creates conditions which incubate innovation in universities and oversees the effective transfer of these technologies into companies.

What is the composition of CRIAQ's community?

Since CRIAQ's inception, we have had over 900 graduate students work on projects with over 650 researchers from universities. We benefit from a network of over 55 industry members and 25 universities and research centers.

Furthermore, over 75 percent of our industrial members are small and medium-sized enterprises (SMEs). SMEs are one of our main focuses, as we look at how we can help these companies leverage their technologies and resources in an effort to be competitive. SMEs participate in projects alongside larger companies. With CRIAQ, SMEs have access to intellectual property and are able to participate in the innovation process and connect to important players in the field.

What is the typical return on investment that companies are able to achieve through collaborating with CRIAQ on applied R&D?

CRIAQ's operations have demonstrated

the effectiveness of applied research and development (R&D). The ratio of return on investment (ROI) that an SME makes from our projects can be as high as one to 44. ROI is less for larger companies, ranging from a ratio of one to eight, so it is still quite substantial. Our network provides a cost effective method of conducting research.

How many projects has CRIAQ implemented since its inception in 2002?

CRIAQ currently has 110 ongoing and completed projects: 57 completed and 53 in progress. These projects represent a cumulative worth of \$107.6 million.

As a case study, what has been one of CRIAQ's recent projects?

CRIAQ's 100th project was launched in 2014. This project's goal was to develop additive manufacturing or 3D printing technology, to produce parts for the aerospace industry. We have 13 partners working on the project, some of whom are outside Quebec, as well as 10 students, whom receive practical experience from the project.

Through its programs CRIAQ aims to cultivate young aerospace talent. How does the structure of your projects provide students with hands-on training?

CRIAQ provides opportunities for students to collaborate on projects in universities and colleges. Montreal has the most universities in North America after Boston and many of its universities prepare students well for entrance into the aerospace industry. The structure of our programs allows students to practice problem solving skills. Moreover, we consult with universities to provide professional and industry training to students, and to teach them what to expect when they enter the workforce.

R&D plays an essential role in ensuring the competitiveness of Quebec's aerospace cluster. What is your opinion on the government's role in providing incentives to the aerospace industry for R&D initiatives?

While research is very expensive and time-consuming, it is vital for innovation and competitiveness. Aerospace is well supported because of its strategic partnership with the government. Defining strategic goals is an important feature for using funding effectively. •



Denis Hardy



President and CEO

**CENTRE DE RECHERCHE
INDUSTRIELLE DU QUÉBEC
(CRIQ)**

●●● **Please provide us with an overview of Centre de Recherche Industrielle du Québec (CRIQ) and its involvement in Quebec's aerospace industry.**

Quebec owned CRIQ was formed in 1969 with a focus on competitive innovation; it is a research industrial center with direct report to the Minister of the Economy, Innovation and Exports. With its research locations based in Quebec City and in Montreal, CRIQ's services include research and development in applied science as well as testing, standardization and certification of products, equipment and processes. Altogether, 1 700 projects a year are carried out by our employees.

In Quebec City, one of the divisions focuses on mechanized and robotic processes as they improve business performance with a return on investment. Another business unit is centered on creative and sustainable solutions for businesses looking to reduce the environmental impact of their industrial activities. As of our Montreal base, we carry out the majority of testing, where most of our Halls testing are located. Furthermore, in 2014, we launched a service supplying strategic intelligent information for new markets using international SH codes. These codes provide transparency to import and export volumes, regulations, and help in the identification of markets for new products; we are marketing this service to the aerospace industry. CRIQ's aim in the aerospace industry is to find help companies find a solution; be it in-house or outside consultation, utilizing its plethora of expert partners.

Can you elaborate on CRIQ's three different emphases within the aerospace sector: research and development (R&D), certification and testing, and advisory services?

Within our R&D work, we invest in partnerships with a company by offering our expertise free to develop product innovation, creating a generic product that can be licensed to other companies within different sectors. Within our area of certification and testing, we have the facility dedicated to compliance testing of products in hostile environments, which includes: vibrations and shocks; climate; altitude; and rapid decompression. Our advisory services provide expertise and consultation for companies looking to enter export markets.

What products has CRIQ developed through its R&D initiatives for the aerospace industry?

CRIQ does not design products for another company; it assists in product development. For example, our tire inflation protection system (TIPS), which was originally for the mining industry: we have since used our expertise to adapt TIPS to suit the aerospace industry. To hasten product development, there are occasions when we seek outside assistance for more comprehensive expertise. Looking forward, CRIQ will focus its efforts on the reduction of aircraft engine-emissions for cleaner air; this is especially important in residential areas.

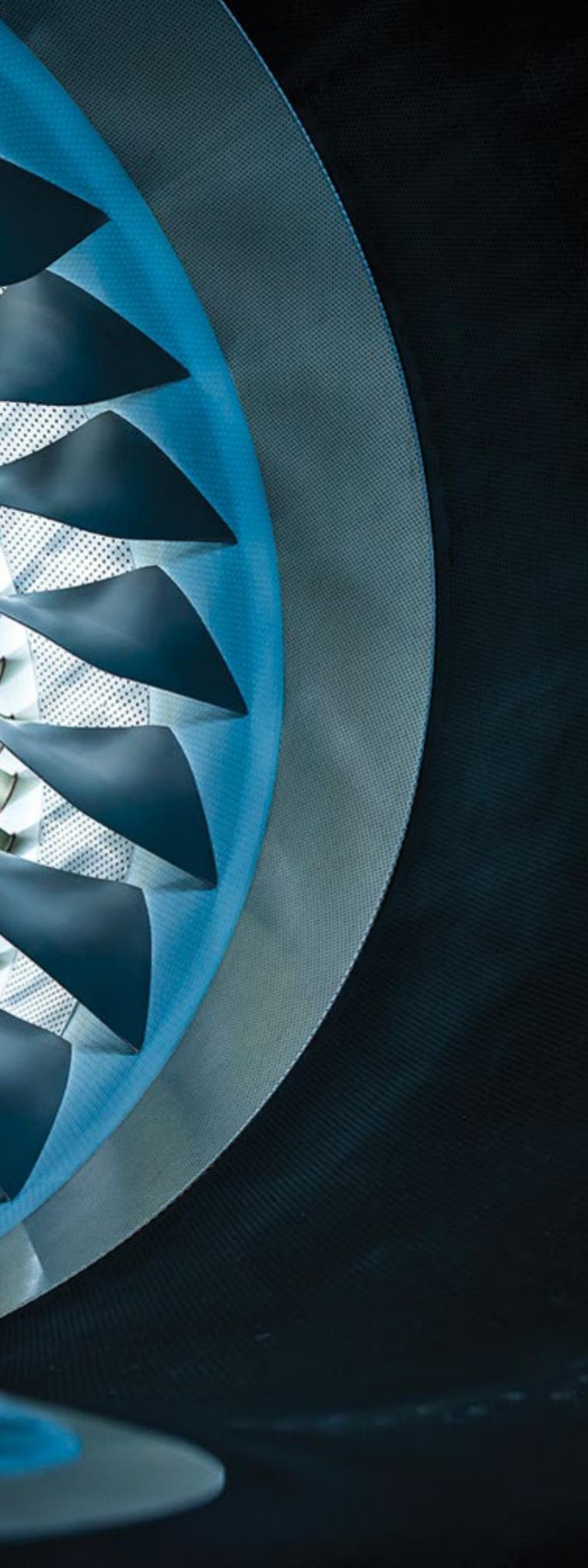
What is the typical profile of companies that CRIQ works with in the aerospace industry?

The vast majority, 98 percent of our work, is with companies located within the province of Quebec. With that said, our testing facilities are also available to companies outside the province. Overall, the companies that we work with vary from small to large in scope.

CRIQ is in the process of developing its 3D printing capabilities. Can you elaborate on this process and the potential it holds for the aerospace industry?

CRIQ has a mandate from the government for implementing and coordinating the new Quebec 3D Printing Network; the company will foster ownership and use of the technology as 3D printing has limitless applications. Furthermore, the Standards Council of Canada (SCC) mandated the Bureau de normalization du Québec (BNQ) to form and lead the Canadian mirror committee to develop and support the Canadian positions on various issues regarding the development of international standards for additive manufacturing by the International Organization for Standardization (ISO) committee ISO/TC 261. Albeit the aerospace industry is leading the charge for its desire in this technology, 3D printing is an application that will come to the forefront of supporting manufacturing profitability in the future. •





COME TOGETHER ORIGINAL EQUIPMENT MANUFACTURERS



“Our top priority for the next several years will be translating our investments into sustainable bottom-line results.”

- Alain Bellemare
President and CEO,
Bombardier Inc.

THE BIG FOUR

Drivers of Quebec's Aerospace Cluster

- The foundation of Quebec's aerospace cluster is built upon four corners: Bombardier, Bell Helicopter, Pratt & Whitney Canada (P&WC), and CAE. Each with distinct focuses, these original equipment manufacturers (OEMs) develop products that shape the global aerospace industry.

Bombardier is considered to possess the world's most comprehensive aircraft portfolio, which includes business and commercial jets and specialized and amphibious aircraft. It ranks among the world's largest aircraft manufacturers and seeks to bolster its position with the upcoming entry of its CSeries commercial jet and Global 7000 / 8000 business aircraft.

Bell Helicopter is a world-leading manufacturer of rotary wing aircraft; its operations in Mirabel, Quebec are dedicated to producing the majority of its commercial helicopter lines. It was the first manufacturer to obtain certification for commercial helicopters, and since the opening of its Mirabel facility in 1986, has brought over 4,400 helicopters to market. Its investment in three new aircraft programs, including the light-class Bell 505 Jet Ranger X, super-medium class Bell 525 Relentless, and V-280 Valor for the U.S. Army's Future Vertical Lift Program, will reinforce its position as a global leader in the helicopter market.

P&WC is on the leading edge of engine technology. Its products address contemporary trends of reducing aircraft fuel consumption, noise, and emission levels. Throughout its 87-year history, it has produced over 80,000 engines, of which 50,000 are still in service, for a range of aircraft that include business jets, regional airliners, helicopters, and military aircraft.

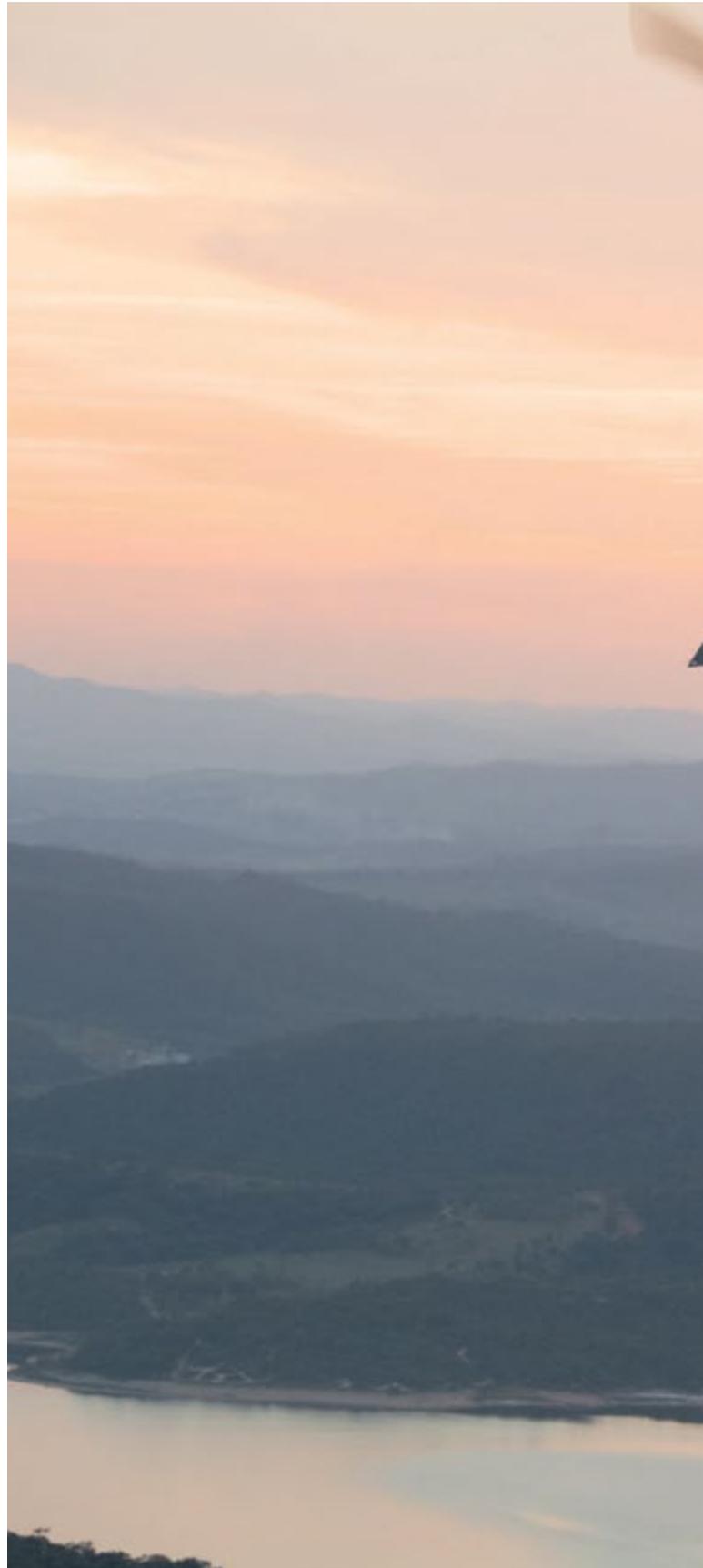


Image: Bell Helicopter Textron Canada



Image: CAE



CAE is a global champion of flight simulation. In 1982, CAE developed the first simulator to receive Federal Aviation Administration (FAA) approval for commercial aircraft, which had a transformative impact on safety measures within the aerospace industry. Since its inception, the company has designed more than 45 innovative simulators for various types of aircraft, has delivered over 2,000 around the world, and continues to incorporate cutting-edge technology in simulators for the aerospace industry's newest aircraft platforms, such as the Airbus A450, the Bombardier CSeries and Global 7000 / 8000. Complementing its simulators, CAE has cultivated a global network of 67 centers and flight schools that train over 120,000 pilots each year.

As world leaders in their respective fields, Quebec's OEMs have complementary specializations that lay the foundation for the

local aerospace industry's breadth of expertise. Indicative of their latest products, these players must continually invest in research and development (R&D) initiatives to sustain their presence in the global aerospace industry. "In every aspect of our business we are innovating faster and in more ways than ever before. Wherever you look, our industry is being challenged by the emergence of new technologies and game-changing improvements, all pushing us beyond the boundaries of our traditional operating models," said Raymond Leduc, president of Bell Helicopter.

As drivers of innovation, OEMs constitute the lion's share of Quebec's annual C\$700 million expenditure on aerospace R&D. In only the last 10 years, CAE has invested over C\$1.2 billion in R&D initiatives, while over the next 4.5 years P&WC has committed to spend C\$1 billion.

The seeds of these R&D efforts are flour-

ishing as innovation is rampant within Quebec's aerospace cluster. Bombardier's upcoming CSeries commercial jet is expected to deliver a 20 percent fuel burn advantage while operating at a 15 percent reduced cost compared to other aircraft in its class. Bell Helicopter plans to integrate fly-by-wire technology, a staple in the fixed-wing community but otherwise not applied to rotorcraft, in its newest helicopters. The incorporation of fly-by-wire technology in helicopters is viewed as a game-changer. "It poses enhanced safety, performance, and reliability benefits," said Leduc of Bell Helicopter.

Maria Della Posta, senior vice president of Sales and Marketing of P&WC, said: "Investments in R&D and a willingness to push the boundaries is critical." A focus on applied R&D efforts have enabled P&WC to expand from a single-engine product family to a 13-engine family today.

Quebec also benefits from a collaborative network of research institutions and universities. CRIAQ, an industry led consortium, has undertaken 110 R&D projects valued at C\$107.6 million. Serving as a bridge between academic and industrial sectors, CRIAQ projects assist OEMs in shouldering the burden of costly pre-competitive R&D efforts, while preparing the next generation for careers in aerospace. OEM participation in CRIAQ projects is extensive with P&WC and Bell Helicopter having participated in 26 projects and 19 projects thus far, respectively. CAE has partnerships with 20 universities and research centers in Quebec. "Through the concerted development of collaborative R&D programs, the local aerospace industry has gained credibility and visibility while developing a talent pool for the future," said Marc Parent, president and CEO of CAE.

While innovation certainly plays a critical role in shaping the competitive edge of OEMs, it is also crucial to translate these efforts into bottom line results. In an effort to enhance quality and drive down costs, OEMs are taking steps to increase the competitiveness of their local supply chains. In an effort to spur supplier development, Aéro Montréal, an inclusive association of industry members, instituted the MACH initiative in 2011, which serves as a framework for encouraging the continual improvement of local suppliers.

The MACH initiative is based upon three principals: to create an improved business culture for more openness, collaboration, and innovation; to improve supply chain competitiveness, one company at a time; and to develop new local integration capabilities. Although OEMs and tier-one integrators have long established their own supplier development programs, the MACH initiative serves as a comprehensive benchmarking system that consolidates aspects of each preexisting program. There are currently 40 companies participating in the program, with plans to scale its membership up to 50 by spring 2015.

Given the transition that is currently underway in which OEMs are displaying a heightened tendency to work with robustly integrated suppliers, the MACH initiative creates a transparent and collaborative environment for suppliers to develop their capabilities in accordance with the needs of OEMs. •

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Alain Bellemare

●●● President and CEO
BOMBARDIER

●●● **As one of the world’s leading aircraft manufacturers, Bombardier plays a significant role in driving the dynamics of Québec’s Aerospace Cluster. How has Bombardier’s relationship with Québec’s aerospace supply chain evolved over the past decade in support of its position within the global aerospace industry?**

At Bombardier, we value our supplier relationships because we know that their capacity to deliver world-class products efficiently and at a competitive cost is a condition of our success.

In Québec, we have been a main sponsor and key mentor of the MACH initiative from Aéro Montréal, since it was launched in 2011. The MACH initiative provides training, continuous improvement and business development support to Québec aerospace suppliers. It focuses on three main priorities: excellence in leadership, excellence in operations and excellence in planning and human resource development.

In addition to helping local suppliers scale up, we also support them in expanding their customer base. For instance, we share information on our own supplier base, we communicate our procurement strategies through active participation in industry associations and we encourage our suppliers to contact other aerospace companies in order to generate new business opportunities.

What steps need to be taken by players across the local aerospace value chain in order to bolster the province’s global competitiveness?

A first step would be to better understand new trends in aerospace manufacturing and the evolving requirements of original equipment manufacturers. In parallel, local players should continue to focus on quality, productivity and cost-competitiveness. This can be done through investments in automation to develop their capacity to manufacture more complex products or the implementation of Lean techniques to reduce waste. Another crucial step is to study market dynamics to determine how they should position themselves in this new competitive landscape where emerging players are a force to be reckoned with.

Last year, Bombardier announced a significant restructuring of its aerospace division, segmenting its activities under three business units: Business Aircraft, Commercial Aircraft, and Aerostructures and Engineering Services. What was the strategic rationale for this shift?

The July 2014 reorganization was all about getting more focused on execution. We put in place a lighter, nimbler structure that will give us more transparency across the company, allowing us to more readily identify and remove obstacles to operational efficiency. This will improve our capacity to answer current challenges and evolving customer needs, as we will adjust more quickly. The new structure will also position us to fully benefit from the tremendous growth potential associated with the upcoming entry into service of our new products: the CSeries commercial jet, the Global 7000 and the Global 8000 business aircraft.

Additionally, the Aerostructures and Engineering Services business segment will enable us to further market our expertise in this field to the aerospace industry, thus generating new revenues. Aerostructures and related aftermarket services currently represent a

\$60 billion market, with forecasted annual growth of 3 percent until 2023. We want to capture a larger share of that market and we have the right tools to succeed, following our recent investments in advanced composite and metallic aircraft structures, including fuselages and wings.

Over the next 20 years, commercial aviation forecasts predict delivery demand orders of 13,100 new aircraft for the 20-149 seat market segment. How will Bombardier utilize its entirely new designed CSeries, CRJ Series, and Q-Series aircraft to capitalize on this market potential?

The CSeries aircraft was designed specifically for the 100- to 149-seat market, which is expected to generate delivery demand for 7,100 aircraft worth \$465 billion over the next 20 years. It provides operational flexibility, being able to take off on shorter fields and benefiting from an extended range compared to competitors in the same category. Most importantly, it offers a 20 percent fuel burn advantage and a 15 percent operating cost advantage over in-production aircraft in its class. The arrival of this new-technology, clean-sheet aircraft will challenge previous-generation aircraft, enabling us to capture a significant portion of the demand in this segment.

The CRJ regional jet family is uniquely positioned to match market demand within the 60- to 99-seat segment, which will see substantial growth from 2014 to 2033 with delivery demand for 5,600 aircraft worth \$185 billion. The CRJ NextGen aircraft is already recognized for its cost leadership due to its optimized aerodynamics and engine thrust, its lightweight design and its low maintenance costs. Our vision is to make it even more competitive, thanks to additional improvements that should result in a double-digit fuel burn reduction by 2020.

In the same segment, the Q400 NextGen aircraft now offers superior capacity with up to 86 seats, true dual class experience and a new cargo-passenger “combi” variant launched last year, which allows airlines to maximize revenue. With the lowest seat-mile costs in the short-haul regional market and jet-like speed, the Q400 NextGen turboprop is best suited to replace 20- to 59-seat aircraft and should remain a market leader in the 60- to 99-seat segment.

Overall, Bombardier’s CSeries, CRJ Series, and Q-Series commercial aircraft provide the company with solid long-term prospects. •



Raymond Leduc

●●●
President

**BELL HELICOPTER TEXTRON
CANADA**

- **Bell Helicopter established its operations here in Mirabel in 1986 and now produces the majority of Bell's commercial helicopter lines. Can you talk to us about the role of Bell's Mirabel facility in its overall global operations?**

Mirabel is home to Bell Helicopter's largest commercial assembly facility. Today we cover 660,000 square feet on 152 acres of land, and are equipped with two runways and a control tower. Since we first opened our doors here in Mirabel, we have produced some 4,400 helicopters. We have a fleet size of more than 900 commercial aircraft used by more than 300 operators in the region. We export nearly 95 percent of our products, so the helicopters we assemble in Canada truly end up across the globe. We have a strong product portfolio and see a significant and vital role for our Mirabel plant in the years ahead.

These 429 models will replace the Coast Guard's existing BO-105 fleet. How will

these new state of the art helicopters improve the operations of the Canadian Coast Guard?

The Canadian Coast Guard deserves the best equipment available, and we are honored to provide them with that. These men and women fly incredibly varied and important missions on our behalf every single day and work hard to protect all of us here today. They have desperately needed modern aircraft designed to operate safely in some of the harshest flying conditions on the planet and now they have it with the Bell 429. The Bell 429 gives the Canadian Coast Guard the most-advanced light twin helicopter in the world certified by the latest airworthiness safety regulations. Now, they have true single pilot instrument flight rules, outstanding single engine performance, and the ability to carry more, travel faster, and stay in the area longer and, most importantly, return from each mission safely. In addition to all of these great performance characteristics, the Coast Guard gets the best product support possible. Bell Helicopter has been recognized for two decades as the top-rated customer service and support OEM in the world by Professional Pilot Magazine and other third parties and we take this rating very seriously. We have a strong team of dedicated professionals ready to support the full lifecycle of every helicopter we make.

In November 2014, Bell completed the maiden voyage of its 505 Jet Ranger X in Mirabel to much acclaim. Describe this new aircraft and your expectations for it?

The Bell 505 Jet Ranger X will be the most cost-competitive, capable light helicopter in its class. By working with our partners like Turbomeca and Garmin, the Bell 505 will bring customers safety enhancements like a dual-channel FADEC with a backup and a standard glass cockpit with fully integrated avionics to increase pilot situational awareness – all wrapped around a proven rotor and drive system. First and foremost it was imperative that we understood exactly what our customers needed. Who better to tell us than the people who are flying the aircraft every single day? Enter the Customer Advisory Council (CAC). The Bell 505 was driven directly by feedback and input from our customers, who required a high performance helicopter that delivers superior value and at a competitive price. The Bell 505 is a direct outcome of listening to and acting upon what the CAC told us. The first flight

of the Bell 505 Flight Test Vehicle 1 (FTV1) exceeded our expectations, and the aircraft performed beautifully. We could not be more excited about this major milestone and look forward to delivering the high-performance, high-value aircraft our customers have been asking for. We now have close to 300 letters of intent for the Bell 505.

Reignwood, a Chinese enterprise recently committed itself to purchasing sixty 505 Jet Ranger Xs for travel and tourism purposes. How important are the Chinese and Asian markets for Bell Helicopters?

As China's airspace continues to open to commercial aviation, helicopter deliveries will continue to climb. China has one of the fastest growing civilian helicopter fleets in the world. We are on the right path towards great opportunities ahead with our innovative products, such as the integrated glass avionics system offered across all of our current product line. From an overall industry standpoint, we expect continued investment in training schools and training school aircraft in China, as there remains a lack of instructors, pilots and maintainers. Economic growth will continue to drive demand for helicopter transportation, especially in the corporate/VIP segment. China's investment in helicopters that provide governmental services, including disaster relief, should continue. Asia is a huge and highly diverse region, with its rotorcraft infrastructure in varying stages of maturity across the region, but also very competitive.

What does Mirabel and Montreal have to offer to major aerospace manufacturers like Bell Helicopters?

In addition to airframe design, product development, composite manufacturing, integration, and product support, our facility in Mirabel also performs flight-testing and certification. The combination of our world-class facility with the talent pool in the region makes for great opportunities. Our employee's passion for innovation, their commitment to quality and engagement in providing the best support has been essential to our success here in Canada. There's an incredible amount of talent in the region and there are several high level academic institutions that we have really great relationships with. Additionally, we have a Textron leadership development program where recently graduated students can move through various Textron divisions. We are committed to attracting the best and brightest to Bell Helicopter. ●



Maria Della Posta



Senior Vice President
PRATT & WHITNEY CANADA

- **Founded in 1928, P&WC is recognized as a global leader in aerospace for its high-technology engines. To begin, walk us through the evolution of P&WC and describe any recent milestones that have contributed to its current positioning within the global aerospace industry.**

For over more than 85 years, P&WC has produced over 80,000 engines, more than 50,000 of which are still in service with 10,000 operators in 200 countries. P&WC's engine fleet, powering business jets, general aviation and utility aircraft, regional airliners, helicopters, and military aircraft, has accumulated more than 650 million flying hours. P&WC has built one of the most comprehensive support networks in the industry, including service centers around the world, strategically located field support representatives and mobile repair teams, 24/7 Customer First Centers and a rapidly expanding offering of online customer services. Every second, a P&WC-powered aircraft takes off

or lands somewhere in the world. P&WC's engine families have grown to 13, allowing the company to make major inroads into all the markets mentioned above.

At the same time, the company transformed the way it developed, manufactured and supported its products, adopting leading techniques, such as LEAN and Achieving Competitive Excellence (ACE) operating systems to gain step changes in productivity and quality. These changes were accompanied by the acquisition and opening of facilities in Poland, China and elsewhere to enhance access to new markets and benefit from global talent. P&WC's development programs are also supported by substantial investments in R&D and advanced manufacturing technologies, as well as innovative engine demonstrator programs and collaborations with leading universities, research centers, suppliers and partners. P&WC is committed to leveraging advanced technologies for a new generation of engines, including the next-generation regional turboprop (NGRT) and the PurePower® PW800. We are also continuing to enhance the performance of the PT6, still the most popular engine in its category after half a century. At the heart of P&WC's success are its dependable people and its drive to continually improve and reinvent itself.

Over the last 10 years, P&WC has invested an average of \$450 million in R&D initiatives. In the coming years, how will P&WC focus its R&D efforts in order to sustain its presence as a world-leading engine manufacturer?

P&WC focuses its research on an array of disciplines, such as aerodynamics, materials, combustion, cooling and acoustics. There is an increasing focus on computational design methodologies as a technological development in their own right because these allow the design of products that make the best use of P&WC's technology portfolio. At the same time, there is an effort to develop manufacturing processes that reduce production costs as this allows P&WC to offer more sophisticated engines at competitive prices. Sustainability is a key driver of its innovation efforts. P&WC's priority is to continue to offer engines with game-changing reductions in fuel consumption, noise and emission levels; and to manufacture and service them using sustainable processes and more ecological materials. Ensuring that its products are designed, produced and operated while minimizing environmental impacts

throughout their life cycle is a top priority.

In this regard, P&WC's latest R&D programs include cutting-edge materials such as composites and advanced alloys to improve engine weight, a high-efficiency compressor technology to enhance engine performance and reduce fuel consumption, and further improvements to combustion systems, to reduce engine emissions. P&WC's sustained R&D investments enable the company to continue to develop the next generation of small, medium and large turbofans, turboshaft and turboprop engines.

Over the next five years, P&WC will invest in the development of new technologies, including: the development, evaluation and certification of new materials, including composites, high strength alloys and coatings to reduce engine weight (a lighter engine results in lower fuel consumption); the design and development of new high pressure, high efficiency compressor modules to enhance engine performance and help reduce fuel burn; the development of combustion system technologies to further reduce engine emissions to levels significantly below the expected upcoming regulations; noise reduction technologies; and advanced manufacturing technologies including technologies required for intelligent cells.

Please provide our international readership with a final message related to P&WC.

This capacity to innovate, both from a technology and business perspective, has enabled P&WC to grow from a single-engine product family, the PT6, to 13 engine family today, with an estimated 25,000 new engines set to enter the market by 2020. P&WC's sustained commitment to innovation will help the company to continue to offer engines with game-changing reductions in fuel consumption, noise and emission level – and to manufacture and service them using sustainable processes and material. P&WC is also investing in enhancing its customers' experience in the aftermarket. The overriding objective is to offer them reliable and responsive services, anticipate their needs and provide them with tailored solutions. For over more than 85 years, P&WC has developed one of the best engine and service portfolios and loyal customer bases in the industry. P&WC's team is now focused on preserving this remarkable legacy and market leadership while building the future for generations ahead. •



MP



HVG

Marc Parent & H el ene V. Gagnon

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MP: President and Chief Executive Officer
HVG: Vice President, Public Affairs and Global Communications

CAE

- **Founded in 1947, CAE is a global leader in modeling, simulation, and training for civil aviation and defense industries. To begin, provide us with a brief history of CAE and describe any recent milestones that have shaped its presence in the global aerospace industry.**

CAE was founded in Montreal in 1947 by Ken Patrick, an ex-officer of the Royal Canadian Air Force. His vision was to create an innovative company focused on technology. CAE received its first ever simulator contract in 1952 from the Canadian Defense Forces. In the following years the company obtained more simulator orders from defense forces, including NATO, as well as contracts from airlines. The 70s were important for the growth of our company, world airlines were hit hard by fuel shortages and environmental concerns so they turned to simulation to train their flight crews. In 1982, CAE reached an important milestone, its Boeing 727

simulator for United Airlines became the world's first commercial simulator to receive a new FAA (Federal Aviation Administration) approval – it meant that it was so realistic that all the training could be done in the simulator. That was a major breakthrough for the industry and for safety.

By the end of 1990s we became the global champion of flight simulation – for both civil and military aircraft and decided to enter a much bigger market: training. We opened our first training centers in the early 2000s. Today, we operate 67 training centers and flight schools and train more than 120,000 pilots every year. Our customers come from 190 countries and include more than 3,500 airlines, aircraft manufacturers and operators as well as the defense forces of more than 50 nations.

In 2009, we decided to leverage our simulation and training expertise in a new and growing market, health care. In just five years we became the world leader in simulation technology for healthcare with more than 9,000 simulators in operation worldwide.

How have the capabilities of Quebec's Aerospace Cluster contributed to CAE's ascendance within the global aerospace industry?

CAE's history and success are closely tied to the growth of the aerospace industry in Quebec and Canada. In addition to major aerospace companies like Bombardier, Pratt and Whitney Canada, Bell Helicopter, to name a few, Montreal has more than 200 small and medium-sized firms that make components and parts and provide services to major manufacturers. Their success is vital to our success. And that's without counting international organizations like IATA and ICAO that are based in Montreal and that add great credibility to our city as a key aerospace player.

How many simulators has CAE sold worldwide; what is the range of flight simulators that CAE is currently developing for new aircraft platforms; and what will be some of their key features?

I'm very proud to tell you that the majority of commercial pilots flying around the world have either trained in one of our centers or on simulators designed and built by CAE in Montreal. As a matter of fact, we've delivered over 2,000 simulators and

training devices around the world, which is the lion share of our industry.

We have designed world's first simulators of more than 45 aircraft types, from the world's smallest business jets to the world's largest airliners like the Airbus A380. Most recently, we developed training solutions for the Airbus A350, Bombardier's new CSeries and Global 7000, 8000 business jets. For the military, we are jointly developing with Boeing the simulators for the U.S. Navy's new maritime patrol aircraft, the P8 Poseidon, and we are part of a team for the sales of the U.S. Navy's MH-60R naval helicopter.

What is CAE's strategy for expanding its global presence in these regions?

CAE has a well-established position in emerging markets. We have been active in India for over 40 years, in the Middle East, South East Asia and Latin America for more than 30, and in China for 25.

A key tenet of our strategy is establishing partnerships with our customers and having our people work on the ground, next to our customers, speaking their language, living their culture. In Dubai for example, where we train more than 10,000 pilots a year, we have a 13-simulator center with our partner Emirates and we opened a second center last year. Another example is China where we operate one of the largest centers with our partner China Southern; it is equipped with 24 simulators and more than 20,000 pilots train there every year.

This year, we are proud to have signed a joint venture agreement with Japan Airlines to provide flight crew training services across Northeast Asia. As part of the agreement, the airline will conduct all its training at the CAE-JAL joint venture. We are also proud to have renewed our long-term outsourcing agreement with Iberia for another 10 years and to have formed a new joint venture for pilot training services with China Eastern Airlines. •





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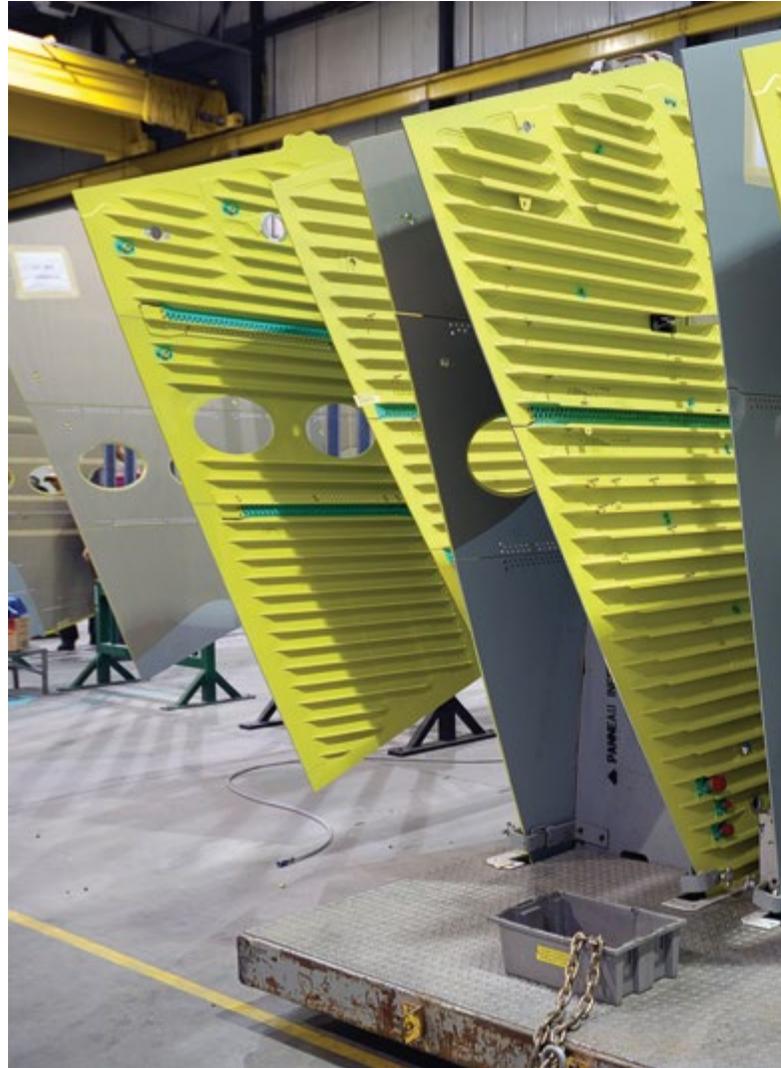
“L-3 MAS is able to take an entire aerostructures package, design it, provide proof of concept, and manage the entire production process from sourcing, including manufacturing in-house to final assembly.”

- Jacques Comtois
Vice President and General Manager,
L-3 Communications MAS

THE CONSOLIDATION OF QUEBEC'S AEROSPACE SUPPLY CHAIN

Suppliers and the Path towards Integration

Image: Sonaca Montreal



●● Globally, aerospace supply chains are undergoing a period of considerable transition. In the past, prime contractors relied upon an extensive network of integrators and sub-tier suppliers to feed their final assembly lines. This relationship is changing, though, as OEMs are taking concerted efforts to consolidate their base of suppliers, displaying a heightened tendency to grant long-term contracts, almost exclusively, to large-scale suppliers with robust capabilities. As the direct channel between prime contractors and sub-tier suppliers weakens, integrators have emerged as the primary conduit linking these groups together.

Quebec's aerospace cluster benefits from a suite of roughly 15 diversely specialized integrators. This class of supplier has expertise in complete systems installations in fields as varied as aerostructures, avionics, cabin interiors, engines, and landing gears. An array of sub-tier suppliers supports these activities by engaging in distinct niches of manufacturing and sub-assembly. Given the industry's transition towards consolidation, it is becoming increasingly important for suppliers to demonstrate an integrated supply chain with comprehensive capabilities. Accordingly, suppliers within Quebec's aerospace cluster are investing in process improvements and considering avenues of organic growth, acquisition, and partnership in an effort to bolster their

capabilities as competitive suppliers within the local and global aerospace markets.

With the emergence of low-cost manufacturing centers abroad, it is critical that suppliers refine their manufacturing processes while developing value-added capabilities. Supplier development programs, such as Aéro Montréal's MACH initiative, encourage suppliers to adopt best practices while providing a framework in which they can monitor their continuous improvement. The MACH initiative also sparks collaboration and innovation within the local supply chain, leading to the further development of integrators and sub-tier suppliers that are better equipped to address the needs of the industry's prime contractors.

While suppliers are taking strides to refine their processes, it is equally important that they expand their capabilities. "Major players are looking to work with suppliers that are financially credible and able to share risk," said Hugue Meloche, president and CEO of Meloche Group.

This train of thought is pervasive amongst sub-tier suppliers and has triggered their goal of climbing the aerospace value-chain through vertical integration. The development of integrated capabilities is a key determinant of a supplier's ability to provide value-added solutions. At the apex of vertical integration is de-



sign capabilities; a segment exclusive to the industry's most robust suppliers. Chris O'Neill, president and chief operating officer of Mecaer America, said: "Everyone within the industry talks about design-integration, yet there are few companies in Quebec that have successfully moved from manufacturing into design."

Sub-tier suppliers that typify this call to action include Meloche Group and NSE Automatech. The former was initially a machine shop that entered the aerospace industry less than 10 years ago, and has since integrated its capabilities to include engineering, special processing, and sub assembly, NSE Automatech, meanwhile, undertook significant investment in the construction of a new facility and has expanded its offerings in machining, surface treatment, electrical integration, and sub-assembly. "If you want to grow in the aerospace industry," said Christian

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Delisle, president of Electro-Kut, "you have to develop these capabilities." Accordingly, Electro-Kut has integrated sub-assembly capabilities within its machining operations.

Quebec's suppliers have also explored acquisition as an avenue of integration: Avior Integrated Products expanded its portfolio of value-added solutions by acquiring companies specialized in machining and mechanical assemblies; Alta Precision became a stakeholder of Tekalia Aeronautik, a special processing shop, to incorporate this process within the production of its landing gear components; and Héroux-Devtek has touted its interest in acquiring complementary manufacturers that have strong intellectual property rights in order to strengthen its profile of landing gear offerings.

Another way in which suppliers expand their capabilities is through partnership. Collaboration is rife within Quebec's aerospace cluster. According to Charles Magnan, vice president sales and engineering of Mecachrome: "Tier-ones and OEMs are constantly questioning the supply chains of their partners."

Recognizing this as the case, suppliers seek to leverage the unique capabilities of partners by consolidating their offerings to attract larger contracts. To this end, Mecachrome frequently partners with Sonaca Montreal and Group Meloche for their capabilities in finishing and small component manufacturing, respectively.

Commenting on the unique role of partnership within the local aerospace industry, Jacques Comtois, vice president and general manager of L-3 MAS, said: "Quebec's aerospace cluster is uniquely positioned in the global aerospace community. It is

highly integrated and its members embrace this approach. While we might compete against each other for a contract, we can easily become partners on another contract."

Despite the dynamic composition of Quebec's aerospace cluster, suppliers will need to continue to focus efforts on R&D in order to sustain their competitive edge in the global market. Commenting on this trend, Solange Fresneau, vice president of TechFab, said: "R&D will be what differentiates us from emerging low-cost markets."

Automation in particular will play a critical role as Quebec's suppliers seek to distinguish themselves from low-cost competitors abroad. General Electric Bromont has led the vanguard for incorporating automation into its manufacturing processes, beginning in the late-1990s. Today, it has over 120 robots installed to undertake repetitive tasks and otherwise at-risk, non-ergonomic movements. "This has led to sustained productivity increases in excess of 7 percent annually," said Alain Ouellette, director of robotization of General Electric Bromont.

Zodiac Aerospace collaborated with Montreal-based AV&R and Excel Finishing Product to develop a robot for automatic sprayer finishing.

As the global aerospace industry is transitioning to favor consolidated supply chains, comprehensive suppliers, and advanced manufacturing practices, Quebec's aerospace cluster has evolved in stride. The capacity of local suppliers to adapt to the expectations of prime contractors reaffirms Quebec's position as one of the world's leading hubs for aerospace activity. •

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AEROSTRUCTURES

Greater than the Sum of its Parts

- The field of aerostructures includes all of the parts that comprise an aircraft's fuselage, wings and flight control, representing one of the largest component groupings of an aircraft. Due to the expansive nature of aerostructures, OEMs commonly rely on an array of suppliers with distinct specializations for an aircraft's complete assembly. Noted for its comprehensive supplier ecosystem, Quebec's aerospace cluster is home to many world-leading manufacturers of aerostructures.

As the aerospace industry has progressed alongside technological advancements, the field of aerostructures is undergoing a transformation in its use of materials. "In recent years the industry has shifted away from solely using aluminum, to a mix of aluminum, composite, and titanium," said vice-president and general manager of RTI Claro, Christian Sauv . RTI Claro is well equipped to address market demand for titanium, as it is a subsidiary of RTI International Metals, a specialist in this form of metallurgical technology.

Within the field of aerostructures, the use of composite materials in concert with titanium is becoming increasingly more prevalent. Avior Integrated Products is attuned to this trend given its expertise in the field of hybrid lightweight aerostructures. The company's knowledge of composites has allowed it to influence the material selection and component design prestigious platforms such as Boeing's 787.

A variety of domestic and multinational suppliers add depth to the range of aerostructure expertise in Quebec's aerospace cluster. Mecachrome, a well-known player in the European market, established itself in Canada with the mandate to exclusively develop its work in aerostructures, while Sonaca Montreal—part of the Belgian Sonaca Group—moved to Que-

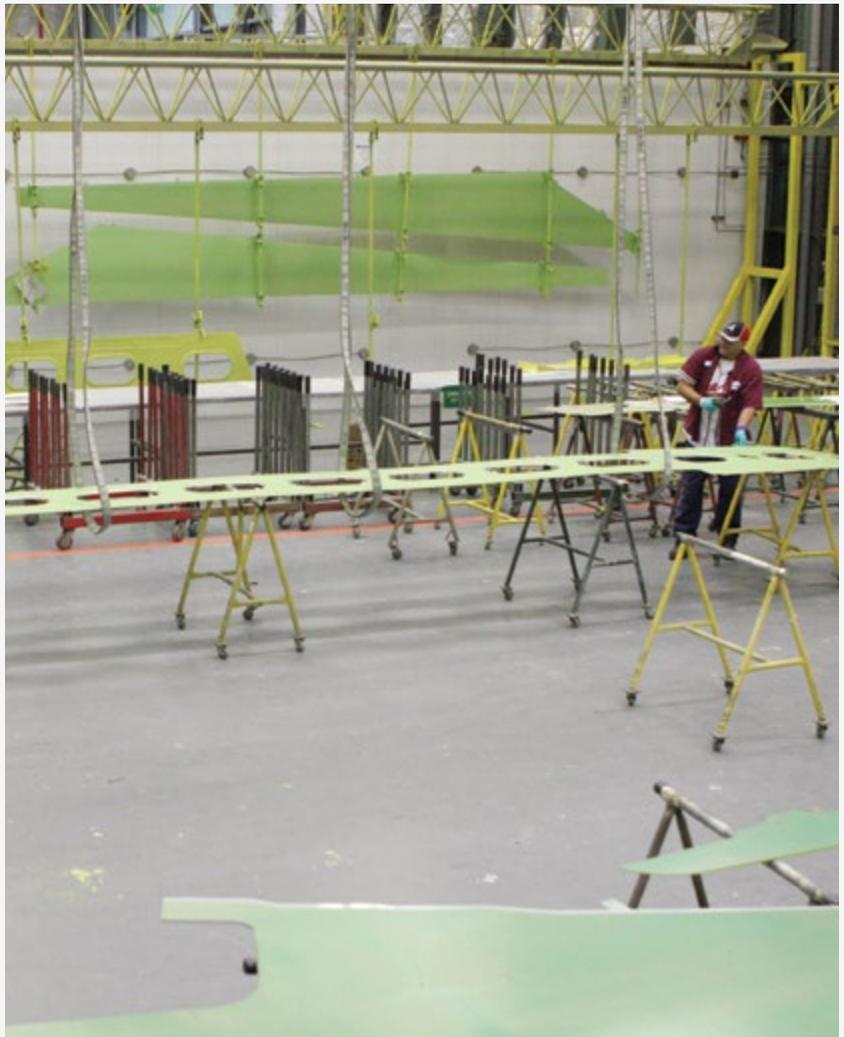


Image: Sonaca Montreal

bec as a world leading manufacturer of wing skins. According to Sylvain B dard, CEO of Sonaca Montreal, its facilities are unique in Canada: "It is the only place in the country capable of manufacturing long and complex aerostructure parts, which can be up to 60 feet in length."

Other players are also eager to enter Que-

bec's aerostructure market. Over the last five years L-3 MAS, known for its work in the military market, has expanded its activities to include complete aerostructure design and fabrication packages. The diverse aerostructures expertise within the cluster helps Quebec's aerospace industry stand out on the global stage. •



Jacques Comtois

●●● Vice President and General Manager
L-3 MAS

●●● **Although L-3 MAS was founded in 2003, its history dates back much further. To begin, please provide us with a brief overview of the establishment of L-3 MAS and its presence in Quebec.**

L-3 MAS was created when its parent company, L-3 Communications (L-3), acquired Bombardier Defense Services in 2003. Bombardier Defense Services was a specialist in the in-service support of the CF-18, a focus that remains at the core of L-3 MAS' operations today. A key milestone for L-3 MAS was the acquisition of the CF-18's data package, which allowed us to modelize and develop repair capabilities for the life extension of the aircraft. Consequently, over the last 27 years L-3 MAS has positioned itself as a world leader in terms of experience, knowledge, and skill on the F/A-18 aircraft maintenance and life extension.

In the last five years, L-3 MAS began to

diversify its portfolio of activity, entering into the commercial aerostructures and aircraft services market. What was the rationale for this move and what solutions do you provide this market today?

We have known for some years that the F/A-18 was approaching the end of its service life, which would cause significant gaps in our business volume. Consequently, we needed to leverage our core strengths and diversify our business portfolio. Our expertise was in aircraft structures for the military market, so we decided to apply this know-how to the commercial aerostructures and aircraft services markets. We began in 2009 with a contract for Pratt & Whitney Canada to design, manufacture, and certify a test pylon for one of its new engines, to be adapted to its flying test bed. Initially, this was a challenge for our engineers to design a new structure, but it fell in line perfectly with our expertise. We have one of the biggest engineering departments in Canada, close to 200 engineers and technologists; this, coupled with the knowledge of maintaining aircraft structures for 27 years, has allowed us to develop maintenance tools, robotics, and strong engineering expertise. Furthering our move into the commercial aerostructures and aircraft services market, we recently opened a facility in Mexico, which enables us to manufacture at a very low cost. This is how we can distinguish ourselves in the market today: we have engineering power in Quebec, the L-3 name, and low-cost manufacturing capabilities abroad.

What type of commercial projects does L-3 MAS concern itself with?

L-3 MAS is able to take an entire aerostructures package, design it, provide proof of concept, and manage the entire production process from sourcing, including manufacturing in-house to final assembly. Some of our projects are for renowned Canadian and international customers and range from a tier-1 role (which could include risk sharing) with large aircraft OEMs to a tier-2 role with local and international customers. When it comes to manufacturing and assembly, it is more difficult to compete with build-to-print specialists, but if our customers want a turnkey product, we can efficiently provide the entire design-to-build solution. Based on this expertise,

within five years we want to be recognized as a leader in the commercial aerostructures and aircraft services markets just as we are in the military market.

What role does research and development (R&D) play in L-3 MAS' overall strategy?

Robotics and technical publications are two core focuses of R&D for L-3 MAS. During our 27-year tenure maintaining the CF-18, we have developed advanced capabilities in robotics, and we are purchasing a new robot this year. These robots are used either for repetitive tasks or to perform precise repairs in very limited spaces. We are also a world leader in technical publications for the aerospace industry. Our Interactive Electronic Technical Manual (IETM) Viewer is compliant to the S1000D specification, the latest and greatest standard for technical publications and also supports other publication standards. IETMs replace written manuals for aircraft maintenance and operations and are accessible through desktops, laptops, and tablets. Our IETM solution provides advanced features, including search capabilities, wire tracing, and interactive Illustrated Parts Breakdowns (IPBs). We develop IETMs for new aircraft and also provide turnkey solutions for the conversion of legacy manuals. Our current IETM Viewer works on Windows tablets and our next release coming out this year will work standalone on iPads. Our next R&D project is to investigate the feasibility of leveraging our IETM technology with augmented reality (Google 3D glasses).

Quebec's aerospace cluster has recently fallen from third to fifth globally in terms of aerospace revenues. What steps need to be taken to ensure that the cluster remains competitive on a global scale?

Quebec's aerospace cluster is very skilled and passionate, but it seems difficult at times to gain traction with the government. While the government realizes the importance of aerospace to its economy, it could do even more to support the industry's growth. R&D incentives are imperative to ensure the cluster's continued competitiveness. Even without direct subsidization or investment, there are many things that the government can do to support the growth of its aerospace industry. •

WAY OF THE FUTURE FOR TECHNICAL PUBLICATIONS

By Brigitte Richer, Technical Writer,
and Anthony Campolini, Technical Lead
L-3 MAS

- The traditional way of producing technical publications has become a thing of the past. Today, customers expect to find information quickly and easily via the Internet or mobile devices like tablets and smartphones. Demand -- always at a lesser cost -- for integration with logistical systems, near real-time updates, and support for newer delivery platforms, is forcing organizations to think outside the older “book-making and printing” technologies. It now involves producing and managing small packets of information that can be shared (sometimes in real time), reused and published on many platforms.

When Claude Dabbas, technical publications supervisor at L-3 MAS, first realized this inevitable change, he quickly saw the potential of the ASD S1000D Specification and grasped the obvious advantages: time savings for end users, cost savings in the authoring process, and interoperability across programs.

“This insight made us rethink our approach, and we convinced our customers to adopt this route for their projects,” said Dabbas. “Today, we have close to 10,000 users on our Interactive Electronic Technical Manuals/Publications (IETM/IETP) on five aircraft fleets. Three of those fleets are fully S1000D-compliant. When we started, there were few organizations in Canada, if any, that were using the S1000D. It’s now the most advanced specification for managing publications in the aerospace industry.”

L-3 MAS has found that partnering with customers can smooth the transition process. Customers realize the importance of following the specifications, including project-specific business rules that complement it, but sometimes have unique issues that need to be carefully resolved.

“This is a common problem we’ve seen multiple times. From our experience, deviations can be detrimental. When following the spec, it will significantly reduce setup and production time and costs, at all levels of the publication process, and improve quality. Working closely with the customer is a key factor to an optimal transition to S1000D,” said Alexandre Cloutier, system developer at L-3 MAS. Like other XML-based markup languages, a single source of structured and modular content is authored and translated once and can be published on all media formats. It reduces the costs associated with authoring and translating each media format individually.

Automating processes is essential to staying competitive. As a result, we have assembled a team of software developers dedicated to developing utilities and tools, which makes it easier to find opportunities for improvement and synergy. In addition, this team has an annual mandate to initiate R&D projects to explore new trends and develop software solutions that benefit from the ever-evolving technologies based on team insights and from process-improvement ideas.

According to L-3 Systems Developer Anthony Campolini, “Some of our main R&D projects have been the creation of our own IETP viewer solution as well as the development of an advanced interactive graphic viewer used for aircraft maintenance (with Intelligent Wiring Support). With the general trend and demand of having mobile application counterparts for every piece of software out there, we are currently migrating our core application to operate across multiple operating systems and devices, while keeping the same general user experience. Being able to work with tablets in the field, where portability is a necessity, and then seamlessly switching to a full desktop computer to resume a working session and vice versa is of great value to users. Mobile and desktop platforms complement each other’s strengths.”

When we look to the future, we currently see two clear paths. The first one is the integration of technical publications with other logistics support disciplines and associated tools. The goal is to establish complete, efficient and cost-effective support strategies for the whole product life-cycle.

“As producers of IETM/IETP viewers and technical publications, we are seeing a clear trend take hold through frequent customer and partner demands for an integrated solution,” said Marie-Claude Brais, manager of technical publications at L-3 MAS. “Organizations are becoming more informed on the subject and supporting specifications are becoming more mature; for instance, S1000D sister specifications S3000L and S1003X. When data can be shared, updated and managed across multiple logistics support disciplines, the benefits of integration by using these specifications become clearer in people’s minds.”

The second path is the demand for mobile IETM/IETP delivery platform support. The ability to deliver IETM/IETP on iOS, Android tablets and smartphones (in addition to traditional PCs), while keeping the user experience seamless, is becoming a requirement we are seeing more often. This requirement is mostly initiated from end users -- especially aircraft technicians -- who know the usability benefits of these new platforms because they have these same devices in their own homes.

Producing technical publications for integration with other logistics disciplines and for delivery on mobile platforms is the new challenge. Technical publication organizations must guide their customers in making their technical content sufficiently granular to be reusable and easily exchanged. The choice of a comprehensive technical publication specification and setting up and enforcing good business rules are key elements for success. Producing technical publications is not what it used to be and organizations must be mindful of the growing demand for newer, Web-based applications support, data integration and ubiquity of mobile devices. •



Christian Sauvé

●●●
Vice-President and General Manager
RTI CLARO

●●● **RTI Claro is a specialist in the field of titanium technologies. What is the significance of titanium and its application to the aerospace industry?**

Throughout the evolution of large aircraft, its composition has grown to include an increasing amount of titanium, a key example being the 787. As aircraft manufacturers strive to identify lightweight solutions, titanium is often paired with composite materials in order to strengthen an aircraft's structural integrity. In recent years, the industry has shifted away from solely using aluminum to a mix of aluminum, composite, and titanium. RTI Claro benefits from the extensive network of its parent company, RTI International Metals, as it is a specialist in titanium technologies. RTI Claro is a fully integrated aerospace manufacturer focused on the production of

medium and large structural airframe components as well as mechanical assemblies, using aluminum and titanium.

RTI Claro recently moved to new facilities. Could you tell us about this move and its key features?

RTI Claro moved into its current 180,000 square foot facilities in mid-2007. The facilities feature state of the art, high-speed five-axis machines, assembly and surface treatment capabilities, in which we continually invest. Our engineers also work with all of the latest software, which enables them to handle 3D models from our OEM customers. Overall, we work with the same tools as the OEMs, but being a smaller company, we are afforded enhanced response time and agility in what we do.

How does RTI Claro differentiate itself from other aerospace manufacturers?

There are many companies in the aerospace sector capable of machining titanium, but where RTI Claro differentiates itself is in its ability to come to the table with complete solutions. From design to assembly, we are a fully integrated company, which allows us to influence the design of our customers' products. We can challenge them to change the raw materials or the manufacturing processes that they work with, and, in some cases, reduce the amount of work and material that goes into transforming our customers' design into finished products. This is an area in which we have a competitive advantage over other companies.

How has RTI Claro performed in terms of recent growth?

Since RTI Claro moved into its new facilities, it has experienced substantial growth. Between 2009 and 2014, we have seen our sales grow tenfold. This has led us to achieve 50 percent annual growth in each of the last two years, a trend that we expect to continue through 2016.

To what do you attribute these strong growth figures?

RTI Claro has developed good relationships with its customers, and consequently, existing customers keep coming back and asking us to do more for them. This has played a significant role in accelerating our growth. We have been lucky to be involved in a number of successful pro-

grams, such as the 787, which has boosted our activity to encompass 10 or more aircraft each month. Looking forward, we want to expand our business and take on new customers. Also, key to our success is our willingness to invest in supporting our customers, and we are currently evaluating what is the next investment that we need to make to continue our growth.

RTI Claro is an active company in Aero Montreal's MACH program. Tell us about your involvement in the program and the role that it plays in strengthening Quebec's aerospace supply chain.

Each OEM has their own custom programs that they use to develop and manage their suppliers. With the MACH program, rather than working on multiple programs in parallel, companies are able to focus on one system that will fulfill the requirements of all of the OEMs. We have found that MACH is a more comprehensive business wide solution than some of the OEMs more focused system. RTI Claro was initially rated as a strong MACH 3 supplier and reached MACH 4 in early 2013. Several months from now, we hope to achieve MACH 5 status.

Over the next three to five years, what are some of your goals, and where would you like to see RTI Claro positioned in the market?

Looking forward RTI Claro wants to further integrate itself and enhance its capabilities to handle more complex and larger assemblies. Titanium offers good growth potential so we will continue developing this side of our business to include areas such as the assembly of titanium parts. We also want to propose solutions to our customers that will reduce the cost of their design and products, and then the next step will be to take design responsibility. The focus will initially be on titanium products because that is where, with RTI International Metals being a fully integrated titanium solution provider capability, we bring a unique expertise. We want the whole RTI Claro experience to be about being able to complete challenging or critical projects that few are able to support to the level desired by the OEMs or Tier I. With this in mind, our short to medium-term goal is to be a high value innovative integrator of products and services to the global aerospace and defense industry. •

Stephen Kearns



President and CEO
AVIOR INTEGRATED PRODUCTS

●●● **Avior Integrated Products was founded in 2002 and has transformed its range of capabilities. Please walk us through the evolution of Avior.**

The genesis of Avior Integrated Products' (Avior) operations was sheet metal fabrication. Over the years, we have developed our position within Quebec's Aerospace Cluster through the expansion of existing operations and the strategic acquisition of companies specialized in machining and mechanical assemblies. Through this expansion, we have developed a more robust product portfolio and became an integrated supplier of lightweight hybrid composite structures and mechanical assemblies. As we developed Avior's product offerings, we also cultivated a strong team of engineers focused on design-to-build processes. This development allowed us to bind our product areas together to provide optimized weight and cost solutions to our customers, and completed our transformation into an integrator.

As Avior completed its integration, what was its first design-to-build project?

Avior's first design-to-build project was in 2005, in which we leveraged our metal fabrication and composite expertise for Honeywell on the A380. Honeywell was in need of lightweight power supply enclosures and they approached us for a solution. Working on the A380 was a significant milestone, as it helped to develop our core team of engineers and showcased our design capabilities. The development of design processes has been critical to growth: it has allowed us to take a more proactive approach with customers on new aircraft programs.

Having developed capabilities in composites, machining, and sheet metal fabrication, what is Avior's product specialization?

Composites are the driving force for much of our growth. Hybrid lightweight structures and mechanical assemblies drive our value-proposition, and most of our products tend to be complex and flight critical. Avior's in house fabrication capabilities in composites, machining, sheet metal, and plastics provides a competitive advantage as well as a one-stop solution for our customers.

What is the significance of composites in providing lightweight solutions to the aerospace industry?

Composites have traditionally been used in the aerospace industry as non-load bearing structures; however, the wave of next generation aircraft uses composites extensively in the airframe to reduce weight. Avior works with an extensive range of composite materials, providing lightweight hybrid solutions. Avior now has composite structures

on a number of next generation aircraft such as the Boeing 787, Bell 429, and Bombardier C Series. The approval process is meticulous for composites, and, once approval is achieved, the competitive landscape of companies who are able to deliver these solutions narrows significantly. Providing an in-house metal fabrication capability for the mating parts to the composite components provides an added level of competitiveness and a turnkey solution.

Avior recently expanded its facilities focused on composites. Tell us about this development.

In 2010, Avior significantly expanded its site in Granby, enhancing its technological capabilities. This year, we plan a second wave of expansion, which will further expand capacity and introduce new five-axis machining capacity and other specialized approvals for metal fabrication processes such as metal-to-metal bonding.

How has Avior fared in terms of recent growth?

Avior has recently experienced rapid growth: three years ago, we averaged annual sales of \$20 million, but today we are over \$50 million. An acquisition contributed to this figure, but we also grew organically through new business on value-added structures such as on Boeing's 787 and Bell Helicopters 429. Overall, our strategy is to keep 60% to 70% of business dedicated to producing the new generation of aircraft. We recently secured business on the Boeing 737 Max and 777 programs as well as the Bombardier Global Express 7000 and 8000, which are high rate programs that are early in their production life cycle. ●

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Charles Magnan

●●● Vice President Sales and Engineering
MECACHROME

●●● **Mecachrome is a multinational company with deep roots in the aerospace industry. To begin, tell us about the evolution of Mecachrome's presence in Canada and how these operations tie into Mecachrome's global network.**

Mecachrome was founded in 1937 in France and has since expanded its international presence in Europe, North Africa, and North America. Internationally, Mecachrome's operations are focused on the design, manufacturing, and assembly of value-added parts and assemblies for the aerospace, automotive, motor sports, defense, energy and medical sectors. As part of Mecachrome's strategy for diversification and regional expansion, in 2004 it established offices in Canada dedicated to servicing the North American market for aerostructures. Mecachrome's mission in the Canadian market is to further cultivate its machining capabilities, while exploring avenues of vertical integration and becoming a tier-1 supplier. In recent years Mecachrome

has developed expertise in design-to-build engineering, working with customers e.g.: Middle River Aircraft Systems, Aerolia, and GE Aviation, and will continue to pursue design projects going forward. Another way in which Mecachrome is pursuing vertical integration is by aligning itself with small forging houses and suppliers of raw materials.

What are some of the specific aerostructure products that Mecachrome manufactures in Canada?

Mecachrome specializes in manufacturing large, complex parts. Many of the parts that we focus on are critical to an aircraft, such as pylons, engine mounts, wing skins, and nose landing bay structures. The machining process is complex as it is made of particular alloys.

Tell us about Mecachrome's capabilities in Canada. What is the breakdown of your facilities and workforce?

Mecachrome has 200 employees in Canada, with a dedicated team of engineers. Our facilities include a large number of gantry machines with over 50 spindles spread throughout 170,000 square feet of production space. The scale of our facilities allows us to handle long parts, both titanium and aluminum. We have an area for inspection, quality assessment, deburring, and painting. Automation has yet to play a dominant role in the machining of large parts, but looking forward, we would like to develop this aspect of our manufacturing processes.

How significant is collaboration in Quebec's aerospace cluster to Mecachrome's overall operations?

Mecachrome works in partnership with several integrators in Quebec's aerospace cluster. While we focus on the manufacturing of large aerostructures, we can benefit from the capabilities and expertise of others within the industry. We previously outsourced much of our finishing processes, which was a costly endeavor. The investment required for large scale chemical lines is significant, so we have partnered with Sonaca Montreal as it is a specialist in finishing. This partnership is highly streamlined and both companies benefit from being able to offer customers more integrated services. Partnerships are important to our business as it broadens our range of product offerings. This is significant because tier-ones and OEMs are constantly questioning the supply chains of their partners; through partner-

ship we are able to attract more business.

As a case study, what has been one of Mecachrome's recent projects?

Mecachrome recently completed a highly expedited project for GE Aviation, in which we manufactured an experimental pylon (flying test bed) for its Leap-1A flying test bed. This type of project is usually handled in the United States, but due to the client's request, we were asked to manage its production. The project was highly complex, comprised of 1,500 steel components, and required very quick turnaround. The typical production time for this type of project is 10 to 12 months, but we had to accelerate and managed to complete the production in six months. To do this, we relied heavily on the strengths of our supply chain and involved many companies within Quebec's aerospace cluster.

Mecachrome is a sponsor in Aero Montreal's MACH program. Tell us about this initiative and the role that sponsors play in making Quebec's aerospace cluster more competitive.

The purpose of MACH is to create a comprehensive, supply-chain program similar to those used by Boeing and Bombardier – which many suppliers are not involved in – and to enhance the quality and competitiveness of Quebec's aerospace industry. It also has the effect of creating a benchmarking system within the industry, in which suppliers can see their progress as they implement process improvements. Mecachrome was approached by Bombardier to act as a sponsor to smaller suppliers within the cluster. Under this initiative, we share the knowledge base of our supply-chain experts and lean manufacturing practices with smaller suppliers in an effort to increase their competitiveness.

What are some of Mecachrome's goals for the future?

Mecachrome will continue its quest of vertical integration, while taking on more design-to-build projects. We recognize that tier-1s desire more consolidation within the industry so we will continue to develop our relationship with major clients while furthering existing partnerships. Our goal is to grow our business with tier-1s and to ultimately increase our direct work with OEMs. The industry message is now to ensure higher performance in terms of quality and delivery while reducing cost through continuous improvement and innovations. •



Sylvain Bédard

●●●
Chief Executive Officer
SONACA MONTREAL

●●● **Please provide us with an overview of Sonaca Montreal's operations, and the evolution of its presence in Quebec.**

Founded in 1991, the company began as a small business providing shot peening services; it then evolved into the machining, surface treatment, painting and assembly of parts. In 2003, the company was acquired by Sonaca Group based out of Belgium. Since then sales have tripled. Sonaca Montreal is now a medium-sized enterprise within the larger Sonaca Group, whose global network offers key synergies to Sonaca Montreal.

Sonaca Montreal has unique facilities in Canada; it is the only place in the country capable of manufacturing long and complex aerostructure parts, which can be up to 60 feet in length. Sonaca Montreal is a fully integrated, one-stop shop that encompasses the manufacturing and assembly of aerospace structures.

Can you guide us through how Sonaca Montreal became a fully-integrated company in Quebec?

Customer-needs are an important ingredient of full-integration. Accommodating customer needs and finding efficient and economical ways to source parts are all important factors that play a role in becoming a fully-integrated company. Sonaca Montreal's management team has first-hand experience in these areas, specifically in the manufacturing of wings structures, and consequently has the ability to bring extensive value to its customers.

What is the key focus of your operations?

Sonaca Montreal's key focus has been to provide the global aerospace market with wing skins. To date, Sonaca Montreal enjoys around 50 percent of the world's market share for business and regional aircraft wing skins. Looking forward, Sonaca Montreal will concentrate its efforts on pursuing larger aircraft, such as those of Boeing, while also monitoring the implementation of Airbus' activity in North America. Additionally, Sonaca Montreal would like to continue to leverage its capabilities of machining long parts, by expanding its offerings to include other long parts related to wing aerostructures such as ribs, stringers, and spars. To do this, Sonaca Montreal has invested, and will continue to invest, in specialized equipment that will enable the expansion of our product offerings.

How many wing skins does Sonaca Montreal produce annually and what different aircraft platforms do they service?

Each year we transform approximately 4 million pounds of aluminum through our manufacturing activities, producing around 4,000 wing skins annually. Sonaca Montreal services the following platforms: all of Bombardier's aircraft except for the C-series, as it utilizes composite for the wing; Embraer; and Gulfstream selling direct or to Tier-1s such as Triumph, MHI and Spirit.

Can you give details related to your work in research and development (R&D)?

Sonaca Montreal's focus on R&D is primarily dedicated to enhancing manufacturing processes; but our team also monitors the needs of OEMs as they seek to reduce the weight of their aircraft through compos-

ites and different aluminum alloys. While Sonaca Montreal does not work in composites, we work with mills to identify and develop new aluminum alloys that can provide solutions that meet the needs of our customers.

Sonaca Montreal recently expanded its facilities. How did this effect this growth and what advantage do your one-stop-shop facilities hold in the marketplace?

In 2012, we increased the capacity of Sonaca Montreal's facilities by 30 percent. We are currently running a 24/7 operation and look to further increase our capacity internally with faster equipment; automation plays a big role in our facility. Being fully integrated, our operations benefit from not having to work with an extensive list of suppliers; this quality allows Sonaca Montreal to price its products competitively in the market. Additionally, we require shorter lead-time than our competitors for producing parts: our typical cycle time is 30 days to process a ship-set; two to three weeks shorter than competitors who need to outsource certain steps in the production process.

Are you targeting any particular regional markets?

We have developed a strategy for 2015 to strengthen our presence in the United States by increasing our sales presence; the objective will be to sell both Sonaca Montreal and Sonaca Group's capabilities. We will also be looking to make acquisitions in the United States, which will complement the Sonaca Group's capabilities in terms of equipment and customer base.

Over the next three to five years, what are some of Sonaca Montreal's overarching goals?

Sonaca Montreal's forward strategy is as follows: double sales by investing in new equipment and in-house automation; diversify our product portfolio whilst maintaining our core competency of large and complex aerostructure parts; and make acquisitions that will complement the group's product offerings. Overall, Sonaca Montreal is a great organization: it understands the needs of its customers, has a unique integrated facility for large and complex aerostructure parts, is price-competitive, and has vast experience of the North American market. ●



SA



FD

Serge Audet & François Desrochers

●●●

SA: Operations Manager
FD: Sales and Business Development Director

A.T.L.A.S. AERONAUTIK

●●● **ATLAS Aeronautik is comprised of three centers of excellence: SIDO, Air-Ground Equipment (AGE), and LEMEX. Please provide us with an overview of these companies.**

ATLAS Aeronautik manages the major corporate functions within the group, such as human resources, business develop-

ment, sales, finance and operations management. Under ATLAS, we have three separate centers of excellence: SIDO, AGE, and LEMEX. SIDO specializes in the production of small engine parts, and mainly supplies to Pratt and Whitney Canada. AGE specializes in the production of gears, and performs gear cutting, grinding, and hobbing. AGE's main applications are actuators, landing gears, and general power transmission for aerospace. LEMEX specializes in aluminum structures, and performs machining of aluminum parts as well as assembly and integration. Its services also include riveting, painting, and sewing. ATLAS assigns quality management professionals in each manufacturing plant, ensuring overall efficiency. Furthermore, 100% of ATLAS' operations are dedicated to aerospace and its main customers are Bombardier and Pratt & Whitney Canada. Our components are also found on most Boeing and Airbus products as well.

What have been the results of ATLAS Aeronautik's recent rebranding and how has the company performed since?

ATLAS Aeronautik has optimized its processes and seen greater efficiency after consolidation. This is due to the fact that we retained all key corporate functions under ATLAS management. We are still working to reap benefits, and our brand is nascent. While LEMEX and AGE are well-recognized names, the ATLAS name is fresh to many industry players. Nevertheless we are in discussions with several

foreign companies who are interested in our capabilities. European companies recognize the breadth of our offering, as we have the rare ability to supply gears, machined parts, finished forgings and castings as well as sub-assemblies.

Could you provide us with an example of a defining project that ATLAS Aeronautik has worked on?

ATLAS recently developed the machining of a door structure for a major business jet program. We are also manufacturing components used in the locking mechanism for this door and are working on assembly feasibility. We are working to manufacture, consolidate and assemble parts in all our centers in order to deliver a complete sub-assembly ready to be bolted on the aircraft. Our vision is to be a leading integrator.

What steps have you taken to implement continuous process improvements within ATLAS Aeronautik?

We need to move towards automation and highly specialized equipment but also value investment in employee development. Any company can purchase high-tech machines and materials and manufacture parts. What differentiates ATLAS is our talent pool. We continually focus on recruiting and retaining human capital, developing problem-solving abilities, finding solutions, and improving the business extensively. We are implementing lean manufacturing practices and fostering creativity, flexibility and motivation among our people. •

ATLAS AERONAUTIK

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TB



AS

Thierry Baussan & Annie St-Onge

●●●

TB: Director of Operations

ASO: Director of Human Resources

S.O.M.R.

●●● S.O.M.R. specializes in precision tooling, machining, and mechanical manufacturing. What is the typical profile of components that you manufacture for the aerospace industry?

TB: S.O.M.R. primarily manufactures small components. The market for larger pieces is one in which we are ready to explore. To achieve this, we are investing in new machinery and new equipment. We have also informed our customers that we have enhanced our capabilities. One of the new machines we have procured, is a five-axis machine with a maximum work size of 850 millimeters (mm) in width by 450 mm in height, so we can machine pieces over 32 inches in length.

We offer our customers experience and quality. What we offer to Bombardier we offer to everyone: experience, precision, and quality. All of our employees are well trained and have been selectively chosen.

What steps has S.O.M.R. taken to ensure the quality and on-time delivery of its products?

TB: Over the last several years, S.O.M.R. has implemented many continuous improvements within its processes. The focus of our efforts has been on metrics such as on time delivery. We were previously located in a building that was limited in terms of space; however, in 2014 we acquired a new facility and now have a larger space that allows us to implement new systems and ensure improved delivery. In the past, our on-time delivery was acceptable but not absolutely perfect. In the past couple of months in the new facility, we have experienced strong performance improvements. We have a new system in place, new people in place, and a new way of doing things and we are still improving. We developed live schedules, which we have in place now. Our ERP system, Genius Solutions, was implemented about two years ago. We have seen a huge improvement since then. We have also started to put visual management tools all over the place. In this way, everybody in the shop will be able to see all the jobs that are currently underway on the floor and those that are forthcoming.

Can you tell us about the growth path that S.O.M.R. has taken?

TB: Two years ago, we were doing about half of the production we are doing now,

so we have doubled our activity in a short amount of time. This rapid growth is due to the quality of our work and our flexibility in adapting our schedule to meet our customer's needs. We are a company that can change our production very quickly to accommodate the customer, which they appreciate. We can have an order be delivered in three months, and then the customer can call us and ask if we can deliver it in one month. We will do everything possible to be able to give them what they want, because customer satisfaction is our number one priority.

What effect has the MACH initiative had on your operations?

TB: One of the great things about MACH is that it pushes every company to go beyond its limit. MACH is helping companies, rather than merely judging them. They are giving us the tools to achieve what they are asking of us. They supply us with the tools to be able to do these things. MACH confirms for us if we are doing something properly or not.

AS: There are three big segments in MACH: leadership and governance, human resources, and production. We went through MACH 1 and MACH 2, and now we are going for MACH 3. We want to reach MACH 4 as well. HR is a key component in the Mach initiative. We want to achieve more and are aggressively pursuing this goal, but we also have to make sure that our employees follow us. We have to provide them proper training to get the skills they need to achieve our goals. And most of all, we also have to create a culture behind it, because without them, we cannot reach our objectives. •



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THE HEART OF THE MATTER

Engines

Engines are the most research and development (R&D)-intensive aircraft component and have greatly transformed alongside technological advancements. As director of AÉROÉTS and senior research fellow at Pratt & Whitney Canada (P&WC), Hany Moustapha comments: “Without the engine technologies that have been developed over the last 30 years, the cost of a plane ticket would be four to five times what it is now.”

For the past 30 years, aircraft engine manufacturers have been dedicated to reducing fuel consumption. According to Dr. Moustapha, fuel accounts for nearly 50% of an aircraft’s total operating cost. Cost pressures, coupled with heightened environmental concerns, are strong incentives for aircraft manufacturers to develop cutting edge fuel-efficient technologies.

P&WC, one of Quebec’s four OEMs, is taking the lead in engine-related R&D. Over the last 10 years, P&WC has invested an average of \$450 million in R&D initiatives, and it plans to continue this strategy looking forward.

Maria Della Posta, senior vice president of sales and marketing at P&WC, stated: “Sustainability is a key driver of P&WC’s innovation efforts. Our priority is to continue to offer engines with game-changing reductions in fuel consumption, noise and emission levels; and to manufacture and service them using sustainable processes and more ecological materials.”

While P&WC is a dominant force behind developing advanced engine technologies in Quebec, other international leaders in engine manufacturing maintain a strong presence. World-class players including GE Aviation, Turbomeca Canada, and Rolls-Royce Canada are all established in Quebec, adding depth to the range of engine expertise in the aerospace cluster. Rolls-Royce Canada and Turbomeca Canada both operate centers for the maintenance, repair, and overhaul of their aircraft engines. GE Aviation, well known for the advanced automation practices that it employs in its Quebec facilities, uses this site to produce forged and milled components and assemblies for its engines.

Local players including Essential Turbines (ETI) and CEL Aerospace have also enjoyed success as engine specialists in Quebec. ETI, an engine maintenance solution provider services the Rolls-Royce M250 Series and SNECMA Larzac engines. While ETI has its roots as a local family-owned company, it has expanded its operations internationally and services engines across the globe. CEL Aerospace on the other hand, develops engine test solutions for R&D, manufacturing, and maintenance applications. There are fewer than 10 companies worldwide that specialize in this field, and CEL has selected Quebec as its international headquarters.

As aircraft engine technology advances, progressive companies in Quebec will evolve to remain at the forefront of the field. Given the host of effort and leadership exhibited to-date, Quebec will continue to be an important hub for engine technologies in the future. •



Alain Ouellette

Director Robotization
**GENERAL ELECTRIC
 BROMONT**

••• What is the specialization of General Electric's Bromont facility within its global network?

The General Electric (GE) Aviation business unit contains over 90 sites. In Bromont, we have a 250,000-square foot facility that manufactures forged and milled aviation parts, such as compressor blades and vanes, while we have also diversified our operations to include component assembly capabilities. We work primarily with titanium, stainless steel, and Inconel alloys and in 2015 we have a forecasted production of 3.5 million parts. In addition to our flagship facility in Bromont, in 2011 we were asked to establish three new business units: GE Aviation Global Automation R&D Center, which officially opened in July 2013; Instrumentation and Vibration Team; and Test System Enabling Design Team. These are the core branches that constitute our activity at the Bromont Facility.

Within GE Aviation's network of over 90 sites, its Bromont facility is one of the most productive. To what do you attribute this productivity?

In the late 1990s, the Bromont facility adopted a lean manufacturing approach. At the same time we also took strong measures to incorporate automation; today, we have over 120 robots integrated into our manufacturing operations. This proved highly effective in enhancing the quality and productivity of our operations. Consequently, we have enjoyed sustained productivity increases in excess of 7% annually. In comparison, many of GE's other sites have only three or fewer robots. Going forward, we would like to scale the application of automation within our other sites. To do this, it will be important to create generic solutions that we can adapt to the needs of each site.

Despite the benefits of automation, robots are often perceived as replacements for manpower. Where did you first start applying robots in your operations and how was this received within the company?

The initial application of GE Bromont's robots was directed at harsh operating environments, such as forging, in which you need to move parts from an oven-forging to a trim-press. This process poses an incredibly hot environment (ovens over 1,800 degrees Fahrenheit); consequently, our employees were enthusiastic about the move towards automation of this process, which has eliminated over 45 million at-risk, non-ergonomic movements each year and has resolved several health and safety issues related to certain aspects of the manufacturing process. In the late 1990s, we implemented an automation project directed at a forming press. Many employees were initially skeptical that a robot could perform the task at the same quality level as a human; however, within five years none of our employees could imagine working without the automated forging press.

What is the contribution of local small and medium-sized enterprises (SMEs) in developing technologies for the aviation industry?

GE will never internally acquire all of the knowledge and capabilities comprised within its supply chain. The partnerships and networks we have established have al-

lowed us to make contact with some of the most advanced minds in robotics. Since opening GE Aviation Global Automation R&D Center, its staff has grown to over 40 employees. However, there is no single organization large enough to support the entire GE group. Consequently, we source expertise and knowledge from universities, SMEs, and local partnerships.

How important is R&D at GE's Bromont facility?

R&D is essential to GE's strategy of maintaining a competitive edge. Once we have identified a vision, we must develop automation processes related to its technology. The commercialization process is often time consuming, so it is critical that we continue to invest early on in the development of new technologies.

The Government of Quebec recently invested C\$8 million in GE's Bromont facility for R&D. How do incentives such as these contribute to Quebec's business environment for aerospace activity?

The aerospace industry is highly competitive globally. Incentives such as those from the Quebec government have allowed us to develop new teams and have provided us an advantageous environment for fruitful R&D efforts. Investissement Québec and other organizations within the province are also very supportive in welcoming companies like GE to invest in the province.

How does its Bromont facility incorporate environmental sustainability into its operations?

GE's Bromont facility has long had a proactive track record related to energy conservation. All of the materials and machinery that we work with are assessed for environmental impact. As part of this focus we are very active in Recycle Quebec; last year the facility achieved a level of 94 percent.

Do you have a final message?

GE has had a presence in Quebec since 1982. The local workforce, skills, and government have all contributed to the success of our Bromont facility. Quebec is an integral part of GE's network, and we are optimistic regarding the years to come. •



Hugue Meloche

●●●
President and CEO
MELOCHE GROUP

●●● **Despite Meloche Group's 40-year history, its presence in the aerospace industry is relatively new. To begin, please walk us through the evolution of Meloche Group and its entry into the aerospace market.**

Founded in 1974, Meloche Group is a family-owned business that has evolved as a machining specialist within the local textile, automotive, telecommunications, and aerospace industries. I joined Meloche Group in 2004, at which point the telecommunications industry was slowing down so we decided to reevaluate our corporate strategy. Over the years, we had developed over 30 years of expertise in machining, while also having facilities dedicated to chemical processing, painting, and assembly. In accordance with this portfolio of capabilities we realized that we could provide a unique value-proposition, as there were few aerospace suppliers that could provide this range of integrated services. In 2007 we initiated our aerospace activity by acquiring various

approvals, and later that year, won a large contract with Bombardier, which earned us notoriety within the sector. Despite adverse economic conditions, we continued to invest in new certifications, contracts, and R&D. In 2011, we injected more capital into the business by taking on equity financing with three financial partners: Fond de Solidarité FTQ, Fondation CSN, and ACE Management. Since this time, we have achieved annual growth of 15 to 20 percent. While we are still a relatively new player in Quebec's Aerospace Cluster, we are one of its largest SMEs, with annual revenues of \$35 million.

What is Meloche Group's vision?

Meloche Group is currently positioned as a vertically integrated tier-3 supplier that has engineering, machining, special processes, and assembly capabilities. Our vision is to become the leading Canadian owned tier-2 aerospace supplier in Canada, capable of major sub-assemblies, engineering, and risk-sharing. In an effort to achieve these goals, we have identified five strategic drivers of growth: technology investment, continuous improvement, front office infrastructure, customer proximity, and collaboration.

As an integrated tier-2 supplier, what is Meloche Group's range of product offerings for the aerospace industry?

Meloche Group specializes in the production of aircraft structural components and sub-assemblies; engine components; hydro-mechanical components; and interiors and cockpit systems components. The components that we work with are typically smaller than one meter³ and the contracts that we take on incorporate all of our integrated solutions, which differentiates us from companies that are focused exclusively on machining. In terms of aerostructure components we work with OEM/tier-1 customers such as Bombardier, Triumph, Mitsubishi, and Stelia Aerospace, and our largest customer for engine components is GE Aviation, while we also work with Pratt & Whitney and Safran. We have also developed a worldwide niche for oil nozzles and fuel fittings. Going forward, we would like to take on projects that require more assembly work.

Meloche Group now has four facilities with distinct capabilities. Provide us with an overview of these facilities and

describe any recent investments in technology.

Technology investment is a key business driver for Meloche Group, which is realized in the capabilities of our four facilities. We have three facilities in Valleyfield, each with its own specialization: CNC machining and engineering, surface treatment and assembly, and one reserved for administration, inventory management and future expansion. Our fourth facility in Bromont is dedicated to our work with GE Aviation. We recently invested in several new, five-axis machines, and in 2016 we will complete a three-year/\$11-million automation project with a robotized palletizer, which will afford us significant increases in capacity and reductions in labor costs.

As Chairman of Aero Montreal's SME working group, what role does continuous improvement play in supporting the cluster's international competitiveness?

Several years ago with the inception of the SME committee, we began to think strategically about the role of SMEs in the cluster and in international markets. SMEs must strive for continuous improvement and differentiation, as the competitive landscape globally is much fuller today. In addition, SMEs should facilitate greater communication, because as a collaborative network we have much more to offer.

Meloche Group has doubled its sales over the last four-years. What do you attribute to these strong growth figures and what are some of Meloche Group's future goals?

Meloche Group's growth performance is primarily attributed to its targeted investment in engineering, machinery, R&D and our development as a vertically integrated company. In the next five-years, our goal is to achieve annual revenues of \$100 million. We would like to grow organically, while also considering the strategic acquisition of companies with distinct certifications. Volume capacity is critical to winning contracts in the aerospace industry, as major players are looking to work with suppliers that are financially credible and able to share risk. As we grow, managing our suppliers is going to become increasingly important. Furthermore, in terms of markets we would like to expand our presence into Ontario, Southeast United States, and later on into Europe. •



Jacques Ouellet

CEO
NSE AUTOMATECH

●●● **NSE Automatech has integrated its manufacturing operations to include surface treatment capabilities, structural assembly capabilities, and electrical harness assemblies. To begin, walk us through NSE Automatech’s range of service offerings and describe the profile of components that you typically work with.**

NSE Automatech manufactures engine parts, structural parts, critical parts, electrical harnesses, and tooling, such as assembly jigs, for the aerospace industry. We have historically specialized in machining, but have since integrated our operations to include surface treatment capabilities, structural assembly capabilities, and electrical integration. Using our expertise in high-precision machining, we are able to work with a wide range of exotic materials in the fabrication of complex components. We do not like to do what everyone else does, which is incorporated in our slogan: “dare to innovate.” One of our key attributes is the delivery of complex parts or electrical harnesses under quick-turnaround.

NSE Automatech recently consolidated its operations into a new, larger facility. How has this affected your operations?

NSE Automatech had three plants located

in Granby (two manufacturing facilities and one surface treatment facility) and one at Ville St-Laurent (Electrical division), but we recently consolidated our activity (manufacturing facilities) within a larger facility which provides us with more capacity for our machines, we kept our surface treatment as a separated division near our new facilities. We have now installed new systems to ensure that our machines are used at a specific level of hours each days. Furthermore, we have three large monitors which allow us to monitor our on-time delivery, budget, and rejections. According to this process, our employees receive a bonus based on performance, which encourages them to work harder on quality and on-time delivery.

With the integration of NSE Automatech’s new capabilities and facilities, what type of projects will you be targeting?

Since the formation of NSE Automatech’s new facilities, we are in the process of developing a large-scale project with a new customer. They approached us from a list of ten suppliers, and selected to develop us as their new strategic supplier. We are in process to be approved by them, and if all goes well, they will help us to become a worldwide strategic supplier.

Could you describe how NSE Automatech collaborates in Quebec’s Aerospace Cluster?

NSE Automatech works with Avior on its contract for the Boeing 787. Avior is an expert in composite and sheet metal parts, and we utilize our strengths by machining all of the aluminum parts for Avior. This is a good opportunity to gain the experience of working on a project for Boeing. The partnership is complementary because Avior has their own small machine shops but lacks the required capacity for machining large volumes of parts.

What is NSE Automatech’s strategic growth plan for next five years?

NSE Automatech would like to move into the market of medium sub-assemblies, including mechanical and electrical parts. We are an integrated supplier, but only a small portion of work currently incorporates integration. Many of our customers are unfamiliar with our integration capabilities, so we would like to showcase them and add value through assembly, surface treatment, and painting. A dream of mine is to move more into medium sub-assemblies integrating mechanical and electrical components. ●

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Stéphane Turcotte



Vice President
NÉTUR

●●● **Your father founded the company in 1978. Can you provide us with a brief history of the company, along with any milestones that have shaped its presence today?**

My father Louis-René Turcotte founded Nétur in 1978. I assumed ownership of the company in 2006, at which point we were a team of 20 employees producing C\$2million to C\$3 million in sales. Since then we have grown our team to 50 employees, producing C\$12 million in sales. In 2012 we invested C\$6 million in new facilities.

Nétur is a fully integrated manufacturer of jet engine components. Can you provide details about your product offering?

Nétur’s main focus is the manufacturing of engine components. We manufacture 30-inch components, and have six different lines of production within our facilities. We produce gas chamber components (200 parts per year) as well as adaptor and smaller components (over 6000 parts per year).

What steps has Nétur taken to evolve into a fully integrated supplier?

We examined and corrected for every customer delivery issue internally. Supplier quality is crucial, and Nétur expanded to build our capacity and conduct all processes within our larger facility. This is ideal for the customer because parts are not shipped to other suppliers. To meet our customer demands we consistently work to provide cost-saving options along with superior quality production and on-time delivery, implementing new technologies to help lower costs. In this regard, automation and robotics have played a large role in our ability to deliver high-quality products on time. We work with thousands of components, and automation helps us to optimize production.

What role has research and development played in Nétur’s new strategy?

We need to innovate in order to satisfy our customers. Nétur has constructed six different cells within our larger facility. Every new product we manufacture is optimized and redeveloped after two years. We spend over C\$1.5 million on new technology and testing each year. Since 2008, we have been developing over 125 components per year. The components we develop this year may go on the market in 2018. This process is crucial for securing Nétur’s future position in the market, and has helped us sustain our high sales growth thus far.

Collaboration is a very important theme within Quebec’s entire cluster. How does Nétur engage or partner with other players in the cluster?

We collaborate with Sherbrooke University, and are looking to establish a partnership with McGill as well. Nétur encourages many of its employees to partake in trainings, and gain insights into new industry trends, competition, and technologies. Each year we spend approximately C\$50,000 on market research, and this kind of investment is crucial for the long term. We also collaborate with our competitors and SMEs to share best practices. This year we found a sponsor—GE Aviation—so that we can participate in the MACH initiative, and next year we will sponsor an SME because we believe it is important to help smaller companies grow.

What percentage of your product is exported?

This year over 10% of our product was exported.

What are Nétur’s goals for the next three to five years?

We aim to increase our sales to C\$25 million. Nétur also plans to remain focused on producing engine components, and increasing our visibility in this space. Our largest international market is Poland, however we would like to expand our North American customer base within the next five years.

Do you have a final message for our international readers?

Nétur has accomplished 100% on-time delivery in the last 24 months and had no quality issues in the last 18 months. Additionally, we maintain consistently low costs. •

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TOP-QUALITY PRODUCTS**

Nétur Inc. is a Tier-1 manufacturer of jet engine components and assemblies, having over 35 years of experience serving commercial aerospace and defense customers worldwide. We are a vertically integrated manufacturer with in-house capabilities for machining, processing and assembling, resulting in a seamless integration of functions. Our cutting edge expertise, consulting-based approach, and ability to carry out complex projects have helped thousands of aircraft take flight.

Stephane Turcotte 450-676-0113 ext 230 s.turcotte@netur.ca



Claude Lauzon

Corporate Vice-President
CEL AEROSPACE GROUP

CEL Aerospace Group has over 25 years of experience in the field of engine test solutions for the aerospace industry. To begin, please describe the evolution of CEL Aerospace Group and its range of testing solutions.

CEL Aerospace Group (CEL Aerospace) initiated its presence in Quebec's Aerospace Cluster in 1988 as a developer of engine test solutions for Pratt & Whitney Canada. It has since expanded its range of testing solutions and global customer base to include civil and military engine maintenance providers as well as many OEMs around the world. There are three primary markets for the application of aerospace engine testing solutions: R&D, manufacturing, and maintenance. Each of these markets requires distinct testing solutions, which we provide accordingly. We design, develop and commission test cells for auxiliary power units (APUs), turboprops, turboshafts, small and mid-size turbofans.

Although CEL Aerospace is relatively small, it offers an array of testing solutions to its customers. What is the breakdown of your workforce and business units?

CEL Aerospace is composed of over 75 employees located in Canada, Europe and the US. We delivered, over the course of our 27 year history, over 700 different projects. Our retention rate is high, which has contributed to deep levels of expertise related to the design of efficient and effective engine testing solutions. Overall, our team is highly innovative from a technical perspective and works on a consultancy basis in its approach. Accordingly, we are able to provide our customers with creative and cost effective solutions that are tailored to their specific needs. There are three primary units within our operations: mechanical design, instrumentation, and data management. We have teams of civil and mechanical engineers dedicated to the mechanical design of our engine test facilities, from physical layout, test bed specifications to intake, exhaust and aero-acoustic design. Another team is focused on the sophisticated instrumentation that engines require, considering aspects like temperature, pressure, and vibration. Finally, our software engineers maintain and develop our proprietary data acquisition system, CELDAS® and evolve concurrently with latest technologies. We benefit from a strong cadre of program managers insuring on-spec, on-time, and on-cost solution delivery to our clients.

What is the competitive landscape globally for engine testing solutions?

Globally, there are fewer than 10 companies active in the market for test cells, many of which are polarized in terms of size. Several players target the market for large, turbofan projects, which require more expensive test cells and construction management, while others are focused in different niches, such as the offering of specific product lines to OEMs or the military market. Overall, there are no other players in the world capable of covering the range of engines that we do, in particular the APU, Turboprop and Turboshafts, where we are leaders. We are unique in the respect that we offer an extensive range of products to OEMs and independent MROs around the world. We also have a credible portfolio, which demonstrates our accomplishments and reputation for on-time delivery and quality. •



Building test solutions



We design, develop and commission fully integrated aviation gas turbine test cells for OEMs and independent Maintenance Organizations; we specialize in APUs, Turboprops, Turboshafts, small and mid-size Turbofans. Our expertise also covers related systems and components, for aerospace and industrial applications. CEL is headquartered in Canada with capabilities in Poland and the USA, we are 80 people strong and have delivered over 700 projects over a quarter century.

CEL is a project-oriented company. It is structured to perform consistently at all levels of its diverse service and product offering, from the design of state-of-the-art test cells and data acquisition systems to the delivery of operational turnkey test facilities, anywhere in the world.

CEL Aerospace newly appointed as Honeywell Test Cell Manufacturer

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David Thibes

General Manager
TURBOMECA CANADA

any spare parts that are required for their specific engine configurations. We have several engine configurations, so consolidating maintenance information through this platform will allow us to provide improved services to our customers. Additionally, we have teams available 24 hours a day, seven days a week to support aircraft on the ground. Many of our customers are working in remote locations across Canada, so it is critical that we are able to support them when they have urgent needs. Accordingly, we can send them a technician on-site, or they can send their module or engine to our facilities to be repaired.

As many of your customers are dispersed throughout Canada, what is the extent of your network of maintenance providers?

Turbomeca has a network of maintenance providers across Canada that manages first and second line maintenance for our engines, affording us close proximity to our customers, while we are the exclusive provider of third line maintenance for our engines in Canada. In terms of maintenance, repair, and overhaul (MRO), we allow other companies to work on our engines under licensing agreements. The ultimate goal of our operations is to ensure customer satisfaction at a competitive price so that our customers will continue to fly with Turbomeca engines.

What is the driver of Turbomeca's activity in Canada?

As the focus of Turbomeca's operations in Canada is on the service of its engines, our operations are not directly impacted by the activity of airframers, but rather by the operations of our customers in the field. Consequently our business is driven by the activity of our customers in areas such as the construction of dams and communications towers, exploration of mines, inspection of power lines, and natural resource surveys. Accordingly, our business is affected wherever there is a need for helicopters.

What is the economic outlook for these different fields and what implications do they hold for Turbomeca's growth?

We have seen a slow recovery since the 2008 crisis, especially given last year's oil and gas developments. Although mining activity has been low over the last few

years, it has been compensated by activity within the oil and gas sector. With that said, the recent declines in oil prices will certainly have an impact on our operators. We have already seen many investments cancelled or postponed. Accordingly, we forecast light growth and stabilization over the next one to two years. Canada benefits from an immense reserve of natural resources, and worldwide growth will certainly encourage demand, so we are confident that growth will continue in the coming years. With that said, it is unclear when this growth will occur. We need for our operators to have one or two consecutive years with solid flight hours and revenues in order for them to consider significant reinvestment in their fleet. In terms of fleet renewal, it will likely take several more years before this takes place.

What is Turbomeca's strategic growth plan for the next three to five years?

In the near-term, Turbomeca will focus on developing new partnerships with maintenance providers to ensure close proximity with our customers. The development of new service centers will be a defining aspect of our activity next year. There are over 2,000 helicopters flying in Canada and approximately 600 are more than 30-years-old. This creates an environment of vast potential for helicopter replacement. We hope for favorable economic conditions in the coming years, which will encourage our end users to accumulate more flight hours on their engines. Furthermore, we hope that the economy will create a demand and need for new helicopters.

Do you have any final message for our international readership related to Quebec's Aerospace Cluster and its capabilities?

Overall, Montreal is a very good place for business: it is a place where the capacity and knowledge is really amazing. Quebec's Aerospace Cluster benefits from a strong network and set of capabilities, which has established its presence as a unique model for the rest of the world. In an effort to encourage growth, it is essential that the government continues to support initiatives that will bring OEMs and suppliers to the Cluster, in order to grow the energy, strength, and competencies that we have here. •

●●● **Turbomeca Canada's operations are focused on providing its customers an alternative for repair, overhaul, and maintenance of equipment. In line with this mission, what new programs does Turbomeca Canada have underway for the maintenance of its helicopter engines?**

Turbomeca Canada (Turbomeca) benefits from a breadth of technical capabilities, which allows us to provide services that cover all types of engine maintenance. We are currently in the test phase for our Bank of Online Services and Technologies (BOOST) platform, which is a program we have developed with IBM to offer our customers new services related to maintenance and navigability. BOOST is a highly secure and comprehensive platform that facilitates visibility for maintenance and follow-up work on our engines. In addition to enhanced maintenance predictability, customers are also able to order online



Michael F. Guntner Sr.



President

ESSENTIAL TURBINES (ETI)

●●● **Essential Turbines (ETI) is an engine maintenance solution provider and specialist in the maintenance, repair, and overhaul of Rolls-Royce Model M250 Series and SNECMA Larzac engines. Please walk us through the range of services offered by ETI.**

ETI is a specialist in the Rolls-Royce M250 Series engine, which we service worldwide. We also overhaul the Larzac engine that is installed in the Alpha Jet, completely in-house. However the age of this engine presents significant challenges to maintaining economical solutions. ETI overcomes these challenges by restoring piece parts and components instead of seeking OEM replacement, which is costly and delays delivery. We offer economical solutions and viable options to our customers and these are the main reasons for our success today. Whether we perform a complete overhaul of the engine or a minor repair, we test the engine prior to returning it to the customer. ETI also offers pre-buy inspections to anyone interested in purchasing a helicopter. If the purchasing party is uncertain of the engine's condition, we offer a service where we will look through the records of the engine, open up specific areas of the engine for inspection and evaluate its general condition. Following this process, we provide our customers with a report that details the serviceability of the engine and notes regarding future repair costs. This is a worthwhile endeavor as the cost of the engine equals close to 50% of the helicopter replacement value.

ETI also provides mobile services, where our employees are dispatched to repair helicopters or fixed wing engines in the field. If the aircraft is grounded, we assist our customers by providing repair solutions, supplying parts and loaning tools to our customers (if they want to manage the repair internally). Additionally, ETI is an Authorized Training Organization (ATO) approved by Transport Canada and EASA, and offers Rolls-Royce M250 Series Engine Maintenance Courses to the industry in-house and remotely.

What is the typical profile of ETI's customers and what steps do you take to ensure the timely servicing of their needs?

Our customer base is diverse, and spans to include international operators in the medical, corporate, forestry, oil and gas, coast guard, law enforcement, firefighting, tourism, defense and governmental (local and foreign) sectors. We are a 24/7 responsive business,

and have a number of exchange and rental assets to expedite aircraft readiness. If a portion of a customer's modular engine is damaged, we can ensure a prompt turnaround time by exchanging just that portion of the engine. If a customer is grounded, we can immediately send out a rental unit for them to install it, and the engine will be serviceable again the next day. We also have mobile repair teams that will deliver the parts and fix the problem in the field. ETI has built its reputation by providing superior customer service and consistently exceeding expectations.

What advantages does Quebec's aerospace landscape afford you?

There are numerous advantages that come with being located in Quebec. The government—federal and provincial—has been very supportive of our company and continues to offer us a considerable amount of tailored programs and solutions that facilitate growth, expansion and business development. To strengthen our position in Quebec ETI works with local technical colleges. We support institutions by providing resources including actual working engines to simulate Removals and Reinstallations (R&R), test cell performance runs and a significant number of M250 training engines. The students who graduate from these colleges have a much better working knowledge and understanding of Gas Turbine Engines when they graduate. This proves useful to us when we hire, because students already have a high degree of product familiarization. We have reduced our new-hire learning curve from two years to a few months, cutting costs tremendously.

What is your strategic growth plan, and what are your goals in the next three to five years?

ETI has an aggressive but well formulated growth plan that includes several other product lines and key target customers. Our customer base is consistently expanding internationally and because of this we have Europe on our horizon. Our goal is to become a full-service international MRO. We are also capitalizing on opportunities that will spur additional growth in the United States and Canada. In the short-term, we have outgrown our existing facility and are looking to either acquire additional shop space or relocate to a larger premise. ETI's longer-term goal over the next five years is to more than double its current revenue. •

INTERNATIONAL LEADERS

Landing Gear Suppliers

●●● Landing gears are responsible for the suspension of an aircraft during taxi, takeoff, and landing. Configuration of these gears depends on the type of aircraft—fixed-wing or rotary—and the surface on which it is oriented to land. Every landing gear system comprises complex subsystems of actuation, braking and steering. These systems play a critical role in the aircraft’s overall configuration, and are thus developed during the early stages of an aircraft’s design process. One of the greatest challenges facing landing gear suppliers is developing value-added products that minimize weight, volume and lifecycle cost, while maximizing quality and performance. Suppliers within Quebec’s aerospace cluster are known for their expertise in landing gear systems, and have developed some of the world’s most advanced aircraft undercarriages.

An example of one of these companies is Quebec-based Héroux-Devtek. In 1969 the company achieved a significant milestone when it manufactured the landing gear for the Apollo Lunar Module. “We are one of the first aircraft component manufacturers on the moon!” said president and CEO of Héroux-Devtek, Gilles Labbé.

Since its early acclaim, Héroux-Devtek has continued to grow in stature, becoming an internationally respected landing gear supplier.

In 2013, Héroux-Devtek earned its largest contract of all time when it won the exclusive package to manufacture the landing gear for Boeing’s 777.

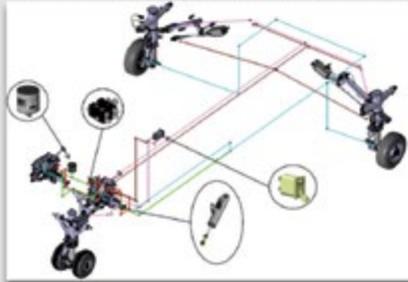
Quebec’s suppliers have achieved international success by integrating innovative technologies into their landing gear systems. “The biggest game changer in actuation right now is electro-mechanical, so this will be an area in which we will focus moving forward,” said Chris O’Neill, president and COO of Mecaer America. A subsidiary of the Italian Mecaer Aviation Group, Mecaer America is based out of Quebec and supplies landing gear systems primarily to the helicopter and business jet markets. Mecaer America is a prime example of an aerospace supplier that has climbed the industry’s value-chain, developing design-to-build capabilities and many new proprietary products. Quebec is increasingly well regarded in the global arena for its expertise in all parts of the landing gear supply chain. Alta Precision, a Quebec-based sub-tier supplier of landing gear components, exports over 90% of its products. Manufacturers that have enjoyed considerable local success in the market for landing gears, such as Electro-Kut and Techniprodec, are currently expanding into international markets. •



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Hélène Séguinotte

Country Delegate
SAFRAN GROUP

●●● **Mrs. Séguinotte, you have extensive experience in the aerospace and security industries in both Europe and North America. Can you give us a brief overview of your professional background?**

I have been working with Safran Group for 25 years now. My career began in France with Turbomeca, where I worked for 21 years. I left the aerospace division of Safran in early 2011, when I was offered a position to develop Morpho in Canada, the group's security pillar. By then I had already adopted a second hat as country delegate. In this role, I am an ambassador of sorts representing the Group, as well as any of the group's Canadian assets, and building supply chain partnerships/relationships to help the group grow and realize business opportunities. I do not get involved in the day-to-day operations of our subsidiaries in Canada, but rather coordinate activities to promote consistent branding. I liaise with ministries, public servants, and

large companies. I am directly involved in most Industry associations and think tanks. Branding has always been a challenge for the group, because we are rich and strong due to each one of our subsidiary's cultures. Hence we are trying to build something new with a strong Safran name. This year, Safran is celebrating its tenth anniversary, and our goal looking forward is to solidify the brand here in Canada. I also hold another position as the Bombardier Focal Point. My role is to strengthen our relations with Bombardier and to ensure the formation of a true partnership that exceeds merely a supplier-customer relationship.

Could you provide a brief overview of Safran Group's companies' operations here in Quebec, and their relative importance to the group?

Safran has three key businesses: aerospace, defense, and security. Within aerospace, Turbomeca, which specializes in helicopter propulsion, and Messier-Bugatti-Dowty, which specializes in landing gears, both have a strong presence here in Quebec. Safran SEngS Services, a subsidiary of Safran Engineering Services, has also established itself here. Within the defense space we do not have a facility in Canada, but instead employ a representative to develop the group's defense market in the region. Finally, within security Morpho Canada is established with head offices located in Montreal. Safran Group has been established in Canada for over 70 years, largely due to Messier-Bugatti-Dowty's longstanding presence in the country.

Safran Group is heavily involved with innovation. Could you discuss some of the group's research and development (R&D) initiatives in Quebec?

Turbomeca and Messier-Bugatti-Dowty have been involved with CRIAQ for a few years. The Group has also developed partnerships with Polytechnique Montréal and Canadian National Research Council / Conseil National de Recherches Canada (CNRC). This year we will renew our agreement with Polytechnique, and will continue to seek new ways of expanding partnerships. Safran is also very committed to green initiatives such as electrical aircraft projects. Safran and Honeywell are developing an electrical taxiing system (EGTS), which was showcased at the Paris Air Show two years ago. This technology enables the

aircraft to taxi all the way to its takeoff position and back without using its engine, conserving fuel, noise and emissions. The group spends 12% of its revenues on R&D; we never make any concessions on R&D because it is crucial that we prepare for the future.

Can you comment on the Quebec government's support of R&D initiatives and other policies intended for multinationals such as Safran Group to come to Quebec?

Safran has always had good support, as the government recognizes the aerospace industry's significance for Quebec. I was present when a unanimous vote was cast in parliament, recognizing the industry as a form of provincial pride. We will continue to work together to make sure that the industry preserves its leading position in the world.

What is Safran Group's strategic growth plan for the next three to five years?

Safran aims to develop R&D partnerships, as Quebec boasts a very reliable network of sources and relationships.

Does the group build partnerships with small and medium-sized enterprises (SMEs) based in Quebec?

Safran is involved in what President of Bell Helicopter Textron Canada Raymond Leduc calls, "the innovation chain." We are forming new partnerships with SMEs, involving them as early as possible in the product development process. SMEs are also getting involved in this channel with our mother companies in France. This is why the MACH initiative is so powerful. By helping SMEs with their processes, we can place them on the international radar to compete and showcase their expertise. In the future, SMEs can grow to become centers of excellence within their niches, as well as join forces to grow the local tier-one network.

Do you have a final message for our international readers?

Safran remains at the forefront of innovation. We never make concessions when preparing for the future and intend to maintain our leadership positions in all three markets going forward. To do this, we will attract new talent, grow through acquisitions, and cultivate a unique, strong, and inclusive culture. ●



Chris O'Neill

●●●
President and Chief Operating Officer
MECAER AMERICA

Founded in 2002, Mecaer America is part of the Italian conglomerate Mecaer Aviation Group. To begin, please walk us through the evolution of Mecaer America and its presence in Quebec.

Mecaer Aviation Group (MAG) began its operations in Quebec in 2002 through the acquisition of Performance LT, which was a manufacturing job-shop. This gave rise to Mecaer America (Mecaer), which has since transformed itself and developed into a fully integrated landing gear company. Everyone within the industry talks about design-integration, yet there are very few companies in Quebec that have successfully moved from manufacturing into design. One of the exceptions is Mecaer; generally speaking, companies that try to do so often go bankrupt. Fortunately, Mecaer benefited from the long-term approach of MAG and was able to be successful in the transition. Conse-

quently, over the years Mecaer has grown its panoply of programs to include entire landing gear systems: structures, control panels, brakes, electro-mechanical actuation, and so on, both for helicopters and airplanes. Mecaer's facilities are capable of handling almost any helicopter landing gear, while also being able to do most airplanes up to regional jet size, size being the only limitation. Nearly all of Mecaer's helicopter landing gears are proprietary, while the vast majority of its airplane landing gears are build-to-print. Mecaer benefits from its position within MAG as its companies share many commonalities, synergies which we actively try to capture.

What have been some of Mecaer's recent achievements?

2014 was a big year for Mecaer. In addition to moving our operations into a new facility, we also designed and industrialized three new programs, one of which being one of the most significant build-to-print programs to come to market in the last 10 years, the Gulfstream G500 for UTAS.

For what Mecaer is able to accomplish, it is a relatively small company. How does your size help position you in the market?

Mecaer's workforce is comprised of 118 individuals. Due to our size, we are highly dynamic. This in turn affords us supreme flexibility in what we are able to accomplish. For instance, while larger companies are unable to fathom short-term design changes, we are able to pull off five design changes in one week. Mecaer is unique in the respect that it is a small company that has worked its way into a sector dominated by massive players. This represents a breath of fresh air for OEMS – who have traditionally been held hostage by the larger companies – as Mecaer offers sophisticated design infrastructure while maintaining the humble approach of a job-shop.

What role does research and development play in Mecaer's continued integration?

On a design level, Mecaer has yet to develop all of its own technology; some technology is purchased and integrated into our landing gears. However, from a structural perspective, which is 80 percent of the gear, Mecaer develops all of its own

technology. Looking forward, we certainly want to grow our capacity to add value to our landing gears by further developing our proprietary technologies. Mecaer invests a substantial amount of money each year, on average \$5 million, on research and development initiatives. The biggest game changer in actuation right now is electro-mechanical, so this will be an area in which we will focus moving forward.

Over the last three years, Mecaer America has posted growth figures of 22 percent. How does Mecaer contribute to the growth of its parent company?

Over the last five years, Mecaer has nearly tripled in sales. Through organic growth alone, we expect to achieve between 50 and 75 percent growth in the coming years. The industry in general probably has between 10 and 15 really excellent years ahead, barring a major economic catastrophe. Having been in the aerospace business for over 30 years, I have seen four or five defined business cycles: we are on our way to the next cycle. We can expect to see the rise of many acquisitions and synergies, as the industry continues to torque itself up over the coming years. Furthermore, the foreign exchange rate is presently an important advantage for Canadian companies and will remain this way for the foreseeable future.

What do you attribute to Mecaer's strong growth rates? What is your strategy for future growth?

Mecaer benefits from a well-established allocation of booked sales. In the coming years we want to balance out the build-to-print side of our business with our own proprietary programs. We will spend a lot of energy diversifying our portfolio so that our business mix is both recession-proof and customer-proof. As far as markets go, right now we are heavily concentrated in the business jet segment. We will try to diversify away from this and perhaps add some military work as well. With that said, overall we have an enviable sales mix and continued growth is promising. We are continuing to invest and develop new programs that will keep us competitive in the market. This is important because the aerospace industry has a very bright future ahead and it would be a shame to be shackled to legacy programs with no new initiatives in the pipeline. •



Gilles Labbé

●●●
President and CEO
HÉROUX-DEVTEK

●●● **Heroux-Devtek has been around for over 73 years. What are some of the major milestones in the company's history?**

Our first major milestone was manufacturing the landing gear for the Apollo Lunar Module, essentially making us one of the first aircraft component manufacturers on the moon. Back in 1969, we were the first on the moon; later, in the 1970s, we won a major contract with the United States Air Force to repair and overhaul landing gears for the KC-135 and C-130. We have maintained this workload since. This means that every C1-30 that flies in the United States Air Force is repaired and maintained by Heroux-Devtek. In 2000, we purchased our major competitor: Devtek Corporation. Subsequently, in 2001 we built an aerostructure facility in Dorval. In 2004 we acquired Progressive Inc., the largest manufacturer of bulkhead for F16 and F35. In 2010, we acquired Eagle Tool



Image: Heroux-Devtek

& Machine Co. and E2 Precision.

In 2011 and 2012, the company was making sales of over \$380 million, but the stock price was undervalued. So, in 2012 we sold off the aero structure and industrial product operations to Precision Castparts Corp. In doing this we created a large increase in value for our shareholders.

In 2013, we landed the biggest contract in Héroux-Devtek history, becoming the sole manufacturer of the Boeing 777 landing gear.

You have a successful track record of maintaining longstanding relationships with customers, for example Bell Helicopters and Boeing. What has differentiated you from your competition?

It comes down to the performance and quality of your product and additionally to your customer service and delivery. We put a strong emphasis on maintaining strong relationships with our customers.

How does research and development (R&D) play a role within Heroux-Devtek?

R&D is a pillar of Heroux-Devtek. We spend from 5% to 6% of our revenue on R&D. In 2010 we built an R&D center in Quebec. The aerospace industry is technology based, and it is to our advantage to maintain a leading position in technology development within the aerospace industry. We believe that we are creating the future for our people.

Within the cluster of aerospace companies in Quebec where does Heroux-Devtek fit?

Montreal is the third largest aerospace center in the world. Montreal is one of the only places in the world where you can build an entire airplane within a 30 kilometer (km) radius. For example, the CL-415 by Bombardier is predominantly built in Montreal, with a few parts from Ontario.

Montreal is a center for aerospace excellence. There are four top universities that are training top engineers and two technical schools that are meeting the need for highly trained and skilled tradesmen. The government is also very supportive of the industry, through the provision of incentives for the aerospace industry.

Where do you see Heroux-Devtek in the next five years?

We are looking at expanding our offering in the landing gear systems and are considering the acquisition of complementary manufacturers to better serve our clients. We are looking for companies with a lot of intellectual property (IP), strong customer relationships and positive relationships with the governing bodies.

In business, there are three things that matter: the customer, your employee and your shareholders. Maintaining a balance of all three is key to the success of any business. Our culture foundation is based on four main values: respect, responsibility, recognition and resilience. ●



Guillermo Alonso



President

ALTA PRECISION

●●● **To begin, please provide us with an overview of your professional background and describe your role as president of Alta Precision.**

I have an engineering background but withdrew from Concordia University to join the family business of Alta Precision, founded by my father and a business partner in 1979. The company was a three-man generalist machine shop within the aerospace industry and took advantage of a government-backed initiative to finance the aerospace industry in Quebec. In 1990, we acquired land to build our own premises; in 2000, we expanded the building to its current size. While remaining generalists, we became increasingly focused on landing gears; 2001 brought the decision to strictly specialize in landing gears. In 2015, we continue to grow with an annual revenue of \$20 million CAD to \$30 million CAD, supported by a staff of 110 employees. We do not work directly

with OEMs, except for Embraer in Brazil, who has their own landing gear design and manufacturing capabilities. Alternatively, we deal with tier-1s such as Goodrich, Messier-Bugatti-Dowty, and Heroux-Devtek.

What is Alta Precision's specialization for landing gears?

Within the landing gear market we focus more on the medium-to-large major structural components, for example large cylinders, pistons, axles. We also carry out assembly work and special processing. Landing gear is a big user of special processing, a part of the aircraft enduring hardship – extreme temperatures, moisture, rust and wear, and needs to be protected by chemical processing. Alta Precision supplies sub-systems; testing of the assembled landing gear is carried out by tier-1s. We manufacture anywhere from 200 to 300 components and are recognized for our expertise in structural components. How does Alta Precision's product offering differ from its competitors; and can you elaborate on your facilities, which provides you unique positioning in the market?

We have the equipment to process heavy parts, which sets us apart from our competitors. Alta Precision is a stakeholder in the special processing shop of Tekalia in Montreal, giving us instant access to this facility. We are sole-owners of our premises, which includes a paint and assembly shop. This vertical integration is the result of learning from our customers' feedback and experience.

What are some of the current projects that Alta Precision is working on?

Alta Precision's major projects include a recent contract to produce the major components for the landing gear of Embraer's E2 program, the second-generation of this jet series. This project will necessitate the doubling in size of our premises; equipment has been purchased and we are considering whether to expand our facility or move to a new location. Our growth will be in Montreal. Another option was the United States, but our military business there has declined due to cuts in military budgets, and the application by the Democrats of previously unenforced laws, which favor the tenders of smaller, American-based companies. Our current

breakdown of business is 75% commercial and 25% military. In the past, it was 50-50. Looking forward, we have not closed the door of expanding into the United States.

What is the proportion of your business between export and the domestic markets; will expanding your customer-base be a focus for your growth; and what is the biggest differentiating factor that Alta Precision brings to the market?

Our only Quebec-based customer is Heroux-Devtek, which accounts for between 5 and 10 percent of our sales. The remainder of our business is from Europe and Brazil. Asia is not an easy market for Alta Precision to penetrate; this market is more akin to repair and overhaul. Our tier-1 and integrator contacts are based in Europe, US and Brazil. The corporate jet market is recovering from the downturn of 2008; it is a market that we would like to develop. We will also grow our portfolio with existing customers. Our value-proposition is that we are a small vertically integrated business with agility.

What steps does Alta Precision take to ensure that its corporate mission of quality is maintained?

The perpetuation of quality control is paramount to Alta Precision. We have on-going in-house training, certified operator programs at manufacturing level, quality managers, and strict quality systems. Every new employee has first-rate training from our quality manager, emphasizing the principle that only the finest work is acceptable. Briefing is given on the dire consequences if this standard is not maintained, e.g. a broken axle on landing with possible loss of life. Our customers never receive a part that does not conform to our high standards. The aerospace industry is realizing that North America is a high-tech low-cost source, and with its expertise is propelling it to the forefront of the market.

In the next three to five years, where would you like to see Alta Precision?

In the next five years, Alta Precision will double in size. This will be achieved through growing its market-share with existing customers, delivering quality on time and maintaining customer satisfaction. We believe in partnerships and are always open to joint-ventures on contracts. ●

Christian Delisle

●●●
President
ELECTRO-KUT



- **Since its inception, Electro-kut has utilized electrical discharge machining as one of its core business offerings. Tell us about this capability and the evolution of Electro-kut's machining processes.**

Electrical discharge machining (EDM) is a very specialized form of machining, typically used for tooling processes. While tooling usually requires several components for assembly, wire EDM processes permit tooling assembly to be facilitated by its characteristics. EDM also yields higher rates of precision than conventional machining methods, capable of achieving measurements down to two or three microns. Electro-kut manages both types of EDM: traveling wire and die-sink systems. Due to these capabilities we have established a presence in areas that range from extrusion dies, die stamping, molding, aerospace and aeronautic components. Building off of 10 years of experience in this area, we decided to transform into a comprehensive machine shop through the acquisition of basic CNC machines that are able to handle proper tooling, which feeds into our EDM capabilities. This has emerged as the most lucrative aspect of our business.

Over the last 10 years, Electro-kut has realigned its focus towards the aerospace industry. What was the strategic rationale for this decision?

Since its inception, Electro-kut has been recognized for its technical skills and commitment to quality. However, around 2005, we began to lose customers to low-cost manufacturing in emerging countries. We attempted to compete, but this proved difficult to sustain. Consequently, we decided to leverage our expertise and apply it to the field of aerospace. We had experience in very high precision machining and tooling, which positioned us well. It took us several years to acquire the necessary aerospace accreditations, including the specific NADCAP for EDM processes, and to integrate this within our capabilities, but the process has proved successful.

What are your machining capabilities and the different types of products that you work with?

Electro-kut specializes in the machining of landing gear components; nearly half of our work is with exotic materials, while the remaining focus is on aluminum parts. As we continue to grow, our specialization will be centered on forging and casting components. These components are framed to size, but require geometric analysis to ensure precision from the datum. Part of this process necessitates tooling design, which holds the component to the machine to ensure precision throughout the process. Oftentimes, this requires separate setups; therefore, the challenge is in maintaining precision between unique setups. Our machines permit automation, which is a theme of increasing importance for our operations. As a company, our plan is to optimize versatile machines capable of managing the production of complex components at low volumes. Our mission is "Simplified Complexity." The emphasis is on improving our manufacturing processes to reduce production time and acquire a larger market share while minimizing capital expenditures on equipment and facilities.

Can you tell us about Electro-kut's move into the market of light sub-assemblies?

In 2009, Electro-kut saw a shift in the market as our customers were looking for suppliers capable of handling light sub-assemblies, and we have recently developed strong competencies in this area. Furthermore, the industry requires extensive specification for all of its components. While smaller companies like us are accustomed to more artisanal work, greater emphasis is now placed on specification, and we intend to continue developing our processes accordingly. ●

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Sebastien Farkas

●●●
Vice President of Operations
TECHNIPRODEC

What is Techniprodec's product specialization? Are your target markets primarily domestic or international?

The products that Techniprodec manufactures are principally landing gear parts and other small assemblies. Around 80 percent of our business is concentrated in the helicopter market, but we also manufacture and assemble an assortment of complex mechanical components for other types of aircraft. As an example, we have worked in partnership with Bell Helicopter on its 429 project since its inception. We have customers in Canada, Japan, Taiwan, and the United States. Exports account for roughly 25 percent of our total sales. There is opportunity everywhere, but looking forward, we have identified the United States and Asia as attractive markets for its products.

Techniprodec recently upgraded its facilities. Tell us about this move and the capabilities that it affords your business.

Over the last five years Techniprodec has achieved an annual growth rate in excess of 15 percent. Consequently, we outgrew our old facilities and in 2014 moved into our new 25,000 ft² facilities which have double the capacity. Prior to the move, our manufacturing and assembly operations were disjointed; today we have the advantage of having everything under one roof. Additionally, as part of the upgrade, we purchased two new 5-axis machines, new lathes, and implemented vast improvements to our assembly area. Assembly is a growing aspect of our business, currently 60 percent of our production requires assembly, and the new facilities will help us enhance this part of our business.

What have been the drivers of Techniprodec's recent growth?

Techniprodec's growth can be attributed to the enactment of its strategic plan in 2007. We implemented lean manufacturing practices and acquired an array of new accreditations related to areas such as assembly, manufacturing of critical parts, and finishing. Through the adoption of these practices the market really opened up for us.

What steps does Techniprodec take to incorporate process improvements into its operations?

Techniprodec has three distinct programs that monitor and encourage process improvements within its operations. The first initiative, Bon Coup Programme, encourages employees to implement small changes

to their processes, while not requiring anyone's permission aside from the chief in their cell. Every month our management team selects a winner as a way to celebrate employee-driven process improvements. The second initiative, TCQP, is focused on more resource intensive process improvements. If an employee believes that our processes could benefit from moving a machine, they submit their suggestion into a box which is reviewed every three months. The third initiative is driven by leaders on the production floor, who are allowed to modify sequences and incorporate changes directly to manufacturing processes.

This is Techniprodec's 4th year in Aero Montreal's MACH program. What is the purpose of the program and how has Techniprodec benefited by participating?

Initially, MACH was designed to replace the industry's fragmented system in which each OEM had its own unique accreditation process. It was burdensome for suppliers to navigate the former systems. The MACH initiative sought to consolidate the standards of the OEMs' preexisting programs, thereby creating a uniform way of evaluating companies' supply chains. This also had the added benefit of creating a benchmark system within the industry. Techniprodec began as a MACH-2 company and has since earned MACH-3 status. When a company has matured and achieved higher levels of accreditation, it may be asked to sponsor another smaller company within the program. Overall, for Quebec in general, the MACH program helps create a more robust and consolidated aerospace supply chain. Hopefully in the future MACH will achieve international notoriety and become a global platform for aerospace companies.

Looking forward, what are some of Techniprodec's primary goals?

Over the coming years Techniprodec's goal is to continue growth and to integrate more assembly operations into its activity. Furthermore we want to increase our supplier base so that we can supply more complex assemblies to our customers, while not necessarily having those capabilities in-house, such as in sheet metal. Customers like Bell Helicopter need these services, so we want to integrate these products into our operations to meet demand. Lastly, we would like to grow our international presence, particularly in the United States. •

●●● **This year represents Techniprodec's 40th anniversary. Please provide us with a brief history of Techniprodec and its aerospace activity.**

Techniprodec began as a small machine shop, focused on the production of molds through lost wax casting. The mold industry was artisanal, so the operation was initially very small. Over time Techniprodec grew its employee base, at which point it decided to enter the aerospace business. At the time, barriers to entry within the aerospace industry were low, and Techniprodec initiated business proceedings with Montreal-based OEMs, such as Bell Helicopter, Bombardier, CAE, and Goodrich. After ten years in the aerospace business, this aspect of Techniprodec's operations began to parallel its molding operations. In 2000 aerospace became Techniprodec's primary focus, and in 2009, we halted our molding operations to concentrate on aerospace.

CRAFTING A NICHE

Aircraft Interiors

- Aircraft interiors are the most customized part of production, and hence stand out as an emblem of craftsmanship rather than a product of the assembly line. While expertise within this market segment is typically credited to regional hubs such as Italy and Germany, Quebec has established a presence within certain niches of this market.

Zodiac Aerospace, one of the world's largest players in the field of aircraft interiors, operates its center of excellence for business aircrafts out of Quebec. "In Montreal, Zodiac Aerospace offers full integration of business jet cabin interiors," said Michel Bussey, vice president and general manager of Zodiac Aerospace.

Quebec's aerospace cluster is also contributing new interior related technologies to world's latest aircraft platforms. GGI International supplies expertise in the form of customized human machine interface technology (HMI). "An aircraft's cabin interior is composed of many parts: seats, galley inserts, lights, in-flight entertainment systems, to name but a few," said Dominique Quintal, director of business development at GGI International. Despite

the company's relatively small size, GGI International's products can be found on Boeing and Airbus platforms across the world.

A vital but unnoticed component of an aircraft's interior is the ducting and air distribution systems. Hutchinson, a multinational specialist in this field, entered the Quebec market in 2013 through its acquisition of Marquez Transtech. The company's proprietary ducting technology is used on Boeing's 787. It also provides a range of composite solutions for business aircraft interiors. Going forward, Hutchinson's strategy is to leverage the composite expertise acquired in the European market and apply it in North America.

A local company that has also successfully carved a niche for itself in the market for aircraft interiors is Delastek. As an integrator of cockpit interiors, Delastek was recently commissioned to design and manufacture the cockpit for Bombardier's new CSeries aircraft. While this was a highly competitive package to secure, Bombardier elected to work with a strong local supplier, known for its reputation as a premium integrator of cockpit interiors. •

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Éric Faucher

●●● President and General Manager
HUTCHINSON

●●● **Hutchinson is a European enterprise with an extensive industrial and regional presence. To begin, tell us about the evolution of Hutchinson's involvement in the aerospace sector.**

Hutchinson has always been present in the aerospace sector, but it was in late 1990 that it really commenced its program of acquisitions and developed a strong group around body sealing, anti-vibration, transmission and fluid transfer. Furthermore, over the last five years, Hutchinson has made several acquisitions within the composite sector: KTN in Germany; Strativer in France; and Marquez Transtech in Canada. A current focal point of the group's strategy is to transpose its European expertise in the composite sector to the North American market.

Hutchinson's acquisition of Marquez Transtech in 2013 afforded it footing in the North American market. What was

the strategic importance of this acquisition for Hutchinson's global operations?

Marquez Transtech was an SME with aspirations to become a tier-1 supplier. This goal was achieved by joining forces with Hutchinson, as it provided an entry-point into the European market. Conversely, Marquez Transtech's technology, such as its composite products present in Boeing's 787, interested Hutchinson and allowed it to develop more comprehensive solutions for cabin interiors, while at the same time providing a stepping-stone into the North American market.

The acquisition also opened up our ability to share technology from other businesses within the group and integrate more functionality into our product. It also provides us with access to customers that were previously out of our sphere and can offer other OEMs our portfolio of composite products for cabin interiors. Looking forward, the group will sustain its strategy by supporting investment in research and development (R&D).

What is the range of cabin interior products that Hutchinson provides to the aerospace industry?

The vast majority of Hutchinson's products in Canada are design-to-build, with build-to-print representing a small portion of our business that is designated for the automotive industry. Our range of aerospace cabin interior products includes full cockpits integration of trim panels and structure, such as glare shields; low pressure ECS ducting; kitting of curved panels for cabin monument; and ring retainers for the prevention of window fogging.

Our proprietary ducting system technology, a composites-thermoplastic product for low-pressure air distribution in Boeing's 787, offers a 50 percent weight reduction when compared to other products on the market. We also differentiate ourselves with a carbon fiber finish on the cockpit of Bombardier's Global 5000/6000 series. Our products are primarily focused on business aircraft, except air distribution ducting, which is used in both commercial and business aircraft.

Please describe some of Hutchinson's other ongoing projects?

Hutchinson is currently working on the interior panels for Bombardier's Global 7000/8000 series monument and was se-

lected to design and manufacture the new Vision Flight Deck on the Bombardier's Challenger 650. We also work closely with CAE, supplying the thermoplastic for its flight simulators and the Volvo Group for the truck industry.

What is the competitive landscape for aerospace composites and thermoplastics globally?

Many of Hutchinson's products are proprietary, such as our composite-thermoplastic ducting, which presents product differentiation for our customers and affords us strong positioning within our niche. With that said, the market for aerospace cabin interiors is highly competitive. Hutchinson benefits from being fully integrated and being able to manufacture entire systems that are competitively priced. Being located in Quebec, we work in close proximity to the assembly facilities of Bombardier, Pratt & Whitney, and Aerolia, which allows us to assist in development and design work, something that is particularly useful for interior finishing.

What are some of Hutchinson's latest R&D initiatives and what new innovations do you have in the pipeline?

Hutchinson has a large R&D group, which partners with learning institutions in the development of new technologies that address the needs of our customers. The government also plays an active role in many of these R&D initiatives. The focus is on liquid molding, which will further differentiate us from other companies. Liquid molding occurs through the resin transfer molding (RTM) infusion process, and our current efforts are directed towards the automation of this process, which will allow us to achieve a more robust method for secondary structures. Furthermore, this will offer a cost-effective alternative to autoclave molding; for instance, on a primary structure, costs can be reduced by as much as 50 percent.

Do you have a final message?

Hutchinson's objective is to offer an integrated interior system that takes on the full design for air distribution, fluid transfer, and interiors for an aircraft. Our differentiating quality is that we offer out-of-the-box solutions to satisfy the needs of our customers. •



Michel Bussey

●●●
Vice President and General Manager
ZODIAC AEROSPACE

- **Zodiac Aerospace has maintained a presence in the aerospace industry since 1896. To begin, please provide us with an overview of the group's overall operations.**

Zodiac Aerospace is comprised of six principal segments: Zodiac Galleys & Equipment, focused on commercial galleys for single-aisle and double-aisle aircraft; Zodiac Seats, which manufactures seats and seat shells for a variety of aircraft; Zodiac Aerosafety, which develops products such as life rafts and parachutes; Zodiac Aircraft Systems, which is the group's most diversified business segment, as it handles electric systems, fuel systems, data systems, hydraulics, and many other aspects of an aircraft; Zodiac Aerospace Services, which provides support to customers across all of our business segments; and Zodiac Cabin & Structures, which is divided into four segments: OEM interiors for commercial aircraft, airline interiors

for retrofitting, structural engineered materials, and business aircraft cabin interiors, which is the focus of our operations in Montreal.

Zodiac Aerospace's operations in Montreal are focused on the development of business aircraft cabin interiors. Can you walk us through the range of products and services that you provide to this market?

In Montreal, Zodiac Aerospace offers full integration of business jet cabin interiors. We manage the engineering, fabrication, and certification of our products and deliver them to our customers with a "plug-and-play" concept. While we offer turnkey solutions, we also provide mix-and-match services and are able to do anything in between. In addition to our facilities in Montreal, we also benefit from an extension of our division in Tijuana, Mexico, which does the layout of parts specifically for us.

What is the composition of Zodiac Aerospace's business units in Montreal, which allows it to function as an integrated supplier of cabin interiors for business aircraft?

Zodiac Aerospace in Montreal has a staff of 950 dedicated employees, of which 125 are engineers in Montreal who are focused on developing and managing product specifications. This team of engineers works with our customers, such as Bombardier, while not directly interacting with the end-user of the aircraft. If the customer desires a specific cabin interior option, we guide them and look at the possibility of using one of our preexisting solutions. We try to limit their choices to preserve continuity within our production operations. We then hand this process off to our design engineers, who complete the drawing package. This is sent out to the planning department, which oversees the purchasing and planning for our floor operations. When production starts, we have segmented our operations into four divisions: cutting with CNCs and pre-finishing of wood, sub-assembly, finishing, and then final assembly. We certify everything throughout the process and ultimately deliver the final package to our customers.

What is the competitive landscape for business aircraft cabin interiors in Quebec and what is Zodiac Aerospace doing to differentiate itself within the market?

The competitive landscape for cabin interiors differs between commercial and business aircraft. Bombardier, for instance, has its own cabinetry manufacturing so on this front my main competitor is also my main customer. Other than that, there is limited competition for business jet cabin interiors in Quebec. We differentiate ourselves in the way that we assemble parts. We have a pressurized system on the floor, which is a lean process that drives significant savings in cost of labor. We are also taking steps to increase the role of automation within our operations. We have developed a robot with AV&R in St-Bruno and Excel Finishing Product for an automatic sprayer finishing, a process that does not otherwise exist in our industry. It is a big investment but will be a factor that will further differentiate us both operationally and environmentally

What is your sense of the quality of human capital being produced in Quebec specifically for the aerospace industry?

Quebec benefits from an excellent pool of engineering talent. In Montreal, we have one of Zodiac Aerospace's largest engineering divisions in terms of bodies on-site. Our operations are very engineering-oriented because each business aircraft's cabin interior requires high levels of customization. We partner with several Quebec universities, such as McGill for finishing and Sherbrooke for acoustics, and provide internships for students of many local institutions of higher education during the summer. The province is more limited in terms of manufacturing expertise. For this reason, we have opted to manage our own training internally. Because Bombardier is a large magnet for aerospace manufacturing, we look for different ways of bringing in manufacturing expertise and often attract workers with little previous aerospace knowledge. We teach them from the ground up. The way our floor is laid out, it is easier for them to enter at the beginning of the line and learn as they move along. This also helps in the case that employees are taken by other aerospace manufacturers, as we are able to just move everyone up the line. In the future and based on growth, we will use this low cost country advantage to improve our offerings to our customer base. ●

Image: Delastek



CL

Claude Lessard & Mathieu Doucet

●●● CL: President
MD: Business Development
DELASTEK

●●● **Delastek was formed over 30 years ago, initially working in the pulp and paper industry and transitioning into aerospace in the 1990s. Could you provide us a brief historical overview of the company?**

Delastek entered the aerospace industry in 1990, and the company's first contract was manufacturing test equipment for Pratt and Whitney Canada's engines. In 1995 Bell Helicopter was looking for an integrator to perform mechanical assemblies and we offered our integration services to them. Around the same time, we began our working relationship with Bombardier in design and manufacturing, which we continue to do today. In 2000, there was an opportunity to delve into the composite and plastics side of the business, and hence we founded Delastek Composites. Our goal evolved to integrate all of these technologies and become self-sufficient. Currently we have 100,000 square feet of facilities and 100 employees, 30% of whom are working in research and development (R&D).



The history of Delastek has been one of vertical integration. Can you tell us about this process?

Our customers have been moving away from the build-to-print model towards design-to-build. As a result, Delastek has been involved with CRIAQ since 2003 and has worked on 14 projects to find new solutions for our customers. We were one of the first small and medium-sized enterprises to get on board with CRIAQ because we acknowledge the importance of innovation.

Delastek is an integrated supplier of composite structural parts as well as interior parts. Can you describe its various business streams?

Delastek produces a wide variety of parts for its customers, which include Bombardier and Bell Helicopter, such as outside air temperature probes, air ducting, mechanical and electrical assembly, and junction boxes. Most importantly, we have been commissioned to manufacture the entire cockpit interior for Bombardier's new CSeries commercial airliner. This is the future of our company, and a key ticket for securing future business with Airbus or Boeing. Working with Bombardier on the CSeries is a huge opportunity and achievement for Delastek. We have also been selected by Bombardier on the Global 7000 and Global 8000 aircraft program in which we are constructing the interior of the cockpit as well. At Delastek, we can take care of everything from the supply chain to assembly. We are a premium integrator, specializing in the design and manufacturing of the cockpit.

Can you tell us about the electrical integration work you do for CAE's simulators?

Delastek developed all of the breaker panels

for the A320 and 737. We built the complete structure, including all of its electrical panels, and performed all of the testing to prepare the part for use on CAE's 5000 flight simulator. Currently, we are working on the pilot chair for CAE's latest flight simulator. Delastek handles all of the mechanical, machining, thermoform of the plastic parts, electrical work, testing, and assembly.

Are you working specifically with OEMs and tier-ones in Quebec or internationally as well?

The majority of Delastek's work is in Quebec, but we also conduct business in the United States. Currently, the company's target customers are Airbus and Boeing. We worked very hard to secure our contract with Bombardier, and now we can leverage our experience towards securing contracts with other large OEMs.

Looking forward, what is your strategic growth plan for the next five years?

We hope to offer a complete interior with cockpit instruments for the helicopter industry. We are also looking to secure contracts with Boeing and Airbus and essentially provide our services in cockpit interiors to other OEMs and sub-tier suppliers as well. In the next five years, we would like to triple the size of the company. Given the production of the CSeries aircraft as well as our participation in the manufacturing of the Global 7000 and Global 8000 business jets, we are poised to expand.

Do you have a final message?

Delastek is truly an integrated supplier and boasts 10 to 12 distinct processes, including injection, machining of parts, electrical bonding and composites. •

Peter Graham & Dominique Quintal



PG



DQ

PG: Co-President
DQ: Director of
Business Development
GGI INTERNATIONAL

●● To begin, please tell us about the evolution of GGI International and its involvement in aerospace.

PG: GGI's roots date to the early 1900s in the product identification business, where our grandfather introduced one of the first pressure-sensitive products into Canada. After several years, our father joined the business and today GGI is proudly owned and operated by my brother and me. GGI has since migrated from a product-identification business to a well-recognized global leader in the design, engineering and manufacturing of custom human machine interface (HMI) technologies. GGI's sectors include defense, medical, higher end industrial controls, and aerospace. It first started to supply product to the aerospace sector in the early 2000s. Only in the past five to six years have we seriously focused our efforts on this demanding industry. We obtained AS9100C certification in 2012, which is an important milestone necessary in order to supply product to leading global OEMs. Today, aerospace and defense represent approximately 30% of our business revenue.

What is HMI technology and how does it apply to an aircraft?

DQ: An aircraft's cabin interior is composed of many parts: seats, galley inserts, lights, in-flight entertainment systems, to name but a few. Each of these items interacts with a user (cabin crew, passengers, maintenance crew, etc.), which is the role of HMI technology. GGI International brings innovative HMI technology to aircraft cabins; examples of our products include: cabin signage, seat control panels, call systems for flight attendants, and reading light switches. Products are expected to be intuitive, esthetically appealing, and seamlessly function. These assemblies must also meet stringent functional and environmental requirements imposed. We are not necessarily dealing with repeat users, therefore having an intuitive platform is important. Furthermore, each airline and aircraft type/model has specific requirements regarding its interior, which make it a highly customized industry.

How significant is HMI technology to airlines in keeping their aircrafts modern?

PG: In older aircrafts, it is common to see galleys with many different pieces of equipment having a more traditional, industrial look. The galley is often the first thing a passenger notices when boarding, so airlines and aircraft manufacturers have recognized the importance of having a modern, uniform look across equipment platforms from coffee makers to wine chillers. Many of today's new, larger commercial aircraft platforms, such as those

from Boeing and Airbus, have multiple galleys visible to the passenger.

DQ: The general metric is that airlines replace or retrofit their long haul aircrafts on average every seven to 10 years.

What is the competitive landscape for companies focused on cabin HMI customization? How does GGI International differentiate itself?

PG: GGI's competition is primarily international. The competitive landscape narrows as the design complexity and requirements increase. Our strength in design, engineering and manufacturing coupled with our experience, reputation, flexibility and certifications position us to serve this demanding industry. Today, our products can be found on multiple Boeing and Airbus aircraft platforms and are flying on more than 35 different airlines.

Looking forward, what is GGI's growth strategy?

DQ: GGI International has always focused on expanding its technologies and staying ahead of the curve. We are not a single technology, single solution, or even a single product company. We specialize in superior product customization with a focus on reliability and invest significantly in research and development (R&D). We will continue to develop and modernize our portfolio of technologies moving forward. We have an excellent team of professionals in the GGI family, who are the foundation for our current and future growth. We see blue skies ahead in the future and are ready for take-off. ●

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Earl Diamond

●●●
CEO
AVIANOR INC.

●●● **Can you give a brief history of the company and some of the milestones over your 20 years in the aviation industry?**

Avianor is celebrating its 20th anniversary this year. The company started off as a very small shop making galley carts and doing some work for Bombardier. The company then got design rights for making seats and the interior side of our business was built up from that. From 1998 to 2000 we were doing job manufacturing and distributing parts, mostly related to cabin interiors. Together with my partner, Sylvain Savard, we have grown the business and in 2000, we acquired another company called MAS (Mirabel Aero services). After the acquisition, we had the ability to incorporate repair and overhaul on interior components, with a particular focus on cabin seats. Currently the company has the largest wheel and brake shop in Canada and is in the process of opening up a shop in Calgary, in order to be closer to the Western airports.

What are the main products that Avianor offers to the airline industry?

Wheels and brakes is one of our main products, but it is still only one part of the business. Avianor also offers engineering certification services. Another product offered to the industry is spare parts. The company buys, sells and trades parts, which is one of our competitive advantages, as we offer something that no other company in the world offers. Avianor is also a Part 21 approved manufacturer of cabin interior components, most notably for pilot seats. Avianor also offers maintenance, repair and overhaul (MRO) for aircraft, and we are approved by Transport Canada to work on a number of different types of aircraft. Our company is not competing with the big MRO companies, as the big players are selling manpower and Avianor is instead selling a service to its customers. The primary effort in terms of our MRO is cabin integration and optimizing downtime. Avianor understands what we have to plan and has the skills, experience, material and people on site to address any unforeseen circumstances to mitigate any delay. This is the differentiating factor between Avianor and the big players in MRO. We offer service and problem mitigation.

Can you elaborate on the growth of the company over the last few years?

The sum total of our four facilities is about 300,000 square feet. We have the main plant here where the administration, engineering and seat shop is based and the manufacturing is done. The wheel and brake shop is across the street, and we also have a large warehouse. The fourth building is the hanger, which is 50,000 square feet, with another 50,000 next door, which we can rent as needed.

The company is growing but is currently in a recovery mode, as it had a bad investment in 2012, which undermined cash flow.

Avianor worked with Gulf Air and has done projects for Air Canada. Can you elaborate on the company's successful projects with major airlines?

Avianor worked with Gulf Air, which was a difficult project. As it is a state-owned company, decision-making was quite slow, and it took nearly a year to close the deal. We did, however, build a strong relationship with the airline and ultimately

realized that we should be in control of the management of the project. There were some challenges and delays in terms of the seats, but Avianor completed all of the aircraft. The company also manufactured some parts and changed the in-flight entertainment system. We also had some design responsibility.

In terms of Air Canada, it was a completely different experience. Air Canada had in its mind what it wanted to do and involved us early on. Avianor was asked to quote on the MRO, but we also proposed that Air Canada buy the parts from us.

Can you elaborate on the accreditations that the company has?

Avianor is approved by Transport Canada for manufacturing and maintenance. The company is also approved by Bermuda, as some aircraft are registered there. We have EASA certifications and we maintained our EASA approval for repair station maintenance. Recently, Avianor got Bahrain approval with the authorities, as Gulf Air governed by the Bahrain Civil aviation authority (CAA). The company is approved for original equipment manufacturing (OEM) by Bombardier and Zodiac.

What is the role of Mirabel in the Montreal cluster?

Currently the terminal is closing down, as the property taxes were too high, and the government did not want to waive them. Mirabel and its airfield offer advantages. It is inexpensive to land here. Moreover, we can store aircraft, and our customers can store parts. Being next to the cargo terminal provides quick access to parts and material.

Where do you see Avianor in the future?

When you have grown as fast as the company has, it is not about growing for growth's sake, but about trying to secure the future for our 300 employees. We have built a considerable amount of expertise with regards to aircraft cabins, but need to expand our capabilities. Thus, the company is looking for strategic partnerships going forward. •



Tony Rawlinson

Director of Sales & Marketing
INNTECH-EXECAIRE

●●● Can you elaborate on some of the major milestones and recent history of Innotech?

Innotech is approaching its 60th anniversary in business aviation. Innotech has always been a very focused company, and we have been lucky to be in a city as successful as Montreal in terms of its business aviation history. Innotech has been able to develop our products to support the business success of many other firms in Montreal. The company started as a completion and maintenance facility, supporting various types of aircrafts and primarily supporting the industry in a local context. In terms of milestones, we have become a much more international organization in the sense that our current customer base is now spread out all over the world. Innotech has also grown a significant amount over the years.

What exactly do you do here at Innotech?

The company does maintenance and refurbishment of aircraft. We have a very close relationship with Bombardier and tailor specifically to its models of aircraft. Innotech is a one-stop shop in the industry in terms of maintenance and refurbishments. We are quite unique in the industry as we are also a completion center. The company completes brand new aircraft on behalf of Bombardier. All of the services that we offer are on the corporate aircraft side and we do business aviation only.

Innotech is a preferred completion center for Bombardier. How important is this relationship?

Innotech's relationship with Bombardier is critically important. We are honored to be a preferred completion center as well as an authorized service facility (ASF) in the industry. It has taken years to become an ASF and preferred completion center, and we are very happy that we have achieved this.

What distinguishes Innotech from its competitors?

The name Innotech is derived from innovative technology. We have an innovative company in terms of the technology that we have launched out into the industry. Innotech was the first to certify satellite communications technology for a particular model of aircraft. The innovation of the company has been a very important component of its success. The company's location in Montreal is also an advantage as we are close to a number of organizations and suppliers and allows Innotech to provide a one-stop shop service, which is a huge benefit. The distinguishing difference of Innotech is the people who work in our facilities and provide relationships and expertise to clients.

Apart from our excellence in quality and workmanship, another advantage is our very specialized paint facility, which meets very high environmental standards. In this facility, we do a substantial volume of aircraft painting, which is very important on the refurbishing side. The paint that we use is of a very high quality and environmentally friendly, which incorporates the latest technology and meets all regulatory. This is certainly a distinguishing part of Innotech's refurbishment business.

In 2014, Transport Canada gave Innotech a rating in the advanced com-

posites. How has the rating affected the company?

Certifications like the advanced composites or advanced structural repair capabilities give companies a huge boost. Innotech has received much more business, as it was recognized as having the necessary levels of expertise and capabilities. These certifications also distinguish one facility from another.

Innotech has recently opened up a new office in Stansted. Is the company starting to focus more on the international market?

The majority of the business that Innotech does is outside of North America. When the company first started, business was more local but as the international market began to open up for the types of aircraft that we work on, we began to develop the necessary international relationships. For many decades, we have had relationships in Asia, the Middle East and Europe. Our international business is sometimes more than 80%, and China is definitely an emerging market. The opening of the office in Stansted gives us the opportunity to step closer to that specific market.

In October 2014, Innotech completed the first installation of the Honeywell Ovation Select Cabin Management System. Can you elaborate on this project?

This is a big project, as we are refurbishing an old cabin management system. The Honeywell Ovation System gives the ability for a user to be able to use and operate their own technologies and devices on the aircraft. Technology changes at rapid speeds, but in the aviation industry has certain certification requirements. We are able to do this work when customers are doing major checks, as the aircraft has to be in our facility for over four weeks.

Where do you see Innotech in the next three to five years?

We hope to see the market continue to develop and grow. This cluster is reliant on a dynamic workforce and the innovative launch of products that the world wants. In the next three years, Innotech will possibly have a stronger presence in Asia, but our core business is in Montreal. We would want to maintain our expertise and knowledge base and build on that from the basis of where we are now. ●

AVIONICS

The Electronics of Flight

●●● Avionics, or the electronic systems of an aircraft, play a critical role in optimizing aircraft performance and flight safety. The application of avionics covers a wide spectrum of functions including navigation, computer monitor interface, flight-control systems, and collision-avoidance systems. Quebec has emerged as a force within the field of avionics, with two key players driving local market activity: Thales Avionics and CMC Electronics.

Thales, a multinational company with diverse expertise, has brought its specialization in developing integrated avionics for critical systems—flight-control systems and fly-by-wire technologies—to Montreal. As a world leader in fly-by-wire technologies, Thales is principally focused on the business and regional jet markets. Looking forward however, Michel Grenier, vice president and general manager of Thales Avionics, believes that this form of technology “will be standard on all new aircrafts.”

OEMs such as Bell Helicopter seek to incorporate this form of technology into their latest platforms, and avionics suppliers are poised to seize the opportunity. “Fly-by-wire technology is a staple in the fixed wing community, but there are no commercially certified helicopters using fly-by-wire today— so we’re changing that,” said Raymond Leduc, president of Bell Helicopter Textron Canada. Local avionics powerhouse CMC Electronics, specializes in the development of integrated avionics for cockpit applications. With its roots dating back to the foundation of the Marconi Company in 1903, CMC is one of the oldest aerospace companies located in Canada. CMC has created numerous innovative products out of Quebec, such as the electronic flight bag, and remains a world leader in aircraft GPS sensors for navigation. CMC constantly invests in research and development, and is currently developing sensors that will allow a pilot to land an aircraft using GPS.

The marriage of modern avionics and software has given rise to significant advancements in the field in recent years. Embedded software provides added value to avionics manufacturers while not adding weight to the ultimate product. A local software development firm, CS Canada, supports certification of engine control systems with its products. “The aeronautics industry is moving towards intelligent aircraft, meaning that avionics equipment is becoming more and more reliant upon safety-critical software,” said Laurent Pieraut, CEO of CS Canada.

As the market for avionics continues to develop, software will play a critical role in its growth. Due to the presence of both manufacturers of avionics and specialists dedicated to the development of related software, Quebec is well positioned to remain a leader in the field. •



Image: CMC



PC

Patrick Champagne & Janka Dvornik

●●●

PC: Vice President Cockpits and Systems Integration

JD: Communications and Public Relations Manager

CMC ELECTRONICS

●●● Please provide us with a brief overview of CMC Electronics and describe any milestones that have helped shape its presence within Quebec's aerospace cluster.

PC: CMC Electronics' involvement in aerospace dates back to the 1950s, when we developed our Doppler Navigation System. In the 1970s, we introduced the Omega System, the first modern organized navigation system incorporated with GPS. This was the precursor to our flight management systems (FMS), a core component of our capabilities today. FMS allows the pilot to follow maps by programing flight plans into the system and providing instructions to the pilot regarding aircraft direction. We mainly supply FMS in retrofits, but as a standard option we do provide forward-fit for Airbus helicopters. CMC also supplies FMS to the Russian Sukhoi SuperJet. We are world leaders in GPS sensors for high-end navigation with over 20,000 units supplied globally. From this technology

we have developed our cockpit systems integration capability. Our FMS product is capable of projecting flight arrival time and optimizing flight paths to minimize fuel consumption, while accounting for adverse weather conditions.

CMC is a subsidiary of Esterline. What is the significance of CMC within Esterline's global network and in what ways do you draw upon synergies from your parent company?

PC: CMC Electronics has designed and built innovative communication and electronics systems since 1903, when Guglielmo Marconi founded the company. Esterline CMC Electronics (CMC) has achieved an international reputation for innovation and excellence in the design and manufacture of electronics products for the military and commercial aviation markets. CMC's focus is on delivering innovative cockpit systems integration and avionics solutions to its customers worldwide. Esterline acquired CMC in 2007 and has supported our growth tremendously. In the last three years, Esterline has been centralizing its activities, including information technology and strategic sourcing, to realize economies of scale.

What was the significance of Esterline's recent acquisition of Barco and how it will affect CMC?

PC: Esterline acquired the defense, aerospace and training division of Belgium-based Barco N.V. in early 2015. The avionics as well as training and simulation businesses will now be operated by CMC. These activities will increase our sales presence around the globe and add to our core capability in displays and display technologies. Most importantly, CMC will gain its first physical footprint in Europe.

What is the scope of products you are developing in your Montreal facility?

PC: In Montreal, CMC has a staff of about 900 people, and our operations are primarily dedicated to manufacturing, engineering and program management. Our products include a wide range of avionics such as FMS, GPS, displays and electronic flight bags.

What percentage of your business is dedicated to retrofit and new aircraft platforms, and what is the breakdown of your business in civil and military markets?

PC: 40% of the work that we do is in retrofit markets, while 60% is in forward-fit. This is a good balance for CMC, as our larger competitors tend to focus on substantial forward-fit programs that are beyond CMC's capabilities. Because of this we focus our efforts within the smaller fleet niche, as customization is our core strength.

CMC's breakdown between civil and military markets is approximately equal, albeit much of our military work is civil-related. When military transport aircraft provide supplies for disaster relief, they fly in civil airspace. Therefore the cockpits we install for these aircraft are civil-certified. We also provide cockpits for military trainer aircraft.

JD: Part of CMC's success is due to the strategy to strike a balance between OEM positions and retrofit solutions as well as the commercial and military markets. Since these markets are cyclical, an upturn in one market mitigates the effects of a downturn in another market.

What are the latest innovations that have come from CMC's research and development (R&D)? Does CMC utilize the resources of Quebec's aerospace ecosystem by working with local partners and universities?

PC: Much of our R&D is devoted to product evolution. CMC invests \$10 million annually into developing FMS functions. We are the only company that can retrofit an aircraft with flight path optimization. Because of our commitment to R&D, specifically in the GPS space, CMC has maintained its status as a world leader. We are currently developing the next generation of sensors to enable a pilot to land an aircraft using GPS. CMC is also developing computers for aviation that will safely host different software applications. We try to leverage Quebec's ecosystem by working with local companies and liaising with institutions such as the Green Aviation Research and Development Network (GARDN), and universities that offer supply chain support in avionics.

What are CMC's strategies and key goals for the future?

PC: CMC's goal is to move up the value chain by adding new products to our portfolio, and furthering alliances to enhance our service offerings. This will enable us to compete with larger companies. ●



Michel Grenier

●●● Vice President and General Manager
THALES CANADA

●●● What is the focus of Thales Canada's operations in Montreal?

Thales has had a presence in Canada for 30 years and has been active in aerospace since the late 1990s, at which point we started to work with Bombardier on its Global Express program. In Montreal, we primarily work within the niche of flight controls and fly-by-wire technologies for the business jet and regional jet markets. While this is our specialization in Canada, we are also able to leverage our portfolio of avionics products in France to complement what we are doing for our customers here.

How does fly-by-wire technology work and how prevalent is it today?

Fly-by-wire is a computer system that controls the surfaces on the wings and tail of an aircraft. It allows planes to turn, go up and down, and land safely. The pilot input is sent to the computer, where it is

analyzed to make sure that it is within the flight envelope of the aircraft. If the input is validated, a command is sent to the actuators on the wings to move its surfaces, which allows the plane to turn.

Fly-by-wire technology is especially prevalent in the high-end business and Air Transport markets, and in our mind will be standard on all new aircrafts. Within the lower-end market, aircrafts valued below \$20 million, there is a trade-off between whether it makes sense to invest in this type of technology or to remain with more conventional technology. Our customers have said that it is becoming easier to certify aircrafts with fly-by-wire technology than conventional technologies, because fly-by-wire is easier to demonstrate how an aircraft will behave while also capturing any potential faults. We also see that helicopters are gradually moving to fly-by-wire technology. Although we do not currently have fly-by-wire for the helicopter market, it is something we are looking at for the future. Fly-by-wire is also applicable to larger commercial aircraft, but here in Canada, our mandate is to work on the business jet and the regional jet markets.

What is the competitive landscape for fly-by-wire technology?

The bar is set high for fly-by-wire technology and its market is very competitive. If you want to develop a flight control computer, it is an intricate process. This is very critical equipment and you cannot tolerate a fault in the computer because if you lose it, you lose the aircraft. The engineering is very demanding because it entails systems engineering, redundancy, and all of the analysis that must be done to make sure that the equipment is safe and reliable.

What are the defining characteristics of Thales' fly-by-wire technology?

The feedback that we get from our customers is that we are able to tightly and neatly integrate our fly-by-wire technology into two computers, whereas some aircraft models have five or six computers dedicated to these functions, primarily for redundancy and dissimilarity. With fly-by-wire technology you want to build the computers differently because you do not want them to have the same faults and fail at the same time. We have been able to integrate our technology into smaller boxes that do not take up too much space on

an aircraft, allowing OEMs to save more cabin space for their passengers.

What trends has Thales identified in the needs of its customers?

Aerospace companies are always looking to reduce the weight of aircrafts for fuel purposes. However, in the business jet market, especially for high-end aircrafts, the concern is more focused on lifecycle costs. One common message that we hear is the desire for more cabin space. Accordingly, the more we can integrate and refine the spatial requirements of our products, the more our customers can expand their cabins.

Looking forward, what is Thales Canada's strategic growth plan?

Thales Canada is very lucky to be working in the business jet market, which has recently benefited from strong trends in growth. Going forward, we want to increase our footprint in this market, not only with flight controls, but with other products as well. We also have a solid presence in the regional jet market, but we need to maintain and consolidate our presence in this area. While the regional jet market is more stable, we see our strongest growth potential on the business jet side.

In three to five years, what position does Thales Canada want to achieve in Canada?

Thales Canada wants to grow its presence by continuing to work with Bombardier on its next platform, helping it with its technology development program. We want to broaden our customer base and to work with other OEMs in the business jet and regional jet markets. Overall, we feel like the Canadian marketplace is a great place to work and are proud to have had an established presence here since 1997. We are well supported by Quebec's aerospace cluster and the Government of Quebec. Quebec provides a good business environment for aerospace, and we think that we have the right skills in Montreal to grow our business. •



Laurent Pieraut

●●●
CEO
CS CANADA

●●● **2015 represents CS Canada's 15th anniversary. To begin, walk us through the development of CS Canada and describe any recent milestones that have shaped its presence.**

CS Canada was created in 2000. Since 2002, we have been working with a major North American engine manufacturer for the development and testing of software for its engines. In parallel, we have added customers from both Canada and the United States. As a result, we have experienced an average annual growth rate of 15% since our opening in 2000. This year, we opened an office in the United States to pursue a strategy of further expanding our footprint in the North American market. Our strategy in the North American market is to approach the entire aeronautics industry where safety-critical software is involved.

How does CS Canada fit into its parent company's global network?

CS's head office is based in France, with subsidiaries in Germany, Romania, India, and Canada. Its activity comprises four business units: aerospace, energy, defense, and space. CS Canada has been located in Montreal from day one, and Aerospace has been the primary focus of our operations. We will now start representing and taking on some of the other technologies and products that CS offers and try to introduce them here in North America. Initially, the focus will be placed on space and defense. In addition, we take advantage of our low-cost sister companies, such as those in Romania and India, to help drive down the cost of our services.

What is the range of software services that CS Canada provides the aerospace industry?

In terms of software services, CS Canada develops, tests, and certifies safety-critical avionics software in accordance with the DO-178 standard. We typically do this on a firm-fixed basis. We take over the entire scope of a project and provide our customers with turnkey solutions. Many of these aerospace companies do not have sufficient software resources to address the large peak in activities which often occur before a certification milestone. The aeronautics industry is moving towards intelligent aircraft, meaning that avionics equipment is becoming increasingly reliant upon safety-critical software. There are many regulations between Transport Canada, the FAA and other

Transport Authorities around the world, so an aircraft's software must meet these safety standards. CS Canada's turnkey solution includes project management, and software development, validation and verification services. We do some consulting and on-site work, but the majority of our activity is done at our offices in North America and with our sister companies or low-cost suppliers overseas.

What is the application of CS Canada's software services?

We offer our software development and testing services to any company that provides safety critical systems on an aircraft. Before an aircraft can fly, we test the software at the appropriate safety level in accordance with Transport Canada and FAA regulations. Once it is tested by us, the customer does not need to worry about it. As an example application, we support certification of engine control systems. Regarding customization, there are always core functionalities that are reused, but each manufacturer nonetheless has to customize software for their customers.

Looking forward, what trends have you identified in terms of the software needs of aerospace companies?

As in automotive systems, we are seeing an increasing number of software functionality coming into avionics. For example, engines are becoming more and more intelligent. Software now plays a role in controlling things like fuel efficiency and in preventing pilot procedural errors. All of the software features that are going into avionics suites cost a lot to design, test and certify in order to satisfy the safety requirements of the Transport Authorities.

CS Canada has recognized that its customers in North America want their core work, such as system design, software development, and some aspects of testing, to be done locally. On the other hand there is pressure from customers to move more repetitive processes to low-cost offshore centers. There has been a big trend in recent years for companies in the aeronautics industry to push a lot of this work to low-cost centers such as India. We are currently using our CS sister companies, such as those in Romania and India, to lower our costs. We manage this network of international suppliers and coordinate the actual certification of software with our customers and the Transport Authorities. •



Eric
Gagnon

●●●
Vice President and General Manager
**ASTRONICS (LUMINESCENT
SYSTEMS CANADA INC.)**

●●● **Astronics has a history dating back to 1958. Could you tell us about its history and any milestones that it has experienced here in Quebec?**

Luminescent Systems Canada Inc. (LSI Canada) is a subsidiary of Astronics Corporation, which is headquartered in East Aurora, NY. LSI Canada was founded in 1988 and acquired by Astronics in early 2000. LSI Canada has been located in Dorval since its founding.

Which of your products are manufactured in Quebec?

The Montreal facility is the center of excellence for human machine interface. This relates to everything that a pilot would touch in a cockpit, including the keyboards of the flight management system, the radio controls, and the autopilot.

What is your involvement in the military?

Our business revolves around the traditional segments of the aerospace industry: business and general aviation, air transport, and military aviation. Typically, our customers are major avionics manufacturers that have a global presence, which by default extends our participation globally into all three segments.

Acquisitions seem to have played a big role in Astronics' growth strategy. Can you talk about this strategy?

Acquisitions have been a part of Astronics' growth strategy and are handled out of our corporate office. We have seen strong organic growth out of the Astronics LSI Canada division. Part of our strategy is quality, on-time delivery and performance. Here at LSI Canada, our evolution is largely based on our successful performance and product delivery, combined with the continued growth of our product offering.

This year has been a successful year for Astronics as a whole. You were named one of Americas Top 20 Small Business Companies and your sales doubled in the last quarter. How has that success translated to the Montreal branch?

We are proud to contribute to the success of Astronics Corporation and pleased that Astronics is listed in Forbes Top 20 small cap companies. We are equally proud of our accomplishment earlier this year,

when Rockwell Collins named Astronics LSI Canada Human Machine Interface Supplier of the Year for the sixth year in a row. We are in the process of building a culture in which our employees are extremely proud of what they are accomplishing day in and day out.

How does research and development (R&D) play a role within your Montreal division?

R&D is an important part of our strategy and we are continually working to improve our processes and products to achieve exceptional performance and quality. These are some of the key drivers for the aerospace industry, so it is essential to continually improve in order to maintain a leadership position in the industry. For example, lighting is essential to aviation, particularly its color, uniformity, and in some applications radiance. In the military, where night vision is imperative, we continually work on developing better products. In order to improve our manufacturing efficiency, we developed a camera system where a picture of our product light can be taken and the key characteristics of the photometric response can be instantaneously translated into a report. This effectively assures that our product enables the pilot to have the optimum lighting conditions in the cockpit.

How has the Quebec government supported the aviation industry's growth?

The Quebec government is very proactive in supporting the aviation industry, and we benefit from the fact that Montreal is home to some of the world's leading aerospace companies.

Where do you see Astronics in three years?

Here in Montreal, we will continue to focus on improving our performance and developing new products. We want to maintain our position in existing aircraft programs and will actively pursue new opportunities in future programs. •



Joanna Boshouwers

Vice-President and General Manager,
Satellite Systems

MDA

- **MDA is a global communications and information company, with one of its operations in Sainte-Anne-de-Bellevue primarily dedicated to satellite systems. Please provide us with a brief history of MDA's activity here in Quebec.**

MDA was founded in 1969 as a partnership between Dr. John MacDonald and Verner Dettwiler. Today, more than 4,800 employees are operating from 11 locations in the United States, Canada, and internationally. The MDA Sainte-Anne-de-Bellevue division, previously known as SPAR Aerospace, can trace its history back to the early 1900's. Our heritage in space started over 50 years ago, with the construction of a payload for the NASA Data Relay satellite launched in December 1962. Around the same time, Canada was busy developing its own satellite designed to monitor the ionosphere, Alouette. Alouette 1 was launched in October 1962, making Canada the 3rd country in the world to launch a

man-made satellite (after the Soviet Union and United States). Space is of particular importance to Canada due to its vast territories, scattered population and long coast lines. Satellites become an efficient and vital means of communication, and offer tremendous advantages for earth mapping, national broadcasting, security monitoring, shipping lanes and ice monitoring applications. MDA has been involved in more than 200 space programs and has acted as a mission and payload prime contractor. Our major ground-breaking satellite programs include many world premieres in satellite services such as Anik A (first domestic communications), Anik C (first direct broadcast), MSat (first mobile communications), and RADARSAT-1 (first commercial radar). MDA also contributed to the International Space Station program by providing the renowned Canadarm 2 and communication subsystem, allowing the astronauts and earth station to communicate.

Can you provide us with an overview of your facilities and workforce?

Today, we provide advanced satellite systems and sub-systems for communication and remote sensing satellites. We employ over 800 highly skilled employees in multidisciplinary functions. We are equipped with 365,000 square feet of state-of-the-art integration, assembly and test facilities in Montreal. We are the world's largest independent commercial supplier of communication satellite antennas and also offer complete payload solutions and advanced electronic products. Four years ago, with support from the Quebec government, we implemented a 40,000-square foot expansion of our facility. This project enabled MDA to accommodate an increasing level of business in the payload segment and acquire additional production and test equipment. The government's financial support allowed MDA to enlarge its capacity in Quebec as well as create and sustain high quality jobs.

What role do innovation and research and development (R&D) play in the aerospace sector of MDA?

Because satellite payloads are largely customized, many of our developments and opportunities for improvement are realized as part of our contracts. Each new order builds on our past developments

and pushes the technology forward a little more. In good years, this is a positive spiral and developments can be fuelled with relatively little dedicated R&D. In bad years, a downward spiral needs to be avoided by injecting more R&D investments. It is also more challenging when we are facing a "technology leap", which happens every five to 10 years or in our industry. The support of the Canadian Space Agency and the federal or provincial government has made a big difference in those times.

What steps are MDA taking to drive down the weight of its satellites?

Due to the high cost of launch per pound of mass, mass efficiency has always been a concern of space manufacturers. Development of lightweight and cost-effective materials is therefore continuously going on. Graphite is now being used more extensively to replace materials such as aluminum and steel. Additive manufacturing is the latest trend and MDA is actively engaged in R&D in this area. Its application in space holds numerous benefits, as it allows you to have more tailored geometry that does just what you need and is not as constrained by traditional manufacturing techniques.

Do you have a final message?

Our vision is to be the best provider of satellite systems and subsystems in the world by offering customers a great experience—by being flexible, offering them good prices, offering them solutions they had not thought of, and developing things ahead of their needs. Our success to date is built on this. Together with our customers and our suppliers, we aim to continue doing great things for the earth and its people from space. •





ATTENDING TO QUEBEC'S AEROSPACE NEEDS SERVICE AND EQUIPMENT



“Altitude Aerospace’s core competencies are in aerostructures and in the support of aircraft structures. Our team has supported the development of large structural sub-assemblies such as aircraft doors, fuselages and wings.”

- Nancy Venneman
President,
Altitude Aerospace

REINFORCING QUEBEC'S COMPETITIVE EDGE

Service and Equipment Providers



●● While Quebec's aerospace cluster enjoys a favorable ecosystem of OEMs, integrators, and sub-tier suppliers, it also contains an array of small and medium-sized enterprises (SMEs) and multinational companies that play critical support roles within the industry as specialized providers of services and equipment. This group of companies has expertise in fields that include engineering; surface treatment and special processing; maintenance, repair, and overhaul (MRO); tests and controls; and human resource management. While varied in focus, each of these companies adds depth to the industry's capabilities by sharing a common trait: an ability to remain agile and provide value-added solutions in a highly dynamic industry.

Multinational service providers have long been attracted to Quebec's aerospace cluster due to its auspicious business environment and growing market potential. Rolls-Royce was one of the first multinational service providers to establish operations in Quebec. In 1947, it instituted a center of excellence for engine MRO services, Rolls-Royce Canada, which serves the needs of more than 600 aircraft operators in 30 countries. As an employer of nearly 1,000 technically trained employees, it has cited the local industry's pipeline of human capital as an essential element to the company's success. Each year Montreal's universities, technical colleges, and trade schools produce more than 4,500 graduates for the field of aerospace.

The issue of aging aircraft is of rising concern within the global aerospace industry. Recognizing this need, Quebec has emerged as a global hub for comprehensive MRO services. Innotech-ExECAIRE provides maintenance and refurbishment services to business aircraft the world over. More than 80 percent of its business is derived from international customers. Other MRO providers

such as Turbomeca Canada and Avianor, which serve the engine and cabin interior markets, respectively, add to the robust composition of Quebec's MRO sector. Tony Rawlinson, director of sales and marketing at Innotech-ExECAIRE, said: "The Quebec aerospace cluster is reliant on a dynamic workforce and the launch of innovative products that the world wants." Through tapping into the local talent pool and driving innovation, Quebec's MRO providers showcase the province's ability to address contemporary market conditions with value-added solutions.

Quebec is also home to myriad uniquely specialized engineering firms that seek to provide the industry with new technologies. Assystem, a multinational engineering firm that has a well-known reputation in the European aerospace market, established operations in Montreal over 10 years ago as the locus of its strategy in the North American market. It strives to leverage its experience in the European market by bringing new design, materials, and technologies to Quebec. Jeff Hoyle, vice president Aerospace of Assystem, said: "In order to penetrate the North American market, you have to demonstrate competency in this value-stream."

Another multinational engineering firm, Adetel Group, recently entered the Quebec

aerospace market under the banner of Adetel Canada. Through its design of innovative technologies, it seeks to drive down fuel-related costs for various next-generation aircraft.

Applying innovative solutions to pressing market needs is a critical determinant of competitiveness within the aerospace industry. SMEs within Quebec's aerospace cluster are afforded a unique window to leverage local resources and meet the industry's innovation needs. Provincial consortiums such as CRIAQ, and federal programs such as CNRC IRAP, have a notable impact on spurring cost-effective research and development (R&D) within the industry. SMEs that undertake joint R&D projects with CRIAQ have realized return on investment (ROI) ratios ranging from one to 44.

Alternatively, CNRC IRAP provides zero-interest loans, grants, and industry contacts to SMEs for the development of innovative products. "The CNRC IRAP is an invaluable resource for SMEs," said James Groundwater, general manager of Beel Technologies. Under this program, Beel Technologies was able to develop its latest generation secondary surveillance radar (SSR) monitor for air traffic control application.

Coupled with innovation, service and equip-



Image: Pratt & Whitney Canada

ment providers must remain versatile in order to address changing industry trends. The segment of special processing and surface finishing is one area that is undergoing considerable change. Given the industry's transition towards consolidation, processing shops must refine their operations and improve on-time delivery while expanding their capabilities in order to secure contracts with larger players. Jean Magny, president of Genius Solutions, said: "Smaller players need to have certain tools in place in order to meet industry best practices and the high standards that large players expect." Enterprise resource planning (ERP) systems, such as those offered by Genius Solutions, is one way in which SMEs can improve their processes.

Industry dynamics have caused many processing shops to make substantial changes to their internal processes. Marc Brindamour, general manager of Tekalia Aeronautik, said: "Everything involved in quick-response manufacturing revolves around flexibility and ensuring that everyone within the organization is aware of processes. Accordingly, we have taken great strides to analyze the setup, layout, and execution of our processes. We assess the pace, beat, and rhythm of our processes to ensure solid production flow." Tekalia Aeronautik provides surface

finishing solutions for landing gear components and is in the process of expanding its capabilities to include the processing of titanium parts, in order to address diversified customer needs.

Other surface finishing specialists are also advancing technological changes within their processes. Guy Levasseur, president of Aerosphere, indicates that "in the next three to five years, it is planning on implementing robotic shot peening processes to its work capability."

An engineering firm that has displayed its ability to adapt to changing industry trends is Altitude Aerospace. By undertaking a joint venture with Trinity Aerospace to acquire a precision machining manufacturer, DICI Industries, Altitude Aerospace integrated manufacturing into its engineering services. Through this process, it was able to "transfer skill sets throughout the organizations and increase the complexity level of projects carried out," said Nancy Venneman, president of Altitude Aerospace.

In each of these examples, Quebec's service and equipment providers have showcased their ability to remain responsive and vigilant to shifting industry conditions. Through agility, innovation, and the continual improvement of processes, this group of players reinforces Quebec's competitive edge. •



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Nancy Venneman

●●●
President
ALTITUDE AEROSPACE

●●● What service offerings does Altitude Aerospace provide?

Altitude Aerospace has been providing engineering support to the aerospace industry for the last 10 years. We have been supporting the development of some of the most challenging and exciting new aircraft programs, but have also been providing in-service support to airlines and MROs.

Altitude Aerospace was initially founded to provide modification and repair support for aircraft in-service. We developed Supplemental Type Certificates (STCs) for airlines and also provided engineering repair services on accidental damage to aircraft. We develop turnkey solutions for airlines which included the conceptual design, engineering substantiation, certification and production of STC kits through a partnership with a Transport Canada approved manufacturer, Trinity Aerospace.

Our team has worked on a wide range of aircraft types and is very knowledgeable

in the certification process with Transport Canada and foreign authorities. This is what sets us apart from our competitors.

What is the composition of Altitude Aerospace's workforce?

Altitude Aerospace's team is currently composed of approximately 65 engineers. Half of our team specializes in conceptual design, while the other half specializes in structural analysis and certification. However, through tailored training programs we ensure our engineers are flexible and capable of moving from one discipline to another. Our chief engineer, Fadi Al-Ahmed, is very practical and hands on. He is dedicated to training and coaching our team of engineers.

What are some of the core competencies and specialization of Altitude Aerospace's engineering teams?

Altitude Aerospace's core competencies are in aerostructures and in the support of aircraft structures. Our team has supported the development of large structural sub-assemblies such as aircraft doors, fuselages and wings. Weight reduction and optimization is also one of our key strengths. This is currently the prevailing trend in aerostructures. It is what allows the end user to operate an aircraft more efficiently. It has long been a focus but even more so in the past few years, as there is heightened competition between aircraft manufacturers to create the best product operating at the lowest cost possible.

Our team is very versatile and is also capable of supporting a full aircraft repair project. If an aircraft is subject to accidental damage, for instance a fuel truck comes into contact with the fuselage of an aircraft. Altitude will deploy a team on-site to carry out a damage assessment. We will then define the components to replace and prepare the engineering to repair its structure to bring the aircraft back to an airworthy state. We have the necessary knowledge and the capabilities to take on these kinds of projects.

In 2013 Altitude created a strategic partnership to acquire a local manufacturing firm. How does Altitude Aerospace intend to position this network of companies in the coming years?

Altitude acquired a precision machining manufacturer, DICI Industries, in a joint

venture with Trinity Aerospace. This has allowed us to expand our services to include manufacturing, machining and sheet metal, but more importantly it has allowed us to integrate our services from engineering to manufacturing. DICI Industries is very active in the defense, electronics and medical industries. We like the diverse nature of this business as aerospace tends to be very cyclical. We see this as an opportunity for Altitude to bring some engineering expertise to these fields, though we obviously are interested in increasing the aerospace content at DICI.

We see that OEMs are increasingly reluctant to deal with an array of separate entities. In the past, they would outsource the engineering and manufacturing separately but they do not want to manage that anymore. Our partnership has already proven successful, as it has allowed us to transfer skill sets throughout the organizations and increase the complexity level of the projects we can carry out.

What is Altitude Aerospace's strategic growth plan for the coming years?

On one hand, Altitude plans to work on more integrated and larger scale projects with our manufacturing partners. And on the other hand, we plan to expand our in-service activities both in the extent of the work we carry out but also geographically to better serve our customers 24 hours a day. This international presence will enable us to support aircraft anywhere in the world in an efficient and cost effective manner.

There have been a great number of new aircraft developments around the world in the last decade. OEMs have invested a lot in development and are now increasing production to meet the increasing demand of aircraft worldwide. Our focus will be on supporting new programs entering service but also supporting those that are sustaining aircraft. •



JH



MO

Jeff Hoyle & Michel Ohayon



JH: Vice President Aerospace
MO: CEO North America

ASSYSTEM

- Assystem is a global enterprise with a storied presence in the European market. To begin, please provide us with an overview of Assystem's global operations and its involvement in the North American market.

MO: Assystem is an international engineering and innovation consultancy, which has a presence in 21 countries throughout Africa, Asia, Europe, the Middle East, and North America. Globally, we have a workforce of over 11,000 employees, of which 4,000 are dedicated to aerospace. Last year our operations generated €870 in annual revenue.

JH: We have historically been well positioned within the European market, as much of our activity comes from France, Germany, and the United Kingdom. Over 10 years ago, we recognized that in order to achieve desired levels of growth, we needed to expand into North America. The plan has been to leverage the strengths of

our global network through the organic development of engineering operations, while also considering strategic acquisitions in order to augment our presence. Ultimately the goal is to grow our North American footprint so that its revenues rival that of our operations in Europe. Today, we have offices in Montreal, Quebec; Wichita, Kansas; Mobile, Alabama; and a strategic partnership in Seattle, Washington. We are also looking at a number of other locations in North America in order to support our global customers, such as Rolls-Royce.

MO: Assystem's Montreal office opened in 2004 and has been the focal point of our strategy in North America. Quebec provides an interesting market to Assystem due to the breadth of its aerospace cluster, which has enough suppliers, technology, and competency to build an entire aircraft.

What services does Assystem provide the North American aerospace market?

JH: Assystem is an expert in providing value-added engineering solutions to its customers. We have experience building relationships with well-established companies and providing wide-ranging services on projects that require complex engineering solutions. Through leveraging our experience in the European market and drawing upon our global network, we deliver the North American market a strong value-proposition.

MO: The services that we provide the North American market include work in aerostructures, gas turbine engines, mechanical and electrical systems, embedded systems, and interiors. While we might not specialize in all of these disciplines locally, we are able to leverage our global network to ensure coverage of all of our local customers' diverse needs. Furthermore, we have institutes in which our engineers are provided with specialized training in distinct fields, such as the automotive, aerospace, and nuclear industries. This affords our employees the opportunity to develop wide-ranging expertise and to crossover and apply this know-how to the aerospace industry.

Please describe Assystem's workforce in Montreal and what types of projects it works on?

JH: Within the global organization, it is imperative to have local experts, and As-

system's Montreal office supports both local markets and our global network. Specifically within Canada, we are focusing on the production environment, as this area offers strong growth potential.

MO: In Montreal we have 70 employees dedicated to the aerospace industry. Within this framework, we have teams working on projects that concern design, analysis, and support of our local customers. Much of our past activity in Quebec was focused on aerostructures, but we are currently more focused on all stages of engineering, manufacturing, and production support. This is one of our value-propositions as we are able to manage multiple phases of production.

What is Assystem's global strategy and how does North America tie into its development plan?

JH: As a global organization, you have to respond to the demands of your customers. Assystem's strategy is to deliver cost-effective complex engineering solutions across the world. Ultimately, the goal is to expand our presence from Europe to include North America and Asia. Each of these offices will then be able to create added value for our global network. For instance, we have offices in India, which affords us a cost advantage for certain activities. Furthermore, it is important to be well positioned globally in order to support our existing customers and attract new customers.

Looking forward, what are some of Assystem's key goals?

JH: Assystem identifies strong growth potential in aerospace and general engineering activities. In the next five years, we would like to take our Global Product Solutions division, which includes the aerospace and automotive industries, from €500 million to €1 billion in annual revenue. In order to accomplish this, we will continue to offer solutions to more complex problems, while moving into new markets. Basic engineering can be done anywhere in the world today. Accordingly, we will look to differentiate ourselves through innovation: new designs, materials, and technologies. In order to penetrate the North American market, you have to demonstrate competency in this value-stream, which we intend to do by applying our expertise from the European market. •



Benoît Morin

●●● Vice President
ADELTEL CANADA

●●● **Adetel Group initiated its presence in the Canadian market with the formation of Adetel Canada in 2012. To begin, describe the evolution of Adetel's presence in Canada and the rationale behind its move into the Quebec market.**

Prior to Adetel Group's move into the Canadian market, it had long considered opening facilities in Quebec. Its rationale was based on the fact that Montreal offers the third largest concentration of aerospace activity in the world. It took time to identify appropriate facilities, programs, and fiscal support, but in October 2012 we initiated our move into the Canadian market with the formation of Adetel Canada (Adetel). Situated in Saint-Hubert, Adetel has grown its staff over the last two years to include 100 employees: today, we have one of the largest aerospace and rolling stock engineering facilities in Quebec. During our time here, we have enhanced our presence through the development of business

activities with aerospace companies such as Thales and Pratt & Whitney.

What industries does Adetel target with its work in Canada?

Adetel's focus in Canada mirrors that of the group's global activity. We are a specialized engineering firm that works in the development of embedded electronic systems for critical environments. The two principal industries that fall under our purview are aerospace and rolling stock. These industries account for roughly half of our turnover, while we also work in fields as distinct as the medical and military sectors.

How do you apply your solutions to the aerospace sector?

Adetel designs embedded electronic solutions for the aerospace sector. The application of these solutions includes data acquisitions and analysis, electricity, fluid, speed, and weather for aircrafts computer system. Another important segment we cover for aerospace is the energy environment of an aircraft; providing solutions centered on energy saving and stocking.

What are some of Adetel's ongoing projects within the aerospace sector?

Adetel is currently in the process of developing an electrical battery management system for Airbus, which will provide its aircrafts with one-hour autonomy on the tarmac prior to starting the engine for takeoff; electrical utilization in this form could provide fuel related cost, while also proposing strong benefits for the environment. This is all part of our green aviation strategy. In an effort to maintain our cutting-edge technology, the group is investing over 10% of its turnover on research and development initiatives. In Canada, we are currently developing a test bench for Pratt & Whitney's PT6 turbine, which will change its current method of driving. We are also working on another project with Thales Group in Quebec focused on the exploration of new technologies for hardware systems, which will complement its software systems. Adetel also works closely with Varitron Technologies and C2MI; strategic relationships such as these enhance our presence as a one-stop-systems-shop.

C2MI is an organization that aims to bridge academic and industrial sectors,

assisting in the commercialization of microelectronic products. What is your relationship with this organization?

C2MI is a spin off between IBM and Teledyne DALSA. Its primary purpose within Adetel's operations is as a testing center for microelectronics; its facilities enable us to ensure that all of our electronics are viable with efficiency in excess of 99.99 percent. C2MI plays a significant role within Quebec's Aerospace Cluster and its activity is essential for us within the aerospace sector, as it provides assurances that we can pass on to our customers.

Looking forward, what innovations do you have in the pipeline for the aerospace sector?

Adetel is currently working with different groups on the development and provision of technologies related to electrically-driven systems for the powering of aircraft engines. Ultimately this solution will mitigate an aircraft's carbon emissions while making its engine more effective. The evolution of this type of technology is apparent in Airbus' line of new engine option (NEO) aircrafts and Bombardier's C Series. With the implementation of new technology, these aircrafts will be more efficient and resistant; less noisy; and consume 20 percent less fuel. Cabin pressurization will also be applied at lower altitudes, for instance 2,000 feet rather than 6,000 feet, resulting in an improved cabin environment for passengers.

What are some of Adetel's goals for the next three to five years?

Over the next three to five years, Adetel will focus on maintaining its customer base and will continue to collaborate with its customers on research and development (R&D) activity. We also have the goal of expanding our North American presence; accordingly, we are in the process of increasing our activity on the west coast through our facilities in Fremont, CA and Seattle, WA. Our overarching goal is to be recognized as a major player within the aerospace industry. •



Fernando Ledesma



Corporate Director
AKKA TECHNOLOGIES

- **AKKA Group North America is a relatively recent implementation of its parent company, AKKA Group. To begin, walk us through the recent history of AKKA Group and any key events that have contributed to its presence in the North American market.**

AKKA Group North America (AKKA) was established in 2010. At the time, our parent company AKKA Group employed around 5,000 staff globally. In the next two years, AKKA Group went through a number of big strategic acquisitions in target sectors including Aeroconseil, one of the world's preeminent systems engineering companies. Aeroconseil was founded in 1984 by Max Fischl and was in command of the first test flight of the prototype Airbus A300-B.

Those acquisitions, together with strong organic growth, resulted in a total group workforce of more than 11,000 employees and a global network that expanded to in-

clude 23 countries.

In Canada, the merger of AKKA and Aeroconseil resulted in AKKA GNA, a company that has showed a robust, sustained growth. After five years, its workforce numbers 100 highly specialized engineers working in the aeronautics, railways and pharmaceutical sectors.

What is AKKA's core service offering to the aerospace sector?

AKKA covers the whole engineering spectrum of building and operating an aircraft, from concept and design engineering to industrialization and in service support, supported by seven specialization areas: systems, mechanical, process and support engineering, electronics and embedded software, information systems and consulting. Our focus in North America in aerospace is primarily concentrated on systems engineering (all ATAs), mechanical design, and certification (including DO178, DO254, DO 160, ARP4754).

In what ways does AKKA benefit from the expertise of its European parent company?

AKKA Group provides its Canadian operations with many key synergies, which affords us solid positioning within Quebec's Aerospace Cluster. There are at least two clear ways to create that synergy:

On the one hand, supported by our local project management teams, we deliver to Quebec's customers work packages and turnkey projects from our best-in-class engineering centers spread across the world.

On the other hand, Quebec it is a very appealing destination for our talent willing to have an international experience. Among the 23 countries where AKKA operates today, we are happy to be ranked as #1 preferred destination for our consultants. This means that with the support of our strong mobility department, we are able to import experts with advanced technical expertise that is difficult or impossible to find locally in Quebec, such as fly-by-wire and ARP certification.

Through this advanced global delivery model, we are able to face virtually any engineering challenge locally and creating jobs locally in the process.

Looking forward, what is the typical profile of projects that AKKA would like to target in the aerospace sector?

Going forward, AKKA would like to target projects related to mechanical and systems engineering; testing; and certification, including modifications. OEMs represent our target focus, while we also work with tier ones and several tier twos.

What is AKKA's strategic growth plan for the coming years?

A balanced diversification strategy is essential to AKKA's operations in Canada. For this reason, we are involved in the aerospace, railway, and pharmaceutical sectors, which enables our financial independence from the group. This formula is repeated throughout the 23 countries in which we have a presence. Expanding our presence in the Americas is a major focus for AKKA Group. Our strategy in Canada will be to grow both organically and through acquisitions.

What are some of AKKA's key goals over the next three to five years?

Over the next three to five years AKKA will strive to increase its footprint across Canada. In 2014 we opened 10 new accounts under our diversification program. It is our goal to have a presence with all of Quebec's OEMs while driving the future development of companies we work with. We came to Quebec only four years ago and over this time we have demonstrated our ambition. We are confident in our world-class engineering expertise and are ready to bring our North American market presence to the next level. ●



Benoît Hudon

●●● Senior Vice President and Chief Operating Office
AAA CANADA

●●● **Please provide us with a brief overview of AAA Canada and describe any key milestones that have contributed to its current position in the market.**

AAA is a privately owned European group with 2,500 employees globally. We perform services for the aerospace sector on-site, at the customer facility. AAA's two main lines of service are industrialization and manufacturing and are comprised of teams of both white-collar and blue-collar workers. We work within commercial, business, helicopter, and military sectors. AAA Canada was formed in 2007 and quickly grew due to one of its main customers, who had three aircraft development programs in progress during that time period.

What is the size of your Canadian operation compared to the rest of your global network, and in what way are you able to leverage the group's expertise in Quebec?

Between our two Canadian offices in Montreal, Quebec and Mississauga, Ontario, we have a total of 170 employees. The group has also recently opened an office in the United States. AAA's goal is to boast worldwide coverage so that we can offer customers local support and a one-stop-shop service for maintenance, manufacturing and industrialization. Our services in Canada mirror the group's core business, drawing on the knowledge and expertise of the AAA group. In our Montreal office, approximately 40 of the 100 employees are from Europe, 30% of which come from within the larger group. Our employees, especially younger personnel, enjoy living the international experience.

What are the core competencies within AAA Canada?

Our personnel have worked on many different aircraft platforms globally. AAA Canada is also introducing a service that is based on the group's offering in France: a one-stop-shop for outstanding work, incorporating the ability to correct a problem on the line quickly without disturbing processes. Our core competencies have recently helped us to secure three major customers in Toronto, where we will be managing outstanding work that consists of five work packages.

Can you provide details regarding your business model? What is the typical profile of customers that AAA Canada works with?

We have two business models. The first is a complete operations management service, charged at a flat rate to the customer for select tasks. The flat rate offers flexibility without straining the customer's budget. AAA Canada's second service is technical assistance, which is billed by the hour. These contracts typically last a few months, whereas complete operations management projects can last for two to three years. Our main customers are OEMs and tier-one companies, but we occasionally work with SMEs on inspection, manufacturing, methods and quality.

How has AAA Canada performed in terms of growth since its formation?

Until 2013, our business grew consistently. We experienced less growth from 2013 to 2014, which was reflective of the aerospace economy in Canada. This year, AAA

is experiencing excellent growth supported by both our Montreal and Mississauga activities. AAA Canada is positive about the future, especially because the aircraft and engineering design phase has largely been completed. Presently, the aerospace industry is moving into the industrialization and manufacture phase, which is AAA Canada's area of expertise.

To accommodate your exceptional growth in Quebec, are you looking to source human capital from within the group, local universities, or internationally?

Recruiting experienced personnel is always a challenge. We try to source expertise from within the group and from partners such as placement agencies. In France, AAA has its own training center. Today, AAA Canada is getting closer to local schools that offer educational degrees that are in line with our field of activities.

What are AAA's goals for developing its presence in North America and specifically in Canada over the next five to ten years?

AAA Group is considering various options. We are aiming to double our current revenue either by organic growth or by acquisition. In 2014, AAA Canada's objective was to consolidate; in 2015, it is to open an office in Ontario; and in 2016 to open an office in Western Canada. Our plan is to have three solid, viable business units in our niche market, and then pursue MROs and OEMs. This strategy will also be used in the United States. Maintaining the status quo is not an option. Our plan is to promote growth that is centered around meeting our customers' needs.

Do you have a final message for our international readership?

The AAA Group's unique approach of deploying qualified and skilled technical personnel directly to the customer's place of business allows customers to reduce operating costs and maintain industrial production at their facilities. This practice keeps jobs local and prevents companies from having to relocate. •

Marc Brindamour & Erick van de Water

●●●

MB: General Manager
EVDW: Program Manager & Business Development

TEKALIA AERONAUTIK



MB



EVDW

●●● **Tekalia Aeronautik is a one-stop-shop for surface finishing solutions, specializing in the market for landing gear components. In recent years, what has been the focus of Tekalia's operations?**

Tekalia Aeronautik (Tekalia) has recently benefited from strong increases in business volume, primarily from Boeing and Airbus. In 2015 we expect growth rates of 30% to 40%, while in 2016 we forecast growth of 20 percent. While we have not added a substantial amount of employees to our workforce, our focus has been on transforming the business through the improvement of internal processes. Accordingly, we have taken great strides to analyze the setup, layout, and execution of our processes. We assess the pace, beat, and rhythm of our processes to ensure solid production flow. Our goal is to incorporate this flow within all of our processes and to be seen as the quickest one-stop-shop in terms of deliveries and responsiveness. This process stems from the training that we provide and the capabilities of our management team, as they instill lean manufacturing and operational excellence. Everything involved in quick-response manufacturing revolves around flexibility and ensuring that everyone within the organization is aware of processes, which has been the focus of our recent efforts.

How does Tekalia perform in terms of on-time delivery?

Generally speaking, the industry requirement for on-time deliveries (OTD) is 95%, which is Tekalia's ultimate goal. We are climbing to reach this level and will likely achieve it by 2016. We have already achieved this standard for several of our customers. Our "TEAM" approach (Tekalia's Engagement to Achieve More) has enabled us to hover at almost 90% OTD since the beginning of our Fiscal Year (Oct. 2014). The pressure received from the market in terms of reducing cycle times is quite high. We are at the end of the supply chain: commonly, after us there is only paint and assembly. There is often not much time remaining for companies in our position in the aerospace supply chain, and time is of the essence. Should the delivery of a landing gear be delayed, it could adversely affect the entire final assembly line of the aircraft. We are required to satisfy all of the requirements of our customers, in which sometimes they ask for only several processes, and other times they ask for 12 processes.

Tekalia works primarily in the surface treatment of landing gear components. What is the typical profile of components that you work with and what steps are you taking to further diversify your service offerings?

While Tekalia's plating tanks are adequately sized to process large components, a fair amount of our work comes from small to medium

sized components. We currently process wide body main fittings to the smallest of pins, and everything in between. As a one-stop-shop we accommodate and supply all of our services at a single location, which makes it easier for customers to work with us. As our customers require diversified services, we are currently in the process of transforming our capabilities to include processing of titanium parts, in addition to aluminum and steel parts for which we already have gained an expertise. Furthermore, we are in the process of developing Zinc-Nickel plating, as the demand has increased significantly from our customers. Also, we are currently expanding the range of specifications for which we can encounter for each service by developing products from other OEMs, notably Bombardier and Embraer. We are consolidating the knowledge we have, we are mastering the complexity we have, and we are synchronizing all of those steps together. ●

THE STRENGTH OF OUR TEAM TO SUSTAIN YOUR GROWTH



Tekalia offers a "one stop shop" solution for Surface Treatments of the Aerospace Landing Gear sector. Our TEAM's dedication to quick response manufacturing, alongside its quest towards operational excellence, has enabled Tekalia to stand out as a trusted partner within the industry. As we continue to build on our integrated relationships with our Customers, our main goal remains to secure the Supply Chain and support the industry's remarkable growth for the future.



tekalia.com

Guy Levasseur



●●●
President
AEROSPHERE

●●● **Aerosphere began its operations in 2004. Please walk us through the evolution of your company.**

Initially, Aerosphere offered consulting services in the fields of shot peening and peen forming, but we rapidly realized that there was a missing piece in the aerospace puzzle. At the time, there were some companies capable of providing shot peening and peen forming on smaller parts, and others on larger parts, but not on both efficiently. We recognized the need for a company that specialized in providing both ranges of parts in one shop, but mostly economically, and with a reliable and fast turnaround. In the beginning of 2007, we focused on the operations side, which was a particularly significant milestone, and led to our position in the market today. Aerosphere's expertise extends from shot peening, shot peen straightening, and peen forming on aircraft

structures and wing control surfaces, to glass bead peening and cleaning using automated and manual equipment.

What is the breakdown of Aerosphere's current projects?

Aerosphere has regularly over 100 work orders in process, which are segmented into various tasks since each work order may include different operations or processes. Some are internal and some are external and are performed by our network of subcontractors. Our lead time is often short, our customers can be demanding, and components can be costly, so we have no room for error. Our customers demand "one-stop-shops," which we provide with our network of subcontractors, who are as devoted as we are to maintaining high quality standards and on-time delivery. The key to our success is our unique combination of "customer first" approach.

How does Aerosphere perform in terms of on-time delivery?

On-time delivery is absolute key for aerosphere, and it is demanding to maintain quality at the same time. This takes a lot of energy and commitment from Aerosphere's employees and subcontractors. Our biggest challenge is what I call it the "open truck door" planning system because we often do not know what we are going to get until we open the delivery truck door, which makes medium- to long-term planning virtually impossible. We have implemented a proprietary MRP system that affords our customers, suppliers and our staff better visibility on the work orders. We provide full visibility on the manufacturing process, either internally, or within our network of subcontractors. Our database systems send status reports in the form of an email every morning to both customers and suppliers, which details the status of all of the work or tasks assigned to them.

What is Aerosphere's strategic growth plan for the years to come?

In the coming years, Aerosphere intends to double the size of its facilities. In the next three to five years, we are planning on implementing robotic shot peening process to our work capability. It takes roughly one year to order and certify this kind of equipment. We already have demand for this type of process and are confident this will lead to other new business opportunities. Furthermore, back in 2008 we decided to develop Automated Peen Forming (APF) for wing forming with a German partner. At the time, the market was not ready for this type of technology; however, because the technology is evolving, the need will increase since the technology will become more and more affordable. There are many different components to the wing; therefore, the investment related to APF provides as a long term solution to manual forming which is dependent on operators to perform the Forming operation. In the next three to five years, we plan to incorporate this technology in our facility in Montreal. •

AEROSPHERE

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Michel Martel



General Manager
TNM ANODIZING & PAINT

●●● **TNM Anodizing & Paint offers a range of finishing solutions to the aerospace industry. To begin, please describe the range of services included in your portfolio.**

TNM Anodizing & Paint (TNM) is a one-stop-shop for finishing solutions. Our services include non-destructive testing, anodizing, painting, and shot-peening; these services can be applied to aluminum, titanium and steel parts. TNM is capable of handling large volumes and everything that the company does is done with an emphasis on quality. Turn-around time is perhaps TNM's strongest feature. Over the years we have refined our processes to achieve + 95 % on time delivery; we are consistently on time and have a very aggressive lead time which we use to measure our on time delivery.

What are some of the differentiating features of TNM's one-stop-shop?

TNM's load capacity and throughput sets it apart from others in the industry. TNM actively invests in new equipment, and the size of its tanks gives the company an advantage. TNM presently has available capacity and is going to expand and increase its capacity further through new processes and automation.

TNM recently undertook a phase of restructuring. Describe this process and the results you have since achieved.

In 2013, TNM realigned its business and set off down a track of positive change. We analyzed our business and listened to our customers' needs and requirements: on-time delivery and a high standard of both quality and service. After following our plan for three to six months, we were able to achieve +95% on-time delivery and ensured that quality followed the same trend. We also made service part of our culture. At this point many people within the company were keen to take on more business; however, we made the executive decision to hold-off and sustain this level of timeliness and quality under the principle that once we became robust internally, business would follow. This strategy worked. Prior to 2012, we were losing money nearly every year; we then climbed back and were able to break-even; by 2014, we became profitable. By following our strategic plan, sales have increased from around \$3.5 million to \$8 million annually and have sustainable profitability.

What are some of the forces that contributed to this significant change within TNM's overall operations?

The processing business is well-established, the basics of which have not changed much over the last 50 years. What has given

us the opportunity to move past other companies is that we are doing many different things to refine our processes and achieve results. For instance, TNM is compliant with Bombardier's 5-star program, despite the fact that it has been temporarily put on hold; the reason being that it helps achieve results. Inside the shop we are optimizing and improving many of our processes, constantly analyzing our approach and reviewing how we handle lot batches as an example, all of these components become an advantage.

What major trends have you identified in the aerospace industry for processing shops?

The defining trend for processing shops is that they must be plugged in to the major integrators, as these are the companies that are locking in business with the OEMs. Integrators must have well-oiled supply chains, or OEMs will discard their business. TNM knows what it takes to address their needs. Timeliness is one of the principle considerations of our customers, and TNM thrives in this area. TNM built its business by identifying customer needs, working with them, and giving them what they want. Today, many companies are approaching us and asking for long-term agreements, a first in our industry for processing shops. ●

FINISHING IS ONLY THE BEGINNING

TNM is specialized in surface finishing for the aviation industry. TNM's goal is to provide their customers with a "one stop shop" for all surface finishing processes. Our mission is to be amongst the elite processors for surface finishing. We are committed to providing superior value and service to our customers.

TNM has:

- ✓ Approvals for all Major OEMs
- ✓ Capacity for small, medium and Large Parts
- ✓ Various Type of treatments
- ✓ Aggressive Lead Time
- ✓ On Time Delivery, Quality and Services are guaranteed
- ✓ Certificate for ISO 9001, AS9100, NADCAP

TNM

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NDT, Anodizing & Paint



Claude Gagliardi

●●●

President

**TECNICKROME
AERONAUTIQUE INC.**

●●● **Can you please provide us with a brief history of Tecnickrome Aeronautique, including any events that have shaped its presence in the market today?**

I founded Tecnickrome Aeronautique in 1986 to serve the growing aerospace industry. The company's model was built in the spirit of integration from original coating services. From 1986 to 1990, more than 75% of our revenue came from the civil aerospace market. In 1990, our business expanded into defense and included processing, repair and overhaul of military aeronautic components. Our diversified market and capabilities allowed us to remain safe from cyclical downturns. From 1990 to 2000, we enjoyed rapid growth, and increased our workforce from 15 to 70 employees. We also began processing parts manufactured in Europe and shipping them to the United States for assembly. Our growth stimulated the aerospace cluster in Montreal, as we sub-contracted work to other local companies. In 2000, the market

suffered a downturn while Tecnickrome Aeronautique sustained its growth and expanded its portfolio of processes to further integrate. By 2010, our workforce reached 100, and our process integration was 90% on target. We introduced new green technologies to the company, and have been growing steadily. Currently, we have 135 employees servicing the aerospace sector; 70% of our production is devoted to landing gear, and 30% to structural components.

Can you provide the details of your service offering, and describe how has the MACH initiative has affected your company.

Today, Tecnickrome Aeronautique is an integrated company. Once the given machine shop has finalized its production, we obtain and inspect parts for compliance in accordance with OEM specifications. We modify surface parameters to increase corrosion resistance, fatigue-life, hardness, and friction resistance of the components to prepare it for assembly.

Since 2007 Tecnickrome Aeronautique's strategic plan has been to evaluate its performance, growth, efficiency, and progression within the aerospace sector. We joined the MACH initiative in 2012, which was in line with our strategic plan. Our MACH sponsor is Héroux-Devtek, with whom we have enjoyed a long and positive relationship.

What differentiates Tecnickrome Aeronautique's product offering from other service providers, and what steps have you taken to ensure quality and on-time delivery to OEMs?

The integration of processes within the aerospace industry is critical to its success. Tecnickrome's integration capabilities within its facility add tremendous value to the component while substantially reducing the actual processing time. Processes that would normally take 12 to 14 weeks can be achieved in only two to three weeks. This formula also supports the reduction of cost associated with minimization of inventory, transportation and risks.

We have a unified system within our enterprise resource planning (ERP) that links production, planning, scheduling, finance and human resources. Our quality system meets the highest standards and is National Aerospace and Defense Contractors Accreditation Program (NADCAP)-certified. Regular NADCAP audits are performed and our successes lead to the achievement of Merit

Status in five of our six cells.

We also have a reactive system in place and can build capacity from within by efficiently allocating manpower and equipment. We always have a surplus of equipment and are aiming at a 24/7 working practice, thus ensuring OEM's that we can keep pace with their growth. Over the last five years, Tecnickrome Aeronautique has invested over \$5 million in equipment. Additionally, we have been proactive in investing in green technology, as the REACH program in Europe (Registration, Evaluation, Authorization and Restriction of Chemicals) is banning select substances by 2017. Some changes we have already instituted include the adoption of flame deposition HVOF (high velocity oxygen fuel spraying) to replace the use of chromium. In 2012, we became the first approved North American aerospace company to replace cadmium for zinc-nickel.

Can you give us an overview of Tecnickrome Aeronautique's facilities?

We have a fully integrated, 40,000-square meter facility, including a pre-process sector for non-destructive testing, shot-peening, stress relieving and etch inspection. The remainder of the facility is devoted to machining, grinding, plating, spraying and painting.

What are your strategic goals for the next three to five years?

The way we position ourselves on the international market is very important. Currently, 30% of our sales are within Quebec, and we anticipate that our international sales revenue will further increase. Tecnickrome Aeronautique's legacy, green technology, REACH regulation conformity, and NADCAP Merit rating help position us strategically to succeed and set us apart from our competitors. Our OEM endorsements include: Boeing, Airbus, Messier-Bugatti-Dowty, UTC Aerospace Systems, Héroux-Devtek, Embraer, and Liebherr on the landing gear for the C Series. We have developed an expert marketing team, and our presence at the Le Bourget exposes us to key suppliers.

Do you have a final message?

Tecnickrome Aeronautique's goal is to maintain growth by innovation and adapt to new markets. We look to improve production and share ideas. We invest more than 10% of our revenue on research and development, helping us to be a leader in key technologies and complex processing. •



Martin Labelle

●●●
CEO
CP TECH

●●● **CP Tech is a well-established processing shop in Quebec's aerospace cluster. What is the overview of your service offerings and the customer base that you work with?**

CP Tech was founded in 1987 and is a one-stop processing shop that provides finishing services to the aerospace industry. CP Tech offers a wide range of surface finishing solutions to its customers, typical services include: surface improvement, anti-galling, electroplating, non-destructive testing, painting, and inorganic treatments. We have an extensive list of approvals from OEMs, and consequently, work with many different customers. The majority of our customer base is centered in Quebec, Ontario, and other locations throughout North America; however, we also work with overseas customers due to our unique list of approvals. Furthermore, if CP Tech does not have the approval or capacity for a certain process, it manages

side contracts and identifies an appropriate partner to handle the job. While a one-stop-shop sounds great on paper, it is important to be realistic about our ability to execute on a cost and performance basis. For this reason, we sometimes utilize partnerships to deliver our customers the best results on certain projects.

CP Tech recently realized a realignment of its strategy. What significant changes have been made to CP Tech's operations?

CP Tech has evolved significantly in the last several years. Between 2011 and 2014 we realigned our strategy, placing a heightened emphasis on quality and on-time delivery. Consequently, our sales have doubled over this time period. We are now trying to move away from forming customer-relationships and towards cultivating partner-relationships. This is a significant paradigm shift for our business as partnerships suggest a greater level of commitment through investment in specific processing techniques. We meet with our customers several times each year to go over their different requirements, and if we do not have the ability to meet their needs, we assess what new processes we need to develop. Ultimately, the goal is to work with fewer customers and take on higher volume projects.

What is the breakdown of your facilities and tank capacities?

CP Tech's tanks are relatively small for now, but as customers approach us with larger part requirements, such as landing gears, we are open to developing larger tank capacities. We have several different ongoing investments that will have a significant impact on our future operations. Currently, we are investing \$1 million in a water treatment project, which will be completed in mid-2015. We also have an automated line that has gone unused for many years, but we now have a project underway that will see it re-opened in the next two to three years. Many things have changed since the line was initially built, environmental standards for instance, so we are investing over \$3 million in its refurbishment.

How does CP Tech fare in terms of quality and on-time performance?

On-time delivery (OTD) is an important

consideration for any processing shop. CP Tech has recently taken great strides to enhance its on-time delivery performance. Part of this process is the establishment of standards, which we use to evaluate our performance. In 2012 our average on-time delivery was 70%; in 2013 this improved to 80%, but with month at 90 % and other at 70 %; since October 2014, we never had a month under 90% OTD, with some months close to 95%. We have recently implemented a new website which affords our customers transparency with their orders. This is hugely beneficial to both customers and the refinement of our own processes, as we have around 1,500 orders every month, each with their own part number and lead-time requirements. Furthermore, we have an ERP system that helps us deliver products on-time.

CP Tech recently launched a new web platform. Tell us about this development and the benefits it affords your customers.

CP Tech is definitely ahead of the game in this regard. The new version to be released next month will be offered to prime-contractors and give visibility to the parts that will eventually make it to their facilities. This is a great value proposition for our customers, as it increases awareness for when parts will be delivered. The goal of our web platform is to make the life of our customers as easy as possible.

What are some of CP Tech's forward looking goals?

We want to increase the size of CP Tech so that it has greater access to resources. In order to accomplish this goal we either need to be patient and grow internally, or partner with companies that share our vision. However, we need to continue to place performance first. Anything is possible following performance and execution. It is important to have a solid foundation for future growth, while at the same time building relationships that have the potential to evolve into mergers, acquisitions, or partnerships. CP Tech is well positioned to grow, which will allow it to have a lasting effect on the industry. •



Nicolas Nassr

●●●
President

VERDUN ANODIZING AND ULTRASPEC FINISHING

●●● **Over the course of the last 80 years, Verdun Anodizing has experienced significant transformation. Furthermore, it has recently expanded its capabilities through the acquisition of Ultraspec. To begin, please walk us through the evolution of Verdun Anodizing and Ultraspec.** Verdun Anodizing (Verdun) was founded in 1935 and was the first anodizing shop in Canada. In 1990, the business changed ownership and was brought to the next level through the acquisition of aerospace certifications and the formation of strategic alliances within the industry, which established its presence as a comprehensive finishing solutions provider for the sector. When I acquired the company in 2010, we had a workforce of approximately 45 employees; today, we have grown our operations to include 75 employees. Over the years we have developed our name as a respected surface finishing shop and have achieved many of the aerospace industry's

most stringent certifications. Our list of aerospace approvals include: Boeing, Bombardier, Héroux-Devtek, Bell Helicopters, Lockheed Martin, and Messier-Bugatti-Dowty. In 2013, we responded to our clients' request for one-stop-shop solutions by acquiring Ultraspec Finishing, which enabled us to offer inspection, anodizing, plating and painting services, while Verdun is specialized exclusively in anodizing. Ultraspec has since grown its workforce from 26 to 45 employees. Upon acquiring Ultraspec, we created and certified a non-destructive testing (NDT) department, added boric sulfuric certifications for Boeing, and NDT certifications for Boeing, Pratt & Whitney, Messier-Bugatti-Dowty, Héroux-Devtek and Goodrich. New green technologies are also being incorporated into our portfolio, such as zinc and nickel, which replace cadmium plating. We have also achieved NADCAP certification for magnetic particle inspection (MPI).

In addition to Verdun Anodizing and Ultraspec, you are also in the process of building a new facility dedicated to surface finishing solutions. Provide us with a breakdown of these different businesses and the solutions they provide Quebec's aerospace industry.

Ultraspec and Verdun will continue to operate as separate entities, while interacting and offering each other key synergies. Both companies have unique strengths and complement each other by providing different solutions for distinct customer needs. The group's corporate plan is to increase its business volume threefold within the next two years. This will be realized through the construction of our new 40,000 ft² facility in Dorval, which will be one of the largest processing plants in Canada, for which start-up is imminent. The new plant will initially handle new commercial and transport business and ultimately offer more comprehensive solutions to the aerospace industry.

Within these three business units, how extensive is your portfolio of finishing solutions and what is the extent of your tank capacities?

We benefit from a diverse product portfolio, which is especially notable in Ultraspec's plating and anodizing solutions. Many of our tanks are dedicated to the aerospace industry, and we have increased this capacity by adding zinc nickel plating. We have

some of the largest tanks in Montreal, and in response to the needs of our customers, we will be adding even larger tanks. Our facilities are currently operating below capacity, but we remain confident that volumes will increase significantly in 2015 and 2016 due to the Bombardier C Series and the ramp-up of Boeing and Airbus production. The integrated finishing solutions that we provide are particularly relevant given the climate of projected increases in production for 2015 and 2016, for which the biggest issues are capacity and on-time delivery.

What is the strategic growth plan for your businesses going forward?

Overall, the group is investing more than all of its local direct competitors combined. With this level of investment, our objective is to be the market leader in terms of quality staff, machines, and innovative processes, which will all be supported by new infrastructure. The new 40,000 ft² facility will be fully automated; its capacity will take us to the next level and allow us to become the largest finisher in Montreal. A further goal is to develop a strategy which encourages customers in the United States to identify us as their preferred supplier for finishing solutions.

As your business continues to grow, what measures are you taking to mitigate the environmental impact of your operations?

We take environmental impact seriously, and have continuously invested in environmental solutions. The new facility will be one of the greenest for surface finishing solutions. The new facility will include: state-of-the-art filtration systems for air and water; 100 percent recuperation of heat generated by processes, which will be used to heat the building; and minimal chemical waste with tight controls on the amount of chemicals used, due in part to automation. Ultraspec's facility already conforms to all environmental rules, while we have further improved the facility's environmental performance by installing chrome scrubbers that exceed Quebec's stringent air emission rules to the standard of California's 0.006 mg/Amp Hour of Chrome Emissions. Verdun's facility is limited for space, but we have installed a new fully computerized system, which conforms to Quebec's environmental standards and includes waste water treatment. •



Eric Ledoux

●●●
President
SINTERS AMERICA INC.

●●● **Sinters America was founded in 2002. Can you provide us with some company background and describe any milestones that have shaped its development?**

Sinters in Canada was originally a subsidiary that Sinters France set up to support and provide services to ATR operators and MROs in the Americas. In 2008, the industry in general was not performing well and Sinters France wanted to close its operations in the Americas. As a consequence, a management buyout was decided but financing and external management expertise was requested, which is when I joined. Sinters America was born. We immediately improved the way that Sinters America interfaced with its customer base in offering enhanced support. Since then, relying on our strong engineering group, our core business has grown drastically, providing value-added tooling and test equipment design services to the

ground support equipment (GSE) manufacturing and distribution activity.

You also have an international network of offices in Singapore, France, and Brazil. Can you provide us with an overview of this global network?

While our customer base is mainly in the Americas, we do have partners and offices across Europe and Asia, given that the roots of the company are in France. Because of this we always make sure that we have a presence in various time zones. Having employees from the same countries as our customers also strongly enhances the customer service dynamics. Employees become attached to their customers and vice versa, which has made a big difference in our performance.

Within this global network your offices here in Montreal serve as headquarters. Can you provide us with an overview of your operations, facilities, and three business units here?

Sinters America's GSE business involves working with OEMs to design and validate new tools and equipment, then making sure that these tools, along with the existing ATR and Techman-Head product lines, are readily available to operators and repair stations. Adoption cycles within the aerospace industry are typically very long and require a lot of planning and testing. Sinters America's second business unit is designing and manufacturing custom, turnkey automatic test equipment (ATE) for equipment manufacturers and maintenance facilities around the globe. With our strong engineering group, specializing in both hardware and software, we are able to effectively answer a broad range of requests; our most recent feat is a Seat Electronics Tester designed for factory integration testing of Rockwell Collins' new PAVES™ On-demand In-Flight Entertainment system.

Lastly, we have our third business unit consisting of cables, harnesses and electrical boxes. In addition to build-to-print manufacturing services, the electrical shop is a great asset, complementary to both the GSE manufacturing and engineering groups, ensuring A-Z manufacturing under one same roof.

Vertical integration is a key theme that we have come across in Quebec's aero-

space cluster, and it seems that Sinters America is really progressing along this path. Can you speak to this trend?

Yes, but you need both vertical and horizontal integration. Companies need to strike a balance looking forward. We have done some acquisitions in the past that have involved both horizontal and vertical integration, which ensured that we could still be as autonomous as possible in giving our customers full support.

You partner with CRIAQ on some initiatives. Can you tell us more about some of the research and development (R&D) initiatives that you have underway?

What we are trying to do is remain close to the industry, the big players, their engineers, and to the technicians on the floor, so that we can gauge what companies need. All these guys have great ideas so we like to pick their brains and derive consensus among key players. We also partner with government associations in a similar manner. For example, we are working on a drone helicopter with CRIAQ and four other Quebec-based small and medium-sized enterprises. Collaboration is necessary to bring about new ideas, and it is much more productive than inventing products from scratch. We also allocate 10% of our revenues on R&D projects as it is necessary to constantly invest capital into potentially new products.

What is Sinters' next move looking forward over the next three to five years? What are your objectives?

Given that our mission is serving customers, we will go wherever we need to in order to satisfy their requirements. For example, we are currently working extremely hard in South America, as our customers keep asking for our expertise on site. We also need to spread our wings in Europe. We have a vision to be recognized among the international leaders both for GSE and ATE. We need to increase visibility and make our capabilities and expertise better recognized. To do so, we have to be balanced, patient, and creative. ●



Solange Fresneau

●●●
Vice-President
TECHFAB

●●● **TechFab is currently celebrating just over a quarter of a century in operation? Can you talk to us about some of the milestones and a brief history of the company?**

TechFab was founded in 1990. It was a small, family-owned company with a local clientele in the industrial market. In 2010, we purchased Emergia Aerospace and decided to diversify. By 2014, we had quadrupled the sales and number of employees. We diversified into the aerospace industry with two areas of expertise: gun drilling and tooling. In September 2014, we purchased a 100,000-square foot plant and combined our three plants into one. In February 2015, we are opening our new plant in Queretaro, Mexico.

What are your major products and services in the aerospace department?

We provide large and complex aerospace tooling. Since 2012, we have been AS9100C-certified. We also produce aerospace parts. This is currently only 8% of our sales, but we plan to grow it to 25%. The commercial market is 55% of our portfolio, and we want to maintain diversity in our company to mitigate against market cycles in the aerospace industry.

How is efficiency important and what are some of the benefits that TechFab offers, particularly with regards to time keeping?

We strive to be a strategic partner for our customers and want to be a one-stop shop. We offer design, fabrication, and assembly to the client. In aerospace, quality is of the utmost importance. We always review every project to ensure the highest cost effectiveness. We also have a team that can work around the clock to ensure on-time delivery and work at clients' worksites, whether they be international or local. We always try to exceed expectation and provide a very specialized service.

There have been a number of acquisitions such as Jet Cut Tools and Emergia. What role have these acquisitions played for the company's overall strategy?

What was important when we purchased TechFab was to diversify and grow. We decided to grow both organically and through acquisitions. JetCut was for cutting tools expertise, and Emergia was for larger, more complex tooling know-how.

What role does research and development (R&D) play in TechFab's strategy?

Innovation is very important. Since 2013, we have been developing a new deburring machine for titanium, which will be commercialized in 2015. We worked on it in partnership with a client. This will be very cost effective and increase efficiency.

Could you please talk about the Montreal aerospace cluster?

I graduated from Embry-Riddle Aeronautical University in Florida. I was very attracted by Montreal, as it is one of the largest aerospace capitals in the world after Toulouse and Seattle. You can build an entire aircraft in Montreal. Aero-Montreal has been able to achieve a very strong base of expertise and knowledge. The key players are involved as well as many of the small and medium-sized enterprises (SMEs).

SMEs play a large role in the dynamism of the Montreal aerospace industry. Where is TechFab positioned in this pool?

TechFab is an SME with 60 employees. To ensure our growth, development and longevity, we must grow into a medium-sized company. For the supply chain to stay as strong as it is in Montreal, the SMEs must be supported through their growth and through the cycles of the industry.

What does the future have in store for TechFab?

The future of TechFab is to maintain growth, expansion and diversity. We are open to mergers and partnerships. As an SME, we strive to maintain our strong partnerships with the larger players. R&D will differentiate us from the emerging, low-cost markets and maintain Montreal's position as a global leader in the aerospace industry. •



Jean-François Hamel



President

PCM INNOVATION

●●● **To begin, please provide us with a brief background and history of PCM Innovation.**

PCM Innovation goes back 35 years to 1980, and our head office remains in Ste-Claire, close to Quebec City. The company originally serviced fiberglass manufacturers and aluminum foundries, and we were mold makers. 10 years ago, we changed direction and entered the aerospace market, utilizing our ability to make molds for advanced composites. Today, we have a much broader service offering in all areas of tooling.

You acquired PCM Innovation in 2007. What was the rationale behind your decision to enter the company as its primary shareholder?

My background has always been in the industrial business. In 2007, I was looking for an investment, and PCM had a good business culture with substantial engineering expertise, potential and first-rate technologies.

Prior to 2007, PCM had focused its business in the Quebec area; upon joining the company, I immediately extended its services beyond Quebec into other parts of Canada and the United States, and rapidly made the decision to focus strongly on aerospace.

As part of PCM Innovation's growth process, it acquired BRT Solutions in 2012. What was the significance of this move and what value did it bring to PCM's operations?

Prior to 2012, PCM was a build-to-print company, manufacturing molds and tooling. Our strategic planning in 2011 determined that PCM should seek to become higher in the value-chain and be closer to OEMs earlier in the large projects, presenting a broader scope of work. The acquisition of BRT added a strong offering of engineering expertise, which resulted in greater exposure to OEMs and considerable growth. In the first year after the transaction we experienced a 33% growth by the acquisition, and a supplementary 33% growth from synergies and natural growth.

What type of engineering services and value added solutions do you offer to the aerospace industry?

The first value added solution will be design for manufacturing, and the other is efficient design of industrialization or tooling including manufacturing. Costs and productivity are greatly enhanced by our value added solutions. Our engineering package consists of selling hours, design packages, or turnkey solutions.

What products do you offer to the aerospace industry?

In addition to engineering services, PCM offers a large area of products and services in assembly tooling for aerostructures: primary parts, sub-assembly, and the final assembly line, including scaffolding and platforms. Clients include Bombardier, Airbus, and Bell Textron, as well as integrators. PCM also offers fabrication tooling for components, servicing companies from tiers one, two, and three. We also have a service offering for advanced composites specializing in molds and tools making parts in composites. In addition, we have to make composites, as often the molds are in composites for composites. We have four, small plants-in-one: composite specialty department; welding and assembly; machining; and a pattern shop. Our other area

is prototype parts. We can provide fit, form and function, enabling our customers to test parts prior to full production. Most of our machining is carried out in our Quebec facility. We also have developed a good supply chain affording the availability of high-quality machining companies, plus other sub-contractors. PCM also has developed a composite mold to manufacture satellite antennas; arguably, the only company globally to have this service offering. Our mold is cost efficient and eliminates the need to machine a mold a 10 mt graphite block. We are looking to launch our satellite solution globally. Finally, our service offering for aircraft engines was inherited from BRT involving engine manufacturing tooling.

Apart from Quebec, what other markets are you working in or targeting? What is the competitive landscape within your niche market of integrated tooling solutions?

Our strongest market is within the aerospace cluster in Quebec, followed by the rest of Canada, then the United States, Mexico, Brazil and an excellent partner in France. China is a region we are continuously monitoring via our agent. PCM's majority focus is within the world-wide aerospace clusters. In Canada, currently there is no other tooling integrator; however, there are competitors providing engineering, and others metal assembly tooling, which are partial solutions. We have big competitors in the United States, and some competition in Europe; the United States has the strongest integration strategy.

What is your greatest competitive advantage?

Our specialty knowledge elevates us from competitors. When we have reached the point of optimum size, we can promote ourselves for larger projects in direct competition with the larger global players. The increasing trend is for OEMs and other tier ones to award larger contracts to more integrated players.

What are your key goals over the next three to five years?

PCM has two main goals. The first is to invest in expertise and technology to keep pace with its customers and enable PCM to provide what is required for the customer's new technology. R&D consortiums play an important role to keep PCM au courant of new technology. A further goal is to grow in size and be present within the market clusters. •

Vicentino Di Sano & Luis Aguilar



VDS



LS

VDS: President
 LA: Business Development Manager
AVITEC TOOLS

●●● **Please provide us with a brief history of Avitec Tools.**

VD: Avitec Tools was founded in 1979 with a focus on custom cutting tools for the aerospace industry. We first started working with Pratt & Whitney and Bombardier, but our customer base has since grown significantly. We also manufacture jigs and fixtures, ground support repair kits and aerospace components.

Can you walk us through the portfolio of products and services that Avitec Tools offers to the aerospace industry?

LA: Avitec Tools produces custom cutting tools, jigs and fixtures and aerospace components. Our cutting tools are used in the machining of composites and metals such as steel or aluminum. Custom cutting tools are mostly one-off products made to order, which require extensive expertise to manufacture but also offer many advantages. Standard cutting tools have shorter life-

spans, while custom tools are of a higher quality and thus have longer lifespans. They can machine faster and reach areas that are difficult to access using standard tools. We also manufacture indexable cutting tools (with or without a tool holder), as well as custom and standard tool holders. We manufacture mainly small- to medium-sized, high precision aerospace components in aluminum, steel, titanium or Inconel. In addition to milling and turning, we offer special manufacturing capabilities such as gun drilling, honing, lapping and grinding. While we are active in different sectors, aerospace is our largest market given its prominence in Quebec.

VD: We also provide custom cutting tools kits for ground support equipment. The kits are sent to the customer and then returned to be refurbished. Their lifecycle is quite long, but they do need to be refurbished, either sharpened or modified, every one to two months.

What is the breakdown of Avitec Tools' facilities and workforce?

LA: Avitec Tools has two facilities located in Montreal, which total over 40,000 square feet. Many employees have been with working at Avitec Tools for the majority of our 35-year history, which is why we continue to be successful. The work that we do is very technical and requires a great deal of experience that takes a significant amount of time to develop. This is one of the reasons that we are diversifying. Our experience in tooling manufacturing has facilitated our progress into jigs, fixtures and aircraft components, and hence we are continuing to expand this expertise.

What is the typical profile of customers that Avitec Tools works with in the aerospace industry?

LA: Avitec Tools works with companies of varying size, from original equipment manufacturers, such as Boeing and Bombardier, to small and medium-sized enterprises. Our custom tools help companies improve their manufacturing processes by reducing time and cost, and improving quality.

What are some of Avitec Tools' key goals for the coming years?

LA: Avitec Tools is well known for its custom cutting tools, but it is also looking to increase its production of aerospace parts. Since few companies are able to do what we do, we have secured a niche in the Quebec aerospace market. Nevertheless, we are in the process of expanding into other markets such as the United States, Mexico, South America and Europe. Avitec Tools has been approached by many overseas manufacturers, who have difficulty finding companies that offer a similar range of services that we do. While we are primarily known by word of mouth, we are increasing our marketing activities and strengthening our presence at strategic trade shows, as we look to expand into new markets. ●

AVITEC INC.
 OUTILLAGES / TOOLS

OVER 35 YEARS OF EXPERTISE

Since 1979, Avitec has been a leading manufacturer of specialized cutting tools, ground support equipment, jigs & fixtures and other specialized services. Our expertise in manufacturing has facilitated our progression into small to medium size, high precision, complex aircraft components.

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|---|--|
| <p>CAPABILITIES</p> <ul style="list-style-type: none"> ■ 3, 4 and 5 axis CNC Milling ■ CNC Turning ■ CNC Grinding ■ Honing ■ Gun drilling ■ Lapping ■ Surface Grinding ■ CMM | <p>MATERIALS</p> <ul style="list-style-type: none"> ■ Aluminium ■ Steel ■ Stainless steel ■ Inconel ■ Titanium ■ Aluminium Bronze |
|---|--|

Certifications: AS9100 and ISO9001

AVITEC Inc. 11355 Armand Bombardier, Montréal, QC H1E 6N2
 Tel: 514-648-9943 ext. 243 www.avitecnet.com



Frederick Centazzo



Vice President

ALPHACASTING

●●● **Alphacasting has been in business since 1990. Could you outline a brief history of the company?**

While Alphacasting started in 1990, the real operations did not begin until 1991. The company started by providing services to the firearms industry. Alphacasting then expanded into the pulp and paper as well as electronics. In 1993, we started working for Bombardier aerospace, manufacturing small aluminum parts for their aircrafts.

Our advantage is that we are the only company in Canada to cast over 120 different alloys, from aluminum to exotic alloys. There was a demand to manufacture products for the firearms industry where one part needs different alloys. In 1998, the aerospace business represented 25% of our business and firearms represented 50%, with the remainder being commercial work. In 2000, we expanded our alloy-manufacturing portfolio. We adopted two technologies called VIM and VAR in order to develop new products for our customers on the military side. From 2010 to 2014, we have been working extensively on developing a new casting technology. The last two years have been mainly dedicated to medical and aerospace parts manufacturing.

One of the main strengths of Alphacasting is the amount of alloys you can manufacture. What are the main alloys that you manufacture for the aerospace industry?

For the aerospace industry we refine all of the aluminum alloys. The aerospace industry has a particular need for integrity casting, so we invested a lot of resources to develop this process and were subsequently able to secure some very high-end producers in need of that particular product.

Who are some of your major clients in the Montreal aerospace sector?

For our unique and patented Kool-Cast process, one of the main customers we acquired was SpaceX. SpaceX manufactures rockets and needs high integrity fuel pump castings. We were able to meet and exceed their requirements in terms of supply and mechanical properties. Since then we have been in the process of trying to improve our output to meet their increasing demands.

You have several large international customers such as Boeing, Airbus and Safran. What is the importance of the in-

ternational market to your overall business sales?

The international market has been booming for us over the past few years. We started in France with the Safran group for the development of all kind of parts. We have a huge advantage being located in Montreal as a French-speaking company compared to our U.S. competitors.

The medical market is also very important for us, particularly in the United States.

What are some other main advantages of Alphacasting?

We compete against very large players that are slower to move and adapt to the market demands. Our advantage is that we are smaller and more flexible and adaptable to our clients needs. We can very quickly start looking into new manufacturing processes or materials. This is very much a part of our company culture. We want to stay on top, if not ahead, of the market demands and expectations.

In 2010 the company started to carve out a niche for itself in the production of ferrous and nonferrous metals. What motivated this move?

This was mainly motivated by the increasing competition from emerging markets in the production of general products. In North America, the only way to survive is to be highly specialized and apply complex methods and technologies. We saw a demand for highly specialized products and invested our resources in meeting those needs.

What role does research and development (R&D) play for Alphacasting? How important is it in the companies overall strategy?

R&D is very important and is a question of survival in this industry. We have advantages being located in Canada and Quebec through extensive support from the government to develop unique technologies and applications. We are the only company in Canada with titanium-casting capacities.

Where do you see Alphacasting in five years?

We expect to double our sales and be the leader in our industry in the next five years. We are confident in our growth and in our team. We have a stellar team of engineers, which is one of our main competitive advantages. ●

Hugo Beaudry & Parviz Majd



HB



PM

HB: President/CEO
PM: VP Sales

INITIAL AVIATION

●●● **Initial Aviation is part of Initial Group; to begin, please provide us with a brief history of Initial Group and describe its involvement in the aerospace sector.**

HB: Initial Electronics was set up in 2003; it is a service provider and sales organization supplying parts and services to OEMs and CMs. The company quickly evolved and added an in-house department that manages surplus material from their customer base worldwide; it started with electronic components but has progressed into the aerospace market. We have benefited from being located within Quebec's aerospace cluster. The service we provide helps to promote efficiency within the supply chain. Our

customers in the aerospace market include major worldwide airlines, MROs and OEMs; we supply them with parts, matching the needs of our customers and selling the surplus material of our customers/suppliers. In addition to engaging with major airlines and MROs globally, Initial also represents manufacturers of aerospace products such as Ancra International, a U.S.-based company serving the aerospace and the military markets.

PM: Our growth strategy will be to expand horizontally by increasing our service offerings, then move vertically to focus more on those new service offerings, adding to our customer base. The military will come under our umbrella of expansion.

What is the typical profile of components that you supply to the aerospace industry; and what is the breakdown of your target market segments?

HB: Initial Aviation's portfolio of components is vast, from hardware to engine parts, anything within the fabrication of an aircraft. We have also a multi-language, AOG desk 24/7 based in Blainville, Quebec that looks after all urgent inquiries whether the parts are supported by us or by one of our partners.

PM: We are interested in entering the military market and expanding our expertise in this niche market, where restrictions and certifications are more stringent.

HB: Our strategy for moving into the military market will dovetail with Ancra International, as it has a cargo division for the military and supplies the U.S. federal government; our goal will be to mirror this setup in Canada.

Can you outline the programs that Initial Aviation provides related to surplus material?

HB: We have a three-pronged program for re-selling of surplus parts: selling from the customer's site for onward shipping; selling on consignment via our warehouse; and buying-up and re-selling surplus products. Selling from the customer's site is currently the most used option; for example, a large airline has \$50 million excess product and we have a 12-month agreement to sell the excess via its warehouse. However, profit sharing by selling on consignment is increasing in popularity. To sum up, 50% of our business is selling from the customer's warehouse, 30% on consignment, and 20% we buy-up customers' excess inventory.

What is the current regional focus of Initial Aviation?

HB: The United States is a massive market for Initial Aviation. Europe is our second largest market, as we deal with major airlines in France, Germany, the Netherlands, and Czech Republic, where we supply parts and sell their surplus. The Middle East is our third largest market and is growing. Finally, we are working to increase our footprint in Asia.

How does Initial Aviation differentiate itself from others within the aerospace industry?

PM: Initial Aviation's advantage is its flexibility and adaptability to change direction and incorporate additional market opportunities, such as those in Asia.

HB: Competitively, in comparison to larger companies, our decision-making is quicker and our cost structure smaller. We do not have massive overheads, are on very solid financial ground, and can expand quickly for the right opportunities. •

INITIAL AVIATION

INTEGRATED SERVICES PROVIDER
FROM PARTS SERVICES, ASSET MANAGEMENT SERVICES,
TO MRO CAPABILITIES THROUGH 3RD PARTY PARTNERSHIP

Providing aftermarket sales support at the highest quality with fastest turnaround time, Initial Aviation supports worldwide customers. Our team of professionals is available 24 hours 7 days a week and will address all your aviation needs from planning to provisioning, to surplus material, repair and part supply.

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DG



MG

David A. Gregory & Marc Gregory

●●●

DG: President

MG: Executive Vice President

CANREP GROUP

●●● Can you give a brief overview of CanRep Group?

MG: The CanRep Group is a total of four companies of which CanRep and AvTec Aero Maintenance are in the Mirabel facility. Aeroparts Plus is our small manufacturing and warehousing facility in the United States. We also have CanRep International, which is a sales office in the UK. CanRep and AvTec were collocated in the same facility in January 2014, in order to use the synergy of technicians of both companies. AvTec Aero is in the repair and overhaul business and its work is in components only, focusing on helicopters, regional aircraft, business jets and small military jet trainers.

CanRep Inc started as a parts distributor 15 years ago and aircraft parts still account for slightly more than 50% of the business. 70% of the parts that we stock and distribute parts are shipped outside of Canada, primarily to the United States and Europe.

As the company grew, it started to provide more services and added the waste/water equipment repair and overhaul side to the business. What we did in the start was to buy unserviceable equipment, fix it, and sell it as overhauled equipment. As a Group we wanted to grow our overhaul capability and thus in 2011 we acquired AvTec Aero Maintenance. For the two companies here in Canada, component repair and overhaul now accounts for about 40% of our group revenues. Over the last 15 years, CanRep Inc. has had a strong presence in international markets, but with the growth of the two companies in the past two years, we started to make a transition to incorporate more of the local market.

What has the growth of CanRep been over the last few years?

DG: Since the recession in 2009, CanRep Group has grown at 10% to 15% year on year to 2012. In 2013, the CanRep Inc remained stagnant and its revenue in AvTec decreased by about 25%. The reasons for this decrease can be attributed to economic environment of other industries that are mainly natural resource driven, such as mining and forestry. However, when one looks at the larger picture, CanRep Group has performed quite well over the past decade. In 2004, the company had revenues of about \$2 million, but current revenues are roughly \$5 million.

What can be done to fix the economic burden and the struggles of the various industries?

MG: Helicopter operators in Canada are used to this situation. Currently these operators have hunkered down and are trying to control their costs as much as possible, to be ready when things pick up again. In terms of the mining industry, an increase in exploration will depend on commodity prices. The segment of the industry that is natural resource-driven must be kept sustainably strong. If you have a sustainable plan, then you have a clear direction for the natural resource companies who then hire helicopters and aircraft, which directly trickles down to us.

DG: Currently there is an adjustment going on in the economics and we have to get a grip on our budgets. The government also needs to get a grip on its budgets as to not inflate taxes and royalties. If you have stable government and industry policies, it is

easier to forecast the cycles and be more sustainable.

Can you talk about how important quality and excellence is here in CanRep?

MG: Quality is important in aerospace and one thing that we as a group do really well. The entire aerospace sector in Canada is amongst the safest in the world with all its checks, balances and systems. There are differences in the way that Transport Canada does things, but high standards of quality are driven into every technician through education. There is a significant amount of time, effort and money invested into making sure that the quality is there and that everything is coming from qualified suppliers.

CanRep Inc. is a Transport Canada approved distributor and AMO and we have AS9100 certification. For distribution, the company also has FAA compliance. AvTec Aero is Transport Canada approved as a maintenance organization for components and it holds a European (EASA) approval as well.

Currently we are looking at getting certification for Latin America for both CanRep and AvTec Aero and are exploring strategic partnerships in emerging markets like Africa. At the moment we have a strategic partnership with a French company called NSE Industries.

DG: If the company stays at the same size, we are not going to be able to compete and grow. We need to actively pursue acquisitions and strategic partnerships.

Do you have a final message for our domestic and international readership?

DG: CanRep is a fairly young company, but we pride ourselves on our excellent quality. We are very competitive and work hard to establish good relationships with our clientele. All of our people have a great background in aviation. The aviation sector is very dynamic, growing and fun to be a part of. ●



Stéphane Roche

●●● General Manager
THYSSENKRUPP AEROSPACE

●●● **Can you provide us with a brief history of your presence here working within Quebec's aerospace cluster?**

ThyssenKrupp's aerospace division was launched in 1989, when Boeing expressed a demand for a service provider to supply raw materials efficiently. Given the difficulty to predict demand for raw materials in the aerospace industry, Boeing was in search of an intermediary to effectively manage relationships with mills. ThyssenKrupp Aerospace, currently one of Boeing's largest material suppliers, has grown continuously and is now also working with Bombardier, who brought us to Quebec seven years ago.

Could you describe your business model and the technologies that you implement to simplify the supply chain?

ThyssenKrupp Aerospace performs demand aggregation. Since gauging demand is a complex endeavor in the aerospace industry, we obtain historical data and use

mathematical algorithms to draft projections. Our business model is not to buy and sell aluminum but rather to understand the mathematics behind inventory management. Mills typically have inadequate on time delivery performance and companies such as Bombardier cannot afford this risk. We are able to reduce this risk and deliver on time at an extremely high average. We manage relationships with mills, ship materials to suppliers, who then ship to the OEM. The OEM does not require a storage facility, nor staff to receive and inspect materials, because we handle all of this for them and deliver the materials to their facility, so that they can machine the parts. We essentially manage all of Bombardier's sub-tier suppliers and have about 60 customers. ThyssenKrupp Aerospace works with everyone who is working with Bombardier and machining aluminum. Thus, we use this window in combination with the inventory required and optimize the size to deliver to Bombardier when they need it. For now, we work primarily with Bombardier here in Quebec, but we have contracts with most OEMs in the world, including Boeing, Triumph, Cessna, Airbus and Embraer.

You discuss a top-down approach in which you work with Bombardier and ultimately their suppliers. In addition to this strategy, do you target suppliers directly?

Yes, however we typically begin with someone who has influence over their supply chain. ThyssenKrupp Aerospace targets large accounts to simplify, optimize and reduce cost to their supply chain and bring about large savings. Additionally we machine, cut, and perform all value-added services so that once an integrator receives materials they only conduct work that is in line with their core expertise.

Prior to ThyssenKrupp's entry into the market, OEMs were working directly with mills. Does this gap in the market still exist?

Yes, it still exists. The main challenge that OEMs are facing is that they are trying to get mills to perform inventory management, which is not part of their business model. OEMs need their suppliers to deliver 100% on time. This was not as important 10 years ago, but today timing is crucial, which has created a new and pressing need.

What platforms does ThyssenKrupp Aerospace use to bridge this gap?

We utilize largely proprietary software. We have also recently put together a team to design new software to further improve our forecasting ability.

Looking forward, what are some strategies that ThyssenKrupp Aerospace plans to implement?

ThyssenKrupp Aerospace is constantly evolving. We see plenty of potential for additional simplification of the supply chain. Moving forward, we hope to address poor demand forecasting, specifically between tier two and tier three suppliers and OEMs. These integrators do not have much visibility with regards to OEM demand, and eventually we would like to manage demand between them and OEMs. By adopting our existing model (managing relationships with mills and shipping materials to suppliers who then ship to the OEM) to the later end of the supply chain, we can drive more efficiency at the machining house and drive down costs significantly. Essentially, we want to take the material and send it to the part manufacturer and then also be available to receive the parts from integrators and deliver them to the OEM. The more disorder you have in your supply chain the more people are taking margins, and our goal is to mediate this as much as possible.

What is your growth strategy for bringing your business to the next level?

In the past, we have been Bombardier-focused and ThyssenKrupp Aerospace has been a de-centralized organization, but we are now working to create more synergies within the group. We have appointed key account managers around the world and have a suite of executives who will correspond with executives at the OEM level. We are targeting customers, who are beginning to centralize their supply chain.

Do you have any closing words?

One key message is that ThyssenKrupp is able to support its customers globally. Our goal is to help our customers optimize their business model by simplifying their supply chain and reducing costs significantly. Secondly, we are working heavily on automation, which in combination with Quebec's low energy costs and government support has the potential to turn Quebec into a low-cost source for the aerospace industry. ●



Jean Magny



President

GENIUS SOLUTIONS

- **Founded in 1989, Genius Solutions has over 25 years of experience in providing enterprise resource planning (ERP) solutions to SME custom manufacturers. What is the application of your systems to the aerospace sector?**

We have been working with manufacturers within the aerospace industry for over 10 years. Our Genius Manufacturing enterprise resource planning (ERP) software is specifically designed for discreet manufacturers and is available in both English and French, making us a very desirable partner for the Quebec market. In the aerospace industry, our core customers are subcontract suppliers of the larger players. In order to secure contracts with the large players in the industry, the smaller-sized supplier needs to have certain tools in place in order to meet industry best practices and the high standards that the large players expect. Our software provides the necessary structures to help all of these aerospace industry

subcontract suppliers grow their businesses. We continue to grow our strong connection to the aerospace industry in Quebec and across Canada through our active memberships in both AeroMontreal and the Ontario Aerospace Council (OAC). We offer end-to-end solutions, which our customers find very advantageous. We not only develop our software, but we also sell it ourselves, implement it, provide in-house support and offer training and consultancy services to enhance our customers' experience with our software across their entire organization. Our leadership team is made up of industrial and mechanical engineers, so we really understand our customers' industry-specific needs.

What type of ERP solutions are most needed within the aerospace industry?

Large players in the Quebec aerospace industry expect to have tier-2 suppliers integrate with smaller players because they do not want to manage a wide range of suppliers. Therefore, an ERP solution ideally suited for the aerospace industry must be able to manage products that are complex with multi-level Bills of Manufacturing (BOMs). Traceability is also extremely important. For instance, if a company has an issue with an aircraft's part down the road, it needs to be able to track the component back to where it came from, which vendor manufactured it, which materials were used, etc. Genius Manufacturing does this really well. Aerospace manufacturers often ask us about material requirement planning (MRP) solutions that help ensure that suppliers have the necessary materials for production. I am always surprised to hear how many companies do not have these tools in place. When we work with small companies that do not yet have robust systems in place, we start by ensuring that they manage and control their inventory based on customer demands and best practices for stock management. It all starts with the BOM, including required material, operations per work center, employees' instructions, material test reports (MTRs), and so on. We also often hear from aerospace manufacturers who are looking to better manage resources by workstation. They want to know things like "what is our workload?" and "how many hours per department, per machine?" This type of valuable information can be credible if the BOM includes these parameters and once the employees on the shop floor

confirm the allocated hours were reasonable. This important feedback is generated by our manufacturing execution system using barcode and/or touchscreen technology. This feature also allows employees to access work instructions and drawings in one centralized place, creating a paperless environment.

What benefits are afforded to companies that adopt a comprehensive ERP solution like that of Genius Solutions?

When companies are small, they may not be using a comprehensive tool to manage all of their processes, but, as they grow, they realize that they need to put something more structured, efficient, stable and high performing in place. They cannot risk being late on delivery or delivering a less than quality product because of a malfunction in their processes. For instance, if there is no system in place to project costs, these small companies cannot give accurate quotes ensuring profits. Small aerospace manufacturers usually contact us when they start receiving bad data from their current system, which causes penalties for late deliveries, or customers calling to say they need to provide proof that a certain material was approved.

Going forward, what growth strategies does Genius Solutions have in place?

We originally started in Quebec, and over the last few years have grown across Canada and the United States. We have doubled in size in the last two years and are currently projected to again double in size in the next two years. We have a large in-house research and development team that constantly works on adding new features and capabilities, which we often base on direct feedback from our customers. We look forward to announcing some major new features in the coming year!

We are also very proud to support the next generation of engineers through partnerships that we have formed with five educational institutions in Quebec to provide our software in their engineering courses. Our educational partnership program allows Quebec engineering students to graduate with real-world skills and experience using ERP software, giving them a leg-up when entering the Quebec manufacturing industry and in-turn providing local manufacturers with new employees who are already trained in the latest technology. ●





TOMORROW'S INNOVATIONS AUTOMATION, FINANCING, AND EDUCATION



“The three major aerospace centers are Montreal, Seattle, and Toulouse, but Montreal has the highest concentration of aerospace students. This is the only city in the world where one in 80 people works in the industry. We have four universities—two English, two French—producing about 1,500 aerospace graduates per year.”

- Dr. Hany Moustapha, Ph.D.,
Professor and Director,
AÉROÉTS,

NSERC/P&WC Chair in Propulsion System
École de technologie supérieure (ÉTS)
Senior Research Fellow, Pratt & Whitney Canada (P&WC)

AUTOMATATION

Revolutionizing Aerospace

●● As aircraft manufacturers across the world continue to experience strong order backlogs, a message is being sent down the supply chain: suppliers need to expand their production capacities and improve their manufacturing efficiencies in order to satisfy growing demand. Competitive pressures from abroad are also encouraging Quebec suppliers to optimize their operations. Automation can help level the playing field by reducing disparities in labor costs and improving throughput, and many opportunities exist both locally and internationally for suppliers seeking to automate their manufacturing processes.

From 2010 to 2014, Bombardier's backlog of aircraft orders grew at an annual rate of nearly 24%, reaching a valuation of \$36.6 billion in 2014. In order to address this growing industry trend, suppliers must be at the leading edge of modern technology to accommodate their customers' needs with efficiency. "This can be done through investments in automation to develop their capacity to manufacture more complex products or the implementation of Lean techniques to reduce waste," said president and chief executive officer of Bombardier, Alain Bellemare.

In Quebec, suppliers have started implementing Lean manufacturing practices under the guidance of programs such as Aéro Montréal's MACH initiative. The industry's suppliers are taking

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The demand for robotics is increasing, and pressure is building for companies to turn towards automation."

*- Chahe Bakmazjian,
President,
Robotmaster (Jabez Technologies)*

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advantage of local resources and incorporating automation into their processes, benefitting from locally developed robotic and software technologies.

General Electric Aviation's facility in Bromont, Quebec exemplifies the benefits of being on the cutting edge of sophisticated automation. Since the late 1990s, GE Aviation has integrated over 120 robots into its production line, and consequently become one of the most automated aerospace production sites in the world. In July 2013, GE Aviation established its Global Automation R&D Center in Bromont to develop advanced robotics, software, and intellectual property for GE Aviation's operations worldwide. The outcome of GE's automation initiative has "(...) proven highly effective in enhancing the quality and productivity of [their] operations. Consequently, [they] have enjoyed sustained productivity increases in excess of 7% annually," said director of Robotization at GE Bromont, Alain Ouellette.

GE Aviation's automation has been facilitated by AV&R, a Montreal-based robotics supplier. AV&R specializes in general automation for vision and robotics, and has supplied many of the robots that are used in GE's Bromont facility today. Based on its success with GE, AV&R is developing relationships in Canada and internationally. Commenting on future projects, CEO of AV&R Jean-Francois Dupont, said, "we are going to be part of the supply chain for Pratt & Whitney U.S. that has built an automated production line that has no human intervention."



We are going to be part of the supply chain for Pratt & Whitney U.S. that has built an automated production line that has no human intervention.

*- Jean-Francois Dupont,
CEO,
AV&R*



While Quebec is known for its engineering expertise, it is also becoming increasingly involved in developing innovative software to support automation. "The demand for robotics is increasing, and pressure is building for companies to turn towards automation," said Chahe Bakmazjian, president of Robotmaster (Jabez Technologies). In response, the software Robotmaster supports most industrial robot models to promote efficiencies in the aerospace manufacturing processes. ICAM Technologies, a local software programming company with nearly 45 years of history, develops software that bridges the gap between CAD/CAM machines and robots. Despite its international reach, over 90% of its solutions are exported. All of ICAM's software development is conducted in the province. Quebec's aerospace cluster is not only at the forefront of adopting leading technologies, but creating them as well. •



Jean-François
Dupont

●●●
CEO
AV&R

●●● **Please provide us with a brief overview of AV&R and its regional presence.**

The roots of AV&R date back to 1994, when the company was initially a product of Walsh Automation. In 2006, AV&R Vision & Robotics was born, specializing in general automation for vision and robotics targeted towards multinational companies. Our research and development (R&D) team produced new solutions for body finishing and surface inspection, and AV&R's goal was to be recognized as the best in this field for the aerospace industry. We have achieved our goal and used our excellent reputation with original equipment manufacturers (OEMs) to move into other market segments. We currently have systems deployed in Singapore, Israel, Italy, France, Germany, United Kingdom, Turkey, Mexico, United States, and Canada. Within the aerospace industry, we follow OEMs through the supply chain.

●●● **What markets does AV&R actively target with its products?**

AV&R is primarily focused on the aerospace market, but has identified the need to diversify its revenue stream in order to avoid the adverse effects of singular business cycles. Accordingly, we have entered the energy sector using our expertise in gas turbines, such as blades. Our technology can also be applied to maintenance, repair and overhaul (MRO) markets, which contribute 20% to 25% of our total work volume. Our strategy has been to keep up with our core competencies, albeit our clients always request new technology and innovations for their automation projects.

●●● **AV&R recently merged with IMAC Automation. In what ways has this merger expanded the portfolio of automation solutions that you are able to offer the aerospace industry?**

The IMAC merger equips AV&R with the following: greater stability and more industrial space in Quebec, increased revenue affording a stronger position for making acquisitions in the United States or opening a new office in Europe, and IMAC's expertise in automation complementing that of AV&R's solutions. We now have new expertise in the form of robotic painting that has become very popular in the aerospace sector. This expertise will supersede manual applications, such as erosion coating on fan blades and painting of landing gears.

●●● **As a case study, what have been some of AV&R's largest projects and greatest achievements?**

AV&R supplied a large number of the 140 robots used at GE Aviation's production plant in Bromont, Quebec, which is the most automated aerospace production site in the world. Three years ago, we started a partnership with GE Aviation to share our technology, and for AV&R to access their production to accelerate the development of its solutions. We also share our automation technology with Rolls Royce and Pratt & Whitney.

●●● **Automation revolutionized the automotive industry in the late 1970s and 1980s.**

●●● **In what ways can automation have a transformative impact on the aerospace industry?**

The aerospace industry requires more intelligent automation than that of the automotive industry since its precision needs are greater. Fuel consumption for commercial aircraft represents a tremendous expense to airlines. This reality has pushed the engine manufacturers to increase fuel efficiency. To do so, they improved aerodynamics on jet engine blades & vanes by using tighter tolerances and more complex elliptical 3D profile. Tolerances on newer engines are around ± 0.0015 in (37 μm) and are planned to go to ± 0.001 in (25 μm). With these new requirements, manual profiling is no longer sustainable. Aspects such as labour cost reduction, difficulty to find skilled operator and to eliminate injury have also push to automate this operation. On the repair side, in addition of fuel saving, better aerodynamic leads also to less scrap and longer blade life.

This transformation on the aerospace industry has slowly started but is likely to get very intense as the new engines are being manufactured. AV&R is ready and eager to get on board! •



Chahe Bakmazjian



President

ROBOTMASTER (JABEZ TECHNOLOGIES)

- **Robotmaster (Jabez Technologies) specializes in industrial robot programming technologies, and has been around for nearly 20 years. Can you please provide a brief overview of the company's history and describe any key milestones that have occurred along its development.**

Robotmaster (Jabez Technologies) was founded in 1996, with an initial focus on industrial automation. After two years we realized our strengths, and decided to specialize in software production. At the time, aerospace and automotive companies were buying expensive CNC machine tools, and not fully utilizing them. This was because there was no software at the time to enable the range of CNC machine features. Hence we ended up working with companies across various industries to help them program CNC machines more effectively. In 2001 we entered into the field of robotics, and one year later performed our first implementation with Robotmaster. By 2003, we had completed three successful

implementations with Fanuc, Motoman, and Staubli (leaders within their respective markets). In 2004, we decided to leave the CNC market and shift our focus towards programming robots for tasks as trimming, 3D machining, deburring, polishing, welding, dispensing, grinding and painting.

Robotmaster (Jabez Technologies) works across various industries including aerospace, military, medical, and transport. What is the relative importance of aerospace to your overall business volume?

Aerospace comprises directly about 40% of our revenue, and indirectly 50% to 60%. Some of our customers are in the defense sector, and a good part of which is devoted to aerospace.

What are the benefits of promoting efficient automation within Quebec's aerospace cluster and what are some key advantages of incorporating this flexible software?

Robots provide flexible automation, quicker return on investment, and require little capital investment. Implementing successful solutions however is a difficult process. For example, a leading American aerospace manufacturer bought several robots and was struggling for about a year and a half to commission them. We worked with the manufacturer to facilitate the adoption of robots and as a result, they are able to focus on process.

What are the key features of your signature software Robotmaster, specifically in its application to the aerospace industry?

The aerospace industry is no stranger to CAD/CAM software, as CAD models are used to design digital models, which are then manufactured into actual parts. Robotmaster is a CAD/CAM approach to programming robots, called 'CAD/CAM for robots.' A given manufacturer can program their task using CAD/CAM software, and Robotmaster will obtain that data and bring it into RISE (Robotmaster Interactive Simulation Environment) where the robotic device simulates it and interacts with the task. Hence we are able to create an error-free, collision-free program and achieve better performance.

Going forward it is going to be important for larger players and aspiring sub-tier suppliers, to incorporate automation into their business models. What is the typical profile of customers that you are targeting with this technology?

While we work with many large players, Robotmaster (Jabez Technologies) works with

many more component providers. Our product ranges from mid-range to high-end, making our offering suitable for SMEs as well as customers requiring all the features of a high profile engineering packages.

What is the breakdown of regional markets in which Robotmaster is active around the world?

Our largest markets are the United States, United Kingdom, Brazil, Germany, and France. We have also been engaging with Singapore, where they are building a re-manufacturing hub, and the Emirates, where aerospace production is just getting started. Furthermore, we are looking to set up an office in Mexico in the very near future.

Robotmaster (Jabez Technologies) has experienced tremendous growth within the past year. Can you describe this trend and what you attribute to its success?

Last year we grew roughly 66%. The demand for robotics is increasing, and pressure is building for companies to turn towards automation. Additionally, several countries are looking to aerospace as a viable manufacturing industry to make up for some offshoring. Research institutes and clusters are forming around the world, as demand for manufacturing-based technology rises. As a result global aerospace shops are emerging and enhancing automation and robotics. Local shops are now competing against international players, and they require the best equipment and technology to do so.

What are your goals for the next three to five years?

On the technical side, Robotmaster (Jabez Technologies) has been building a multidisciplinary team to increase its innovation capacity. Whenever we present our technology, we consistently turn heads. Now we need to do is package this technology in a digestible format. On the business side we aim to grow our sales and distribution strategy, primarily in the United States. We took charge of distribution in North America about a year and half ago and are in the process of finalizing and implementing our North American strategy. We will be opening offices in the United States, as our goal is to create a network of resellers, distributors, and application engineers there. We have a very good distribution strategy in China and Brazil, and are currently working on an expansion plan for Japan, Mexico, Turkey, and Russia. •

John Nassr & Jean-Nicolas Ruby



JN

●●●
 JN: President
 JNR: Vice-President of Technical Marketing & Services

ICAM TECHNOLOGIES

●●● Could you provide us with a brief historical overview of the ICAM Technologies?

ICAM Technologies was founded in 1971 to provide programming services to local companies servicing Canadair. By the 1980s, ICAM had specialized in CNC programming software and interfacing between CAD/CAM systems and CNC machines. This link, called post-processing software, was a landmark innovation as it facilitated the efficient translation of information from different CAD/CAM systems to the array of CNC machines on the market. Since then ICAM has consistently upgraded its software capabilities and developed an unparalleled expertise in the field of post-processing. We have developed our software to interface with all major CAD/CAM systems and the ever-evolving, increasingly complex world of CNC controls and multi-axis machine tools.

Through 2010 the company invested heavily in developing machine simulation software that uses graphics to simulate the output of the post-processor (G-code) before running it on a CNC machine. By 2014 ICAM successfully integrated post-processing and machine simulation into a cutting edge solution: Adaptive Post-Processing™.

What key aspects of the software lend to the improvement of manufacturing efficiencies?

Adaptive Post-Processing™ is a new technology developed by ICAM that changes traditional CNC programming methodology by creating a unique integrated environment for the traditionally independent steps of post-processing, tool-path optimization and G-code simulation. This new methodology allows all these steps to be executed simultaneously, permitting cross-communication among them.

The integration allows for the in-process evaluation of feedback from the post-processor, machining simulator and ICAM's other tool-path optimization technologies to automatically create an optimized NC program for a target CNC machine. This all occurs in one programming step, allowing users to automatically and efficiently reduce NC programming time and machining cycle times.

ICAM's Adaptive Post Processing solutions also allow the programmer to "create tool-paths for the part" without much consideration to machine kinematics and without reprogramming the part at the CAD/CAM level for a second or new target machine. The ability of ICAM's software to automatically find and correct these errors significantly reduces programming time and human errors while allowing for easy movement of part manufacturing jobs between differing machines.

As CNC technology evolves, it is important that ICAM software stays up to date. What are you observing with regards to industry trends and demands?

Industries are increasingly relying on software to automate manufacturing processes because programming knowledge among professionals has diminished. Over time, more programming knowledge has to be built into advanced automation software. ICAM's research and development (R&D) team continues to accomplish this with its latest development and release of Adaptive Post-Processing™ technology. Additionally, companies purchase complex CNC machines with average lifespans of 15 years, whereas the CAD/CAM software purchased alongside these machines is typically replaced every six years. Thus, aerospace companies are faced with the challenge of re-developing post-processors for new CAD/CAM systems. ICAM addresses this by specializing in the continual upgrade of the link between all CAD/CAM systems and CNC machines, new and old, allowing companies to preserve their ICAM developed post-processors and manufacturing methodologies.

Can you explain the key features of the latest release of ICAM's Adaptive Post-Processing software?

Manufacturers do not have to go through a long iterative process of repetitively correcting NC programs and testing them,

because ICAM's software automatically adapts the program to the selected machine in one programming step, saving 25% to 35% of programming time. This is accomplished through the simultaneous execution of ICAM's seamlessly integrated post-processing, machine simulation and G-code optimization software modules.

Adaptive Post-Processing also relies on SmartPACK, which consists of three new innovative products called SmartPATH (patent pending), SmartCUT and SmartFEED. These products work together to automatically adapt, correct and optimize NC programs based on the parameters and kinematics of the machine and part you are making. The resulting adapted NC program includes more efficient tool/positioning paths and optimized tool motions and feed rates, which when combined substantially increase the speed of part production. The software also improves overall productivity by extending tool-life and improving surface finish quality, while optimizing cutting forces and power consumption.

Can you explain the "adaptive" concept in your solution?

"Adaptive" refers to the automatic changing and optimization of the NC programmer's original part program (tool-paths) prior to it being used in production on a specific CNC machine. Our software factors in the unique limitations, functions and kinematics of the target CNC machine and recalculates tool paths, resulting in an optimized part program. The software considers all degrees of freedom within the machine and automatically adjusts the part program for the user.

Do you have any closing message that you would like to leave our international readership?

Parts manufacturers should feel comfortable investing in new CAD/CAM systems, CNC machines, robots and other new, innovative manufacturing machinery, but are well advised beforehand to investigate how each of these will integrate and function within their current manufacturing environment. We are efficiently integrating the latest manufacturing technology within our customer's current manufacturing environments. ICAM targets its efforts towards important areas of innovation and automation that have been neglected by the rest of the CAD/CAM industry for years. •

LOCAL FINANCING



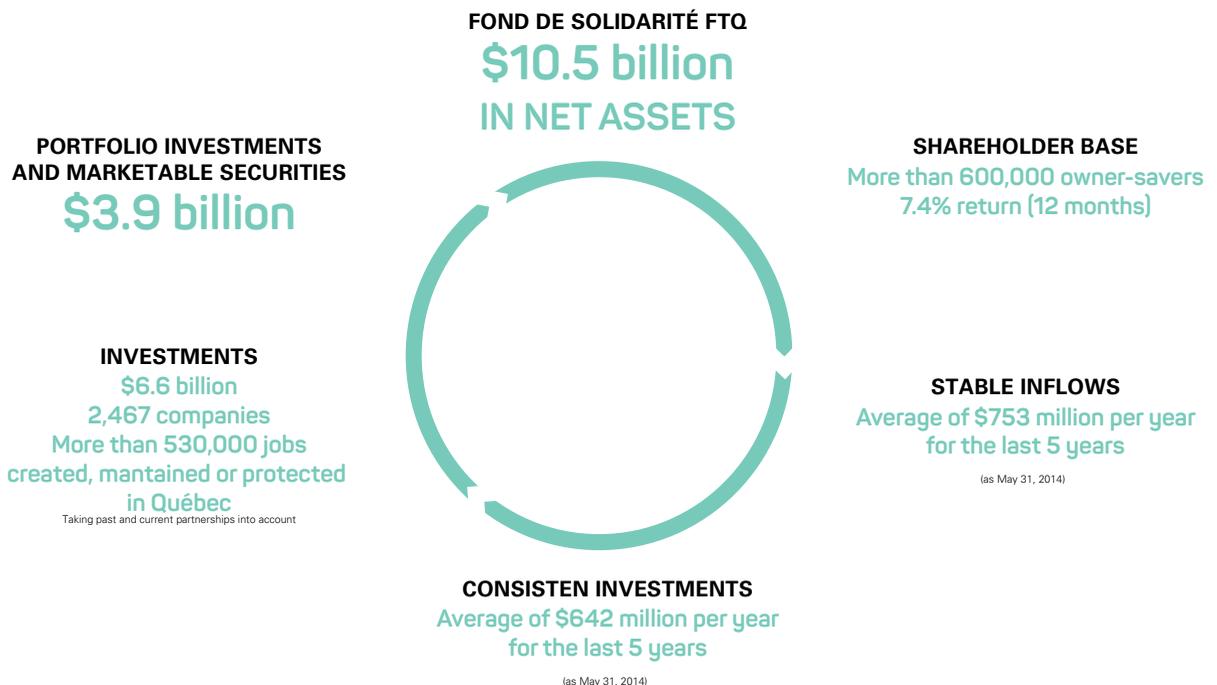
The Fonds de solidarité FTQ is a labor-sponsored investment organization. Capital is provided by common and preferred shares, and mezzanine financing in the form of non-guaranteed debts and instruments. We are a custom-made type of investor, differentiating from other financial institutions, such as banks. By law, we have a specific mandate for economic development and job creation in Québec.

*- Jean Wilhelmy,
Senior Vice-President Aerospace, Construction, Services and Transportation,
Fonds de solidarité FTQ*



QUEBEC'S LARGEST DEVELOPMENT CAPITAL NETWORK

Source: Fonds de solidarité FTQ



The range of financing solutions that Desjardins provides is determined by the size of the company. The traditional rule of thumb is that we finance 15% to 20% of the whole liability of any company. For this, our intervention usually ranges between C\$2 million to C\$10 million. When an owner wishes to remain in a majority position, we can also facilitate the transfer of the company to a new owner, new management, or a second-generation entrepreneur.

*- Martin Perreault,
Manager, Investments,
Desjardins*





Jean Wilhelmy, Gilles Poulin & André Viau

●●● JW: Senior Vice-President Aerospace, Construction, Services and Transportation
 GP: Senior Director, Investments Aerospace, Construction and Transportation
 AV: Portfolio Manager, Aerospace Industry
FONDS DE SOLIDARITÉ FTQ

●●● **To begin, please provide us with a brief introduction and description of each of your roles within the Fonds de solidarité FTQ.**

JW: I am senior vice-president with the investment group heading the aerospace, transportation, services and construction group, being ultimately responsible for aerospace. I have ongoing contact with personnel from this sector, wherein there is a team of two dedicated people solely focusing on Québec's aerospace cluster to help the financing of companies to grow and develop business abroad.

GP: I am senior manager of a team of investors, which reports to Jean Wilhelmy, aerospace, transportation, construction and infrastructure are the sectors that fall under my purview; André Viau and Martin Fournier are responsible for the aerospace industry within my team.

AV: I am portfolio manager for aerospace; my brief is to develop the aerospace portfolio of the Fonds. Our team dedicated to the

aerospace sector was officially formed in the year 2000.

Can you explain the evolution of the aerospace team since its foundation and its involvement in the Québec aerospace cluster?

AV: Before 1998, the Fonds was not specialized within the aerospace sector, but this sector has become a very important manufacturing contributor to Québec's economy. Initially, we attended aerospace trade shows to become familiar with the market and its key players; from this, we developed our portfolio commencing with small and medium-sized enterprises (SMEs), resulting in a network of contacts at home and abroad.

Can you outline the financial services solutions that you offer the criteria used to evaluate the companies that you work with?

JW: The Fonds de solidarité FTQ is a labor-sponsored investment organization. Capital is provided by common and preferred shares, and mezzanine financing in the form of non-guaranteed debts and instruments. We are a custom-made type of investor, differentiating from other financial institutions, such as banks. By law, we have a specific mandate for economic development and job creation in Québec.

AV: The Fonds backs companies who are growing and consolidating, such as the merger of AV&R Vision and Robotics with IMAC Automation, Adetel Canada's first implementation and acquisition, and Sonaca's acquisition of NMF.

How many aerospace companies do you work with in Québec; and are they primarily SMEs?

AV: The Fonds' portfolio consists of 12 aerospace companies. Our portfolio is primarily constituted of SMEs but we also work with OEMs and integrators such as Bombardier, Héroux-Devtek, Mecachrome, and Sonaca.

GP: In addition, our portfolio includes three aviation companies involved in transportation, such as helicopters.

The Fonds also works with an assortment of well-known multinational aerospace companies. Tell us about your involvement in international aerospace markets.

JW: Aerospace is becoming an increasingly internationalized industry. Accordingly, we look beyond Québec's aerospace cluster to incorporate its supply chain and assist

its funding. We have tried to create links and synergies between aerospace SMEs in Québec and Toulouse, France; the goal is to create a triangle of links between the aerospace clusters of Québec, Toulouse and Seattle. In addition, the Fonds has created a strategic partnership with Ace Management and its three private equity funds, Aerofund I, II and III, based in France that specialize in aerospace.

GP: There are many examples of the links we have participated in between Québec and France. For instance, Mecachrome has invested in a plant in Montréal from France, and exports and produces components for OEM such as Airbus; Sonaca, which is headquartered in Belgium, has a manufacturing plant in Montréal for wing skins; Adetel Canada is investing in a new facility in Québec; and AJW Group of the United Kingdom has relaunched in Montréal the component repair business of the liquidated company Aveos.

To what extent are you targeting multinational expertise to strengthen and reinforce the competitiveness of Québec's aerospace cluster?

AV: Strengthening Québec's aerospace cluster through multinational expertise is very important; when the Fonds finances and partners with multinational companies, such as those involved with Airbus, job creation will permeate down to SMEs.

GP: Our presence at trade shows allows us to develop our business and explain to multinationals the benefits of investing in the Québec aerospace sector. We have three objectives when building international partnerships: cross selling; complementary expertise; and Québec impact. Overall our mission is to create wealth in Québec.

What customized solutions are in place to assist local SMEs who are struggling against the influx of multinational players, and what impact has this had?

AV: SMEs in our portfolio are not struggling, but we help them respond to competition. For example, Groupe Meloche is a well-structured family-owned company, and the Fonds helped provide the company with a strong board of directors.

GP: The Fonds provides capital to build solid companies, followed by covenants, structures, growth plans, and assistance with contacts and mergers and acquisitions that help companies progress to the next level. •

Martin Perreault

●●●

Manager, Investments
DESJARDINS



●●● **Of the 15 to 20 companies that Desjardins has targeted in Quebec's aerospace industry, what is the range of financing solutions that you provide and how are you helping them grow?**

The range of financing solutions that Desjardins provides is determined by the size of the company. The traditional rule of thumb is that we finance 15% to 20% of the whole liability of any company. For this, our intervention usually ranges between C\$2 million to C\$10 million. When an owner wishes to remain in a majority position, we can also facilitate the transfer of the company to a new owner, new management, or a second-generation entrepreneur. We support our clients by understanding their specific needs. We try and facilitate measures that have worked in other companies and apply them in new companies.

Desjardins is also building a very strong consultant base, which has worked well in the aerospace industry and can support an expansion strategy for businesses in this sector. We first determine our strategy, then find the right people, add appropriate resources, and turn what began as a growth plan into something material.

Many of the aerospace companies that we work with are family-owned businesses, and one of the greatest challenges associated with this type of business is implementing strong governance systems.

In what ways does Desjardins help companies work through these challenges?

In fact, it is quite easy. Upon obtaining shares in a company, Desjardins imposes the requirement of having a board, not an advisory board but a real board that establishes a framework for accountability and a new set of expectations. As an investor, I want the companies that we work with to grow and make money. The first step that we take is to differentiate the roles of shareholders and employees within the company. We have to determine who is going to evaluate targets and what indicators we are going to try to follow. By conducting a strong follow-up we can help a business that used to make C\$20

million in annual revenues with a C\$2 million profit, to double their profit in two to three years. Following-up and maintaining a strong board are strategies that can help challenge business decisions.

With the emergence of heightened levels of competition abroad, what does Quebec's aerospace cluster require in terms of financing in order to retain its position as a world leading aerospace hub?

It is not a financial challenge. Right now there is a lot more money than there are good projects. Access to credit is easier than it has ever been. Banks are willing to grant loans and facilitate transactions when there is a good project on the table. It is not a financial problem, it is a leadership problem. If you find the leadership, the money is there. Our goal is to find leaders and develop them. We want to develop skills for the entrepreneur and can achieve our goal with our strategy. We can never have enough strong leadership. We do not lack leadership in Quebec, but it may need support.

Additionally, it is easy for societies to over-leverage and then become fragile. With the restructuring of the supply chain, competition from all over the world now competes with Quebec's small and medium-sized enterprises (SMEs). We need to build multinational businesses that can compete, but building multinational in such a capital-intensive industry is not possible with only family savings. •

EDUCATION

Academic Alliances Fortify the Future

●●● Quebec's education system plays a critical role in the province's diversified aerospace ecosystem. The province has evolved to offer a range of over a dozen universities, engineering schools, and technical training institutes that provide aerospace education to meet the industry's growing demands. Each year a total of 1,500 aerospace students graduate from four universities: Concordia University, McGill University, École de Technologie Supérieure (ETS), and École Polytechnique. There are an additional nine technical schools, and two universities that also provide aerospace and relevant engineering education to those seeking to enter the industry. "In Quebec, it is estimated that one worker in 97 possesses an aerospace diploma, 1.5 times higher than the proportion in France and 2.5 higher than in the United States," said Minister of Economic Development, Innovation and Export Trade (MEIE), Jacques Daoust. Many of Quebec's educational institutions have been established for over a century, resulting in what Daoust describes as "an extensive pool of highly qualified manpower (semi-skilled workers, technicians, engineers, and scientists) and a presence of universities and research centers at the forefront of worldwide innovation."

Partnerships between industry members and educational institutions are instrumental for increasing the cluster's capabilities. PARC, an initiative started by JMJ CEO and entrepreneur MarieChantal Chassé, seeks to add value to various business sectors through the establishment of sharing communities via university-industry collaboration. "We would like to globally interconnect the Aerospace communities forming a network of knowledge that innovates and creates new projects. This collaboration between industries and universities will help connect people while bridging silos and allowing us to share our best practices," said head of knowledge management at Bombardier and PARC participant Marco Beaulieu.

A research project has already been launched in collaboration with all four OEMs and four educational institutions including McGill, Polytechnique, ETS, and HEC. "The idea of collaboration is critical for the aerospace industry, as it has the ability to accelerate innovation by optimizing the utilization of the industry's resources," said Chassé.

An example of this type of collaboration, which is directed by Pratt and Whitney Canada senior research fellow and professor Dr. Hany Moustapha, is the Chair Program at ETS. ETS places their students within companies to conduct research and work on specific projects in order to gather industry knowledge and experience. The program has enabled a total of thirty undergraduate students to work at Pratt and Whitney Canada on various engine design projects. "This provides them an excellent and unique hands-on experience," said Dr. Moustapha.

In order to ensure that institutions continually evolve to meet industry demands, CAMAQ (Center for Adaptation of the Aerospace Workforce in Quebec), founded in 1978 and supported by

the MEIE, works to ensure that schools provide manpower in accordance with the cluster's needs. CAMAQ conducts annual censuses to forecast the number of workers and type of labor required by aerospace companies. The organization distributes detailed analyses of labor needs to Emploi Quebec and training schools to optimize enrollment. "We do not want to create a surplus of workers who cannot find employment; we want the right amount of people for the right amount of jobs," explained executive director of CAMAQ, Nathalie Paré.

CAMAQ also works with technical schools to strengthen and maintain Quebec's skilled technical workforce, and has established the École des Métiers de L'Aérospatiale (EMAM), a technical trade school, to which they provide active guidance. "Every year we invite representatives from the industry to evaluate the programs so that we know the processes and parts being used line up with what is currently being used in the actual industry," said Paré.

In line with this trend of partnership and collaborative evolution, HEC Montréal has developed a Global Supply Chain Management program to train managers and address an important industry challenge. "One of the major issues faced by OEMs today is the management of subcontractors and the supply chain, which often causes delays. The chain is complex, and OEMs have to work with tier-one, tier-two, and tier-three companies to deliver on time," said HEC Montréal professor, Dr. Jacques Roy.

In light of globalization, companies need to strengthen their expertise in supply chain management to remain competitive. "OEMs need their suppliers to deliver 100% on time. While this was not as important 10 years ago, today timing is crucial and this shift in mindset has created a new and pressing need," said general manager of Thyssenkrupp Aerospace, Stéphane Roche.

HEC Montréal places its students within OEMs including Pratt and Whitney Canada and Bombardier to conduct interviews, benchmark, and examine best practices around the world. These students are often hired after completion of their programs to implement improvements. HEC Montréal is also working to launch a specialized 15-credit graduate program that will be recognized within their MBA program and focused specifically on aerospace management.

Through close university-industry ties of this kind, students and professors are able to identify industry challenges and tailor programs and research accordingly to produce a world-class aerospace workforce. It is this type of collaboration that sets Quebec apart from its competitors. As Moustapha emphasized: "Beyond the technologies coming out of Quebec's aerospace cluster, the high quality of our employees also solidifies our standing in the international aerospace industry."

Quebec's continued dedication to educating its next generation of aerospace workers will allow it to remain competitive internationally for years to come. •

MAP OF HIGHER EDUCATION AND TRAINING INSTITUTIONS IN QUEBEC

Source: Aéro Montréal

- A**
 1. École de technologie supérieure (ÉTS)
 2. École des métiers de l'aérospatiale de Montréal
 3. Polytechnique Montréal
 4. Université Concordia
 5. HEC Montreal
 6. Université McGill
 7. Air Richelieu - École de pilotage
 8. École nationale d'aérotechnique (ÉNA)
 9. Université de Sherbrooke - Campus Longueuil
 10. Centre De Formation Professionnelle Des Moulins
 11. Collège de Bois-de-Boulogne
- B**
 12. Cégep de Saint-Jérôme
 13. École des métiers de l'aérospatiale de Montréal (Mirabel)
- C**
 14. Université de Sherbrooke
- D**
 15. École des métiers de l'aérospatiale de Montréal (EMAM)
- E**
 16. Université Laval
 17. Visionair Québec - École de pilotage
 18. Centre de Formation Aéronautique de Québec (CFAQ)
- F**
 19. Centre québécois de formation aéronautique - Cégep de Chicoutimi



Dr. Hany Moustapha, Ph.D.



●●●

Professor and Director

AÉROÉTS

NSERC/P&WC Chair in Propulsion System

ÉCOLE DE TECHNOLOGIE SUPÉRIEURE (ÉTS)

Senior Research Fellow

PRATT & WHITNEY CANADA (P&WC)

●●● Please provide a brief overview of your professional background and your involvement in Quebec's aerospace cluster.

I spent around 35 years at Pratt & Whitney Canada (P&WC). I retired from P&WC five years ago, but shortly after received an offer to be a professor at ETS.

During my career at Pratt, I was managing technology and collaboration programs and was heavily involved in the creation of consortia such as CRIAQ, Aero Montreal, GARDN, SA2GE, Montreal Aerospace Institutes, etc. I now spend four days a week at ETS,

managing aerospace programs (AÉROÉTS) and teaching one course per year on aircraft engines. I spend the other day at P&WC as a senior research fellow.

What is the nature of ETS' curriculum and how does it cater to the aerospace industry?

ETS does not have a department specifically dedicated to aerospace but the mechanical, electrical, industrial and software engineering departments are all active in the field. Of our 160 professors, 55 are working on aerospace. About 80% of our research programs are with the industry. There is also a meeting of professors, who meet annually to discuss the strategy of the programs. I manage this group and all industry relationships.

How important is industry experience to ETS?

All of our 55 professors have industry experience, while our students come from technical colleges, where they have studied for three years. After four years of training and working with these companies, our aerospace students receive more than one offer after graduating.

In terms of creating a pipeline of human capital, how does Quebec compare with other aerospace hubs?

The three major aerospace centers are Montreal, Seattle, and Toulouse, but Montreal has the highest concentration of aerospace students. This is the only city in the world where one in 80 people works in the industry. We have four universities—two English, two French—producing about 1,500 aerospace graduates per year.

What is the objective of your Chair research program with P&WC?

The objective of the five-year Chair program is to deploy a fully automated propulsion system integrator and optimizer, capable of finding the optimum balance between performance, durability, cost, weight, etc. to achieve the best engine design. 30 undergraduate and graduate students have worked on various projects, which have shown a great reduction in iteration and design time and improved design fidelity.

How important are advanced technologies and innovation to Quebec's aerospace industry?

To put it simply, without the engine technologies that have been developed here over the last 30 years, the cost of a plane ticket would be four to five times what it is now. Our main focus in the last 30 years has been on the fuel consumption of the engines, as fuel accounts for almost 50% of the operating cost of an aircraft.

The main challenges now are weight and cost reduction and environmental aspects such as emissions and noise. Every year, we see a 5% increase in the number of people flying. The forecast for the next 30 years anticipates the need for 1,000 new aircraft per year to replace aging fleets. Future engines will be more electrical and have a generator, which will simplify it and reduce its weight. They will also be more intelligent and able to adjust performance to different loads. The high quality of Quebec's employees will solidify our standing internationally. Over the next 10 years, Canada's aerospace industry will need an additional 50,000 workers, roughly 20% of which will be engineers. In the past, we had to recruit engineers from Europe, but we no longer have to do so. •

ÉTS IS A WORLD-CLASS ENGINEERING SCHOOL FOR AEROSPACE ENGINEERING & RESEARCH WITH A FOCUS ON INDUSTRY NEEDS.

- + Out of the 160 professors at ÉTS, 55 are active in the aerospace field. They have more than 340 years of cumulative industry experience.
- + 14 research laboratories and 10 research Chairs are involved in projects addressing all areas of aerospace engineering.
- + More than 500 internship students per year get to apply their hands-on skills in aerospace companies.
- + We offer practical professional development courses designed to meet the needs of the aerospace industry.

aeroets.etsmtl.ca
ÉTS is a member of the Université du Québec Network.

ÉTS
Engineering for industry



Dr. Jacques Roy, Ph.D.

●●●
Professor, Department of Logistics and
Operations Management
HEC MONTRÉAL

●●● **Please tell us about your professional background both as an engineering officer in the Canadian armed forces, in academia here at HEC Montréal, and beyond.**

After graduating from the military college in St. Jean, I worked as an aerospace engineer in the Canadian Air Force. I was later selected to pursue an MBA at HEC Montréal and was sent back to military college to teach after completing my degree. I later decided to pursue a doctorate degree here in transportation logistics, which marked the beginning of my academic career as a professor. I also worked part-time for an international aviation management training institution for ten years, where I was responsible for management training and research and development (R&D). Additionally I conducted studies for the Canadian and provincial governments in the field of aviation and was asked to participate on the advisory council for the

Canadian review of aerospace programs and policies.

What is HEC's role and involvement within the aerospace industry in Quebec and internationally?

Until recently, HEC has not been extensively involved with aviation or aerospace other than through research projects and some executive education seminars in collaboration with Toulouse Business School. Generally, operations research applied to aviation is conducted at HEC Montréal by individual researchers. HEC Montréal is now working on the design of a specialized 15-credit graduate program that will be recognized within our MBA program. It will be packaged as a micro-program in aerospace management, offered to the local market, and tailored to the needs of the local aerospace industry. HEC will allow its MBA students to select the program as part of their MBA courses, and it will also be a standalone program. Given that the MBA program is currently divided into two main sections, core courses and electives, if a student allocates his/her electives towards courses in aerospace, he/she will receive a specialized MBA degree. If taken on its own, the candidate needs not be accepted into the full MBA program. Eventually, if the new program gains momentum, HEC may offer it worldwide. HEC does attract many international students to its MBA program, and by offering something more flexible we may be able to satisfy the local market and concurrently provide training to international students. The specialized aerospace program will be offered within the expected tuition range for local students.

Can you discuss existing industry-university collaboration at HEC Montréal?

At HEC Montréal, most of our collaborative work is in the field of research, performed largely by our master's-degree students. We have a masters program in global supply chain management, which is offered in French (Logistique Internationale) and English, and a program in my department that is focused on process and quality improvement. These programs are in line with industry needs. For example, one of the major issues faced by OEMs today is the management of subcontractors and the supply chain, which often causes delays. The supply chain is complex, and

OEMs have to work with tier-one, tier-two, and tier-three companies to deliver on time. Thus, HEC Montréal places its master's students in the global supply chain program with companies such as Pratt and Whitney Canada and Bombardier to tackle their most pressing challenges. I met with a student today who had spent all summer and winter conducting interviews, benchmarking and examining best practices around the world. He was working on a very specific problem within the CSeries production: gaining visibility on the supply chain. Oftentimes after working within these companies, students will get hired to implement what they have found. Our continuous involvement in research and the development of programs are how HEC Montréal collaborates with the industry.

Moving forward, is a specialized masters degree program something that Quebec could utilize to remain competitive internationally?

Definitely. If aerospace companies become more adept in managing their supply chain and gain a better understanding of each party's needs, they will grow substantially. Nevertheless, Quebec fairs well compared to many other European countries that do not have initiatives such as CRIAQ. On the management side, however, there is not much in existence that is targeted specifically to the aerospace industry. Business schools tend to remain general and offer courses such as finance and marketing, and developing a program for one specific industry is always challenging. But it is worth mentioning that there is merit to be gained by the industry itself. Given that Montreal is truly an aviation capitol of the world, we need to have at least one specialized graduate program to showcase that universities are also involved in management training. While close internal links exist on the engineering side, they are absent on the management side. We can help target specific industry issues such as marketing new planes, dealing with small businesses, or implementing lean practices, and by doing this we can provide value to the industry. ●

MarieChantal Chassé

●●● President
JMJ AEROSPACE



●●● **JMJ Aerospace works in the field of aerospace human resources. To begin, tell us about the formation of JMJ Aerospace and the services it provides the aerospace industry.**

JMJ Aerospace was founded by an associate and me in 1996, its specialization being an outsourcing of human experts & technical assistance service provider for the aerospace industry. JMJ Aerospace's initial service offerings were quite traditional in scope, providing the aerospace industry with outsourcing solutions that include onsite technical assistance, recruitment, team logistics, and personnel management. Through this value-proposition, JMJ Aerospace enjoyed success and, in 1999, we opened an additional office in the United States. Over the years, JMJ Aerospace expanded its customer base and profile of service offerings, continuing its evolution within the sector through today. Overall, JMJ Aerospace's mission is to be an extension of its customers' activity, supporting their human resource needs in any way possible.

How has JMJ Aerospace evolved since its inception?

An essential influence on JMJ Aerospace's evolution has been my technical background in engineering; a quality that has allowed me to view our aerospace human resources niche under a unique lens. Beginning in the late 1990s I started to study how workers in the aerospace industry were being managed, and much to my amazement, I discovered that the industry's human resource management practices were not a highly systemized as I would love it to be. It became evident that companies tend to work in silos; a propensity that is not conducive to highly cyclical industries, such as aerospace. Stakeholders within the aerospace industry need to be aware that its workers will be moving, and rather than expending effort on stabilizing the workforce, need to accept that it is a cyclical industry, and need to establish a system that is capable of addressing this dynamic. Following this revelation, I proposed solutions to our customers that would change their mindsets. While continuing with JMJ Aerospace's philosophy, we began to offer services that were in sync with the industry's cyclical conditions: building contracts with customers, assigning experts and teams that were in sync with their fluctuations, supervising and providing logistics of mobile teams. Regarding our customers that work with production units, such as Safran and Pratt & Whitney, we

began to take charge of their internal outsourced teams. In this sense, both the industry and our services started in the traditional way and now we are evolving together to embrace the new ways of the new economy, the sharing economy.

Could you please tell us about the Pairing Automation of Resources in Communities (PARC) program that you initiated?

Organizations typically place great emphasis on their engineering, finance, or marketing departments; human resources is often an underappreciated, albeit critical, function of an organization. As an engineer, my mindset is to think proactively and put a system in place where we think collaboratively and are engaged in new ways to leverage human resources. Over the years I have worked with customers on the transformative idea of sharing human resources among the industry. The aerospace industry's workforce has always been divided into two categories: permanent and temporary employees, with nothing in between. This has the unintended consequence of discrediting a large portion of the industry's human capital. If we take synergies from variations in personnel, superimposing the entire industry's pool of human capital, we can mitigate fluctuations within the industry and enhance its stability. Through the years, we have focused on putting human knowledge at the center of the solution. The role of PARC is to create a systematized platform in which the industry can collaborate and synergize its pool of human resources, which has the effect of promoting business predictability. ●

Technical Human Integrator JMJ

USHERING THE INDUSTRY IN THE NEW ECONOMICAL ERA: SHARING ECONOMY

JMJ Aerospace is a leader in the outsourcing and integration of specialists in the aerospace industry incorporated in both Canada and the United States with operations in 4 continents, 23 countries and now in Asia-Pacific.

PARC
PAIRING AUTOMATION OF RESOURCES IN COMMUNITIES

www.jmj-aerospace.com

PARC: SHARING RESOURCES WHERE OPEN COLLABORATIONS ACCELERATES INDUSTRIES INNOVATION

Co-written by:

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●●● More and more, people are realizing that individual resources are limited, but as a collective whole, there is a plethora of opportunities. Companies have taken notice and some have created business models based on sharing everything from hardware tools, houses, books, and car rides to hosting services where people share their skills in exchange for other knowledge they wish to acquire. It seems the sharing economy movement is here to stay, and for good reason. Resource sharing is key in optimizing costs and reshaping unused value. One company that has taken resource sharing to another level is JMJ Aerospace, an outsourcing and technical assistance company with almost 20 years of service in the aerospace sector. Seeing the need to optimize resource usage, to create a means for continuity of employment for specialized workers during slow economic times, and to improve knowledge transfer in the industrial sector, CEO & Entrepreneur MarieChantal Chassé Eng., ICD.D initiated project PARC - PAIRING AUTOMATION OF RESOURCES IN COMMUNITIES. Funded in part by the Quebec government as the 5th Mobilising Project in Quebec, PARC seeks to bring value to different business sectors through establishing sharing communities of different types of resources; human, material and even immaterial. By systemizing and automating the sharing conditions, PARC will create stable access to resources for SMEs and large corporations alike, and at the same time provide a stable work environment for the job force.

“Being an engineer at heart, and leading a company that works in outsourcing resources, I have picked up very quickly the inefficiency that surrounds the current way of handling resources. And after long time of persistence, hard work and conviction, we won the 5th mobilising project and PARC was initiated. We are embarking in a new economical era. And in order to strive as an industry, as a community, we have to switch from working in separate silos and start embracing the new economy, the sharing economy.” - MarieChantal Chassé, Eng., ICD.D – CEO JMJ Aerospace and President PARC

PARC is accomplishing this vision by implementing subprojects geared towards testing a sustainable sharing model. One such project was launched as a research/action project in collaboration with 4 industrial partners (Bombardier Aerospace, Pratt & Whitney Canada, Bell Helicopter Textron & JMJ Aerospace), 4 research partners (McGill, Polytechnique, ÉTS & HEC) with the support of AeroMontreal & CRIAQ. This project aims to field test the operations of a collaborative virtual lab for the sharing of research equipment and expertise in the aerospace sector.

The collaboration between these organizations is in itself an example of how resource sharing can benefit organizations and business initiatives overall. The controlled organization of partners pooling together

financial resources, expertise, research capacity, and human resources ensures the efficient and effective use of the project partners' collective resources.

“We would like to globally interconnect the Aerospace communities forming a network of knowledge that innovates and creates new products. This collaboration between industries and universities will help to connect people while bridging silos allowing us to share our best practices.” - Marco Beaulieu, Head of Knowledge Management practice, Product Development Engineering, Bombardier.

This successful synchronisation between the university and the industrial worlds in terms of achieving a common goal, allows the community to work together to accelerate innovation.

“This project has the potential to trigger a paradigm shift in the way academics interact between each other and collaborate. The current model “1 professor = 1 independent SME” could bloom into a collective of collaborating academics. This evolution will not only optimize the costs for operating and maintaining infrastructure, but will also create real synergies between academics and industrial, thus increasing our national competitiveness”. - Prof Martin Lévesque, holder of the Canada Research Chair in Multiscale Modelling of Advanced Aerospace Materials, Polytechnique Montréal.

What has made this success possible? Partners adjudicate success to four interrelated factors: (1) participatory research approach, (2) co-design methodology, (3) proactive role of participants, and (4) the establishment of common rules and expectations based on values of trust and transparency.

“Collaboration is often approached using a “build it and they will come” mentality. The so-called soft factors of trust, reciprocity and shared understanding of goals are often neglected and yet they will make or break the project” - Prof. Kimiz Dalkir - B.Sc., MBA Ph.D. - Graduate Program Director MIST, School of Information Studies, McGill University

Where each partner individually would have to invest substantial efforts to advance the project, as a community, each partner can take part in the initiative as per the availability of their resources and still maximize the collective benefits of the project.

“I heard an African proverb once that says “If You Want To Go Fast, Go Alone. If You Want To Go Far, Go Together”. What a true quote, Quebec is already leading the industry, imagine where we would be if we effectively and efficiently work together.” - MarieChantal Chassé, Eng., ICD.D – CEO JMJ Aerospace and President PARC •



Nathalie Paré

●●● Executive Director
CAMAQ

●●● To begin, what was the rationale behind the formation of CAMAQ and what is its core mission today?

In 1978, when companies and union representatives met for the first time, their initial goal was both simple and ambitious: work together to plan the needs and specialized training of the workforce that the aerospace industry in Quebec needed to take his place and shine on the national and worldwide scene. To fill these technical and engineering positions, aerospace industry of the time was recruiting primarily its workforce abroad. The center of adaptation of the aerospace workforce in Quebec (CAMAQ) would be released in August 1983. Prior to CAMAQ, there were no sector-specific committees in Quebec; we are the first and oldest. Due to its success, CAMAQ has since been used as the prototype to form other sectorial committees. At its height, there were 36 sectorial committees, but some industries

have merged, leaving the current number at 29 sectorial committees.

Our mission is to ensure the quantity and quality of manpower for Quebec's aerospace, aviation and airport industries. We make sure that the schools are meeting the industry's manpower needs and interact with different government ministers to achieve this goal.

What have been some of the milestones that have occurred to help shape CAMAQ's position within Quebec's aerospace industry?

A key milestone for CAMAQ was the construction of the École des métiers de l'aérospatiale de Montréal (ÉMAM) 20 years ago. At the time, there had been no school dedicated to training workers with what we call intelligent hands, a skill set that goes beyond the minimum standards of quality. It took some years of negotiation with the government before actually building the school. We do not create the programs, but we provide guidance. For example, every year we invite representatives from the industry to evaluate the programs, so that we know that the processes and parts are those that are currently being used in the actual industry. We want all of the students' training to be as relevant as possible. Every year we also conduct a census of the industry to forecast manpower needs for the next two to three years; we have been collecting this data for 31 years now, and we have seen a steady increase in demand. We have also created CRIAQ (Consortium de recherche et d'innovation en aérospatiale), whose mission is to increase the competitiveness of the aerospace industry and enhance the collective knowledge base in aerospace through improved education and training of students

What other educational institutions does CAMAQ work with?

We coordinate a joint masters degree program in collaboration with a number of universities, such as, McGill, Concordia, ETS, Polytechnique, Laval, and Sherbrooke. All of the students in this program are required to take at least two courses in other universities because we want to make sure that the knowledge is being shared—this is a very collaborative research environment. Every year, we meet with these six universities to ensure that

the focus of the program is in line with the industry and to see what aspects need to be adjusted. With the École des métiers de l'aérospatiale de Montréal (ÉMAM) who have national programs dedicated to aerospace, there is also the École nationale d'aérotechnique (ÉNA) who have national programs for collegial degrees. No other school in the province can offer the same specialized program in aerospace. We may not be selling anything built in these schools, but they are still producing things—we view them as factories of manpower. With globalization, it does not matter where you build a factory, but the quality of manpower makes a huge difference. Multinational companies establish operations here because of our quality of production.

Is it correct to say that Quebec's educational institutions are producing approximately 4,500 students per year for the aerospace industry?

The total number fluctuates from year to year to adjust with the needs of the industry. Schools usually want to maximize enrollment, but we have an agreement with the government that if the industry slows down, we reduce the number of students. We do not want to create a surplus of workers who cannot find employment; we want the right amount of people for the right amount of jobs.

The programs at École des Métiers de l'Aérospatiale de Montréal take between six to 18 months to complete, but they are easy to adjust, which is the beauty of the system. If there is an immediate need, we can respond quickly. The students can also partake in a dual work-study system, where they spend two to three days a week with a company and two to three days a week in school.

How will CAMAQ work with the industry to stay competitive with manpower coming from other markets?

First, we conduct a census to capture the data regarding the industry's needs. From there, we inform the different partners as Emploi Quebec or the schools to make sure we always have the required number of employees. CAMAQ is the reference regarding the knowledge of the manpower in Quebec's aerospace industry. ●

G rard Bastien & Emilie P loquin



GB



EP

GB: President
EP: Manager, Operations
and Business Development

TECHNO AERO SERVICES (TAS)

●●● What is the typical profile of candidates that you work with?

EP: TAS specializes in staffing technicians in the aerospace industry. Mr. Bastien's technical background and extensive industry knowledge differentiate TAS from its competitors, and helps it maintain its high quality standards.

Do you primarily source experienced workers or do you look for recent graduates as well?

GB: Yes, we look for experienced workers. Sometimes, we have mandates to hire students out of schools directly, but clients usually look for candidates with at least one or two years of work experience in the industry, especially for shorter contracts. We do however go to schools to share our experience and knowledge with students, and inform them of opportunities within the industry.

Can you walk us through all of the different services you provide to your customers?

EP: 80% of our business is in staffing. We have a limited consulting practice in order to engage our clients and discern their specific needs, and we also consult with our candidates to prepare them for interviews. It is important to find a reliable pool of candidates for each of our clients, and to do this we have to thoroughly understand the company's demands.

TAS' candidate selection process is very intensive. How do you ensure the quality of your personnel?

GB: If candidates are not fit for the job, TAS will not accept them. It is very important to put the right people in the right place. We have a great reputation and are recognized for the quality of our candidates. We place great emphasis on worker competence and attitude.

EP: The process begins with the customer. At TAS, we take the time to meet with plant supervisors and their human resources teams to understand client needs. To source an appropriate worker, we tap into our extensive database of candidates and usually find someone. The candidate is screened on the phone initially, before meeting with TAS for an hour and a half. Only after this approval process does the candidate meet with his potential employer, at which point the deal is largely done. Finally, TAS conducts a thorough background check (we have to certify them for the Control Goods Program) before placing a candidate. We take more time at the beginning of the process to ensure success later.

Does TAS work primarily in Quebec or do you bring in international talent as well?

GB: TAS primarily works in Quebec, but has been expanding inter-

nationally since 2013. We received great feedback from our presence at Le Bourget and discussions are in place with potential clients. Economic conditions are not ideal for international recruitment and the certification process is lengthy and difficult, but we are optimistic about establishing partnerships with European companies.

What are the strengths and weakness of human capital graduating from universities and technical schools in Quebec?

GB: There is a large and diverse range of specialized aerospace technical programs offered in Quebec. L' cole nationale d'a rotechnique ( NA) and l' cole des m tiers de l'a rospatiale de Montr al (EMAM), are leaders in training hundreds of skilled technicians every year. For various reasons, however, students are selecting other career paths, or pursuing university degrees in aerospace, and companies are having difficulty sourcing technical manpower. TAS is proud to participate in scholarship programs to encourage student success.

How do you plan to adapt your business model to changing trends, and what is your growth strategy going forward?

EP: TAS' primary goal is to diversify its activities to overcome the cyclical aerospace market trends. Our growth strategy includes acquisitions, partnerships, and expansion into markets such as mining, in the next five years. However, our specialization will remain the staffing of technical workforce.

GB: As TAS continues to grow, we aim to maintain our high quality standards. The management of TAS will gradually be transferred to Ms Emilie P loquin and my role as the President of TAS will remain on the high level growth strategy. ●

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“A better alignment between customers and suppliers will inevitably result in the enhanced performance of the Quebec aerospace supply chain.”

- Suzanne M. Benoît
President and CEO,
Aéro Montréal

STAKING QUEBEC'S CLAIM IN THE GLOBAL AEROSPACE COMMUNITY

●●● With the rise of new emerging hubs internationally, it is imperative for Quebec's aerospace cluster to sharpen its competitive edge and adapt to changing market conditions in order to remain at the forefront of the global aerospace industry. Quebec's Big Four prime contractors – Bombardier, Bell Helicopter, P&WC, and CAE – have consolidated their networks of suppliers in preference of robust integrators that can function as risk-sharing partners. This transition is reshaping Quebec's entire aerospace supply chain. Integrators are tasked with managing an increasing number of sub-tier suppliers in order to deliver their end products. While integrators are encouraged to solidify their supply chains, sub-tier suppliers are spurred to vertically integrate and refine their own manufacturing processes. As Alain Bellemare, president and chief executive officer of Bombardier comments: "Local players should continue to focus on quality, productivity and cost-competitiveness. This can be done through investments in automation to develop their capacity to manufacture more complex products or the implementation of Lean techniques to reduce waste." From the Big Four to local small and medium-sized enterprises (SMEs), a ripple effect is taking place down the supply chain in which stakeholders are unifying their efforts to advance their manufacturing processes.

Quebec's aerospace industry has a rich heritage and scope of competencies to in-

novate and adapt to changing market conditions, and the Big Four harness robust R&D programs to develop cutting edge technologies. Amid rising fuel efficiency and environmental concerns, P&WC now incorporates composites and advanced alloys into its engines, and directs its R&D towards the reduction of fuel-consumption, noise, and emission levels. Quebec's OEMs can further enhance their research capabilities by partnering with local research institutions, universities and SMEs. A great example of collaboration is the Greener Aircraft Catalyst initiative (SA²GE). This partnership seeks to develop pre-competitive technologies for the next generation of aircraft. In its 2015-2016 budget, the Government of Québec earmarked C\$40 million, which is being matched by industry members, including OEMs and over 20 SMEs, for a total investment of C\$80 million for SA²GE during this period of time. Collaborative initiatives will be crucial for Quebec going forward.

As Quebec's aerospace cluster strives for continual advancements, local stakeholders and governments are creating an environment that is conducive to the industry's growth. Aéroports de Montréal, the non-profit corporation that oversees both of Montreal's airports - Montréal-Pierre Elliott Trudeau International Airport and Montréal-Mirabel International Airport – is actively courting the arrival of aerospace companies that are eager to establish operations in Quebec. Granby Industrial, the organization responsible for the industrial development of Granby, Quebec, is

also seeking to attract aerospace industry members to its industrial park by offering them reduced land costs and favorable tax credits. In addition to its specialized training establishments and state-of-the-art research centers, the government also offers financial incentives for private investment projects through R&D tax credits, as well as a tax holiday for major capital ventures. In 2014, the government announced a C\$300 million repayable contribution to P&WC under the Strategic Aerospace and Defense Initiative (SADI) program and C\$1.38 million in repayable funding for two aerospace companies based in Quebec, Avior Integrated Products and Techniprodec, to help improve productivity. Through federal support, the Consortium for Aerospace Research and Innovation in Canada (CARIC) was created in 2014 on the same model as Quebec's CRIAQ. CARIC is aligning its efforts to provide a powerful platform for Canada to multiply its innovative capacity through inter-provincial collaboration. As the success of Quebec's aerospace cluster is enabled by its internal consolidation, integration, and continued process improvements, local players can also take steps to broaden their presence outside of Quebec by mobilizing and leveraging the attributes of the cluster's resources. Jacques Daoust, Minister of Economy, Innovation and Exports posited: "Through the expertise, the determination and the ability to innovate of the cluster's more than 200 companies, Quebec is reaffirming its strength as one of the largest aerospace centers in the world." •



The orange part of this image represents the new phase of development of Granby's industrial park. 280 000 m² of land are available at \$8.07/m². Manufacturers in aerospace who build a plant in Granby will benefit a property tax credit of 100% for 5 years. Courtesy of Granby Industrial.

Patrick St-Laurent & Éric Tessier

PSL: Director General
ET: Industrial
Commissioner
**GRANBY
INDUSTRIEL**



PSL



ET

●● Can you provide us with a brief introduction to what you do at Granby Industriel, and your role in attracting business to Granby?

Granby Industriel is the organization responsible for the industrial development here in Granby. Our mission is to guide and support existing industrial companies with their needs, challenges, growth and projects. We also sell the industrial land for the city of Granby. If a company wants to purchase new land to construct a new plant, we work with them to facilitate the process with the city.

Can you elaborate on the existing aerospace ecosystem and supply chain, and why aerospace companies might be attracted to Granby?

With regards to Granby's aerospace ecosystem, we have three key players established in our park: Avior, NSE Automatech, and Atlas Aeronautik. These three players based in Granby are tier-two companies. They work with Bell Helicopter, Pratt and Whitney Canada, Bombardier, and Boeing. Under them in the supply chain there are about 21 companies machining components. GE Aviation, located in Bromont, and Pratt and Whitney Canada are not too far away either, bringing us to an ecosystem of about 20 to 25 companies working across the aerospace supply chain. The municipality has developed good incentives to attract aerospace companies to the park, including a special price for land and a full tax credit for five years on new constructions.

In addition to the incentives that the municipal government is providing to companies that are entering the market, what other factors distinguish Granby from other clusters?

Labor costs are very competitive in Granby and are almost 20% less than in Montreal. Proximity is another factor given that we are located just thirty minutes away from the United States border and have access to major highways. We have land readily available and access to Quebec government support. Quality of life is another key driver because Granby is a city in the countryside, and hence there is access to many forms of recreation and leisure, as well as proximity to Montreal. Additionally, we have created a forum specifically for the aerospace industry to organize roundtables. We are also developing the link between training centers and the industry, facilitating local training centers' access to appropriate human resources.

Granby is undergoing a massive expansion right now. Can you tell us a bit more about this expansion plan and your goals with regards to its development?

The city of Granby has decided to expand its industrial park because in the actual park we currently have only two more lots available. Over 280,000 square meters of industrial land will be developed to accommodate new businesses in the aerospace and specialty vehicles industries.

We have already announced a new project in 2015 in partnership with the University of Sherbrooke, and the construction of a new building in that new area will begin in June. The engineering faculty of Sherbrooke has established a research center in Granby and its goal is to attract companies who will innovate and build value-added products in collaboration with the university.

There is a local incubator available for startup companies who can also have access to common infrastructure such as conference rooms and reception areas. They can benefit from the support of personalized committees, which are mandated by Granby Industriel.

Do you have a closing message?

We work closely with Investissement Quebec and have access to professional training centers and university research faculties. Collaboration has been a major theme especially between training centers and the industry, and continues to play an important role in Granby. Every six weeks, industry professionals gather with members of the training centers and the College (CEGEP) to discuss course content and material, to ensure that appropriate training is being conducted in line with industry needs. ●

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Charles Gratton

●●●
 Vice President, Real Estate and Commercial Services,
AÉROPORTS DE MONTRÉAL (ADM)



●●● **Please provide a brief history of Aéroports de Montréal and describe any important milestones that have shaped its presence today.**

Aéroports de Montréal (ADM) is a not-for-profit corporation created in the early 1990s as part of the Canadian government's airport privatization program. In 1992, we took over the management, operation and development of Montréal-Pierre Elliott Trudeau International Airport (Montréal-Trudeau) and Montréal-Mirabel International Airport (Montréal-Mirabel) under a long-term lease that will expire in 2072. Our mission is three-fold: to provide quality airport services that meet the specific needs of the Montréal community; to contribute to the economic development of the Greater Montréal region; and to coexist in harmony with the environment/community. At the time of their transfer to ADM, both Montréal-Trudeau and Montréal-Mirabel airports shared passenger traffic, with international flights operated at Mirabel and domestic and transborder flights concentrated at Trudeau. This made connecting flights difficult and the airports were operating at a deficit. An important step was taken in the early 2000s when we began consolidating all passenger flights at Montréal-Trudeau and redefined the role of Montréal-Mirabel as an all-cargo and industrial airport. This specialization strategy for the platforms has paid off.

The repositioning of Montréal-Trudeau has been accompanied by an extensive modernization and expansion program valued at some C\$2 billion. From 2001 to 2009, the terminal was almost completely rebuilt and its capacity doubled. Today, as we proceed with a new phase of the expansion, including an enlarged international jetty, Montréal-Trudeau has become a world-class airport and emerging international hub. Over the past decade, pas-

senger traffic has increased by 4.6% annually, to a record 14.8 million in 2014, and Montréal-Trudeau now serves more than 130 direct destinations. The number of international direct flights has jumped to 75 from 30 in just a decade. Montréal-Mirabel, for its part, has become a world-class center for aeronautics, helping to place Montréal among the world's top three cities in this sector.

What steps has Aéroports de Montréal taken over the years to encourage aerospace businesses to establish operations in Québec and join its aerospace cluster?

We have had considerable success in positioning our two airport sites in the industrial real estate market and in attracting new businesses, especially in aerospace. We have some 250 companies, including many related to aviation and logistics, working on our airport sites, generating a grand total of 60,000 direct and indirect jobs. Montréal-Mirabel, in particular, has become a major hub for aerospace manufacturing and related activities. Some 23 cargo carriers currently operate at Montréal-Mirabel, which covers a vast area of 5,214 acres and offers two 3,660-meter runways capable of handling approximately 40 aircraft movements per hour, 24/7. Montréal-Mirabel's runways have the added advantage of being located at the heart of a growing industrial zone that is now home to about 30 manufacturing and other industrial companies accounting for close to 3,700 direct jobs – 96 per cent of which are in the high-value-added aeronautics industry. They assemble commercial aircraft as well as assemble and test engines, perform in-service aircraft maintenance and overhaul, and even deconstruct old aircraft. In addition, several facilities formerly used for activities related to passenger transportation have found a new vocation. On-site companies include major aerospace lead-

ers including Bombardier Aerospace, Pratt & Whitney Canada, Mecachrome, Stelia Aerospace, L-3 Mas and Avianor Inc. Montréal-Mirabel is the site for assembly of Bombardier's all-new CSeries passenger jet, which made its inaugural flight from the airport in September 2013.

Working in conjunction with the government of Québec, ADM has developed incentives to attract companies to Mirabel. We have had a lot of success with French companies because of cultural factors as well as by offering creative solutions to their needs. For example, we built and leased a customized facility in Mirabel for Stelia Aerospace, formed through the recent merger of Aerolia and Sogerma, which is using it as its Canadian headquarters and to produce the centre fuselage assembly for Bombardier Aerospace's Global 7000 and 8000 business jets. This arrangement was a key factor in Stelia Aerospace's decision to establish its first North American plant in the Montréal-Mirabel Airport industrial park. Aéroports de Montréal has a lot of land available for development both at Montréal-Trudeau and Montréal-Mirabel, and we are trying to attract more businesses and diversify the type of companies that we work with. We see it as quite natural to build a cluster around an airport and this synergy among companies has worked well.

What is Aéroports de Montréal's message to many of these multinational and local players that want to come to Québec and establish their aerospace businesses?

Greater Montréal is one of the world's three aerospace capitals, along with Seattle and Toulouse. It is among the rare places in the world where all the main components of an aircraft are manufactured within a 20-mile (30-kilometer) radius. Nearly two-thirds of Canadian production is centered here. We have all the ingredients needed for aerospace companies to be successful: a large pool of highly-skilled workers, excellent educational and research institutions, competitive costs and proximity and access to major markets. Companies such as Mecachrome, Stelia Aerospace and others, for example, have chosen Mirabel as the launching point for their businesses in the North American market.

Looking forward, what is Aéroports de Montréal's strategic action plan for the coming years?

ADM intends to continue to enhance the roles of Montréal-Trudeau and Montréal-Mirabel airports as essential drivers for business, tourism and economic development. We are working diligently to develop Montréal-Trudeau as an active secondary hub between North America and Europe, and especially French speaking countries. We are planning \$800 million of improvements at the airport over the next five years and are also actively looking to further develop its extensive land bank, the largest of its kind on the Island of Montréal available for development. ADM is open to all proposals, especially from developers and companies in the cargo, light industry, general aviation and recreational/leisure tourism sectors. Montréal-Mirabel is a top-quality asset that ADM plans to continue enhancing in the coming years. New investment projects include the full reconditioning of the main runway, the revitalization of the existing airport hotel, demolition of the former passenger terminal and construction of a sports center. With the globalization of trade and growth in the world aerospace industry, the long-term outlook is promising. •

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Kent Fisher,
Vice President/General Manager
BCA Supplier Management

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