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Economic Impact Analysis and Capabilities Study of the BC Aerospace Industry

Prepared for AIAC Pacific

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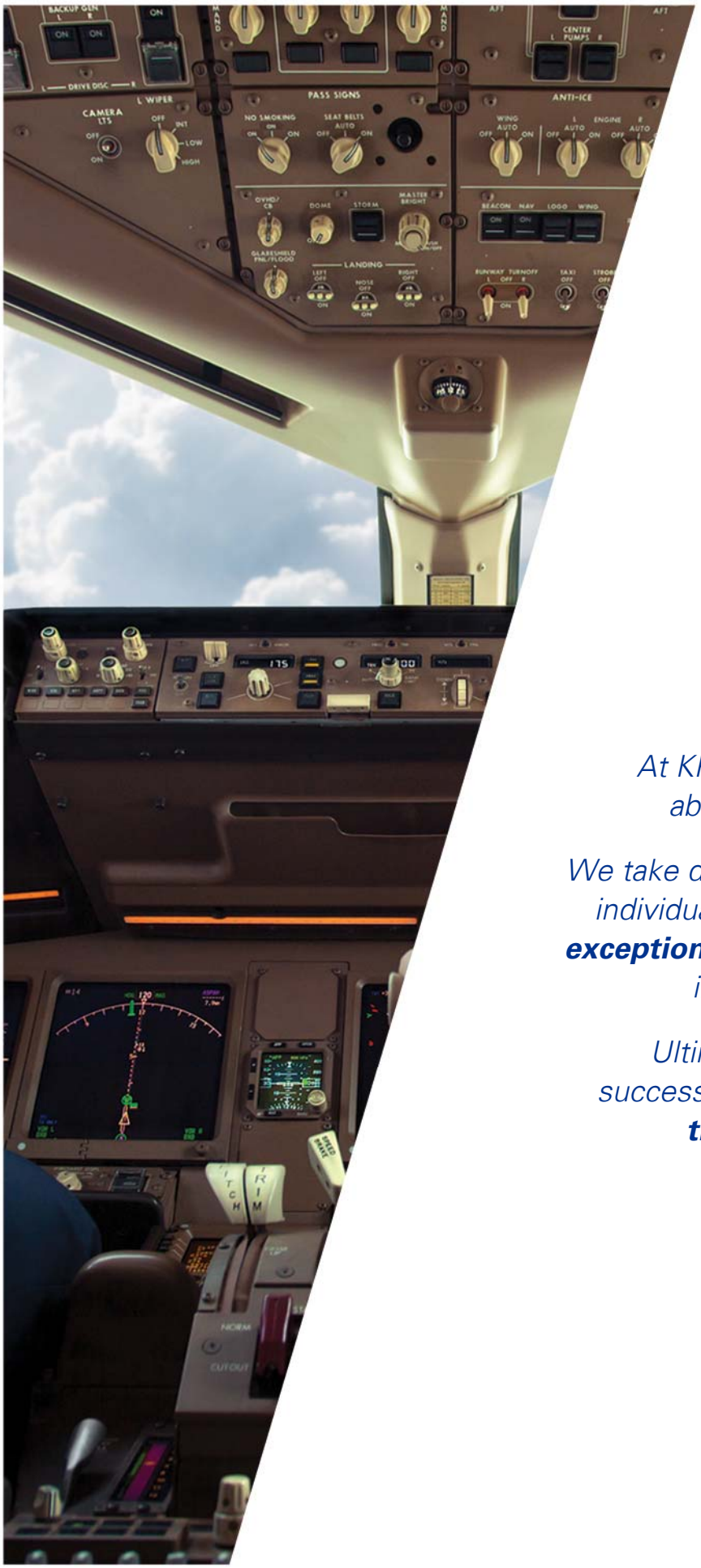

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Table of Contents

1. Summary of Findings 1

2. Economic Profile of BC Aerospace 8
- 2.1 Introduction 8
- 2.2 Description of the Aerospace Industry 8
- 2.3 Description of Economic Analysis 9
- 2.4 BC Aerospace Industry in the National Context 9
- 2.5 BC Aerospace Overall Industry Size 11
- 2.6 BC Aerospace MRO-ISS Service Sector 12
- 2.7 BC Aerospace Manufacturing Sector 14
- 2.8 BC Space Sector 18
- 2.9 BC Aerospace Export Intensity 19
- 2.10 R&D Investment in the BC Aerospace Industry 20
- 2.11 Talent Availability in the BC Aerospace Industry 21
- 2.12 IRB Obligation Overview 22

3. Economic Impacts of the BC Aerospace Industry 24
- 3.1 Overview of Economic Benefits Created 24
- 3.2 Current Economic Impact 25
- 3.3 Economic Impact of Growth in BC Aerospace Industry 26
- 3.4 Tax Revenue Impact of the BC Aerospace Industry 27
- 3.5 Provincial Comparison of Economic Impact 28
- 3.6 Industrial Comparison of Economic Impact 29

4. BC Aerospace Capabilities Mapping 31
- 4.1 Aerospace Firm Structural Overview 31
- 4.2 BC Aerospace Value Chain 32
- 4.3 BC Aerospace Capabilities – Summary Assessment 33
- 4.4 Alignment of the Value Chain to the Key Industrial Capabilities 37

5. Aerospace Case Studies 39
- 5.1 Aéro Montréal – MACH Initiative 39
- 5.2 MacDonald Dettwiler & Associates Impact on BC Aerospace Ecosystem 40

6. Aerospace Industry Future Outlook 43
- 6.1 Macro Trends in the Aerospace Industry 43
- 6.2 Trends with Specific Implications for BC 51

Appendix I: BC Aerospace Capabilities – Detailed Mapping 62
Detailed Mapping: Pre-Assembly Manufacturing 62
Detailed Mapping: Aircraft Component Manufacturing 64
Detailed Mapping: Aircraft Final Assembly 66
Detailed Mapping: Supporting Services Delivery 68
Detailed Mapping: Maintenance, Repair and Overhaul 70

Appendix II: Data Sources 72

Appendix III: Economic Impact Analysis Methodology 73
Economic Impact Definitions 73
Economic Impact Methodology 74

Appendix IV: Industry Capabilities Mapping Methodology 76
Identification of Aerospace Firms in BC 76
Breakdown of Capabilities 76
Survey Administration and Response Rate 76
Survey Data Analysis 76

Appendix V: Current IRB Obligations for Canadian Defence Procurement Contracts 77

Table of Figures

Figure 1: BC as a share of national aerospace industry Revenues, GDP and Employment 10
Figure 2: Composition of the aerospace industry by province 10
Figure 3: BC Aerospace Firms Distribution by Size (Survey Respondents Only) 11
Figure 4: The BC Aerospace Industry economic performance summary 11
Figure 5: BC Aerospace MRO-ISS Service Sector GDP 13
Figure 6: BC Aerospace MRO-ISS Service Sector GDP per Employee, 2011 13
Figure 7: Canadian Aerospace MRO-ISS Service Sector skilled employment, productivity and wages compared to other Manufacturing industries 14
Figure 8: BC Aerospace Manufacturing GDP, 2011 15
Figure 9: BC Aerospace Manufacturing and Other GDP per Capita, 2011 15
Figure 10: BC Aerospace Manufacturing GDP per Employee, 2011 16
Figure 11: Growth of the Aerospace Manufacturing Sector by Province 16
Figure 12: BC Aerospace Manufacturing GDP over time 17
Figure 13: Canadian Aerospace Manufacturing skilled employment, productivity and wages compared to other Manufacturing industries, 2011 17
Figure 14: Canadian Space Sub-sector Revenue Distribution and Revenue Growth 19
Figure 15: Aerospace Industry Export Intensity by Province, 2011 19
Figure 16: Aerospace Manufacturing and Other Sector R&D Investment by Province, 2011 20
Figure 17: Aerospace R&D as a Percent of Aerospace Manufacturing GDP, 2011 21
Figure 18: Canadian Aerospace Industry Talent Requirements 22
Figure 19. BC Aerospace Industry Direct, Indirect and Induced Economic Impacts 26
Figure 20. BC Aerospace Industry Economic Impact Multipliers 27
Figure 21. Economic Impact of Growing the BC Aerospace Industry by $100M in Annual Revenue 27
Figure 22. BC Aerospace Tax Revenue Estimate 28
Figure 23. GDP Impact: Provincial Comparison 28
Figure 24. Employment Impact: Provincial Comparison 29
Figure 25. GDP Impact: Industrial Comparison 29
Figure 26. Employment Impact: Industrial Comparison 30
Figure 27: Aerospace Ecosystem: Firm Structural Overview 31
Figure 28: Aerospace Value Chain Breakdown 32
Figure 29: BC Aerospace Capabilities Assessment Summary 34
Figure 30: OEMs Served by BC Aerospace Firms Summary 37
Figure 31: Historical Air Traffic Growth (2004-2014) 44
Figure 32: Forecasted Air Traffic Growth (2014-2033) 44
Figure 33: Airline Profits and Fuel Expenditure 45
Figure 34: Total Aircraft Backlog (as of August 2014) 46
Figure 35: Projected New Aircraft Deliveries (2013-2033) 46
Figure 36: Aerospace and Defence M&A Volume 47
Figure 37: Military Expenditure for US and Europe, in Constant US $ 48

Figure 38: Military Expenditure for India and China, in Constant US $ 49
Figure 39: Growth in Aerospace Industry Deals in 2013, by Sector 50
Figure 40: Fleet Size 51
Figure 41: Airframe Technology Evolution 52
Figure 42: Aerospace M&A Heat Map by Country: 2007-2012 54
Figure 43: Aircraft Parts Manufacturing Cost Index (US = 100) 55
Figure 44: Market Share by World Region ($ Billion), 2013-2023 56
Figure 45: MRO-ISS Service Sector Outsourcing Forecast by Segment 56
Figure 46: Correlation between EBIT margins and proportion of service revenues in selected OEMs 57
Figure 47: Space Payloads Proposed for Launch, 2013-2032 58
Figure 48: Percent Change in Revenue by Space Sector of Activity (2008-2012) 59
Figure 49: BC Aerospace Pre-Assembly Manufacturing Capabilities Assessment 62
Figure 50: BC Aerospace Aircraft Component Manufacturing Capabilities Assessment 64
Figure 51: BC Aerospace Aircraft Final Assembly Capabilities Assessment 66
Figure 52: BC Aerospace Support Services Capabilities Assessment 68
Figure 53: BC Aerospace MRO Capabilities Assessment 70

Nomenclature

AIAC	Aerospace Industries Association of Canada
CSA	Canadian Space Agency
EO/IR	Electro-Optic/Infrared Sensors
FTK	Freight Tonne Kilometres
GDP	Gross Domestic Product
HS	Harmonized System
IFE	In-flight entertainment
IRB	Industrial Regional Benefit
ISS	In-Service Support
ITB	Industrial Technical Benefit
JIT	Just-in-time
KICs	Key Industrial Capabilities
M&A	Mergers and Acquisitions
MDA	MacDonald Dettwiler & Associates
MHI	Mitsubishi Heavy Industries
MRO	Maintenance, Repair & Overhaul
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NRC	National Research Council
OEM	Original Equipment Manufacturer
R&D	Research and Development
RPK	Revenue Passenger Kilometres
SADI	Strategic Aerospace and Defence Initiative
SARs	Synthetic Aperture Radars
SMEs	Small and Medium-Sized Enterprises
SR&ED	Scientific Research & Experimental Development
UAVs	Unmanned Aerial Vehicles
WIP	Work-in-Process Inventory

1. Summary of Findings

This study presents a first-of-its-kind detailed analysis of British Columbia's aerospace industry. It establishes a baseline for the industry's current economic performance, assesses its importance to the province and maps out the aerospace capabilities of BC companies. We believe this study's findings will be fundamental in guiding industry, government and academia in how to support and grow this sector of BC's economy.

F1. BC's aerospace industry has a significant impact on the BC economy

The BC aerospace industry includes more than 160 firms and directly generates annual industry revenues of approximately $2.4B, value-added output (GDP) of $1.3B and employs over 8,000 people. Accounting for indirect impacts (impact to supplier industries) and induced impacts (impact of re-spending of wages and salaries earned within the industry and its suppliers), the total impact of the industry is estimated to be $2.9B-$3.5B in GDP contribution and 14,300-19,800 jobs sustained in BC.

Growth in the aerospace industry can significantly benefit the BC economy. We estimate that growing the industry by just $100M in annual revenue will result in approximately $114M-$138M contributed to provincial GDP, approximately 330 additional jobs within the aerospace industry, and 240 to 450 jobs supported in the economy via indirect and induced impacts.

BC aerospace **contributes** **$1.3B in GDP** directly and **$2.9-$3.5B** indirectly

BC aerospace **sustains** **8,000 jobs** directly and supports **14,300-19,800** jobs indirectly

F2. BC is a significant player in the Canadian aerospace industry

BC is home to the third largest aerospace sector in the country (by revenues, GDP and employment), following Quebec and Ontario. In the context of Western Canada, the BC aerospace industry is comparable in size to the aerospace industries of Manitoba, Alberta and Saskatchewan combined.

BC has the **3rd largest aerospace industry** in Canada

F3. BC is a leader in MRO-ISS Service Sector nationally

The Maintenance, Repair and Overhaul (MRO) sector along with the rapidly evolving In-Service Support (ISS) sector (an evolution of MRO that encompasses traditional services with high value activities such as engineering, integrated logistics support and major systems upgrades) is an important aspect of BC's aerospace industry. Leaders in the BC MRO-ISS Service Sector have evolved their service offering in recent years to move up the value chain to incorporate more value-added work into their businesses.

BC has one of the **largest MRO-ISS Service Sector** in Canada

BC aerospace leads the country in MRO-ISS Service Sector in economic value-added output, across total GDP, GDP on a per capita basis, as well as on a GDP per-employee basis, generating $768 million in GDP annually. BC leads the second largest provincial MRO-ISS sector, Ontario, in GDP by over 9%. Additionally, the MRO-ISS Service Sector in BC generates the highest per-employee GDP in the country at $173,000 per employee, exceeding the Canadian average by 35%.

F4. The BC aerospace industry is fragmented with majority of firms being small- and medium-size enterprises (SMEs)

A scan by KPMG identified over 160 firms located in British Columbia reporting aerospace capabilities. In a survey of these firms conducted by KPMG over 65% of respondents reported revenues of less than $5M per year and over 90% of respondents reported revenues of less than $50M per year (this number is likely even higher among non-respondents).

F5. BC firms' capabilities vary significantly across the value chain

BC has relatively modest capabilities in the **Pre-assembly Manufacturing** segment, with approximately 16 companies operating in this space, 7 of which report revenues in excess of $20M per year. Within the pre-assembly manufacturing capabilities, particular strengths are Tooling and Build-to-Print.

A large number of BC firms participate in **Aircraft Component Manufacturing**, with at least 50 companies reporting capabilities in this area (about half of the survey respondents). While these companies represent a broad range of capabilities, the vast majority are relatively small, with only 7 firms reporting revenues over $20M per year. The size of firms can be a significant factor in the aerospace manufacturing sector where scale is critical to securing major statements of work.

BC is home to a single **Final Assembly** firm operating in a strong niche market and expanding capabilities across additional parts of the value chain. The existence of any final assembly capability in the province is of critical importance to the aerospace ecosystem, since a final assembly firm brings together the broad range of skills and technology required to build a complete aircraft.

BC is home to an Aircraft OEM

Compared to other segments of the value chain, BC's capabilities in **Supporting Services** delivery are relatively strong. There are 33 firms reporting capabilities in this area, 8 of which report revenues in excess of $20M per year. Within Supporting Services, Education and Training stand out as the strongest capability areas, followed by Business Services and Flight Simulation. In each of these areas there are at least 4 companies reporting revenues in excess of $50M per year. Given the relatively niche nature of simulation services, BC firms represent a significant capability in the Canadian market.

Consistent with the findings of our macro-economic analysis the **MRO-ISS Service Sector** stands out as a key strength within the BC aerospace ecosystem. There are 34 firms reporting capabilities in this category, 9 of which report revenues in excess of $20M, and 4 of which report revenues in excess of $100M.

British Columbia is home to one of the most capable **space** firms in Canada with established capabilities that encompass activities from complete space system design and development to earth observation data and service provision. BC's space sector generated revenues totalling $237M in 2012, a 13% increase from the previous year. More importantly for BC, this revenue growth represents the majority of space sector gains for all of Canada. Additionally, BC has firms with capabilities that align well with the Earth Observation segment which is a significant growth sector for the Canadian space industry.

BC is home to a Space OEM, one of the most capable in Canada

Our analysis of BC firms' capabilities by OEM finds that Airbus and Boeing are both strongly represented, particularly in the MRO-ISS and Aircraft Component Manufacturing segments. A significant number of BC firms have also reported serving Lockheed Martin and Viking. We find that Bombardier is less representation across all value chain activities relative to other OEMs considered. Further detail on this analysis is available in **Section 4.3.7.**

F6. There is a lack of tier 1 integration capabilities in the BC aerospace ecosystem

While BC is home to two Aerospace OEMs (Viking Air in the fixed-wing segment and MacDonald Dettwiler and Associates (MDA) in the space segment), compared to other aerospace clusters in North America, there is a relative lack of large-scale tier 1 integration capabilities. Developing or attracting such capabilities can bring significant benefits to BC, including stimulating industrial clustering due to closer proximity to BC suppliers, promoting technology transfer to BC, higher investments in R&D, development and attraction of senior leadership talent, attraction of capital investments, higher economic impact through demand for ancillary services (e.g. communications, legal, IT, advisory, audit, tax, etc.) and raising the profile of the jurisdiction in the global aerospace market.

F7. BC's space sector is experiencing significant growth and is well positioned for the future

Development of a strong private space sector and alignment of the BC space strategy with CSA and AIAC national space strategies will be critical to the long-run growth of the space sector in BC. The space sector in BC is well positioned for growth. There are two key reasons for BC's advantageous positioning for future growth in the space sector:

- BC has capabilities and a tier 1 firm that operates in the largest space sector in Canada, Satellite Communications.
- BC has highly capable firms that operate in the fastest growing space sector in Canada, Earth Observation.

F8. BC has room for growth in aerospace manufacturing when compared to leading Canadian provinces

British Columbia trails Ontario, Quebec and the Atlantic region in aerospace manufacturing GDP per capita, a measure that suggests that the BC aerospace manufacturing sector is comparatively small relative to other Canadian provinces. We also find that BC lags these jurisdictions in terms of GDP per employee, a measure of labour productivity. This could be a result of large number of small firms in the manufacturing sector and the associated challenges of achieving economies of scale. There are potentially significant advantages to growing the aerospace manufacturing sector as it typically employs a higher proportion of skilled labour, exhibits higher labour productivity and pays higher wages than other manufacturing industries (refer to section 2.7.4). BC needs an actionable strategy to leverage the growth potential in the aerospace manufacturing sector in the context of the competitive global aerospace manufacturing market to glean the benefit of the high skilled, high wage jobs that growth in the sector would attract.

F9. BC is well positioned geographically vis-à-vis Boeing's Washington State final assembly lines

BC aerospace manufacturing firms are in an advantageous geographical position to serve Boeing final assembly line operations in Washington State. The ability for BC firms, particularly those firms located in the lower mainland, to transport components to Boeing final assembly lines in only a few hours creates the opportunity for BC firms to service as just-in-time (JIT) inventory suppliers. This opportunity is further enhanced as Boeing's commercial final assembly lines ramp-up production rates in the coming years and Boeing looks to dual source suppliers to meet the increased component demand. BC aerospace firms' proximity to Washington State could potentially reduce work-in-process inventory (WIP), reduce working capital costs and simplify the supply chain; a meaningful value proposition for a large-scale OEM such as Boeing.

F10. There are significant existing IRB/ITB obligations and upcoming defence procurement opportunities

OEMs have accumulated significant outstanding obligations under the IRB/ ITB program, currently estimated at over $20B and expected to grow to $49B by 2027. These obligations can take the form of transactions directly related to the Canadian equipment purchase, or work investments which are not directly related to the Canadian purchase such as post-secondary R&D, venture capital funds, consortia, etc. In addition to the existing IRB obligations, the Government of Canada is currently in the process of updating the current fleet of a number of military aircraft such as the CC-130 Hercules, and CC-115 Buffalo to new platforms. This presents significant, long-term opportunities for In-Service Support and manufacturing through the Defence Procurement Strategy. BC need to create the right investment, regulatory and policy environment to attract targeted Canadian commitment through the IRB/ITB program.

F11. BC is lagging other jurisdictions in aerospace R&D

Our analysis finds that business R&D investment in BC is only 5% of the levels in Quebec and 10% of that in Ontario. When we assess R&D in aerospace manufacturing at the provincial level as a percent of total output we see that BC invests 8% of its total manufacturing output in R&D, as compared to 22% in Quebec and 19% in Ontario. Some potential factors may be the levels of collaboration between industry and academia, use of available funding programs (NRC, SADI, MITACS, SR&ED etc.), scale of enterprises (larger enterprises being typically associated with higher R&D spend), and proportion of MRO and manufacturing activity (manufacturing being typically associated with higher levels of R&D). BC aerospace needs to develop a strategy to close the investment gap in R&D relative to other leading provinces.

F12. There is limited understanding of aerospace-specific talent requirements and talent availability

Our study finds that there is currently limited industry-level data available regarding the talent requirements for the aerospace industry in BC and the degree to which these requirements are being met. Labour supply and demand requirements are understood by individual BC aerospace firms based on their experiences in the labour market. Additionally, the BC Ministry of Advanced Education, the BC Ministry of Jobs, Tourism & Skills Training and the Industry Training Authority (a provincial government agency) have a shared interest in collecting data on labour supply and demand to better inform and support decision making in the aerospace sector.

The gap between the knowledge of the individual firms and aggregate knowledge of provincial agencies must be bridged to achieve a holistic view of the aerospace talent market in BC. A comprehensive talent supply and demand model is critical in understanding access to talent, visibility to skilled labour availability and support of advanced skills training; all critical for growth in Aerospace across all major segments: space, manufacturing and MRO-ISS Service Sector.

F13. Demands from OEMs are evolving and require a BC-specific strategy

Recent actions and comments by OEMs indicate that they are looking to procure goods and services in a consolidated fashion and are less likely to deal with a host of small suppliers. OEMs looking to decrease management effort required for sub-tiers and increase the amount of local integration. This is particularly true with complex large-scale integrated work packages in which OEMs are looking for risk-sharing partners. Given the fragmentation of the BC aerospace sector, without presenting an integrated service offering, it will be difficult for BC firms to compete globally.

F14. OEMs are expanding in the MRO-ISS Service Sector market, increasing competition to BC firms

Our research shows a macro trend of aircraft OEMs expanding into the MRO-ISS Service Sector market by entering into service agreements with airlines at the point of sale. Moreover, we expect MRO-ISS Service Sector work to increasingly be outsourced to Asia, because of a growing Asian fleet and lower labour costs. This transition is further complicated by the potential bifurcation of the MRO-ISS Service Sector into firms that continue to do low value pure MRO work and firms that successfully transition into the high value-add aspects of ISS such as Project Management, Engineering Services, Integrated Logistics Support, Modifications, Airworthiness and Lifecycle Management.

We expect this trend to specifically affect MRO-ISS Service Sector sub-sectors heavy maintenance (more than 22 firms in BC), propulsion maintenance (more than 13 firms in BC) and component maintenance (more than 20 firms in BC). We expect that BC MRO-ISS Service Sector firms – especially SMEs – will face significant competition and potentially declining market share over the next decade. But, some BC SMEs have an inherent advantage to their business model in that the service they provide in the MRO-ISS Service Sector is highly specialized and that specialization may insulate some firms from the increased OEM competition.

F15. Current aircraft fleet is rapidly retiring and BC firms must adapt to new aircraft materials

Our analysis finds that as much as 80% of the current commercial aircraft fleet will be retired over the next twenty years and replaced with more fuel efficient aircraft. Newer generation aircraft – like the Boeing 787 and Airbus A350 – will make higher use of advanced materials such as composites and advanced metallic; electrical systems will fully replace hydraulics along with other advanced technologies in systems; and sensors and propulsion and in-flight entertainment (IFE). Materials that we expect to comprise an increasing share of airframe structure include Carbon fibre/ Graphite, Ceramic Fibres, Advanced metallics, such as titanium, aluminum-lithium, CentrAl, and GLARE.

Our analysis finds that there are very few firms in BC that have these capabilities for major OEMs. For example only 12 BC aerospace firms reported Composites and Plastics capabilities and 75% of these firms reported revenues of less than $5M. While certain government programs exist that can support firms in developing capabilities in these areas, BC industry experts have pointed to a low uptake of these programs among BC firms, presenting a potential threat to the long-term competitiveness of BC firms.

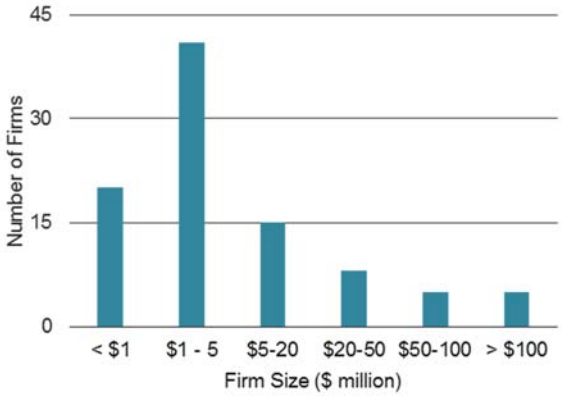
F16. Nationally, aerospace jobs are higher paid and generate higher value-added per employee than industry benchmarks

A comparison of the Canadian MRO-ISS Service Sector to all industries in Canada finds that the MRO-ISS Service Sector has labour productivity that is 50% higher and annual wages that are 18% higher. Additionally, a comparison of the aerospace manufacturing sector to all manufacturing industries in Canada finds that aerospace manufacturing has labour productivity that is 68% higher and annual wages that are 23% higher.

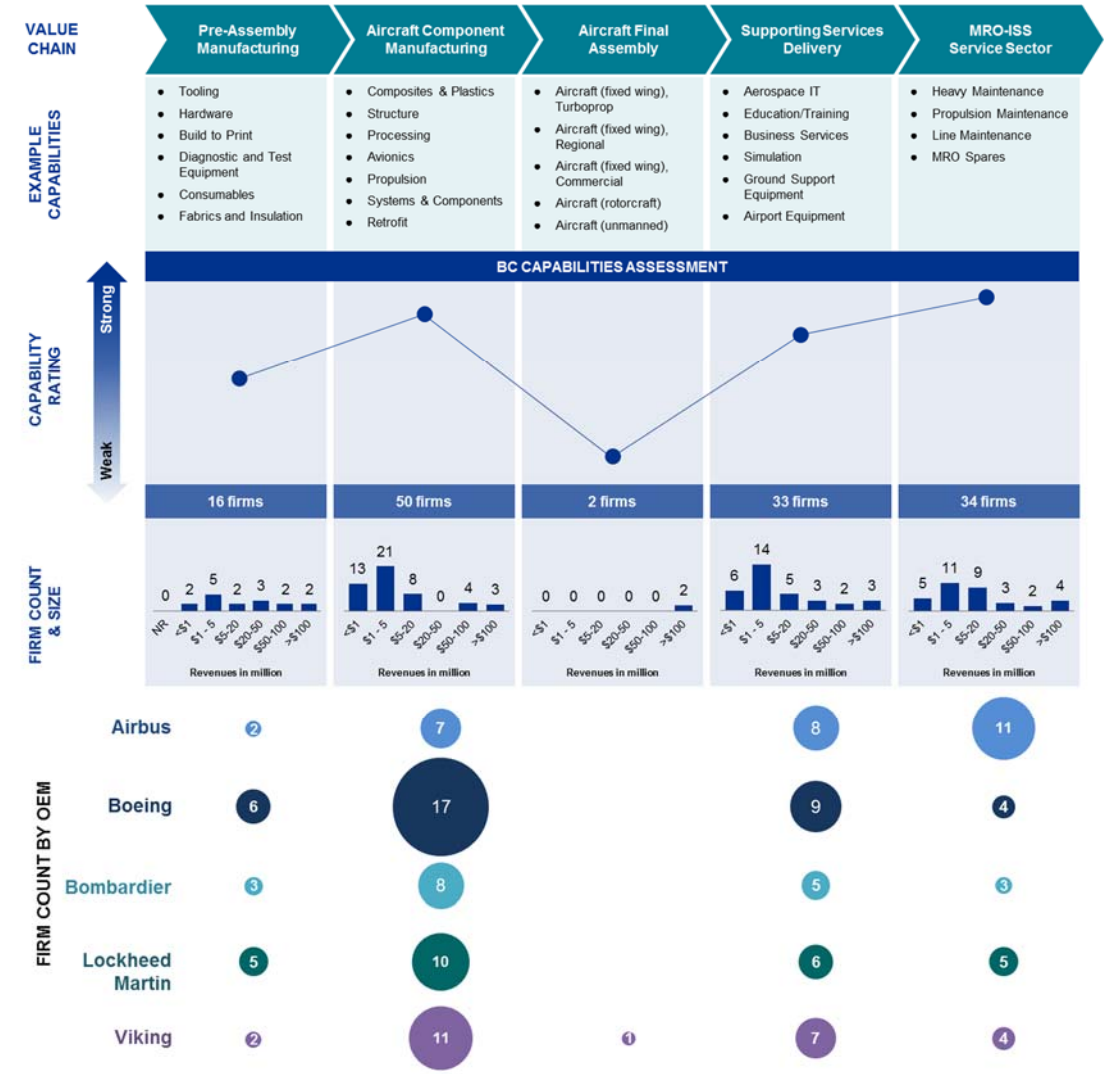
The BC Aerospace Industry at a Glance

Number of Establishments	~160
Aerospace Employees	~8,360
Industry Revenues	~$2.4B
Direct GDP contribution	~$1.3B
Total jobs supported in BC	14,300 – 19,800
Total GDP contributed to BC	$2.9B – $3.5B

BC Aerospace Firms Size by Revenue



BC Aerospace Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

2. Economic Profile of BC Aerospace

2.1 Introduction

BC has a strong base of over 160 companies operating in the aerospace industry in the province, or reporting specific aerospace capabilities. The majority of these firms are small- and medium-sized enterprises, with niche capabilities across different segments of the value chain.

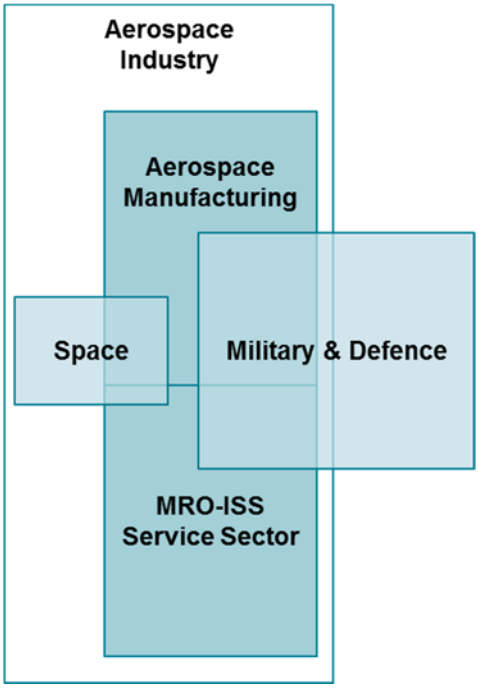
In this section we present a statistical analysis of the BC aerospace industry, which estimates its size and compares its performance to other jurisdictions in Canada and other industries in BC. The data used in this analysis has been sourced from a special dataset created by Industry Canada, which has been extracted from tax files and business registry databases. This dataset enables segmentation at the establishment level (as opposed to firm level) by province. It is our belief that this data provides the most accurate picture of the aerospace industry in BC at this time. A more detailed description of the data sourced in this analysis is provided in **Appendix II**.

In our study, we distinguish between five sub-sectors of the aerospace Industry in BC, including manufacturing (pre-assembly, aircraft components, and final assembly), supporting services, MRO-ISS service sector and space. A detailed description of each of these sub-sectors can be found in **Section 4: BC aerospace Capabilities Mapping**. National and BC-specific data for the aerospace industry is not available at the level of detail of these sub-sectors, and instead has been aggregated into two major segments: manufacturing and other, and MRO-ISS Service Sector[1]. Historically, this data segmentation has been done to protect confidentiality of company data and due to significant challenges segmenting companies that participate in multiple sectors.

2.2 Description of the Aerospace Industry

Aerospace in BC encompasses a broad high-tech industry with several important subsectors. This report focuses on two major sectors within aerospace: manufacturing and MRO-ISS Service Sector. The manufacturing sector generally concentrates on the production of systems and components for use in new aircraft. The MRO-ISS Service Sector generally concentrates on serving the in-service aircraft market.

Space is a highly specialized sector of aerospace that overlaps into the aerospace manufacturing sector but has many unique features that require dedicated effort. Military and Defence is another major sector that overlaps both the manufacturing and MRO-ISS Service Sector, requiring similar products and services as the civil market with unique requirements. The BC aerospace industry serves all of these market segments to varying degrees.



[1] In the following sections, "Manufacturing" refers to the "Manufacturing and Other" data segment.

2.3 Introduction to Economic Analysis

The first-of-its-kind economic analysis of the BC aerospace industry contained in this report focuses on total firm revenues, Gross Domestic Product (GDP) and employment. Moreover, the data used in the study has been collected on an establishment basis. This means that only revenue from the BC operations of aerospace firms, whether the firm is headquartered in BC or elsewhere, has been included in the analysis thus ensuring that only the economic and employment benefit to BC is measured.

GDP is a measure of the economic performance of the region, used as a more precise measure of economic benefit relative to revenue as GDP adjusts for the source of inputs used in generating revenue. GDP Multipliers are used to estimate the total economic benefit of the revenue generated in the industry to the economy. Employment Multipliers are used to estimate the total employment the industry creates within the region. See **Section 3. Economic Impacts of the BC Aerospace Industry** for additional detail and analysis on BC Aerospace Multipliers.

For the purposes of the BC aerospace industry analysis contained in this report we focus on the BC aerospace industry in the context of two overarching sectors; aerospace manufacturing and MRO-ISS Service Sector. The aerospace manufacturing sector includes items such as Aircraft components, structure, propulsion, avionics; space, satellites, telecommunications and flight simulation. MRO-ISS Service Sector includes items such as Aircraft and component maintenance, inspection and testing services and ISS engineering, integrated logistics support, and project management.

Firms are categorized into their respective sectors based on the primary source of the firm's revenue in BC. It should be noted that firms that perform pure support services such as engineering firms are captured in the indirect economic impact to the BC aerospace industry.

2.4 BC Aerospace Industry in the National Context

Canada is home to the fifth largest aerospace industry in the world. In 2011, the Canadian aerospace industry generated $22.6B in revenues and $12B in GDP, and supported approximately 69,000 jobs directly within the aerospace sector nationally. The Canadian aerospace industry is a global competitor and home to industry leaders such as Bombardier, MDA and Héroux-Devtek, CAE, along with major Canadian offices for companies including Aerolia, Bell Helicopter, GE, Pratt & Whitney, Rolls-Royce, Airbus Helicopters, L3, MHI, General Dynamics, Boeing (AeroInfo Systems) and StandardAero.

Our analysis shows that BC is a significant player in the Canadian aerospace sector. It is the third largest in the country, and the epicenter in Western Canada – roughly the same size as the other three western Canadian provinces combined.

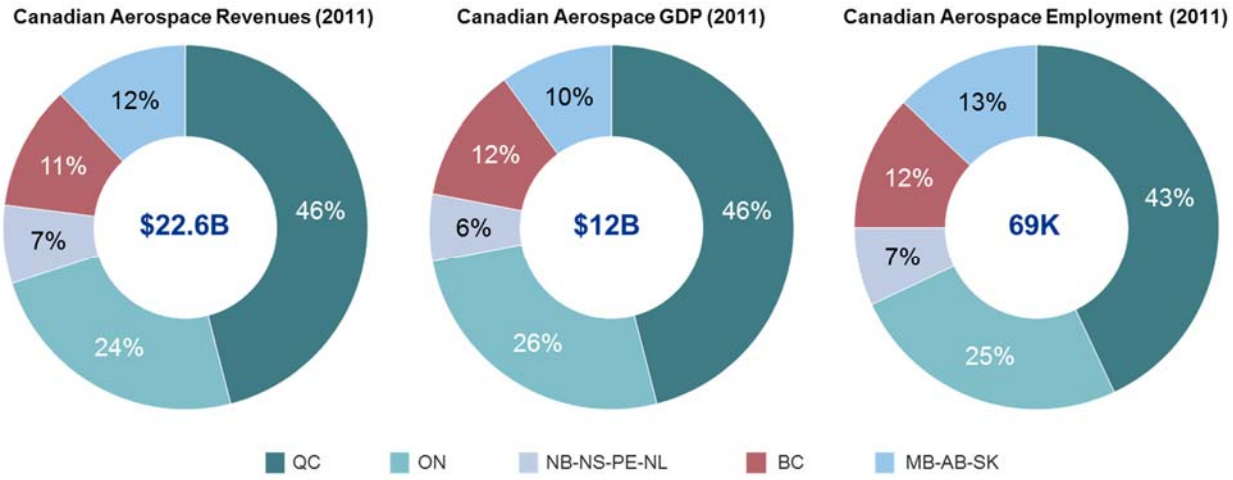
We find that BC makes up 11% of the Canadian aerospace industry's revenues and contributes 12% of the total Canadian aerospace GDP[2]. Proportional to its share of Canadian Revenues and GDP, the BC aerospace industry employs 12% of the total Canadian aerospace workforce. Given that the entire BC economy is roughly 10% of the Canadian economy, these numbers indicate that BC's aerospace industry is pulling its own weight relative to the size of the province.

[2] Revenues measure the value of goods and services sold by the aerospace industry, and thus include the costs of inputs that are used to produce them. GDP on the other hand, is a measure of value-added, such that it removes the costs of inputs that are sourced from other industries, and from other jurisdictions, and therefore captures only the value of the transformation of those inputs that was achieved by aerospace firms.

Note: for ease of reference in this report, we have used Canadian Postal Abbreviations for the provinces:

AB..... Alberta
BC..... British Columbia
MB..... Manitoba
NB ..... New Brunswick
NL..... Newfoundland and Labrador
NS..... Nova Scotia
ON ..... Ontario
PE ..... Prince Edward Island
QC ..... Quebec
SK ..... Saskatchewan

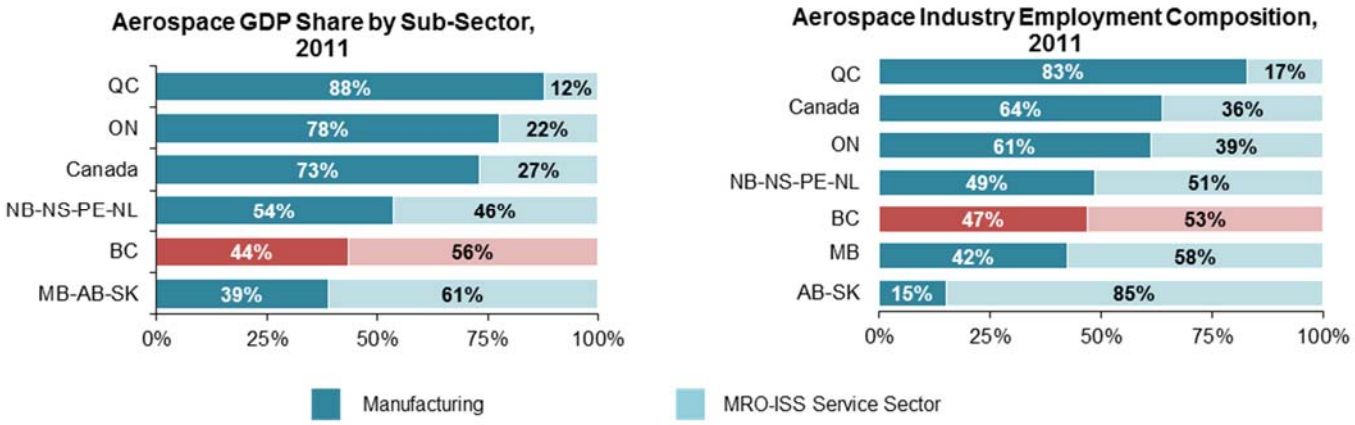
Figure 1:
BC as a share of national aerospace industry Revenues, GDP and Employment



Source: KPMG Analysis of data sourced from Industry Canada

There is a clear distinction in the composition of the aerospace industries in the eastern and western parts of Canada. In the eastern provinces of Quebec and Ontario, more than 70% of the GDP and more than 60% of employment is the manufacturing sector. In BC – and more generally, in western provinces – the majority of output and employment is in the MRO-ISS Service Sector. The economic performance of the BC aerospace industry in each of these sub-sectors is explored in further detail in the following sections.

Figure 2:
Composition of the aerospace industry by province

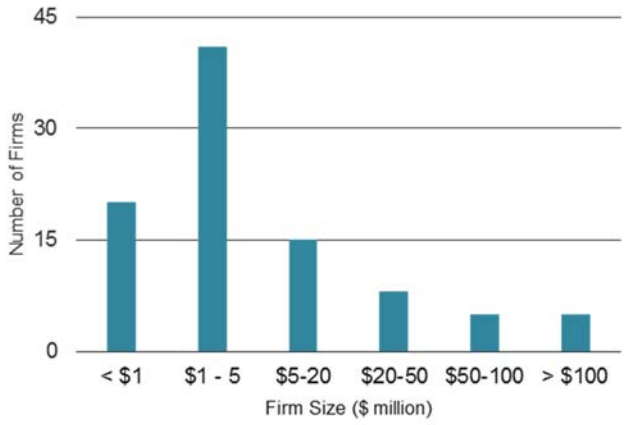


Source: KPMG Analysis of data sourced from Industry Canada

2.5 BC Aerospace Overall Industry Size

The BC aerospace Industry creates significant economic activity in BC, generating **$2.5B** in revenues, **$1.4B** in GDP or value-added output, and employing over **8,000** people. KPMG identified over 160 firms that operate within the aerospace industry in BC. The vast majority of these firms are small enterprises, reporting $1M-$5M in annual revenues.

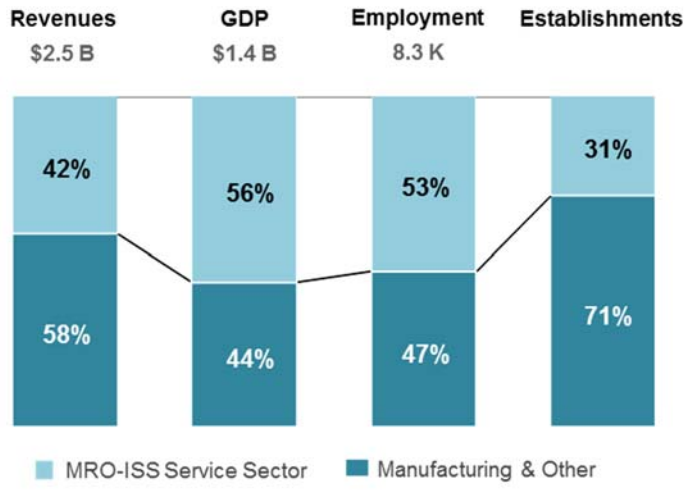
Figure 3:
BC Aerospace Firms Distribution by Size (Survey Respondents Only)



Source: KPMG Capabilities Study Survey3

Over 70% of firms within the BC aerospace industry operate in the manufacturing sector. Collectively, they generate nearly 60% of the industry's revenues. However, over half of the GDP and employment in the BC aerospace industry is generated by the MRO-ISS Service Sector.

Figure 4:
The BC Aerospace Industry economic performance summary



Source: KPMG Analysis of data sourced from Industry Canada

[3] This graphic is representative of the firms that responded to KPMG's capabilities survey, and the revenue figures depicted in this analysis are self-reported by the firms.

The fact that only 30% of all aerospace firms in BC are generating over 55% of the industry's GDP suggests that the MRO-ISS Service Sector firms in BC are highly productive enterprises which generate significant value-added to our economy. This is confirmed in the following sections, which assess the performance of the MRO-ISS Service Sector and manufacturing sectors against other jurisdictions and industry sectors.

2.6 BC Aerospace MRO-ISS Service Sector

Maintenance, Repair and Overhaul & In-Service Support (MRO-ISS) is a major sector of the aerospace industry that primarily consists of the ongoing service, upgrading and retrofit of in-service aircraft. Within the MRO-ISS Service Sector we must define each major component of the sector. MRO is generally referred to as touch labor based aircraft maintenance and covers a broad range of services from basic line maintenance and overnight checks at airports to major aircraft tear-down, overhaul and refit in highly specialized, dedicated facilities.

The ISS Service Sector can be thought of as an evolution of the capabilities and offerings within the MRO sector. ISS Service Sector encompasses all of the activities in the MRO sector as well as value-added activates such as Project Management, Engineering Services, Integrated Logistics Support, Modifications, Airworthiness and Lifecycle Management. It is with respect to all of these advanced serviced that ISS can be viewed as an extension of MRO that generates intellectual capacity. The increased amount of value-added activities shifts ISS Service Sector from the labour based MRO sector up the value chain in encompass knowledge work through a reduction in the proportion of touch labour content and increase value-added activity.

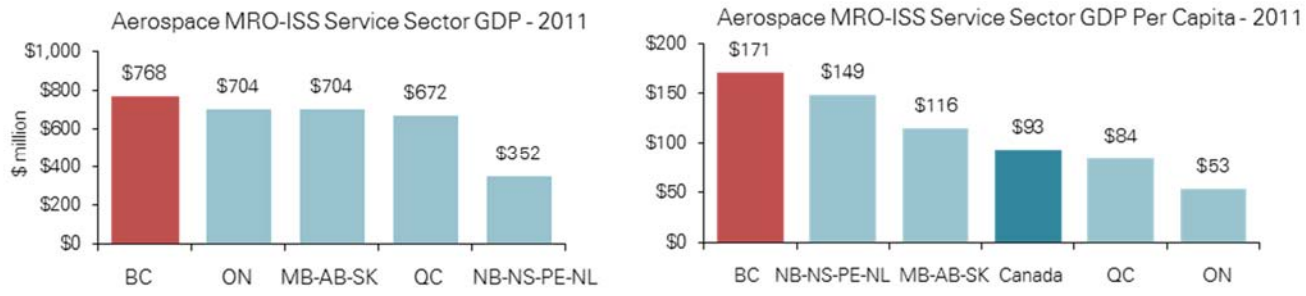
BC is home to some of the largest and most capable aerospace MRO-ISS Service Sector firms in Canada, including Cascade Aerospace, one of two C-130J heavy overhaul facilities in the world, Kelowna Flightcraft, WestJet's structural maintenance contractor, and Heli-One, one of the largest helicopter maintenance service companies in the world. BC is a national leader in the aerospace MRO-ISS Service Sector. Not only does the BC aerospace MRO-ISS Service Sector contribute significantly to the provincial economy, but in multiple measures of economic performance, the BC MRO-ISS Service Sector ranks above every other province in Canada.

2.6.1 MRO-ISS Service Sector GDP

We find that the MRO-ISS Service Sector in BC generates $768 million in GDP. By comparison, the MRO-ISS Service Sector sectors in Ontario and the rest of Western Canada each generate roughly $704 million and Quebec generates $672 million. Thus, BC is the national leader in MRO-ISS Service Sector, outperforming provinces that are larger and with traditionally stronger overall aerospace sectors.

BC retains its first place when accounting for population size, as indicated by the GDP per capita analysis below. The high GDP per capita for MRO-ISS Service Sector indicates the sector is a relatively larger part of the BC economy when compared to the MRO-ISS Service Sector in other provinces.

Figure 5:
BC Aerospace MRO-ISS Service Sector GDP



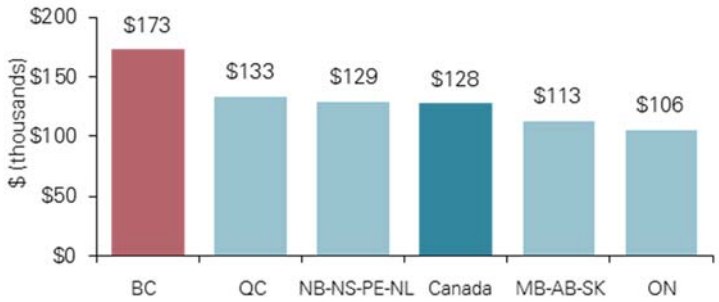
Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

2.6.2 MRO-ISS Service Sector Productivity

GDP per employee is a rough measure of labour productivity in an industry[4] as it measures the industry's value-added production taking into account the size of the labour force employed to produce it. Consistent with BC's MRO-ISS Service Sector performance on an absolute and per capita basis, BC's MRO-ISS Service Sector labour productivity is also highest in the country. At $173,000 GDP/ employee, BC performs 30% higher than QC, 35% higher than the Canadian average, and 53% above the rest of Western Canada.

This implies that BC has significantly higher productive capabilities in the MRO-ISS Service Sector as compared to other provinces in Canada. An additional consideration of note is that high revenue per employee could be indicative of a provincial MRO-ISS Service Sector market that may be pricing in an uncompetitive range. But, BC MRO-ISS Service Sector revenue per employee is well in-line with other Canadian provinces coming lower than MB-AB-SK and QC and just above NB-NS-PE-NL alleviating risk on uncompetitive pricing in BC relative to other Canadian provinces.

Figure 6:
BC Aerospace MRO-ISS Service Sector GDP per Employee, 2011



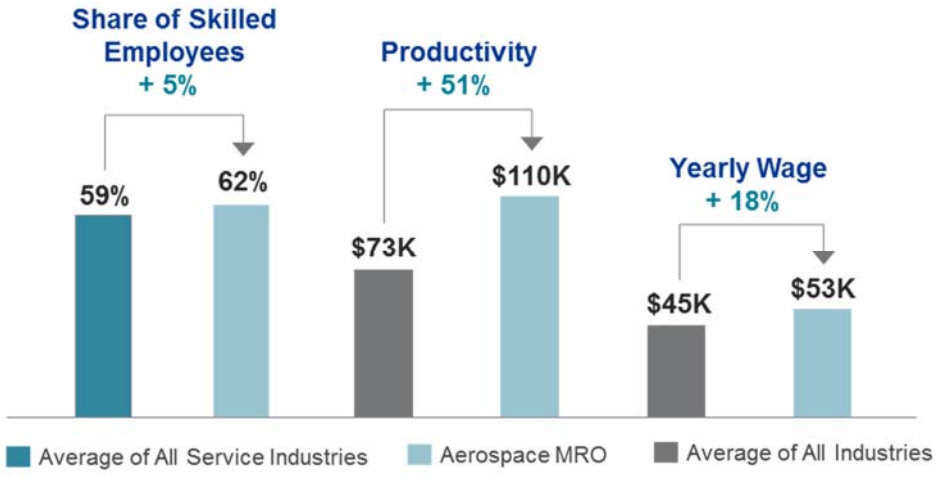
Source: KPMG Analysis of data sourced from Industry Canada

[4] This measure is derived by dividing MRO GDP by MRO employees

2.6.2 MRO-ISS Service Sector Employment

The Canadian MRO-ISS Service Sector outperforms the average of all industries across measures of productivity and yearly wage. The sector also has a larger share of skilled employees when compared to all service industries in Canada. An analysis of industry data suggests that the MRO-ISS Service Sector has workforce productivity that is 50% higher than the average of all industries in Canada. Additionally, wages in the sector are 18% higher than the average of all industries in Canada.

Figure 7:
Canadian Aerospace MRO-ISS Service Sector skilled employment, productivity and wages compared to other industries



Source: KPMG Analysis of data sourced from Industry Canada

2.7 BC Aerospace Manufacturing Sector

Manufacturing in the aerospace sector can be defined across a broad range of attributes but here we are focusing on the production of components used in the manufacture of new aircraft. Aerospace manufacturing in BC is diverse and includes production of metallic structures, aircraft systems and major retrofit kits. BC is home to many small- and medium-sized manufacturing firms producing items for a large number of OEMs with a diverse range of complexity and scale. Often these smaller firms act in a supply chain function, producing products that are integrated into larger assemblies by firms downstream in the production chain.

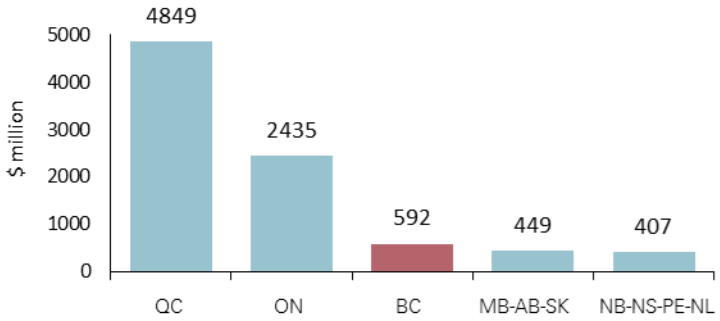
Large BC firms that manufacture components for new aircraft include Avcorp Industries, specializing in the production of complex metallic aero-structures and ASCO Industries, specializing in large-scale, complex hard and soft metal machining. But, when compared to other provinces in Canada, there is room for growth in BC's aerospace manufacturing sector.

2.7.1 Manufacturing Sector GDP

Aerospace manufacturing activity in Canada is concentrated in the Eastern provinces of Quebec and Ontario. The aerospace manufacturing sector in Quebec alone is eight times the size of the sector in BC. The fact that the manufacturing sector has grown to its current size in the Canadian East reflects the

success of deliberate, multi-sectorial efforts by government and industry alike. Despite being farthest from the Eastern epicenter, BC is currently ranking third in the country in terms of manufacturing GDP.

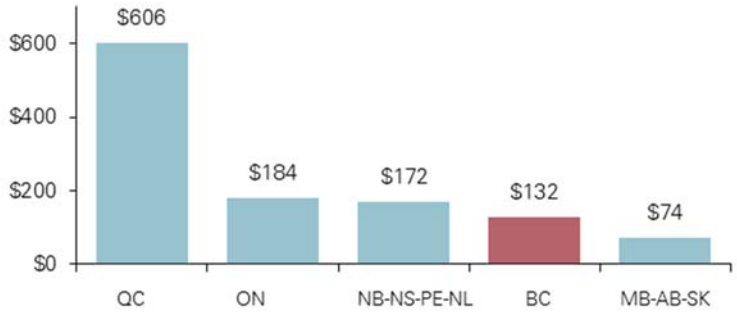
Figure 8:
BC Aerospace Manufacturing GDP, 2011



Source: KPMG Analysis of data sourced from Industry Canada

Accounting for the overall size of the provinces, BC is not too far behind the eastern provinces of Ontario and the Atlantic region in aerospace manufacturing GDP per capita. This suggests that BC has performed relatively well in the country, and leads Western Canada in manufacturing sector output relative to its share of the national population. Quebec stands out as a clear national leader; however, with more than triple the value of aerospace manufacturing GDP per capita compared to other provinces.

Figure 9:
BC Aerospace Manufacturing and Other GDP per Capita, 2011



Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

2.7.2 Manufacturing GDP Productivity

In contrast to its ranking in other metrics of economic performance, BC lags all other provinces in terms of its labour productivity in the manufacturing sector. This is likely a result of the fact that the manufacturing sector is populated with many small firms that do not have the scale to invest in large-scale machinery that would reduce labour input. Unlike the manufacturing sectors in other provinces, BC has fewer firms operating in higher tiers of the aerospace value chain. This has a direct impact on the level of process innovations that are implemented, and subsequently on productivity gains that can be achieved.

Figure 10:
BC Aerospace Manufacturing GDP per Employee, 2011

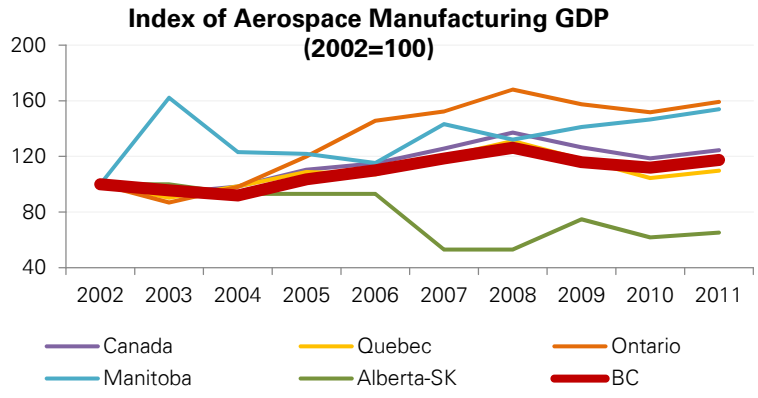
Source: KPMG Analysis of data sourced from Industry Canada

2.7.3 Manufacturing GDP Growth

The aerospace manufacturing sector in BC has been growing steadily, at approximately 2% annually since 2002. While this growth rate is at par with Canada as a whole, there is significant room for improvement. BC currently lags Ontario and Manitoba, each of which have grown at 5% a year over the same time period.

The fact that Ontario started at a much higher base than BC in aerospace manufacturing GDP in 2002 and managed to achieve higher growth suggests that concentrated, multi-sectorial efforts to nurture the industry have been successful, and can serve as a model for action in BC. For example, one of the potential drivers of growth of the aerospace manufacturing sector in Ontario is the establishment of Japan-based Mitsubishi Heavy Industry's (MHI) facility in the province, to assemble aircraft components for the Bombardier Challenger series in Quebec. A combination of proximity to the final assembly plant, access to a coordinated cluster of suppliers and skilled workers, and the presence of government incentives together created an enabling environment for MHI to establish a tier 1 integration facility in the province of Ontario.

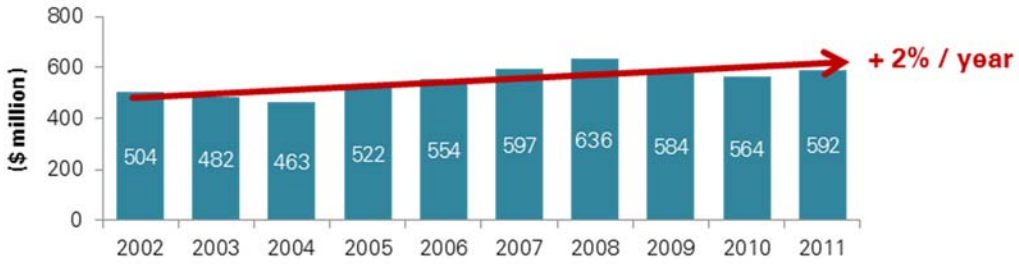
Figure 11:
Growth of the Aerospace Manufacturing Sector by Province



Region	GDP CAGR
Ontario	5%
Manitoba	5%
Canada	2%
BC	2%

Source: KPMG Analysis of data sourced from Industry Canada

Figure 12:
BC Aerospace Manufacturing GDP over time

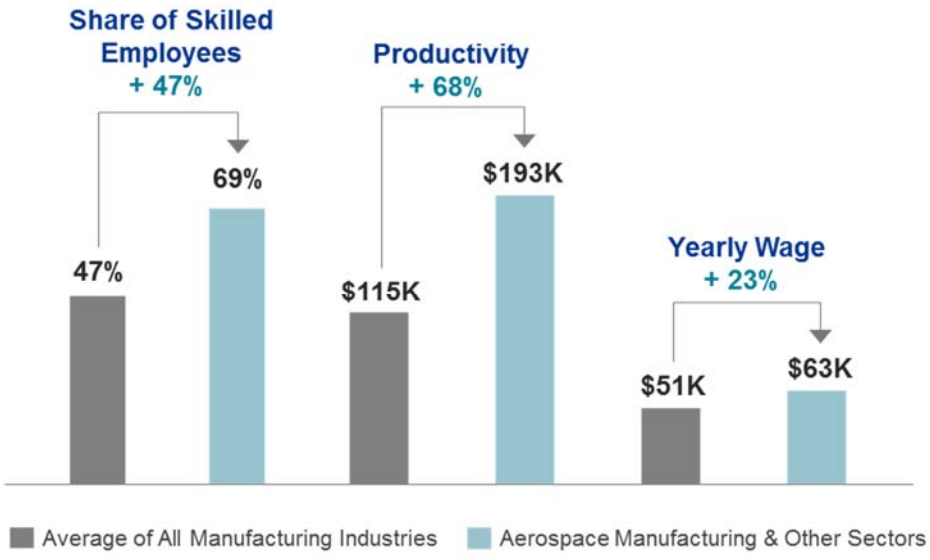


Source: KPMG Analysis of data sourced from Industry Canada

2.7.4 Aerospace Manufacturing Employment

There are significant advantages to growing the aerospace manufacturing sector in BC. An analysis of national aerospace industry data suggests that nearly 70% of the workforce in the aerospace manufacturing sector is classified as skilled labor, as compared to under 50% in other manufacturing industries. Consistent with this finding, labor productivity in aerospace manufacturing is 68% higher than that in other manufacturing industries, as a result of which, aerospace offers 23% higher wages than other manufacturing industries.

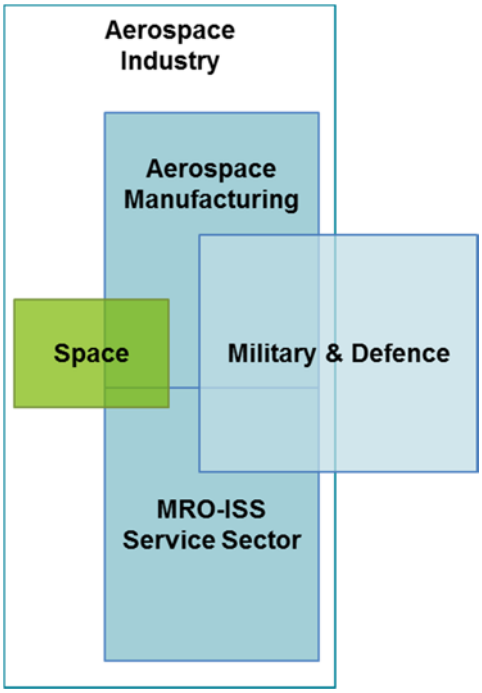
Figure 13:
Canadian Aerospace Manufacturing skilled employment, productivity and wages compared to other Manufacturing industries, 2011



Source: KPMG Analysis of data sourced from Industry Canada

2.8 BC Space Sector

The space sector is a unique component of the BC aerospace industry. The space sector overlaps with aerospace manufacturing and the MRO-ISS Service Sector but has many space specific aspects. Importantly, manufacturing and systems development in the space sector typically involve the development of one-of-a-kind/first-of-a-kind technologies developed to meet a specific need.



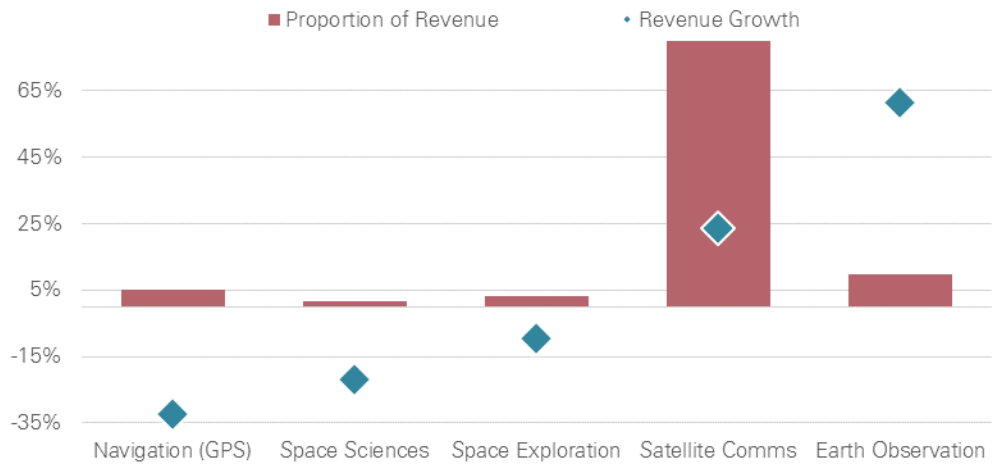
This contrasts with the conventional aerospace manufacturing sector. Though one-of-a-kind/first-of-a-kind development does occur, the primary focus of conventional aerospace firms is volume production.
The constant technological development in the space sector requires significant engineering and project management capability beyond even the sophisticated technical requirements of aerospace generally.
This need creates demand for high value jobs and a skilled labour requirement making access to talent hyper-critical.

In the Canadian context space is an important sector with respect to the Canadian North, national security and resource management and extraction; growth in these areas will drive demand for earth observation services, satellite communications, surveillance, weather forecasting, ice condition monitoring and the like.

BC's space sector generated revenues totalling $237M in 2012[5], a 13% increase from the previous year and importantly for BC that revenue growth represents the majority of space sector gains for all of Canada. Additionally, BC's has firms with capabilities that align well with the Earth Observation segment which is a significant growth sector for the Canadian space industry; with revenues increasing by 61% from 2008-2012 in Canada[6]. BC also has capabilities that align well with the Satellite Communications sector; by far the largest sub-sector of the space sector. Both of these observations can be seen in Figure 14. Refer to **Section 4** for more detail on the capabilities of BC firms in the space sector.

[5] State of the Canadian Space Sector, 2012; Canadian Space Agency
[6] State of the Canadian Space Sector, 2012; Canadian Space Agency

Figure 14:
Canadian Space Sub-sector Revenue Distribution and Revenue Growth



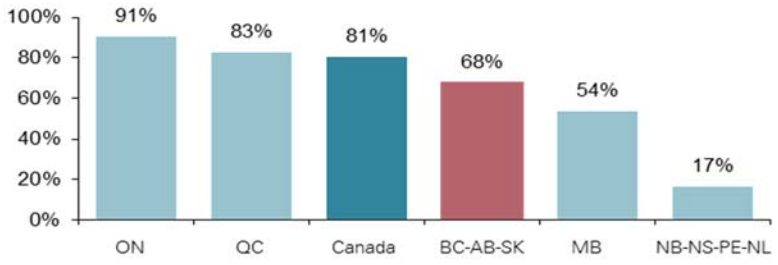
Source: State of the Canadian Space Sector, 2012; Canadian Space Agency

2.9 BC Aerospace Export Intensity

Export intensity measures the proportion of aerospace industry output that is exported to international jurisdictions. Given the global nature of the aerospace industry, export intensity is thus a measure of the competitiveness of BC aerospace manufacturing firms.

The export intensity of the aerospace industry in the BC-Alberta-Saskatchewan region is 68%. As such, BC trails eastern provinces of Quebec and Ontario where exports make up more than 80% of total output, while performing better than Manitoba and the Atlantic region in this regard. The Export Intensity information is based on exports as measured by Harmonized System (HS) codes. This measure is focus on the export of products. Services, by their very nature, are challenging to measure and are not captured in HS code data. Therefore, the lower export intensity of BC aerospace relative to eastern provinces is likely the result of a lower share of manufacturing sector output in BC.

Figure 15:
Aerospace Industry Export Intensity by Province, 2011



** Note: Export data for BC aerospace was only available at the BC-Alberta-Saskatchewan level of aggregation due to confidentiality agreements with firms operating in these regions.*

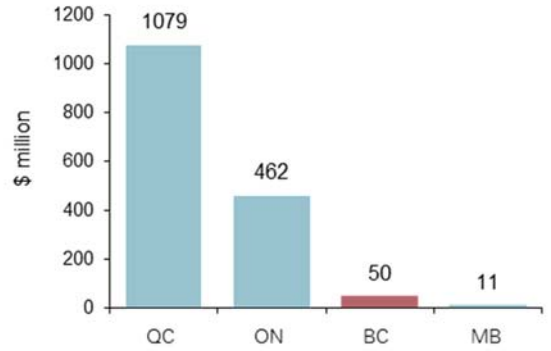
Source: KPMG Analysis of data sourced from Industry Canada

2.10 R&D Investment in the BC Aerospace Industry

Research and Development activity is critical for the long term competitiveness of aerospace firms and the sustainability of the industry as a whole. The economic value-added of aerospace manufacturing in particular is highly correlated with investments in R&D, since successful R&D investments fuel the growth of firms, and larger firms in turn have the scale to invest in R&D.

BC has significant room for growth in this regard, as illustrated by a comparison to Ontario and Quebec. On an absolute basis, BC firms invest at 5% the level in Quebec, and 10% of that in Ontario. The national R&D breakdown of the aerospace manufacturing sector suggests that the operations in Quebec and Ontario are large-scale enterprises that have the capacity and mandate to develop product innovations, whereas the large firms in Manitoba are branch plants rather than centres of product innovations.

Figure 16:
Aerospace Manufacturing and Other Sector R&D Investment by Province, 2011

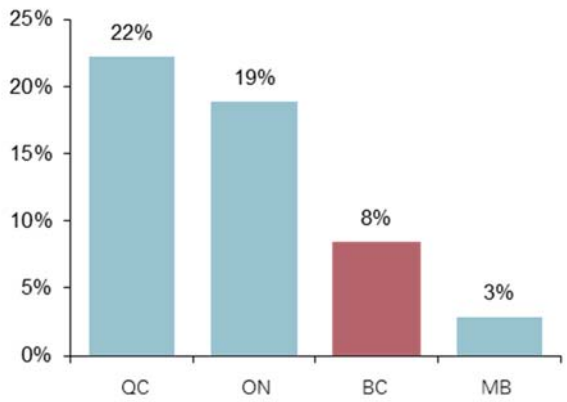


Source: KPMG Analysis of data sourced from Industry Canada

* *Note: the R&D figures in this analysis capture industry investments in development of new products and services, but do not capture operational process improvement.*

A more equitable comparison is an assessment of R&D intensity by jurisdiction, which measures R&D investment as a percent of total output. In this measure, BC invests 8% of its total manufacturing output on R&D, as compared to 22% on Quebec and 19% in Ontario. The low R&D intensity in BC is likely the result of the lack of large anchor firms in the province's aerospace manufacturing sector, which can support significant R&D investments as is the case in Eastern Canada.

Figure 17:
Aerospace R&D as a Percent of Aerospace Manufacturing GDP, 2011



Source: KPMG Analysis of data sourced from Industry Canada

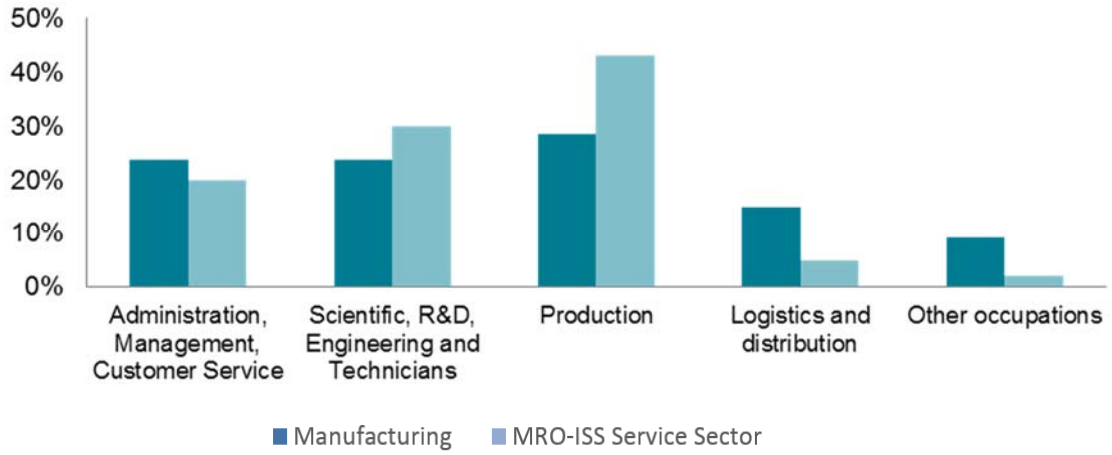
2.11 Talent Availability in the BC Aerospace Industry

Our research and interviews with industry and government experts revealed a lack of information on the talent requirements and availability for BC aerospace firms. There is currently no system in place for tracking the labour demanded by the aerospace industry, forecasting future needs, and evaluating the supply of such talent through universities and technical institutions. Labour supply and demand requirements are understood by individual BC aerospace firms based on their experiences in the labour market. Additionally, the BC Ministry of Advanced Education, the BC Ministry of Jobs, Tourism & Skills Training and the Industry Training Authority (a provincial government agency) have a shared interest in collecting data on labour supply to better inform and support decision making in the aerospace sector.

Developing a labour market understanding for the aerospace industry in BC is critical for developing strategies to promote the growth of the industry and part of our key recommendations within this report. A talent supply and demand model is critical in understanding access to talent, visibility to skilled labour availability and support of advanced skills training; all critical for growth in aerospace across all major segments, space, manufacturing and MRO-ISS Service Sector.

National analysis suggests that the majority of employment in the Canadian aerospace sector as a whole requires production expertise, with aerospace scientists, engineers and technicians being a close second. There is some variability as the demands of the individual sub-sectors within aerospace.

Figure 18:
Canadian Aerospace Industry Talent Requirements



Source: KPMG Analysis of data sourced from Industry Canada

2.12 IRB Obligation Overview

The Industrial Regional Benefit (IRB) program is a feature of major Canadian Defence and Security procurement contracts in which the successful proponent of the RFP process is required to place business activity into Canadian industry at the same value of the contract awarded. Often this policy is referred to as "obligations" or "offsets". This program is intended to ensure that when a federal procurement contact for a major defence and security program is signed with a company that value is created for Canadian firms through the procurement process. Of particular note when discussing the current IRB program is the use of multipliers in the policy for investments in educational institutions, R&D programs and facilities and technology development, as much as 5-10 times credit for obligors.

A complete list of the current IRB obligations as publically available from Industry Canada is detailed in **Appendix V: Current IRB Obligations for Canadian Defence Procurement Contracts**. The information contained in Appendix V is the only publically available information on the state of current and future IRB obligations.

The projection of outstanding IRB obligations is based on the same assumptions used in the report *Leveraging Defence Procurement Through Key Industrial Capabilities* of $49B through 2027. The authors make note that the calculation can only be roughly estimated due to the substantial uncertainty in the fulfilment rate of IRBs.

The current IRB policy is subject to transparency deficiencies such that a replacement for the program is currently being rolled-out. The new program, referred to as Industrial Technical Benefits (ITB) is intended to improve the economic outcomes of the policy while adding transparency. Future decisions will be heavily weighted on the Value Proposition achievable with the placement of business activity. Value Proposition will focus on maximizing economic outcomes from investments that: improve Canadian Key Industrial Capabilities (KICs) as defined in *Leveraging Defence Procurement Through Key Industrial Capabilities*, improve productivity at Canadian firms and broaden industrial and technical activities and knowledge at Canadian firms.

Moreover for the BC aerospace industry, other Canadian provinces have established commissions or other bodies specifically focused on securing IRB obligations for their respective provinces. If we are to take the estimated $49B in total obligations in 2027 and BC's current share of Canadian GDP, approximately 12%, we see that BC's share of obligations would be $5.9B. Attracting BC's share of obligations to the province would constitute a significant increase in provincial aerospace revenue to the province.

3. Economic Impacts of the BC Aerospace Industry

3.1 Overview of Economic Benefits Created

The aerospace industry brings a wide range of economic benefits to our province. While GDP and employment are frequently used as a measure of the overall impact of an industry or sector on the economy, there are at least six additional important dimensions of economic benefits that the industry brings to BC, including labour income, government revenue, improved balance of trade, investment attraction, innovation and technological transfer, talent pooling, and quality of life and standard of living. We provide a description of each of these benefits below, followed by details on the Gross Domestic Product and Employment Impacts.

- **Gross Domestic Product**
  GDP is a measure of the value-added by the aerospace sector within the local economy. The aerospace industry creates a significant impact on the BC economy, contributing $1.36B directly to the economy, $0.68B to $1.20B through indirect impacts of suppliers to the aerospace industry, and an additional $0.85B to $0.94B through the spending of labour income in the economy. A detailed analysis and explanation of the GDP impact is presented in the following section.

- **Employment**
  The BC aerospace industry employs 8,348 people directly within the aerospace sector, supports an additional 3,155 to 6,477 jobs within industries that supply to the aerospace sector, and an additional 2,830 to 4,986 jobs through the spending of labour income earned in the aerospace and supplier industries. A detailed analysis and explanation of the employment impact is presented in the following section.

- **Labour Income**
  The aerospace industry employs highly skilled workers, and pays relatively high wages. In Canada, the wage offered by aerospace manufacturing jobs is 38% higher than other manufacturing jobs, and that offered by aerospace MRO is 18% higher than other industries. This labour income gets re-spent in the economy and generates follow-on economic benefits by supporting jobs and value-added in sectors that provide goods and serviced demanded by employees in the aerospace and supplier industries.

- **Government Revenue**
  The BC aerospace industry produces high value goods and services generating total revenues of $2.5B in 2011. This activity brings significant government revenues through corporate taxes, export taxes, and goods and services taxes.

- **Balance of Trade**
  The aerospace industry is inherently global in its operations, as there are a select number of Original Equipment Manufacturers (OEMs) that service the world demand for both commercial and military aircrafts. In Canada, 81% of aerospace industry revenues are from exports of goods and services. Through its export-orientation, the aerospace sector therefore generates significant inflow of capital into the economy and improves the overall balance of trade.

Innovation and Technology Transfer

Aerospace firms are at the cutting edge of innovation in industrial materials, electrical systems and computer software to develop products that support new generation aircrafts. By supporting a vibrant aerospace ecosystem, BC will benefit from both organic innovation, as well as transfer of technical know-how as local firms fulfil work packages for tier 1 and 2 integrators.

Talent Pooling

The presence of a robust aerospace supply chain, with participants in all tiers of the value chain, can organically create a pool of technical talent, senior management talent, as well as marketing and sales talent, which are all key to the growth of any industry. While BC has developed a pool of highly technical talent with niche capabilities, a significant opportunity remains to increase the breadth and depth of the talent pool by attracting large integrators and OEMs, who tend to employ a broader array of professionals in order to support their global operations.

Quality of Life and Standard of Living

The employment income and government revenue that the BC aerospace industry generates lead to direct and indirect improvement in the quality of life and standard of living. The aerospace industry generates high-paying jobs in the province, which not only impacts the standard of living of employees within aerospace, but also, as they spend their income on consumer goods and services, it further creates wealth in the economy. Through its contribution to government revenues, the industry indirectly funds public programs that improve social outcomes in the province. Lastly, the presence of a robust aerospace ecosystem, with firms operating in the higher tiers of the value chain tend to make significant contributions to the community through the funding of public events and societies, thereby facilitating the transfer of economic benefits to society at large.

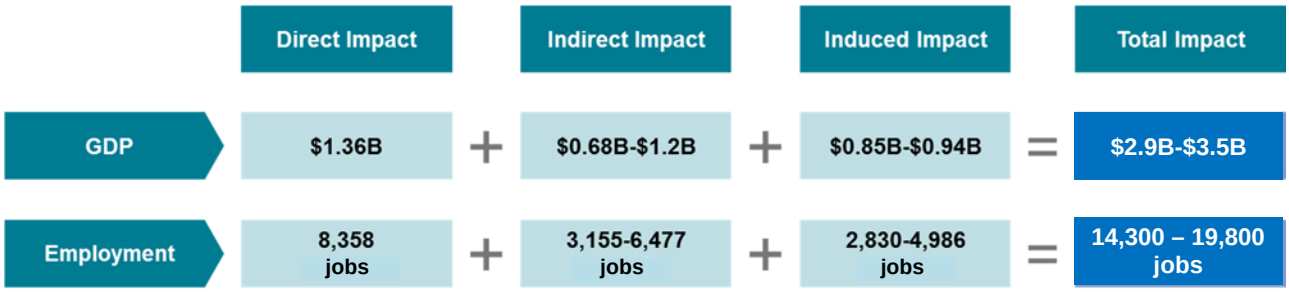
3.2 Current Economic Impact

In addition to the above summary of benefits, we have further quantified and analysed the economic impact of the aerospace industry in terms of GDP and employment. For each of these, we have estimated the **Direct Impact** of the industry (employment and value-added created directly by aerospace firms), the **Indirect Impact** (employment and value-added generated by suppliers to the aerospace industry), and **Induced Impact** (the impact of re-spending of labour income earned in the aerospace and supplier industries). For a technical definition of each type of impact, refer to **Appendix III**.

A limiting factor in our analysis is that in Canada no standard industry code comprehensively captures the multitude of sectors within the aerospace industry. For this reason, we have used two different approaches to develop a range for the economic impacts, within which we predict the true impact to lie. We used national, aerospace-specific impact multipliers sourced from Industry Canada, and BC-specific general industry impact multipliers sourced from Statistics Canada. A detailed description of our Economic Impact Methodology can be found in **Appendix III**.

We find that the BC aerospace Industry has a significant impact on the economy, generating **$2.9B to $3.5B** in total GDP impact, and supporting **14,300-19,800 jobs** through direct, indirect and induced impacts. We provide a breakdown of these impacts below.

Figure 19.
BC Aerospace Industry Direct, Indirect and Induced Economic Impacts



Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

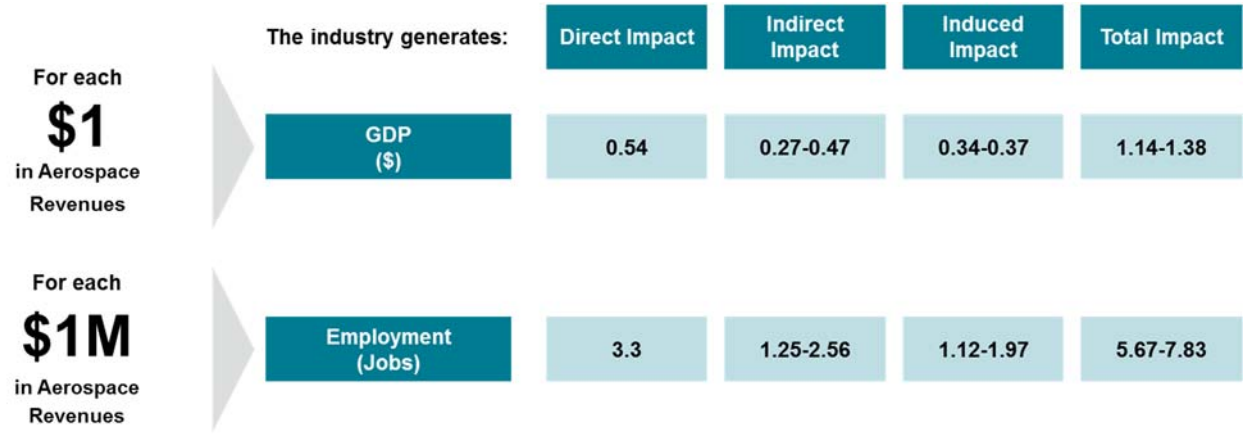
3.3 Economic Impact of Growth in BC Aerospace Industry

To quantify the economic impact of growth in the aerospace industry in BC, we have estimated the economic impact generated (for GDP and Employment) for every extra dollar of revenue earned in the industry. We find that for each dollar in aerospace industry revenue, the industry contributes $1.14-$1.38 in provincial GDP, through direct, indirect and induced impacts. For each million dollars in aerospace industry revenues, the industry contributes approximately 6-8 jobs, through direct, indirect and induced impacts.

It should be noted that employment multipliers for BC aerospace are relatively conservative when compared to other studies of jurisdictions with more developed aerospace sectors or studies of the national aerospace industry as a whole[7]. This highlights the potential of increasing the job impact of the industry by developing a more robust ecosystem.

[7] For example, 2012 study of the Canadian Defence and Security industry which included aerospace as a sub component estimated the total direct jobs impact to be approximately 5.6 FTE/$1M as compared to 3.3 FTE/$1M in our study of BC Aerospace, Economic Impact of Defence and Security Industry in Canada, KPMG 2012. A recent study commissioned by the BC Jobs and Investment Board reported the total job impact of Aerospace and Defence in the US as a whole of approximately 8.7 FTE/$1M as compared to an upper bound of 7.8 FTE/$1M in our study of BC Aerospace.

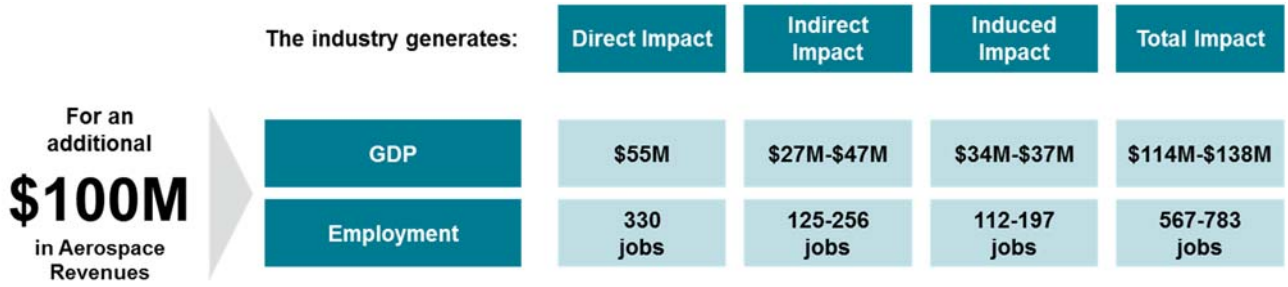
Figure 20.
BC Aerospace Industry Economic Impact Multipliers



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

To put these numbers in perspective, we have estimated the economic impact of growing the industry in BC by $100M in annual revenue. This is an arbitrarily small factor chosen to demonstrate the significant benefits to the province of even modest growth in the industry. We find that growing the industry by $100M in annual revenue generates $114M to $138M in provincial GDP, and 567 to 783 jobs created through direct, indirect and induced impacts.

Figure 21.
Economic Impact of Growing the BC Aerospace Industry by $100M in Annual Revenue



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

3.4 Tax Revenue Impact of the BC Aerospace Industry

Accurately estimating the government revenue contributed by the BC aerospace industry is challenging and requires a dedicated study beyond the scope of this report. Here we have made rough assumptions to derive a high-level estimate of corporate income tax revenue and personal tax revenue. For illustrative purposes we assume 7%-10% average corporate profits in BC, total industry revenue of $2.5B based on 2011 data and average national aerospace manufacturing and MRO-ISS salary for all BC aerospace FTEs[8].

[8] Information on corporate income taxes paid by industries is not available at the province level. There is also limited information available on industrial profit margins by province. Our approximation of 7-10% average profitability is based on Statistics Canada's national estimates of industrial profit margins for the industries "air, rail and ship products & other transportation products manufacturing" (publication 61-219X), and national aerospace firm EBITDA margins as estimated by the 2010 AIAC Survey.

Based on these assumptions we find that the BC aerospace industry likely generates in excess of $150M in annual corporate and personal income tax. Of note is that these estimates do not include revenues from GST or PST.

Figure 22.
BC Aerospace Tax Revenue Estimate

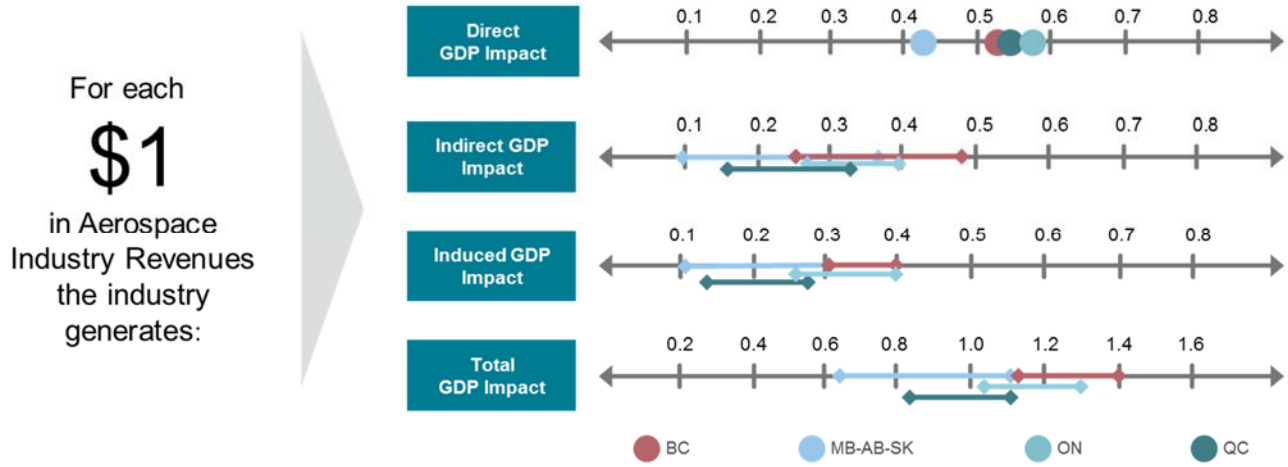
The industry generates:	Mfg Sector	MRO-ISS Sector	Est. Incremental Federal and Provincial Income Tax Revenue
Corp. Income Tax*	$25M-$40M	$20M-$30M	$45M-$70M
Personal Income Tax **	$57M	$53M	$110M

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

3.5 Provincial Comparison of Economic Impact

We find that per dollar of revenue, the BC aerospace industry has a relatively high GDP impact – through direct, indirect and induced effects – compared to other provinces with significant aerospace industries.

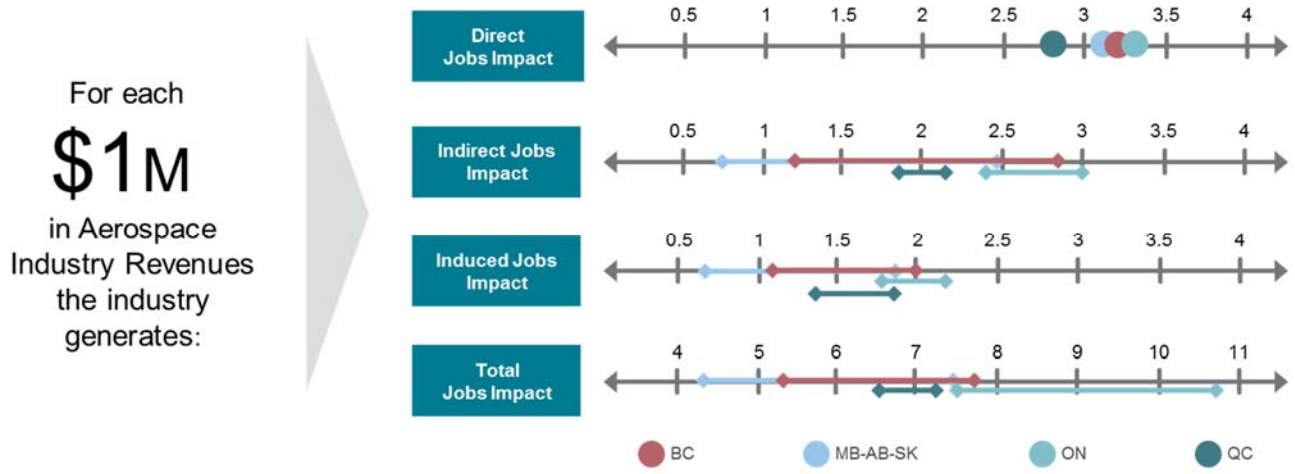
Figure 23.
GDP Impact: Provincial Comparison



Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

Looking at employment, we find that the BC aerospace industry has a higher overall impact on employment per dollar of revenues -- through direct, indirect and induced effects -- than the Rest of Western Canada. It is comparable to the level in Quebec, and slightly lags Ontario.

Figure 24.
Employment Impact: Provincial Comparison

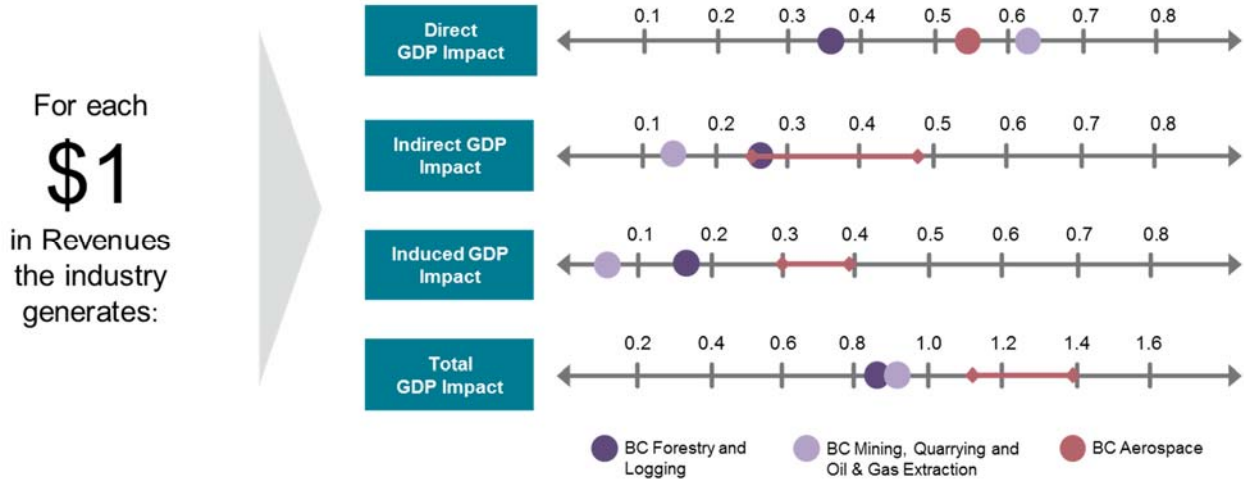


Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

3.6 Industrial Comparison of Economic Impact

We find that per dollar of revenues, the BC aerospace industry has a higher overall GDP contribution, through direct, indirect and induced effects than primary resource industries in BC. High GDP per dollar of revenue is indicative of high value-added during the production process (as measured by a relatively high value of the final product/service net of the intermediary inputs in production). From an income perspective, high GDP per dollar of revenue is associated with high levels of labour income and company profits generated by the industry (net of depreciation, interest, taxes and subsidies).

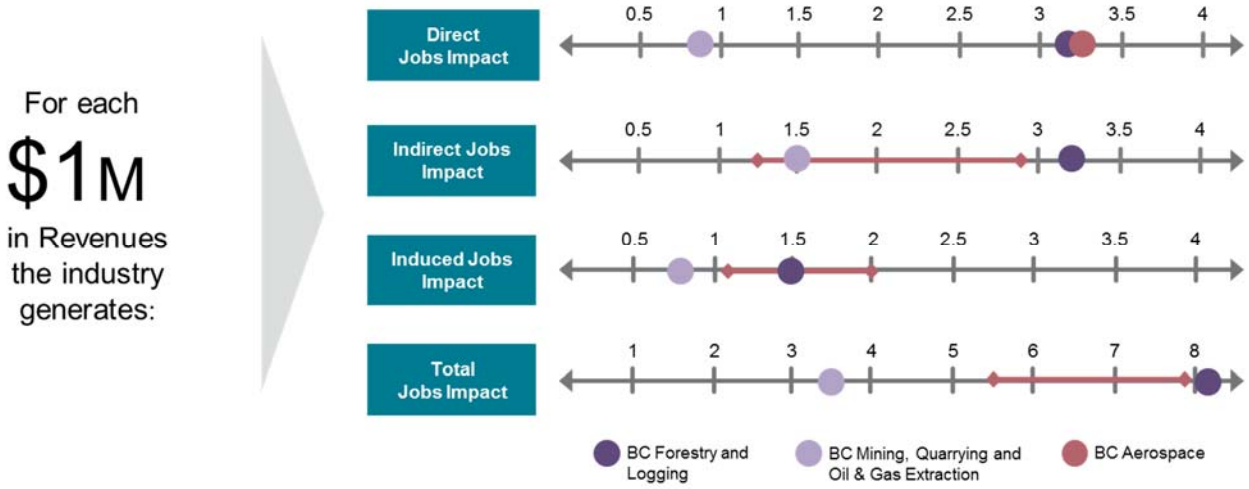
Figure 25.
GDP Impact: Industrial Comparison



Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

The BC aerospace industry has a higher overall impact on employment per dollar of revenues, through direct, indirect and induced effects than the Mining, Quarrying and Oil & Gas Extraction industries, and slightly lower impact than the Forestry industry.

Figure 26. Employment Impact: Industrial Comparison



Source: KPMG Analysis of data sourced from Industry Canada and Statistics Canada

4. BC Aerospace Capabilities Mapping

This section presents a detailed assessment of the capabilities that exist within BC's aerospace ecosystem, based on a survey of firms operating within the aerospace sector in BC. This is the first-of-its kind assessment of the capabilities of firms that operate within the BC aerospace industry, and thus serves as a baseline for further, targeted analysis of specific strengths and weaknesses within the sector, as they relate to global trends in the aerospace industry, and the evolving demands of the OEMs.

4.1 Aerospace Firm Structural Overview

Introduction to the Aerospace Ecosystem

Overall, the aerospace manufacturing ecosystem that facilitates the transformation of raw materials through to the production of a complete aircraft conforms to a hierarchical structure that is common across the majority of the aerospace industries. Original Equipment Manufacturers (OEMs) are the top of the aircraft production hierarchy, leading the design, engineering, development and final assembly of the aircraft. Examples of OEMs include Boeing, Bombardier, Lockheed Martin, Airbus and Viking.

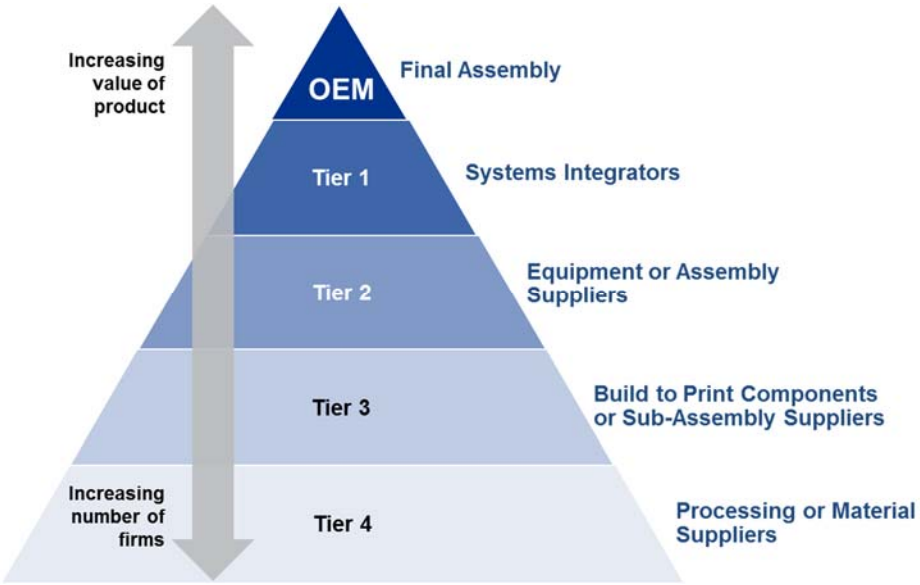


Figure 27: Aerospace Ecosystem: Firm Structural Overview

Tier 1 firms act as system and component integrators bringing together a broad range of assemblies and systems to create large assembly modules that OEM firms integrate into the final aircraft assembly. Examples of tier 1 firms include MHI Canada and Spirit Aerosystems.

Tier 2 and tier 3 manufacturers build components to varying scale and complexity, feeding components to tier 1 firms to be integrated into larger assemblies. Tier 4 firms function as material, consumable and processing suppliers to firms throughout the hierarchy. This general structure, which aligns with the structural overview in the Emerson Report, provides a general framework for the flow of goods through the aerospace production ecosystem. The hierarchy is subject to various exceptions in practice, but functions well as a conceptual tool. Of particular note going forward is the evolution of the aerospace ecosystem and supply chain as firms at various tiers look to lever intellectual property, proprietary processes or other means to move up the value chain.

BC Firms in Relation to Aerospace Ecosystem

BC aerospace firms consist of a large number of small and medium firms that operate at modest levels of technical sophistication along with a handful of larger anchor firms with sizeable more sophisticated operations. There is a clear dichotomy in BC aerospace between the small and medium sized firms and the few large operators.

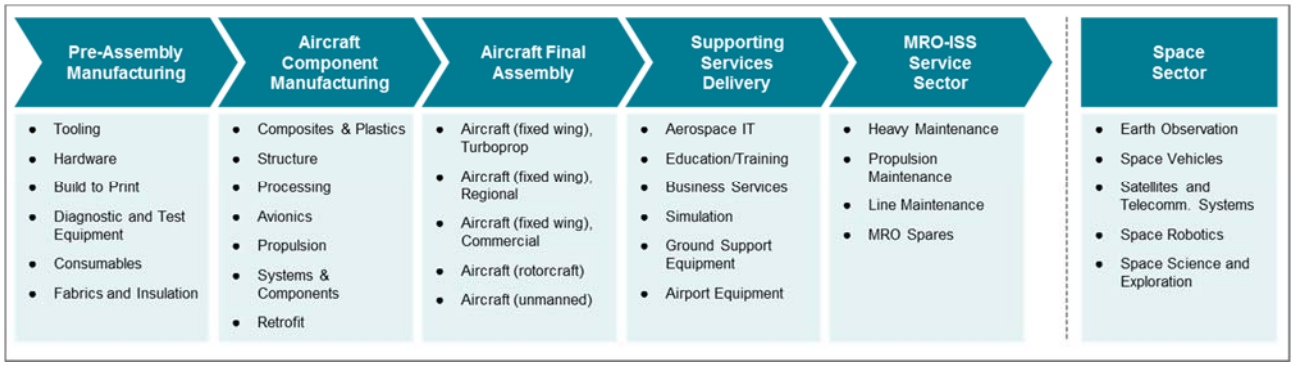
The small- and medium-sized firms typically focus on a narrow product type offering for a limited customer group. Generally these firms are not in the early stages of growth but are in steady state operation.

The few large aerospace firms that operate in BC are differentiated from small and medium aerospace firms by their advanced technical capabilities and depth of aerospace qualifications. These firms generally have the ability to produce components for tier 1s and OEMs.

4.2 BC Aerospace Value Chain

We present a detailed mapping of BC's aerospace capabilities in the context of a "value chain" for the provision of aerospace products and services, which represents the lifecycle of aircraft production and operation. Much like the aerospace ecosystem hierarchy described above, this framework is not intended to be accurate in all cases but rather to provide a conceptual overview of the value chain associated with aircraft production and maintenance.

Figure 28:
Aerospace Value Chain Breakdown



Source: KPMG Analysis

We provide a brief description of each component of the value chain below:

Pre-Assembly Manufacturing

This segment consists of firms that produce products that facilitate the production of aircraft components such as tooling, consumables and test equipment. These firms provide the inputs needed to manufacture the components of the aircraft.

Aircraft Component Manufacturing

This segment includes firms that focus on creating products that are specifically designed and manufactured to be installed on production aircraft. These firms can be thought of as building the modules that will eventually be assembled into complete aircraft. These firms produce or transform

physical goods including the structure of the aircraft, avionics and electronics, and propulsion systems among other components.

- **Aircraft Final Assembly**
  This segment includes the aircraft manufactures aggregating all of the components of the aircraft and combining those components to create an operational aircraft. These firms are often of the largest scale and complexity of any of the points in the value chain.

- **Supporting Services**
  This segment includes firms that provide supporting services within the aerospace sector, such as pilot and technician training and education, airport equipment, business services and others. These firms typically provide services or products that are not part of the aircraft directly but contribute to the development or operation of the aircraft.

- **Maintenance, Repair and Overhaul – In-Service Support (MRO-ISS)**
  This segment includes firms that provide ongoing support over the in-service life of the aircraft, including maintenance, repairs and overhaul. This segment also In-Service Support a segment that includes value-added activities such as Project Management, Engineering Services, Integrated Logistics Support, Modifications, Airworthiness and Lifecycle Management. ISS is a contemporary evolution of the MRO segment that encompasses MRO itself along with various intellectual capacity services.

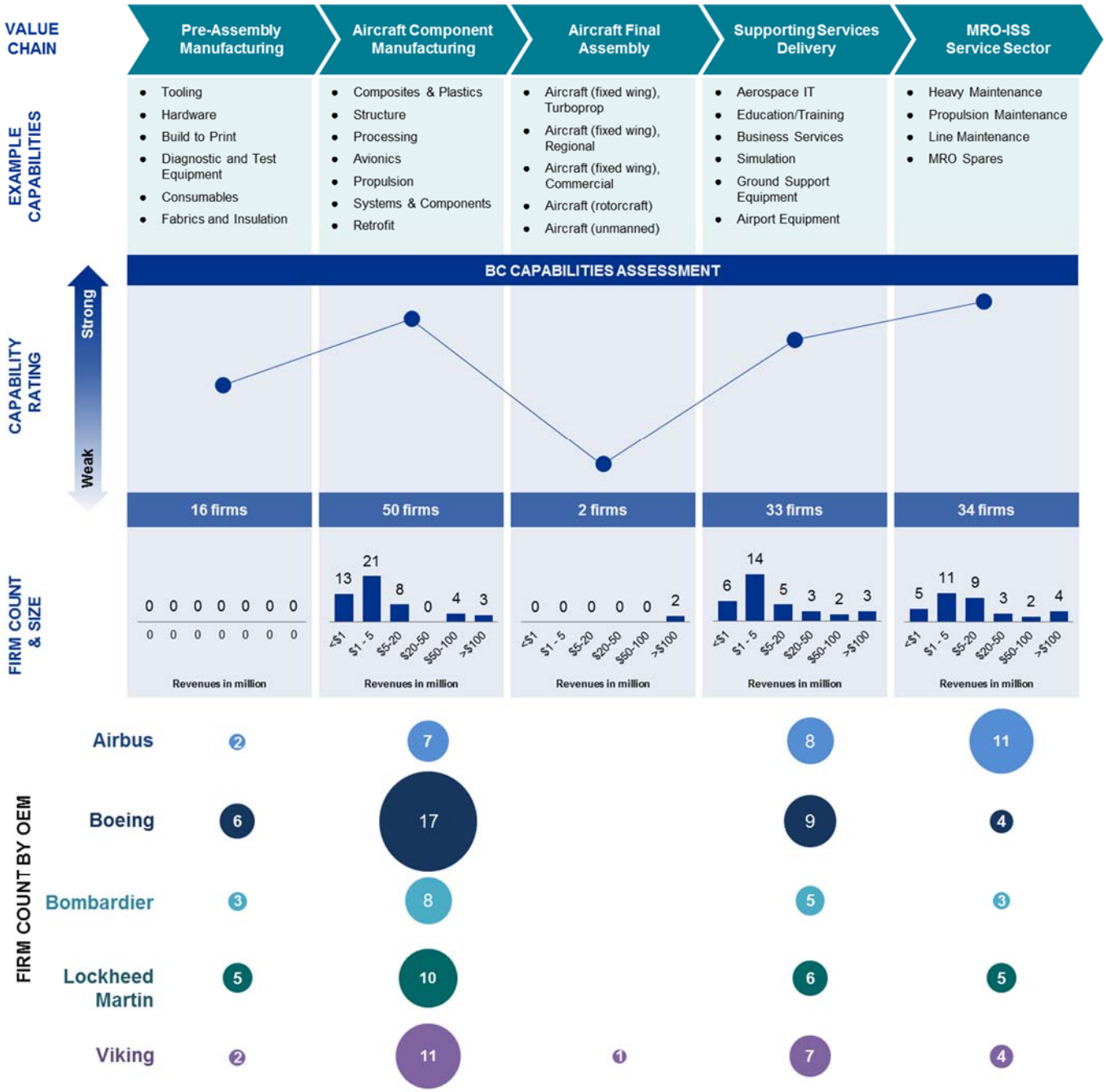
- **Space Sector**
  The space sector is included in a dedicated section in our analysis below. Though space and the technology associated with the industry segment overlap with aircraft production in some aspects the space segment contains enough unique features that it benefits from special treatment in the value chain. The space segment includes firms that manufacture space vehicles, satellites and telecommunication systems, earth observation, space and system engineering services and data and application development.

4.3 BC Aerospace Capabilities – Summary Assessment

This section summarizes the findings of our industry capabilities assessment, which are presented at several levels of detail of the value chain. It should be noted that this is not an assessment of the strengths and weaknesses of the BC aerospace industry relative to the aerospace industries in other jurisdictions. Rather, this section is intended to highlight specific capabilities that exist within each component of the aerospace value chain in BC, and the strengths and weaknesses of sub-components relative to each other.

In order to develop the base capability mapping, KPMG conducted a custom survey of more than 160 aerospace companies in BC. In assessing the strengths and weaknesses of the BC aerospace industry, KPMG considered both, the number of firms reporting capabilities and their size, and positioned them based on this score. Please note that since firms have reported capabilities across multiple categories of the value chain, the number of firms reporting each capability is not additive. Further details on our survey methodology can be found in **Appendix IV**.

Figure 29:
BC Aerospace Capabilities Assessment Summary



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

4.3.1 Pre-Assembly Manufacturing

BC has modest capabilities in the pre-assembly manufacturing segment. There are comparatively fewer companies operating in this space (approximately 16), 7 of which report revenues in excess of $20M per year. Within the pre-assembly manufacturing capabilities, particular strengths are Tooling and Built to Print. Of the 16 players, 13 companies report Tooling capabilities such as assembly fixturing

design and fabrication, and layup and bonding jigs. Half of these companies generate revenues in excess of $20M per year. There are also 10 companies reporting Build to Print capabilities (manufacturing based on customer supplied engineering and fabrication methods), 5 of which generate revenues higher than $20M per year.

Only 3 companies in our survey have reported Fabrics and Insulation capabilities, such as confor, latex and carbon polymers. Similarly, only 3 companies have reported diagnostic, test and inspection equipment capabilities. These are areas of relative capability gaps within the pre-assembly manufacturing category.

4.3.2 Aircraft Component Manufacturing

A large number of firms participate in Aircraft Component Manufacturing in BC, with at least 50 companies reporting capabilities in this area (about half of the survey respondents). On initial inspection this could be considered a strength of the BC aerospace industry but we must note that many of the firms are small and few large anchor firms are present, with only 7 firms reporting revenues over $20M per year. The small size of firms can be a serious limitation in the aerospace manufacturing sector where scale is critical to securing significant statements of work. Within components manufacturing, BC's capabilities are strongest in the structure segment, with 27 companies reporting capabilities, 6 of which generate revenues in excess of $50M per year.

While there are 16 companies manufacturing various systems and components, the vast majority are small, with only 2 reporting revenues in excess of $20M per year. BC's capabilities in Propulsion and Avionics appear to be relatively weak.

4.3.3 Aircraft Final Assembly

BC is home to a single final assembly firm. The existence of any final assembly capability in the province is of critical importance to the aerospace ecosystem. Benefits typically associated with the presence of tier 1 integrators and OEMs include stimulating industrial clustering due to closer proximity to BC suppliers, promoting technology transfer to BC, higher investments in R&D, development and attraction of senior leadership talent, attraction of capital investments, higher economic impact through demand for ancillary services (e.g. advisory, audit, tax, communications, legal, etc.) and raising the profile of the jurisdiction in the global aerospace market. Over the long run, the lack of any other tier 1 integrators or OEMs will likely have a limiting effect on the growth prospect of the aerospace industry in BC.

4.3.4 Supporting Services Delivery

Compared to other segments of the value chain, BC's capabilities in Supporting Services delivery are relatively strong. There are 33 firms reporting capabilities in this area (likely more among non-respondents), 8 of which report revenues in excess of $20M per year. Within supporting services, education and training stand out as the strongest capability areas, with over 17 firms operating in this space, followed by Business Services with 14 firms and Simulation with 9 firms. In each of these areas there are at least 4 companies reporting revenues in excess of $50M per year. Given the relatively niche nature of simulation services, BC firms represent a significant capability in the Canadian market.

While many of the companies in the Supporting Services sector are small, the size of firms in this category is not as detrimental as it is in the Aircraft Component Manufacturing category. Support

Services firms typically do not need scale to take on risk sharing type contracts making small firm size a less significant issue.

4.3.5 Maintenance, Repair and Overhaul – In-Service Support (MRO-ISS)

Consistent with the findings of our macro-economic analysis the MRO-ISS Service Sector stands out as a key strength within the BC aerospace ecosystem. There are 34 firms reporting capabilities in this category, 9 of which report revenues in excess of $20M, and 4 of which report revenues in excess of $100M. An area of particular capability strength is Line and Component maintenance, in which there are 25 firms reporting capabilities such as avionics testing and repair, flight control, fuel systems, interior finishing, landing gear, rotor blade, and life support equipment. Seven of these companies report revenues in excess of $20M per year.

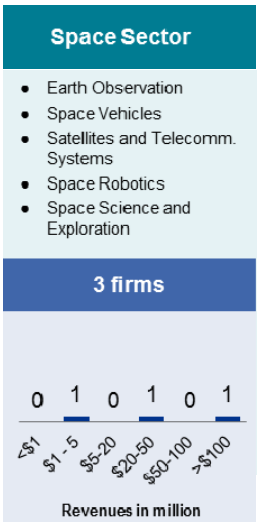
There are also 22 firms reporting Heavy maintenance capabilities. While this is a significant number of firms, many of them are small (at least 10 with revenues less than $5M per year). As with Aircraft Component Manufacturing scale can be an important aspect of Heavy Maintenance MRO-ISS Service Sector, where firms often need to be of sufficient scale to take on risk-sharing type contacts.

Also of note is the relatively few firms participating in propulsion maintenance (approximately 13), about half of which report revenues of less than $5M per year.

4.3.6 Space

While BC has a limited number of firms that report capabilities within the space sector, BC is fortunate to be home to a tier 1 space firm and one of the largest firms in the Canadian space sector, with the ability to execute on a complete space system, from complete space system design and development to earth observation data and service provision.

However, a limitation to growth in the BC Space sector is the lack of small and medium sized firms. These type of firms are important in creating a healthy supply chain ecosystem that can support large firms. The lack of intermediate firms in the space sector mirrors the same issue in the manufacturing sector; but due the specialized nature of the space sector the impact is even greater. Of important note is that space programs are often unique solutions for each project, unlike typical aerospace programs that look to high rate work packages. This necessitates that space sector firms have access to a healthy space specific supply chain.

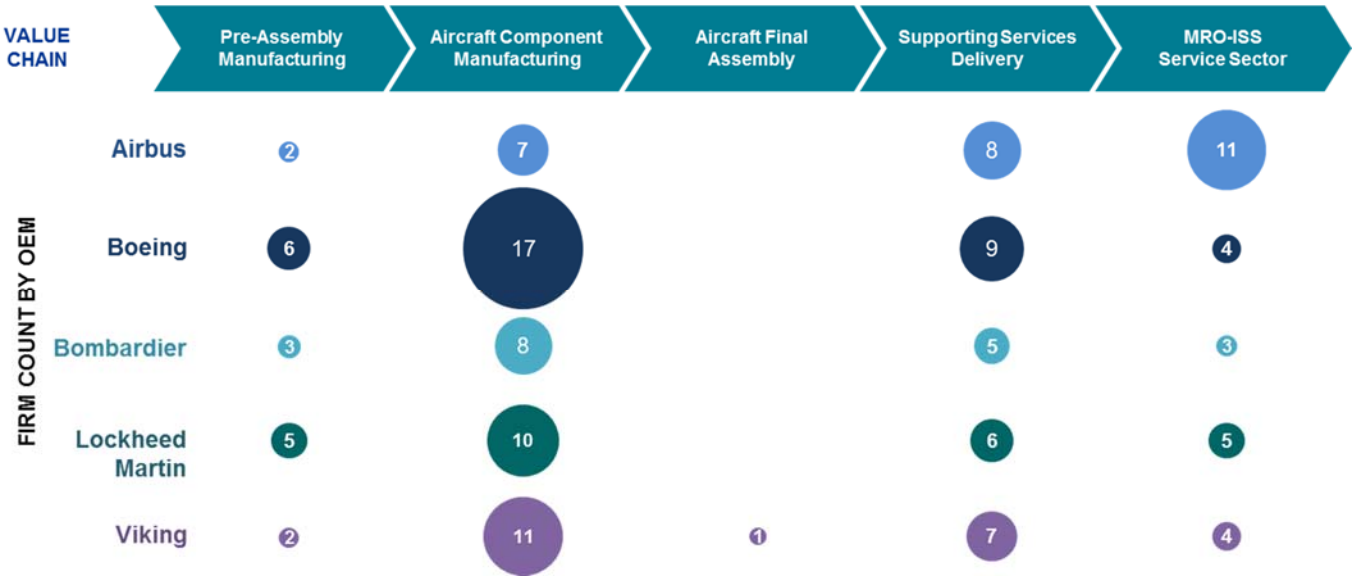


Source: KPMG Analysis

4.3.7 OEMs Served in BC by Value Chain Activity

The KPMG BC Aerospace Industry Capabilities Survey requested respondents indicate if they have capability to manufacture for or service select OEMs across all of their indicated capabilities. The pre-defined OEMs are Airbus, Boeing, Bombardier, Lockheed Martin and Viking. Pre-defined OEMs were specifically selected to demonstrate BC firm's capabilities across major OEMs with final assembly lines in North America. Respondents were also requested to indicate Other OEMs outside of the selected group and that detailed information is available as needed.

Figure 30:
OEMs Served by BC Aerospace Firms Summary



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Observations of note with respect to OEMs served include the relatively strong representation of Airbus in the MRO-ISS sector while being underrepresented in Pre-manufacturing and manufacturing sectors. Airbus has recently setup a final assembly line for the A320 in Alabama and this presents a new opportunity for North American pre-manufacturing and manufacturing firms to develop a new OEM customer relationship.

As would be expected due to BC's close proximity to Washington State and Boeing's significant operations there, firms that serve Boeing are well represented, particularly in the Aircraft Component Manufacturing sector. Of note is the low number of firms that have Boeing capability in the MRO-ISS sector. This could be indicative of BC consisting on a few very large, capable MRO-ISS firms. Further investigation is warranted on this point.

Lockheed Martin and Viking are both relatively well represented in BC firm capabilities given the relatively low number of aircraft in-service and the highly specialized nature of the aircraft both firms produce. Finally, Bombardier is less represented across all value chain activities relative to other OEMs considered.

4.4 Alignment of the Value Chain to the Key Industrial Capabilities

The opportunity to leverage Canadian defence procurement spending to generate maximum benefit to Canadians was identified in the 2013 paper "*Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities*". The underlying concept is focused consideration on generating significant industrial benefits for Canadian firms through federal Defence procurement activities. The report identified six KIC Clusters:

- Arctic and Maritime Security
- Protecting the Soldier
- Command and Support
- Cyber-Security
- Training Systems
- In-Service Support.

The report suggested that federal defence procurements should strongly consider the elements of technology transfer and IP retention, Canadian innovation, the need for global products and development of specific skills and training.

BC aerospace has capability strengths that align well with the three of the six KICs.

- **Protecting the Soldier:** BC has a growing UAV sector that can be leveraged to protect Canadian soldiers on the battlefield. The rapidly advancing technology of UAVs means less exposure for soldiers during reconnaissance exercises along with improved visibility to movement patterns
- **Training Systems:** BC firms have strong capabilities in pilot training in both traditional methods and advanced 3D simulations.
- **In-Service Support:** The MRO sector is very strong in BC. MRO firms in BC are well positioned to provide comprehensive in-service support on all future defence aerospace procurement activities.

5. Aerospace Case Studies

5.1 Aéro Montréal – MACH Initiative

Across the world, the aerospace industry is evolving. Amid growing competition and globalization, large manufacturers like Bombardier increasingly rely on a strong network of suppliers to hold them up and ensure the future of the industry in Canada. Yet our supply chain has gaps, and Canada's position as a leader in the sector is far from guaranteed. The familiar supply landscape is changing.

As David Emerson explained in his 2012 "*Aerospace Review*", major manufacturers increasingly prefer to work with suppliers who offer integrated solutions and manage multiple sub-contractors. This allows the manufacturers to reduce the risk and cost of managing their supply chains, and has resulted in dramatic consolidation. Bombardier has roughly 30 suppliers on its new CSeries airliner, for example, compared to 130 on its older CRJ platform (Emerson, 2012).

And while the threats of an evolving supply landscape are concerning, one group has taken a particularly proactive approach to addressing them. Aéro Montréal is a strategic think tank comprised of all the major decision makers in Quebec's aerospace sector. In 2010, following discussions by their Supply Chain Working Group, Aéro Montréal launched the MACH Initiative, with the ultimate goal of "[optimizing] the performance of Québec's aerospace supply chain and [increasing] its global competitiveness" (Aéro Montréal, 2010).

The MACH Initiative aims to go about doing so in a number of ways. Launched in 2011, initial funding for the initiative came from both public and private sources, including a $4 million grant from the government of Quebec, $131,250 from the government of Canada (Canada Economic Development, 2011), and $1.5 million from Aluminerie Alouette, an aluminum manufacturing company based in Sept-Iles (Dunn, 2011).

Key focus areas of the initiative are helping small and medium sized enterprises (SME's) evaluate their performance, supporting them in implementing and measuring improvement initiatives, and increasing their visibility by creating linkages among customers and suppliers. The MACH Initiative uses a common methodology to improve implementation of key business practices, provides mentoring from a prime contractor, and oversees a recognized certification process, resulting in MACH performance labels from MACH 1 to MACH 5. Combined, these tools help individual SME's progress along a path to becoming world class suppliers, thereby strengthening the Quebec aerospace cluster as a whole.

Early indications suggest that Aéro Montréal's efforts are paying off. A total of 39 suppliers and 21 sponsors are now part of the MACH Initiative. These companies have benefitted from extensive training and mentorship. In 2013, a majority of the SME's in the initiative's first cohort progressed to a higher MACH performance level, reflecting considerable overall improvement in supplier competitiveness relative to the first audit. The MACH Initiative also hosted a series of 4 sold-out conferences in 2013 and led a number of successful trade missions (Aéro Montréal, 2013). Collaboration agreements have been inked between Aéro Montréal and a number of international aerospace organizations, including the Italian Aerospace and Defence Industry Association.

More impressive, perhaps, are some of the recent funding announcements out of Quebec. This July, the Quebec government announced a grant of $1 million to RTI Claro, a firm that specializes in the manufacture of titanium components (Government of Quebec, 2014) . A member of the original cohort of

the MACH Initiative, RTI Claro has one of the top performance ratings of the group, at MACH 4. Aéro Montréal claims that since the beginning of the initiative, there has been $4.6 million of direct investment in supplier projects, $1.1 million of in-kind contributions from sponsors, and at least $3.9 million of indirect investment in supplier projects (Aéro Montréal, 2014).

Aéro Montréal and the MACH Initiative serve as success examples of an industry group rallying around its individual member firms, working together to address the challenges and opportunities of a constantly evolving world.

References

Aéro Montréal. (2010, July 20). Press Release: Aéro Montréal Launches MACH Initiative. Farnborough, United Kingdom.

Aéro Montréal. (2013). *Rapport d'Activité.*

Aéro Montréal. (2014). The Mach Initiative: A Tool for Enhancing Québec's Supply Chain Competitiveness. *Aerospace Supply Chain Summit.* Burlington, VT.

Canada Economic Development. (2011, March 21). Press Release: Aero Montreal Receives $731,250 in Funding From the Government of Canada. Montréal, Quebec, Canada.

Dunn, B. (2011, September 26). Racing toward the future. *Wings Magazine*.

Emerson, D. (2012). *Beyond the Horizon: Canada's Interests and Future in Aerospace.*

Government of Quebec. (2014, July 15). Press Release: Minister Jacques Daoust Announces Substantial Financial Support for two Québec Aerospace Firms. Farnborough, United Kingdom.

5.2 MacDonald Dettwiler & Associates Impact on BC Aerospace Ecosystem

Large "anchor" companies are crucial to any industrial cluster. They increase the visibility of a given sector, improve access to capital for smaller firms, and facilitate increased access to technology (Lucas, Sands, & Wolfe, 2009). In the British Columbian Aerospace and High-Tech sectors, MacDonald, Dettwiler and Associates (MDA) has long been considered such an "anchor" company.

Founded in 1969 by John MacDonald and Werner Dettwiler, MDA is a global communications and information company, providing operations solutions and systems to commercial and government organizations. Over the course of its 40+ year history, MDA has emerged as a market leader in the areas of Satellite Communication Solutions, Intelligence, Surveillance and Reconnaissance Systems, Robotics and Automation Systems, and Geospatial Data and Services. Headquartered in Richmond, B.C., MDA employs over 1,700 people in Canada, and has an additional 3,100 employees around the world (MDA, 2014).

MDA's impact on B.C. is well documented. The British Columbia Technology Association has repeatedly acknowledged that the company "delivers cross-cutting innovations that touch all sectors of the economy" and "helps put the spotlight on BC by making their mark on the world" (Canadian Defence

Review, 2010). One of the less frequently discussed impacts of MDA's presence in BC, however, is also one of the most significant: the massive pool of highly-skilled human capital generated by the company.

It is recognized by labour economists and policy makers alike that anchor companies have tremendous human capital spillover to smaller, adjacent firms (Moretti, 2010). Particularly in the high-tech and aerospace industries, the human capital developed by anchor firms feeds into a plethora of smaller suppliers, spin-offs and start-ups (Noisi & Zhegu, 2005). MDA is living proof. Between their founding and 2008, MDA estimates that they have directly resulted in over 40 spin-off companies (which they define as "enterprises started by ex-MDA principals and/or with significant outflow of MDA personnel and technology"). From Cambian Networks to Sierra Wireless, MDA has served as an incubator for bright people with big ideas, ultimately helping write new success stories in the British Columbian aerospace and high tech sector.

A young company called Urthecast is a salient example of this phenomenon. Founded by Wade Larsen, a former VP of Business Development at MDA, Urthecast is a publically traded company with plans to collect and sell the world's first ever Ultra HD video of the Earth from space along with a medium resolution multi-spectral camera. The idea for the company originated when Larsen and an MDA colleague were in Russia meeting with RSC Energia, a Russian spacecraft manufacturer and the main contractor of the Russian Federal Space Agency. RSC Energia was curious about the possibility of installing a camera on the outside of the International Space Station. The project wasn't the right fit for MDA for a number of reasons, but Larsen couldn't shake the idea. So he left MDA, and together with his brother, founded Urthecast.

This January, using some back end hardware supplied by MDA and with the help of Russian astronauts, Urthecast installed two cameras on the International Space Station. Urthecast plans to sell its footage to a wide variety of customers, from governments and aid organizations to the Discovery Channel. In August of 2014, UrtheCast announced a second set of advanced optical and radar sensors to be installed on the NASA segment of the International Space Station. This announcement was followed in November 2014 by the signing of a 5 year, $65 million contract for imagery and technology development; analyst Eyal Ofir predicts revenues of $48.5 million by 2015, or as much as $75 to $125 million (Parry, 2014). Moreover, Ofir estimates the market for these types of services to be up to $1.5B. There are expected social benefits too – the United Nations has already signed on as a customer (Hartley, 2013), and plans to use the footage for everything from monitoring environmental degradation to aiding in disaster relief.

Urthecast's story, though exciting, is far from unique. The same story has played out numerous times across the aerospace industry in Canada and around the world, highlighting the importance of "anchor" companies such as MDA to the overall aerospace ecosystem.

References

Canadian Defence Review. (2010, June 12). MDA Wins B.C. Technology Impact Award.

Hartley, M. (2013, June 26). Vancouver tech firm UrtheCast to land on TSX before heading into space. *Financial Post*.

Lucas, M., Sands, A., & Wolfe, D. A. (2009, February). Regional Clusters in a Global Industry: ICT Clusters in Canada. *European Planning Studies*, pp. 189-209.

MDA. (2014, November). *About Us*. Retrieved from MacDonald Dettlwiler & Associates Website: http://www.mdacorporation.com/corporate/index.cfm

Moretti, E. (2010). *Local Labor Markets (Working Paper 15947)*. Cambridge, MA: National Bureau of Economic Research.

Noisi, J., & Zhegu, M. (2005). Aerospace Clusters: Local or Global Knowledge Spillovers? *Industry and innovation*, 1-25.

Parry, J. (2014, April 1). UrtheCast Looks Skyward. *BC Business*.

6. Aerospace Industry Future Outlook

The global aerospace sector is currently dominated by a handful of countries, which makes the aerospace industry within BC or any other jurisdiction highly sensitive to global trends in this sector. This section describes the key trends in the aerospace industry and identifies trends with specific implications to BC. **Section 6.1** of this chapter provides a context and overview of the industry in the commercial and military segments, by examining the demand and supply dynamics of the industry as a whole. **Section 6.2** delves deeper into trends in specific segments of the aerospace value chain, and draws implications for firms operating in BC.

6.1 Macro Trends in the Aerospace Industry

This section provides a high-level overview of the commercial and military aerospace sectors, by examining the global trends in the demand and supply for aircrafts in both the commercial and military sectors. Overall, we find that supply growth has largely lagged demand growth, which has led to an increased level of supply chain consolidation over the last few years.

6.1.1 Commercial

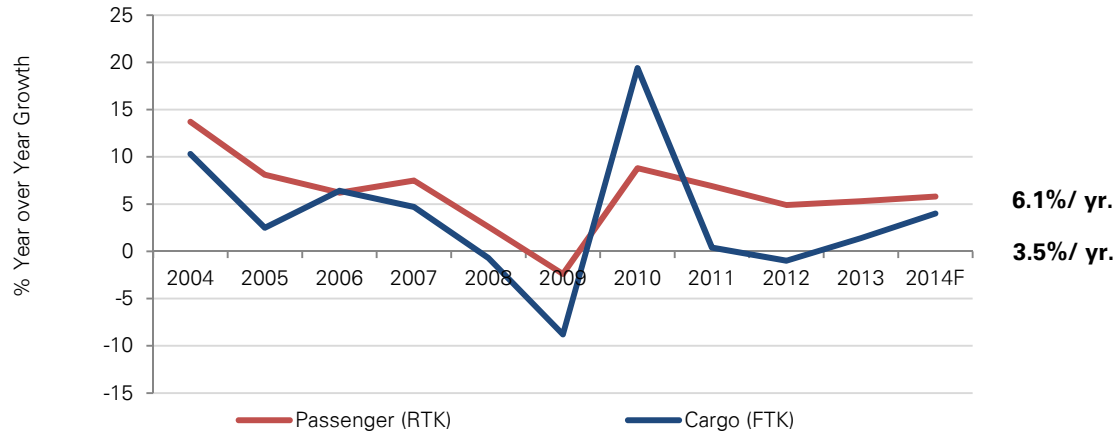
Global demand for aircraft is being driven by the growth in passenger and freight traffic, and the need for fuel efficiency to curtail airlines' declining profit margins. However, supply has not kept pace with this growing demand, with the major OEMs experiencing a major backlog in deliveries; especially in the single aisle segment. This is creating increasing pressure across the supply chain, which has led to increasing levels of consolidation across the supply chain.

Global Demand Trends

Continuing Up-Trend in Commercial Air Traffic:

Over the last decade, worldwide passenger traffic has grown at 6.1% on an annual basis, and cargo traffic, at 3.5%. Both passenger and cargo traffic have recovered from the 2008 economic downturn, which had significantly impacted the commercial aerospace industry.

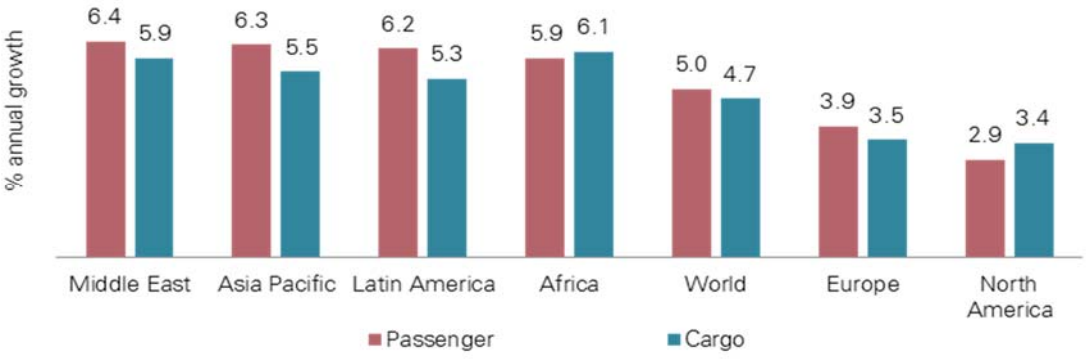
Figure 31:
Historical Air Traffic Growth (2004-2014)



Source: KPMG Analysis; Data from IATA Financial Forecast, 2014

Over the next 20 years, average annual growth in air traffic is expected to remain strong. Boeing estimates that Revenue Passenger Kilometres (RPK) is expected to grow at 5% on an annual basis, and Freight Tonne Kilometres (FTK) at 4.7%. Since passenger air travel is highly correlated with GDP, it is expected that demand for commercial aircraft will be driven by the air travel growth in emerging economies.

Figure 32:
Forecasted Air Traffic Growth (2014-2033)



Source: KPMG Analysis; Data from Boeing Current Market Outlook, 2014 - 2033

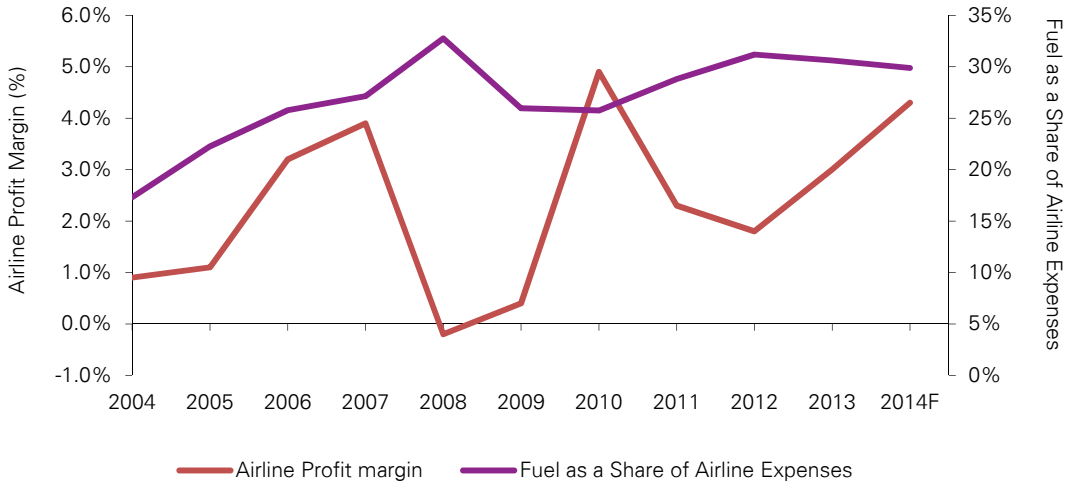
Demand for fuel efficient aircraft

The past decade has witnessed a dramatic increase in the price of oil. Today's crude oil price is 137% of what it was in 2004.[9] As a result, fuel currently makes up 30% of total airline expenses, which is nearly double its share in 2004. Worldwide, airline profit margins are very low, which makes them highly

[9] US Energy Information Administration, Crude Oil (Petroleum), Dated Brent Monthly Price (comparison of Aug 2004 and Aug 2014 price)

sensitive to fuel price volatility. Since fuel prices are expected to continue rising in the future, there is a continuing demand for new, fuel efficient aircraft to replace existing fleet. We see the demand for fuel efficient aircraft as a long-run macro trend. As the price of oil fluctuates in the short-run customers may push out delivery of new aircraft in favour of operating older, less fuel efficient aircraft during periods of lower fuel cost. We see demand for fuel efficient aircraft as the dominant trend.

Figure 33:
Airline Profits and Fuel Expenditure



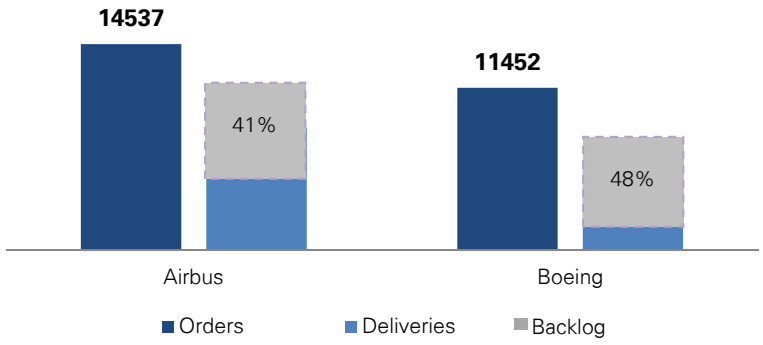
Source: KPMG Analysis; Data from IATA Financial Forecast, 2014

Global Supply Trends

Large Aircraft Delivery Backlog

Worldwide, the delivery of aircraft has not kept pace with the rising demand. As of August 2014— the current order book for both Airbus and Boeing compared to the aircraft production forecast (2014 to 2033) for both firms—we see that Airbus will have a remaining backlog of 41% of their current order book in 2033 and Boeing will have a 48% backlog of their current order book in 2033.

Figure 34:
Total Aircraft Backlog (as of August 2014)

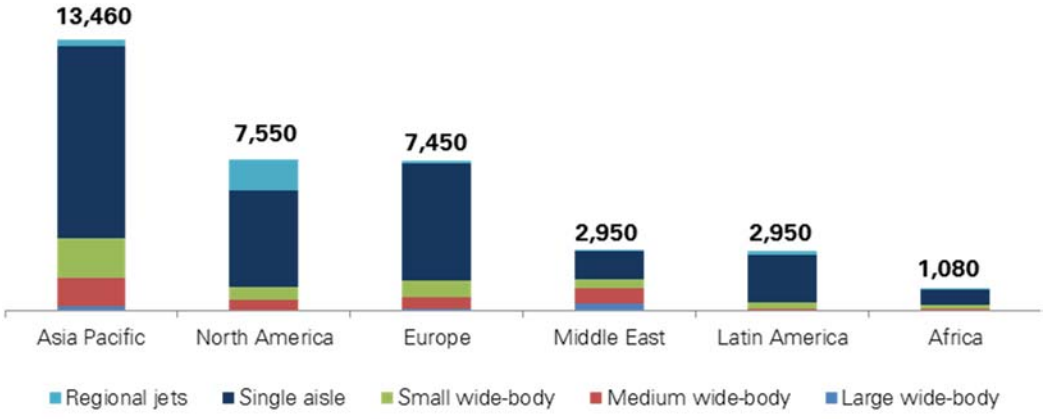


Source: KPMG Analysis; Data from Boeing Current Market Outlook, 2014 - 2033

Largest New Deliveries will be in Asia and in the Single-Aisle Segment

Consistent with the projected demand growth in the Asia-Pacific region, it is expected that this region will receive 37% of new aircraft deliveries over the next 20 years. Moreover, the majority of the new aircraft fleet, worldwide, will be in the single-aisle segment.

Figure 35:
Projected New Aircraft Deliveries (2013-2033)



Source: KPMG Analysis; Data from Boeing Current Market Outlook, 2014 – 2033

Increase in single-aisle competition

The demand for single aisle aircraft is the engine that is driving the commercial aerospace market, with significant order backlogs for both the Boeing 737 and Airbus A320. As a result, recent years have seen a significant increase in new aircraft designs from global OEMs to compete against Boeing and Airbus directly and at the fringe of the single aisle market.

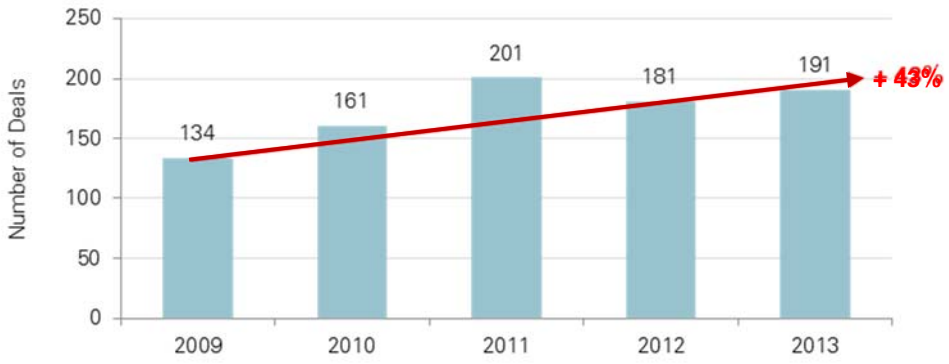
Importantly for Canadian firms is the introduction of the Bombardier CSeries platform. This platform with be Bombardier's first entry into the single aisle commercial aircraft market. Some of the new competitors in the single-aisle commercial aircraft segment include:

- Canada – Bombardier CSeries, expected in 2015
- China – COMAC C919, expected 2019
- Russia – Sukhoi Superjet 100, a large regional aircraft design that competes at the small end of the single aisle market. In current production
- Japan – Mitsubishi MRJ, a large regional aircraft design that competes at the small end of the single aisle market.

Consolidation and Vertical Integration of Commercial Supply Chain

The large order backlog and increasing competition in the single aisle segment has created increasing pressure across the supply chain.[10] As a result, there is growing consolidation at all tiers of the supply chain, as evidenced by increasing M&A activity in the aerospace and defence sector. In the last five years, the volume of global aerospace and defence deals increased by 43%.

Figure 36:
Aerospace and Defence M&A Volume



Source: Aerospace and Defence Industry Snapshot – Winter 2014, Stout Risius Ross

Over the last decade, OEMs have sought to optimize their supplier bases across production lines. With fewer tier 1 suppliers being used on new platforms such as B787 and A350, these suppliers have been pursuing horizontal acquisition strategies to provide more complete system solutions on each platform. At the same time, OEMs have begun a process of pushing larger, more complex statements of work into the supply chain. These statements of work typically include design engineering, technology investment and risk sharing (investment in CapEx with no guarantee of aircraft production rate). By taking this approach OEMs increase the need for technical capabilities, capital investment and risk tolerance in the supply chain. This has led to higher horizontal as well as vertical acquisitions among tier 3 and 4

[10] Catalyst Corporate Finance: Global Aerospace Sector M&A Update 2012

suppliers, in order to achieve sufficient scale to take on large work statements while remaining competitive.[11]

6.1.2 Military

Military expenditure is on the decline in the US and EU, and rising in emerging economies like India and China. However, with the sector shrinking in the in the two largest defence markets in the world – the US and EU – overall demand for military aircrafts has been on the decline in the world. As with commercial aircrafts, there has been increasing levels of consolidation in the military supply chain.

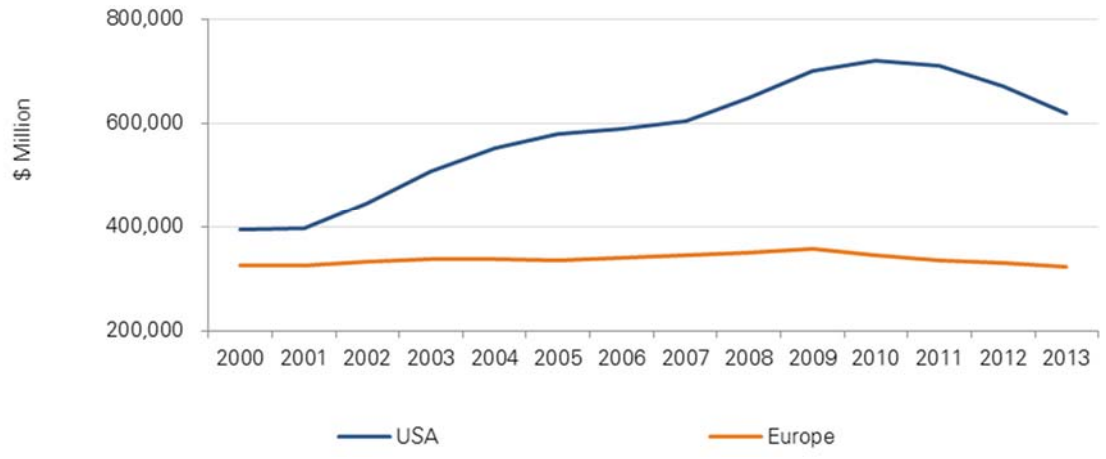
Retaining legacy aircraft and deferring the acquisition of new platforms can be an opportunity for firms operating in the ISS sector, especially firms with the ability to modify, upgrade and integrate systems. These high value-added activities can upgrade aircraft to allow for extended service life and enhanced capabilities. This approach is a viable alternative to new procurement.

Global Demand Trends

Shrinking Defence Spending and Weakening Defence Sector, Especially in Europe and US

The US, the largest defence market in the world, and Western Europe have been reducing defence-related spending in recent years to mitigate budget deficits. The reduction in defence spending from these two markets has had a significant impact on the defence industry globally. Examples of major changes to US aerospace defence spending include scheduled discontinuation of the Lockheed U2 ultra-high altitude reconnaissance aircraft and the Fairchild Republic A10 Thunderbolt close air support aircraft programmes in 2015.

Figure 37:
Military Expenditure for US and Europe, in Constant US $



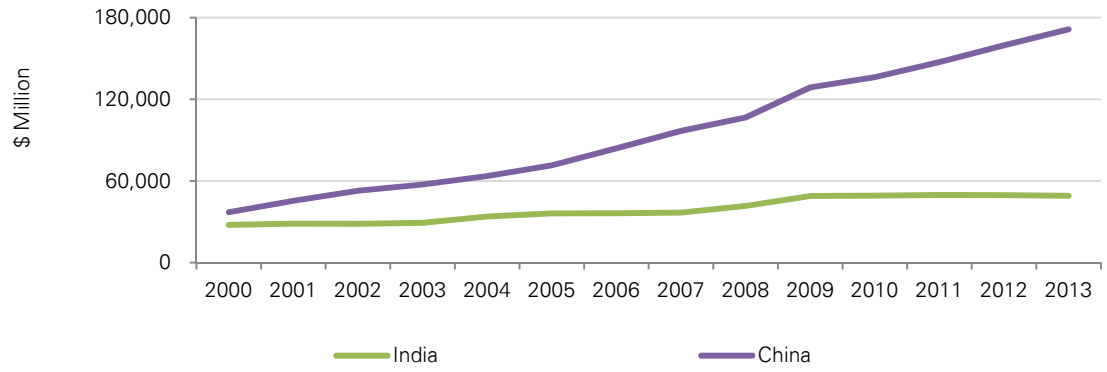
Source: SIPRI Military Expenditure Database, 2014

Globally, not all defence related expenditure is negative. Growth in defence spending in India and China offers potential for Canadian aerospace firms. However, the opportunity in India may be limited as the country works to develop their own capabilities, in which case the opportunity may be for knowledge

[11] Catalyst Corporate Finance: Global Aerospace Sector M&A Update 2012

transfer & process design services. Selling military technology of any kind to China will be complicated to say the least. With this trend as the driving force, commercial aviation is generally perceived to be more attractive than defence/military due to current budgetary pressure in major global markets.

Figure 38:
Military Expenditure for India and China, in Constant US $



Source: SIPRI Military Expenditure Database, 2014

Additionally, defence spending generally has shifted from transformational procurement initiatives to modernization of existing equipment. American and Western European defence agencies are focusing on getting maximum life from platforms already deployed through upgrading, retrofitting and modernization. Looking to developing totally new platforms may be seen as less than cost effective. The F35 program is a high visibility counterpoint to this observation. But, even the F35 program is experiencing difficulties in scaling production up to meet planned production rates primarily due to global economic factors

Ongoing government procurement reforms

Many recent, current and near-future government procurement initiatives are favouring companies as full suite providers of products and services. With respect to aerospace this full suite approach typically involves the procurement of aircraft, pilot and technician training and ongoing in-service support within a single procurement contract.

Demand for Unmanned Aerial Vehicles (UAVs)

The UAV market is a prime area of growth for defence and aerospace companies. The demand for UAVs surged during the US combat operations in Afghanistan and Iraq post 9/11, since they offered a cost-effective way to access distant and dangerous territories to support ground forces. Going forward, despite current and predicted future cutbacks in the US budget, demand for UAVs is expected to grow; not only in the military market, but also in the civil and commercial market as the surveillance technology evolves.

It is expected that UAV spending will nearly double on an annual basis, such that the UAV market will be $91B in 2014.[12] Moreover, it is predicted that the US will account for 65% of total worldwide R&D spending in UAV technology.[13]

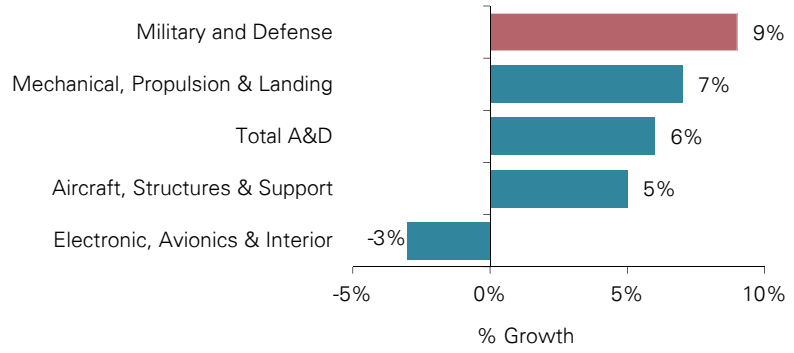
Military will continue to be the largest UAV market, although the commercial applications of UAVs are expected to grow over the next decade. For instance, UAV payloads such as Electro-Optic/Infrared Sensors (EO/IR), radio frequency replacements for EO/IR, Synthetic Aperture Radars (SARs), SIGINT and EW Systems are forecast to double in value from $2.8 in 2014 to $5.6B in 2023.[14]

Global Supply Trends

Increasing consolidation of large defence related suppliers

With shirking markets for their products and constant cost pressures many defence companies may look to consolidation as a path to stability in the near-term. In 2013, the M&A volume in the military and defence sector experienced the largest increase among other sectors in the aerospace industry, driven by a demand for capabilities in defence electronics, UAVs, and satellite systems which are required by next generation military and defence markets.[15]

Figure 39:
Growth in Aerospace Industry Deals in 2013, by Sector



Source: Aerospace and Defence Industry Snapshot – Winter 2014, Stout Risius Ross

As defence companies look to increase their competitiveness in the sector, it will become even more challenging for smaller Canadian aerospace firms to compete in the marketplace.

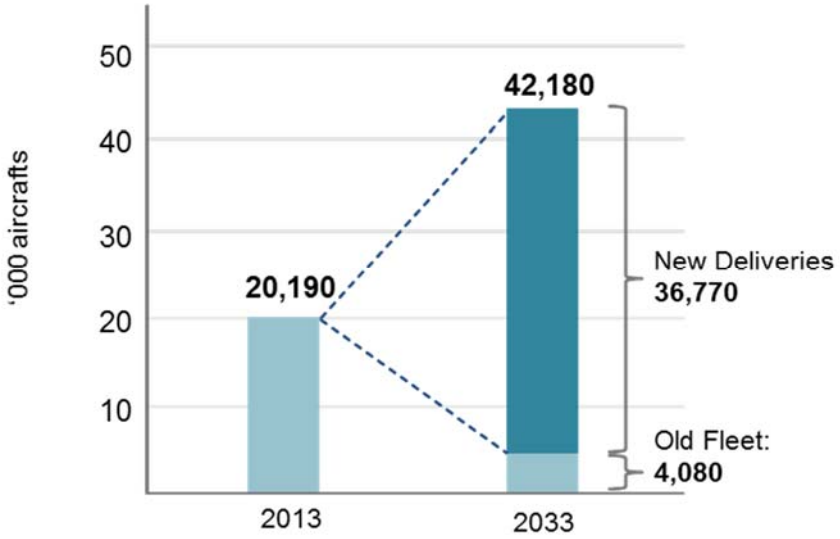
[12] "Teal Group predicts Worldwide UAV Market Will Total $91 Billion in its 2014 UAV Market Profile and Forecast"
[13] Ibid
[14] Ibid
[15] Stout Risius Ross, Aerospace and Defense Industry Snapshot, Winter 2014

6.2 Trends with Specific Implications for BC

6.2.1 Fleet Modernization

Historically, the retirement age of passenger aircrafts has slowly been rising since the 1980s, such that it is 25-28 years today.[16] Some predict that due to the recent economic downturn, as well as the large aircraft order backlog, the average retirement age will move up again in the next couple of years. Over a 20-year horizon however, the demand for greater efficiency will mean that the majority of the current fleet will be retired, comprising only 10% of the total fleet in 2033.

Figure 40:
Fleet Size



Source: KPMG Analysis; Data from Boeing Current Market Outlook, 2014 - 2033

Fuel economy needs in the current commercial aircraft product offering is driving the push not only for modern fuel efficient engines, but also for weight reduction through extensive use of composites and advanced metallics, fly-by-wire and other technologically advanced design features, all with the goal of maximizing efficiency.

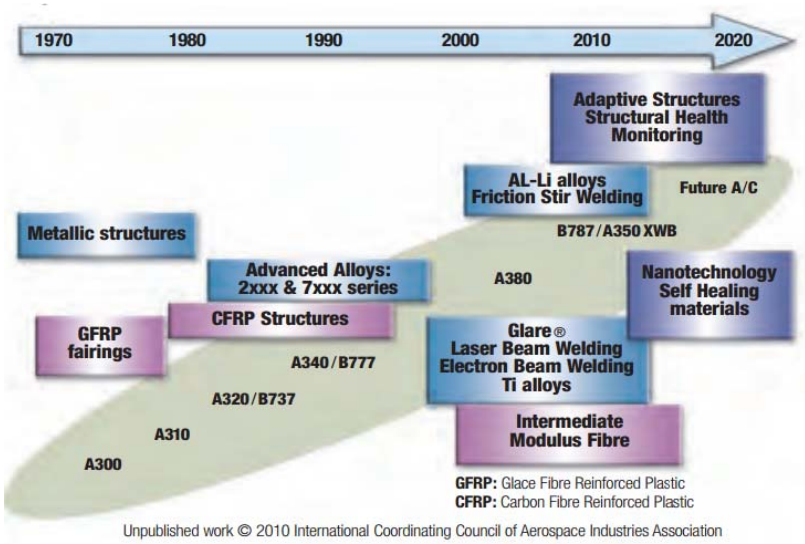
Importantly, demand for new more fuel efficient aircraft is highly correlated with the price of fuel and as such the price of oil. The uncertain nature of the future price of oil creates significant sensitivity in the estimated replacement timeline of less fuel efficient aircraft. If the price of oil decreases and remains low for an extended period of time, demand for new more fuel efficient aircraft is likely to weaken.

Recent years have seen significant advancement in materials technology used in aircraft, specifically the large volume of components making use of composite materials such as carbon and Kevlar and advanced metallics such as titanium and aluminium-lithium. In the 1990s, aircrafts typically employed only 12% of composite materials, whereas the new generation fleet today incorporates close to 25% of advanced

[16] Rolls Royce Market Outlook 2006 - 2025

composites.[17] Platforms such as the 787 and A350 make extensive use of advanced materials creating a leap in aircraft production technology in the past decade.

Figure 41:
Airframe Technology Evolution



Source: ICAO Environmental Report 2010, Aircraft Technology Improvements

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Due to the major technological step change in the materials and technologies used in the latest aircraft platforms, it is likely that derivatives and new platforms will employ similar technologies and materials. It is expected that the new fleet of aircrafts such as the Boeing 787, Airbus A350 and the Bombardier CSeries that will enter the market in the coming years will incorporate a higher share of similar materials (close to 70% composites).[18] Thus, short-term expectations are that another significant leap in materials technology is not likely; rather incremental evolution of existing material technology can be expected.

Implications to BC

Our analysis finds that as much as 80% of the current commercial aircraft fleet will be retired over the next twenty years and replaced with more fuel efficient aircraft. We expect that newer generation aircraft will make much higher use of advanced materials such as composites and advanced metallic, electrical systems will fully replace hydraulics along with other advanced technologies in systems, sensors and propulsion. Materials that we expect to comprise an increasing share of airframe structure include Carbon fibre/ Graphite, Ceramic Fibres, Advanced metallics, such as titanium, aluminum-lithium, CentrAl, and GLARE.

Currently, BC firms are not well equipped to thrive in an aerospace market with advanced components and materials. For example, out of 94 survey respondents only 12 firms reported Composites and Plastics capabilities and 75% of these firms reported revenues of less than $5M. BC has strength in

[17] ICAO Environmental Report 2010: Chapter 2: Aircraft Technology Improvements
[18] Ibid

conventional technologies but generally firms in the manufacturing and MRO sectors have not made a significant shift to the latest technologies in current and near future aircraft production. Increasing the technological sophistication of BC firms could allow them to improve their market positions. There is significant risk that if BC firms fail to adapt to new technologies, the quantity of in-service legacy aircraft that BC firms can serve with existing technology will shrink to an unsustainable point.

6.2.2 Supplier Proximity to Final Assembly /Near-shoring

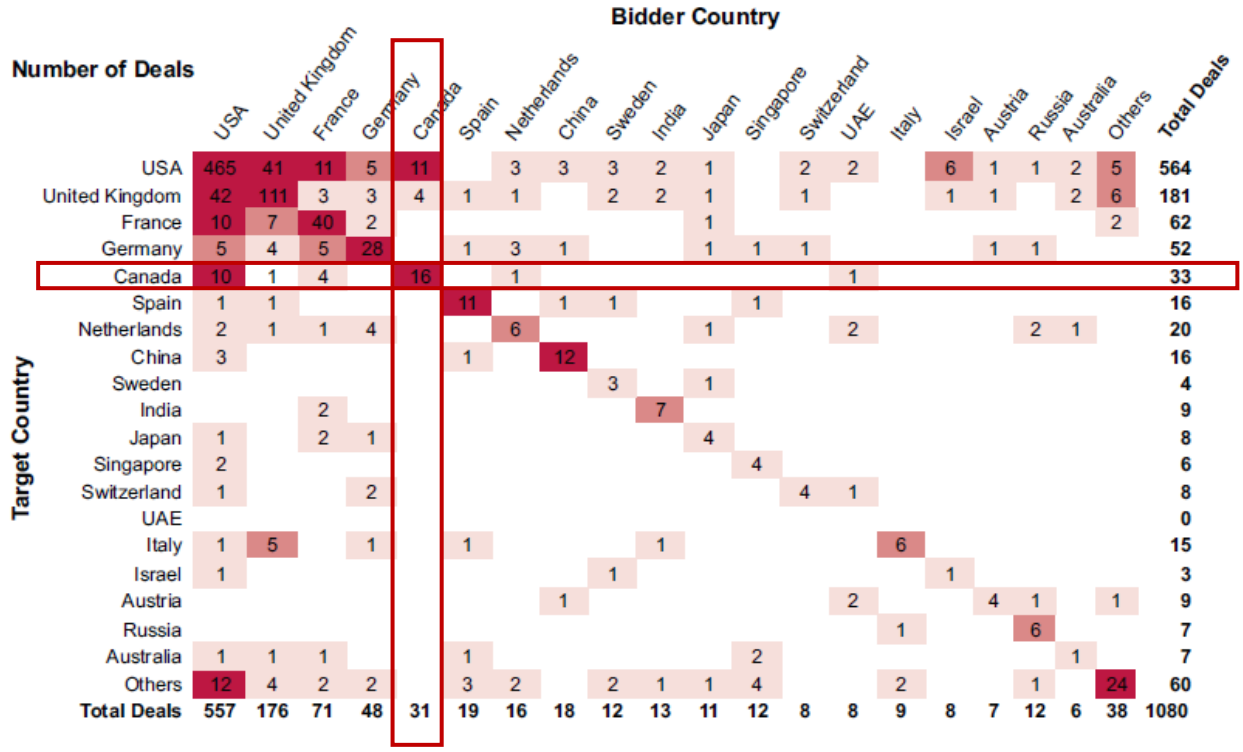
Major OEMs invested heavily in global supply chain diversification in recent decades. The intent of global supply chain diversification was to source components from the most capable, lowest cost producers available. This approach to supply chain planning was effective at reducing direct procurement cost but introduced quality and schedule risk into the supply chain. The initial intent of many of the global supply chain programs was to develop the supply chain in such a way that quality and schedule risk would be mitigated through supplier development programmes. In hindsight many OEMs realized that they had over extended their supply chains and introduced an unacceptable level of risk into their procurement process.

In addition to the increased quality and schedule risk introduced with a highly diversified supply chain, oversight and management of suppliers can become a significant burden that mitigates some of the benefit of the diversified supply chain. From an OEM perspective dealing many suppliers is cumbersome and costly. This has continued with the trend of OEMs pushing larger risk-sharing work packages into the supply chain to decrease OEM management oversight and effort and increases the level of integration for the procured assembly.

In order to mitigate the risk associated with highly diversified supply chains OEMs are exerting pressure on the current supply chain participants to consolidate operations closer to final assembly lines. A case in point is Boeing's acquisition of the South Carolina facility of Vought Aircraft Industries in 2009, which built key fuselage structures for the Boeing 787 Dreamliner. This move spurred the development of an aerospace cluster in the state by recruiting other suppliers to the region; most recently Japan-based composites manufacturer Toray Industries.[19] Recent cross-border aerospace M&A activity also suggests that supply chain consolidation has been geographically concentrated. The majority of acquisitions by aerospace firms in the US and UK have been within North America and Europe. Only 4 deals in China and 2 in India involved inbound acquisitions by firms in North America and Europe, as compared to 16 in Canada, and 8 in Italy and Netherlands.

[19] South Carolina Department of Commerce: Press Release. "Toray selects Spartanburg Country for its business expansion in the U.S.

Figure 42:
Aerospace M&A Heat Map by Country: 2007-2012

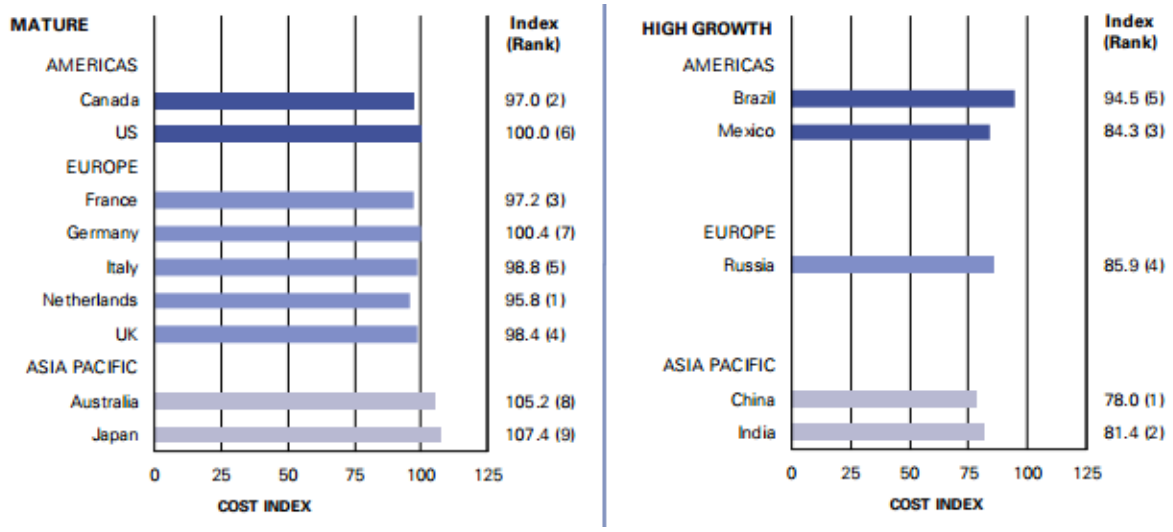


Source: Global Aerospace Sector M&A Update 2012, Catalyst Corporate Finance

User permission pending

In recent years the emergence of legitimate competitors in moderate skilled, low cost markets such and Mexico and Eastern Europe has changed supply chain dynamics in North America and Western Europe. With cost per unit output levels comparable to those in China and India these new competitors represent a serious challenge to Canadian firms.

Figure 43:
Aircraft Parts Manufacturing Cost Index (US = 100)



Source: KPMG; Competitive Alternatives; KPMG's Guide to International Business Location Costs 2012

Implications to BC

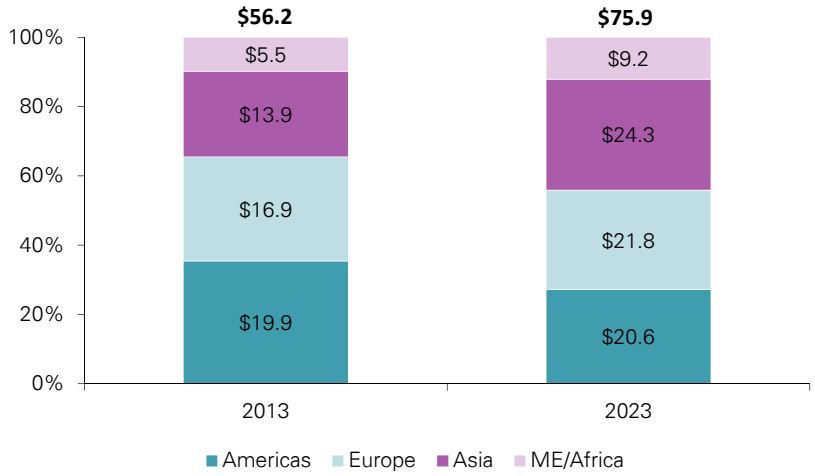
BC's geographic location in close proximity to Boeing final assembly line operations in Washington State as well as one of Boeing's largest supplier groups in Japan is a meaningful competitive advantage and an indelible part of BC aerospace manufacturers' value proposition. A clear advantage for BC firms, the shift towards consolidating parts of the global supply chain for close proximity North American OEMs aligns well with BC's geographic location. Additional benefits of BC firms' proximity to Boeing final assembly lines in Washington State, specifically those BC firms in the lower mainland, include a potential reduction in work in process inventory (WIP) and a simplified supply chain; a meaningful value proposition for a large-scale OEM such as Boeing.

6.2.3 MRO-ISS Service Sector Outsourcing and Competition from OEMs

With the longer in-service life of the current aircraft fleet, the Americas hold the largest share of the MRO-ISS Service Sector market today, ahead of Europe and Asia. However, a reversal of this situation is expected in ten years, given the large-scale replacement of fleet in North America, and the expansion of fleet in Asia.[20] In 2023, Asia will be the largest MRO market in the world, followed by Europe and the Americas. Moreover, airline operators have been out-sourcing MRO activities for many years and this trend continues as airline operators work to keep operating costs as flexible as possible. The high fixed cost of aircraft and the highly volatile fuel market contribute significant risk to operations. Therefore, contracting MRO remains a desirable option for operators in the future as well, adding to the market growth in Asia.

[20] A Time for Renewal: The Global MRO Forecast 2013 – 2023, Team SAI

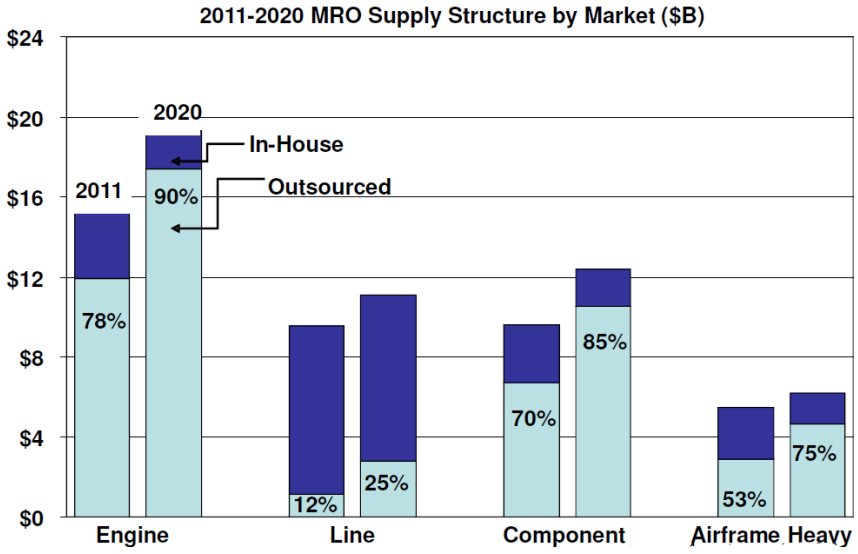
Figure 44:
Market Share by World Region ($ Billion), 2013-2023



Source: A Time for Renewal: The Global MRO Forecast 2013 – 2023, Team SAI

Greater level of outsourcing is expected to occur across the four sub-sectors within the MRO-ISS Service Sector. Line Maintenance is the only segment wherein the majority of operations will be in-house. On the other hand, 75%-90% of work in Engine, Component and Airframe Heavy Maintenance will be outsourced.

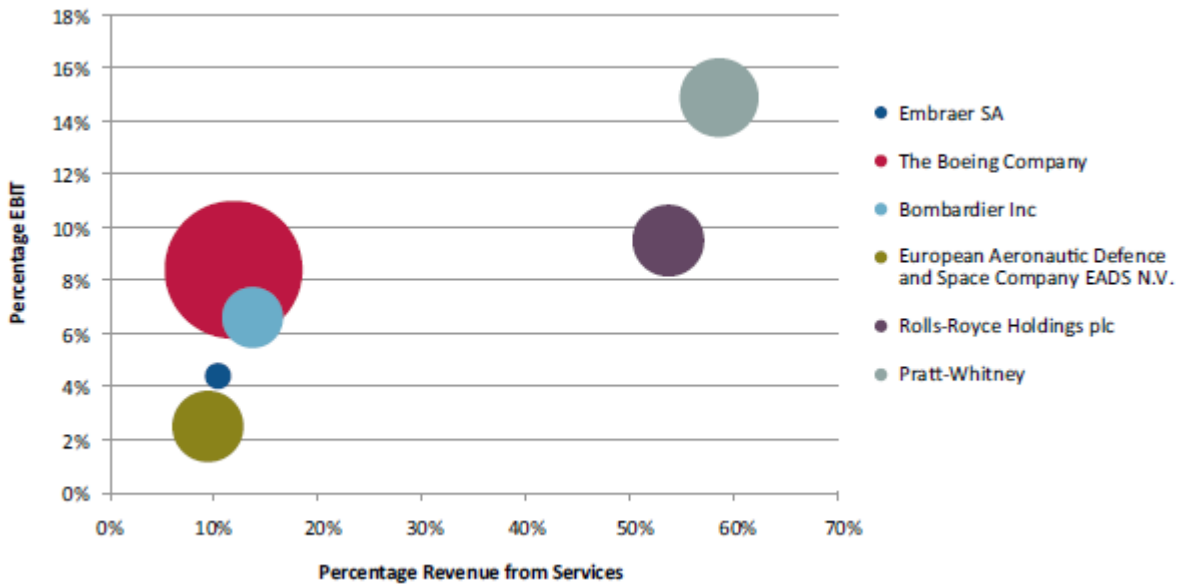
Figure 45:
MRO-ISS Service Sector Outsourcing Forecast by Segment



Source: Trends in Aviation and Impact on MROs, IATA 2011

Aircraft OEMs are under pressure to improve their profit margins, which are typically lower than that of their suppliers as well as that of engine OEMs.[21] As a result, OEMs are seeking to expand their service offering. In this setting, technological advances in the new generation of aircrafts have presented OEMs with an opportunity to penetrate the MRO-ISS Service Sector market. Engine OEMs like Rolls Royce and Pratt-Whitney have already penetrated the engine/ propulsion MRO market, collecting a large portion of their revenues from services, and boosting their EBIT margins.

Figure 46:
Correlation between EBIT margins and proportion of service revenues in selected OEMs



Source: Global Aerospace Sector M&A Update 2012, Catalyst Corporate Finance

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The ability for OEMs to limit access to technical publications and spares is a competitive advantage that independent MRO firms have limited scope to combat. As a result, OEMs are increasingly participating in the MRO market, through integrated contracts with airlines, while many independent MRO firms have entered into agreements with OEMs in efforts to expand their service offerings to newer aircrafts. For instance, Airbus entered into integrated contracts with British Airways, China Southern and Singapore Airlines, and acquired the MRO firms Vector Aerospace and Satair to fulfil these obligations. [22] Similarly, Boeing acquired service parts distributor Availl in a bid to increase its presence in the MRO market, and has invested in an MRO facility in India towards this end as well.[23]

Implications to BC

The MRO-ISS Service Sector market is poised to grow over the next decade, which presents an opportunity for BC – with strong capabilities in MRO-ISS Service Sector relative to the rest of the country – to position itself globally. However, our research shows that aircraft OEMs are expanding in the MRO-ISS Service Sector market by entering into service agreements with airlines at the point of sale. BC firms

[21] Catalyst Corporate Finance: Global Aerospace Sector M&A Update 2012
[22] Ibid
[23] Ibid

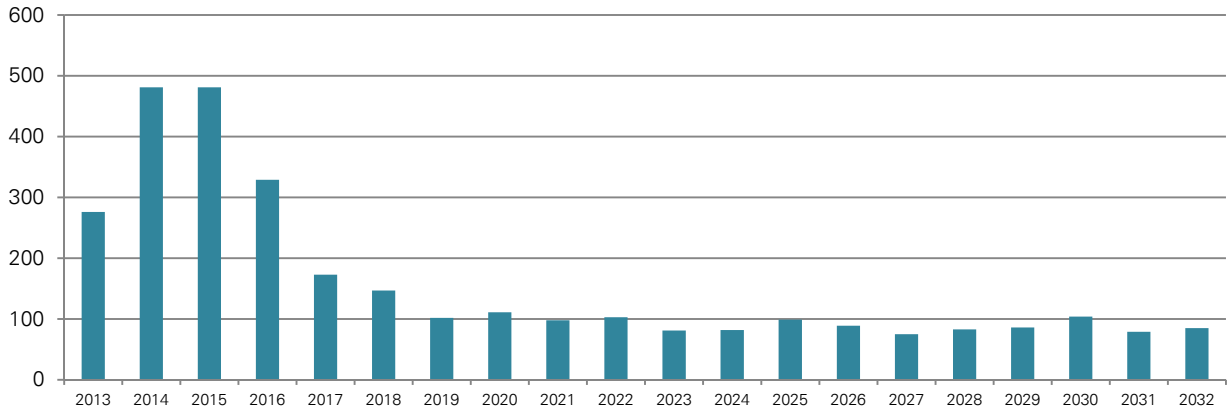
need to invest in long-term strategies today in order to mitigate risks that are posed in the future. It will be important to ensure that BC MRO-ISS Service Sector firms' capabilities are aligned to the current in-service fleet across civil, commercial and military aviation in order to continue servicing the current, ageing fleet of aircrafts. At the same time, it will be just as important to start developing capabilities that are aligned to the next generation of aircrafts, with an eye to identifying areas of growth in light of the OEM expansion in the MRO-ISS Service Sector market.

6.2.4 Emergence of Private Space Services & Growth in Commercial Payloads

Demand for privately funded space launch services for commercial payloads, in particular for commercial satellites continues to grow. It is estimated that in total, 3164 space payloads will be launched over the next 20 years.[24] Most of the proposed spacecrafts to date are due to be launched within the next few years, while less is known about later years.[25] One third of these are for commercial use, wherein the fastest growth is expected to be in the Asia-Pacific region, to meet its growing demand for communications, imaging and navigation services.

Satellite communications systems is one of the largest Space market segments. Future systems will evolve to longer life platforms with flexible payloads to adapt to changing market conditions. These systems will meet the need for additional bandwidth, greater coverage and lower cost. One of the factors driving the demand for commercial payloads is the increasing availability and sophistication of single purpose satellites that are smaller in size and lower in cost than traditional satellites. Further fuelling demand for these small single purpose satellites is the cost of launch services is starting to decrease providing private customers greater access to space assets.

Figure 47:
Space Payloads Proposed for Launch, 2013-2032



Source: Teal Group Press Release, November 2013

[24] Teal Group Press Release: November 2013. "Teal Group Analysis Identify 3164 Space Payloads Proposed for Launch to 2032, with an Estimated Value of More than $235 Billion"
[25] Ibid

Implications to BC

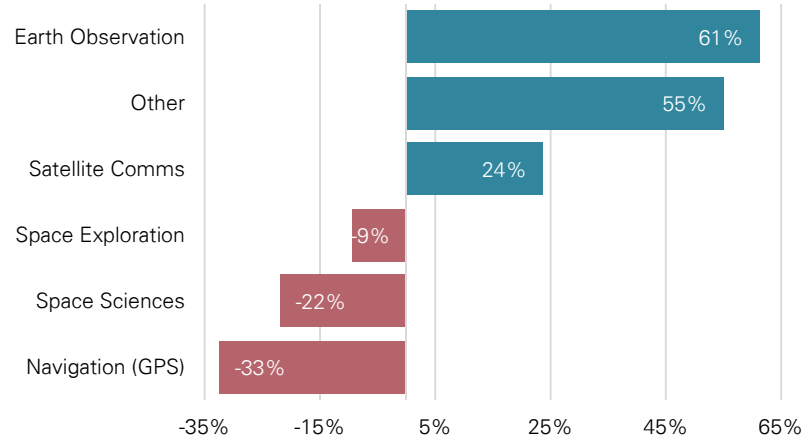
The trend of increasing demand for commercial launch services and the growing demand for smaller more cost efficient satellites aligns well with the capabilities of BC space firms. Within BC the capabilities exist to fully develop satellite systems, from design through to operation once in orbit. Growth in this segment creates downstream benefits with respect to increased demand for data and application services for space based assets, again well aligned with the capabilities of BC space firms. BC is well positioned to drive growth in the space sector based on the capabilities of the few firms in the province and the growth markets in the space sector.

6.2.5 Commercial Market for Earth Observation Services

The space sector is experiencing significant growth in Earth Observation services; both commercially and for public sector. Earth Observation services are primarily focused on the collection, analysis and application of data collected by space based assets. This data is used across a broad range of purposes including monitoring of atmospheric and environmental conditions, use in security and surveillance activities, and natural resource management. Earth Observation is of particular importance in the Canadian North where continued development and resource extraction activities will drive demand for, surveillance, weather forecasting, ice condition monitoring along with satellite communications.

As the space sector continues to evolve there is significant opportunity in the Earth Observation sector as demonstrated by MDA's significant revenue in Oil Services (approximately $40 million annually) and Aeronautical Chart Services (approximately $20 million annually). As noted by the CSA the Earth Observation segment has grown by 61% from 200-2012; more than any other Space segment.

Figure 48:
Percent Change in Revenue by Space Sector of Activity (2008-2012)



Source: State of the Canadian Space Sector, 2012

Implications to BC

BC is home to Space firms that have industry leading capabilities in the Earth Observation sector. The development of space products and services is increasingly being recognized as a vehicle of economic growth. With their use in communications, navigation, and imaging and satellite technologies can create a host of downstream benefits through diverse applications such as climate change

monitoring, natural resource management, traffic management, urban planning, and disaster prevention.[26] Thus, opportunities to deploy innovative technologies in space will create new markets for firms operating in this sector. Currently, BC has a limited number of firms that operate in this sector, but a select group of the firms in this sector are significant industry leaders.

6.2.6 Growth in Virtual Training and Simulation

As the cost of pilot training continues to climb for reasons such as escalating aircraft operating expenses and increasing training duration due to systems complexity, military and civilian operations look to virtual training and flight simulation as lower cost alternatives. It is estimated that in 2012, the virtual training and simulation market for military applications was $9B, and that for the civil aviation market was roughly $3B.[27]

Over the next decade, it is expected that despite the recent budget cuts, the US and European countries will drive the growth of the military virtual training and simulation markets, although the demand for these services will continue to grow in Asia and the Middle East. In the civil aviation sector on the other hand, Asia-Pacific, Middle East and South America will provide significant opportunities for growth, given their growing air traffic demand, and their need for trained pilots.[28]

Growing demand for training and simulation services in Asian markets is demonstrated by BC-based Viking, an aircraft OEM manufacturer that has moved along the value chain to add pilot training services to their product offering through their affiliate Pacific Sky Aviation. In 2010 Viking sold six aircraft to the Vietnamese Navy and as part of the same contract has trained and graduated the first contingent of Vietnamese Navy pilots in 2013 from their Victoria, BC based training centre.

Implications to BC

BC aerospace firms have a strong capability base in flight training and simulation technologies, which puts them in a competitive position to access global markets. Although BC firms may increasingly face competition from technology companies in Asia, South America and the Middle East which are looking to capitalize on the growing demand for trained commercial pilots in the region, BC firms have a history of research and innovation which can be leveraged to develop advanced motion and visual models that more accurately simulate the aviation experience.

6.2.7 Other Aerospace Trends of Note

Factory of the future – automation, interconnected manufacturing value chain

Technical expertise in aerospace manufacturing in BC is an excellent foundation on which to build highly automated and interconnected manufacturing facilities. By starting from a technologically sophisticated base the step to a highly automated production environment is less dramatic thus improving the likelihood of successful implementation.

[26] OECD: The Space Economy at a Glance, 2011
[27] Visiongain: The Military Simulation and Virtual Training Market (2012-2022), and The Civil Aviation Flight Training and Simulation Market (2012 – 2022).
[28] Ibid.

Additive manufacturing/3D printing & Nanotechnology/nano-manufacturing

The lower mainland is well positioned as both an aerospace centre and a technology cluster. The combination of these two industries creates the potential for technological innovation in new production materials and techniques.

Weakness in order book for CSeries relative to expectations

Bombardier's entry into the single aisle aircraft with the CSeries has been weaker than expected. The orderbook for the aircraft has not filled as expected and there have been several major delays to the program. Bombardier appears to be overcoming these early issues anticipates first delivery of the CSeries in late 2015. Though Bombardier has struggled with the CSeries if we take into account business & regional aircraft (Global 7000/8000 & Learjet 85) and view in absolute terms, the outlook for Bombardier and Canadian aerospace appears very positive.

Aircraft health management, new value-added opportunity:

The monitoring of aircraft systems health through software supported predictive/preventative maintenance programs is a growing aspect of OEM aircraft offerings and MRO operations. The effective integration of the software and MRO aspects of this growth industry for airlines that sub-contact maintenance will be an opportunity for firms in the near future.

Growth in MRO demand in new and small markets as airline operators expand to new destinations

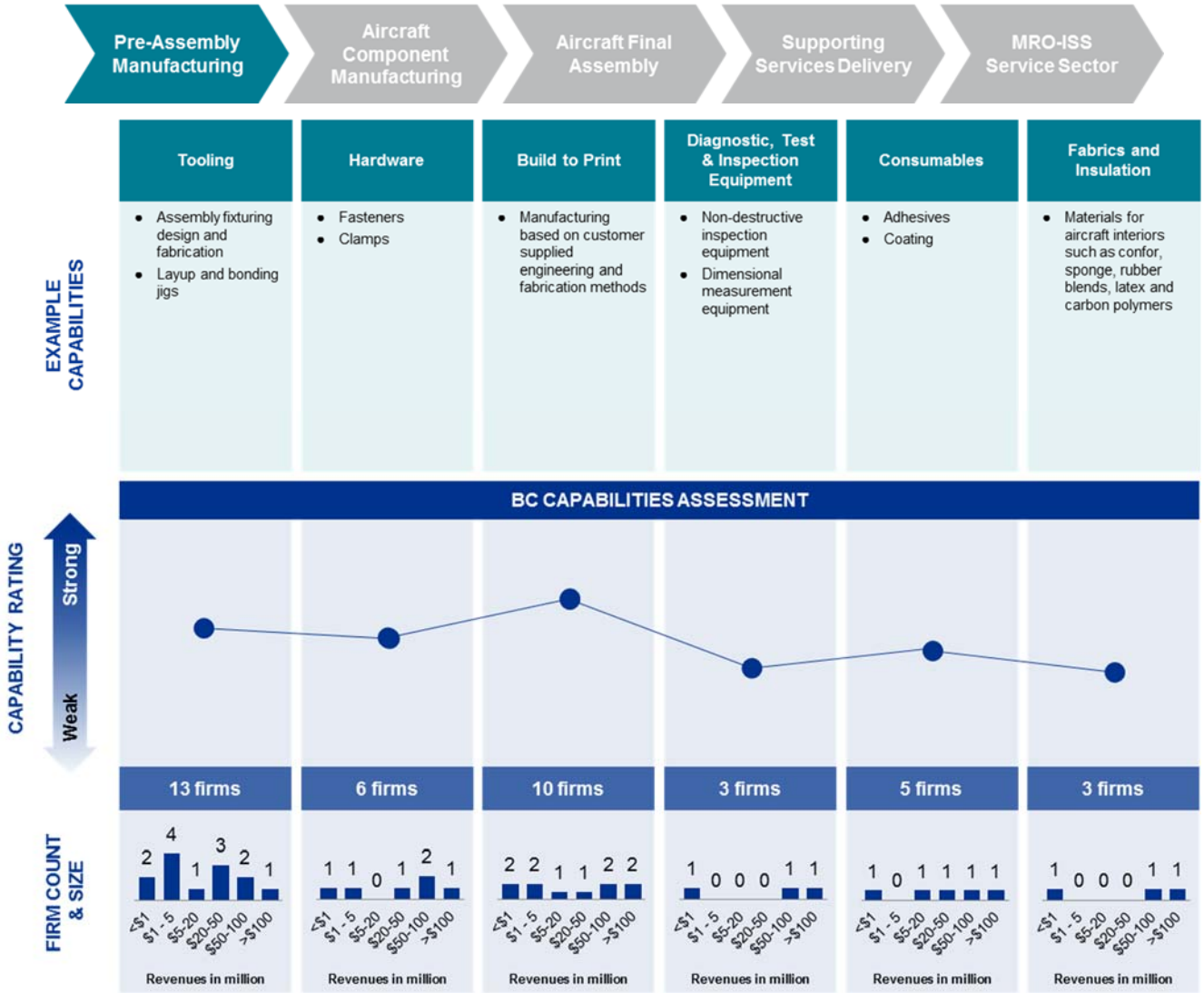
Airline operators, both large established national carriers and small start-up firms, are expanding regular services to new markets in diverse geographies. With the expansion of theatre of operations the need for MRO capabilities in new locations emerges. Again, airline operators are likely to contract out MRO services in these new areas.

Appendix I: BC Aerospace Capabilities – Detailed Mapping

Detailed Mapping: Pre-Assembly Manufacturing

Pre-Assembly manufacturing consists of suppliers and manufacturers that build or provide the physical means of aircraft component production. This sub-sector includes many of the items that facilitate the production of components including tooling design and fabrication; suppliers of hardware, consumables and fabrics; and diagnostic, testing and measurement equipment specialist firms. Generally these firms do not build aircraft components directly, but the products they build or provide facilitate the development of the components.

Figure 49:
BC Aerospace Pre-Assembly Manufacturing Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

	< $1 million	$1-$5 million	$5-$20 million	$20-$50 million	$50-$100 million	> $100 million
Airbus				2		
Boeing		1		2	2	1
Bombardier				1	2	
Lockheed Martin			1	2	2	
Viking			1			1

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Pre-Assembly Manufacturing Capabilities Observations

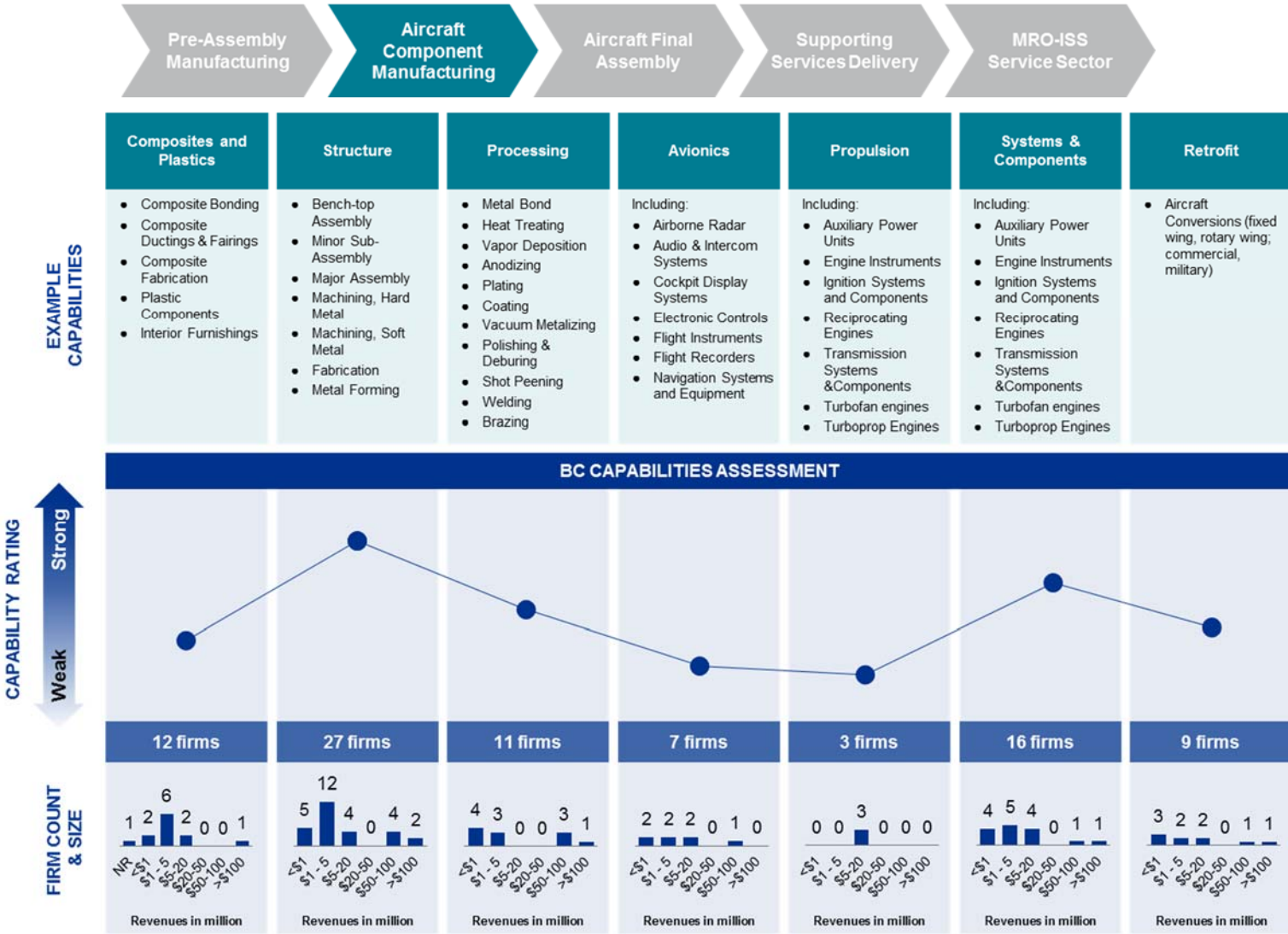
BC has modest capabilities in the pre-assembly manufacturing segment. There are comparatively fewer companies operating in this space (approximately 16), 7 of which report revenues in excess of $20M per year. Within the pre-assembly manufacturing capabilities, particular strengths are Tooling and Built to Print. Of the 16 players, 13 companies report tooling capabilities such as assembly fixturing design and fabrication and layup, and bonding jigs. Half of these companies generate revenues in excess of $20M per year. There are also 10 companies reporting build to print capabilities, 5 of which generate revenues higher than $20M per year.

Only 3 companies in our survey have reported Fabrics and Insulation capabilities, such as confor, latex and carbon polymers. Similarly, only 3 companies have reported diagnostic, test and inspection equipment capabilities.

Detailed Mapping: Aircraft Component Manufacturing

Aircraft Component Manufacturing consists of firms that transform various production inputs into a broad range of components, sub-assemblies, or assemblies. These firms function at numerous levels of complexity, scale and scope but the common link in the production of physical items for use on production aircraft. Aircraft Component Manufacturing firms span aerostructures, the shell of the aircraft; to avionics; the electrical and mechanical components that allow the aircraft to manoeuvre through the air; to propulsion systems, providing forward movement for flight.

Figure 50:
BC Aerospace Aircraft Component Manufacturing Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

	< $1 million	$1-$5 million	$5-$20 million	$20-$50 million	$50-$100 million	> $100 million
Airbus		7				
Boeing	4	8	1		3	1
Bombardier	1	4			3	
Lockheed Martin	1	3	2		3	
Viking	5	4	1			1

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Aircraft Component Manufacturing Capabilities Observations

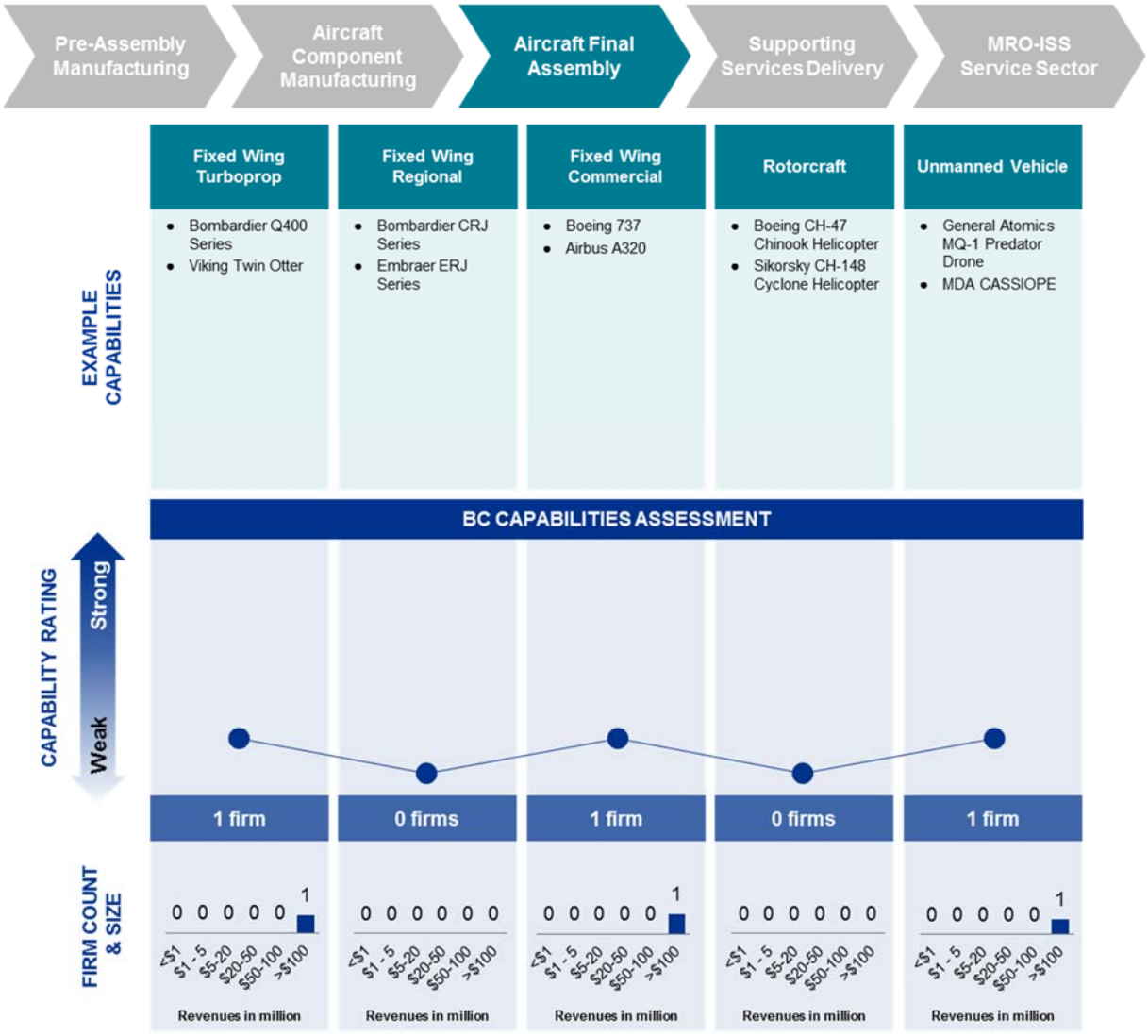
A large number of firms participate in Aircraft Component Manufacturing in BC, with at least 50 companies reporting capabilities in this area (about half of the survey respondents). On initial inspection this could be considered a strength of the BC aerospace industry but we must note that many of the firms are small and few large anchor firms are present, with only 7 firms reporting revenues over $20M per year. The small size of firms can be a serious limitation in the aerospace manufacturing sector where scale is critical to securing significant statements of work. Within Components manufacturing, BC's capabilities are strongest in the Structure segment, with 27 companies reporting capabilities, 6 of which generate revenues in excess of $50M per year.

While there are 16 companies manufacturing various Systems and Components, the vast majority are small, with only 2 reporting revenues in excess of $20M per year. BC's capabilities in Propulsion and Avionics appear to be relatively weak.

Detailed Mapping: Aircraft Final Assembly

Aircraft Final Assembly typically consists of an OEM aggregating components required for production of a complete aircraft and assembling the components in a modular fashion on a large production line. Final assembly of an aircraft is a large scale operation and is one of the most complicated and intricate tasks any aerospace firms faces. The specific nature of the final assembly process varies considerably across aircraft type but the concept and major tasks associated with final assembly of an aircraft are relatively consistent across aircraft types.

Figure 51:
BC Aerospace Aircraft Final Assembly Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

	< $1 million	$1-$5 million	$5-$20 million	$20-$50 million	$50-$100 million	> $100 million
Airbus						
Boeing						
Bombardier						
Lockheed Martin						
Viking						1

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Aircraft Final Assembly Capabilities Observations

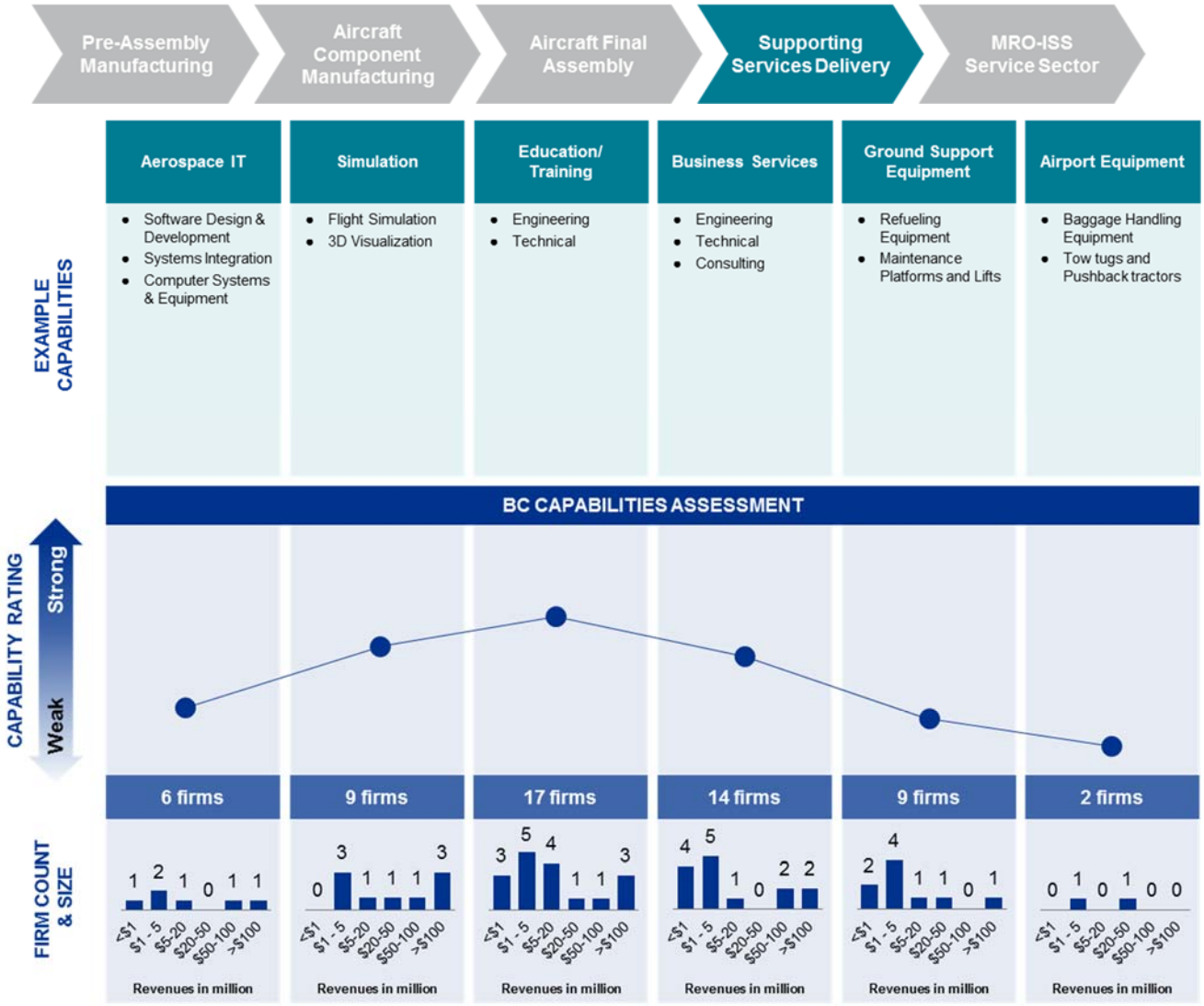
British Columbia is home to an aircraft final assembly OEM and a Space sector OEM. The existence of any final assembly capability in the province is of critical importance to the aerospace ecosystem and BC being home to two OEMs is a meaningful advantage. Benefits typically associated with the presence of tier 1 integrators and OEMs include stimulating industrial clustering due to closer proximity to BC suppliers, promoting technology transfer to BC, higher investments in R&D, development and attraction of senior leadership talent, attraction of capital investments, higher economic impact through demand for ancillary services (e.g. advisory, audit, tax, communications, legal, etc.) and raising the profile of the jurisdiction in the global aerospace market.

Over the long run, BC will benefit from attracting tier 1 integrators or OEMs to the province to create sufficient critical mass of anchor firms to support a highly capable aerospace ecosystem. If BC fails to attract additional tier 1 integrators or OEMs to the province there will likely be a limiting effect on the growth prospect of the aerospace industry in BC.

Detailed Mapping: Supporting Services Delivery

Support services consist of two major groups. First we have technical and training support services for aerospace production and MRO-ISS Service Sector firms. These services consist of aerospace specific engineering, consulting, and IT support for industry firms. Aerospace is significantly unique from other industries in many aspects and thus requires specialized support services. The second aspect of support services is focused on aircraft operation. These services involve pilot and technician training, education and flight simulation. Additionally, ground support equipment is also included in supporting services as a key part of aircraft operations.

Figure 52:
BC Aerospace Support Services Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

	< $1 million	$1-$5 million	$5-$20 million	$20-$50 million	$50-$100 million	> $100 million
Airbus	1	4		2		1
Boeing	1	5	1		1	1
Bombardier	1	2	1			1
Lockheed Martin	1	3	1			1
Viking	2	1	2			2

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Supporting Services Delivery Capabilities Observations

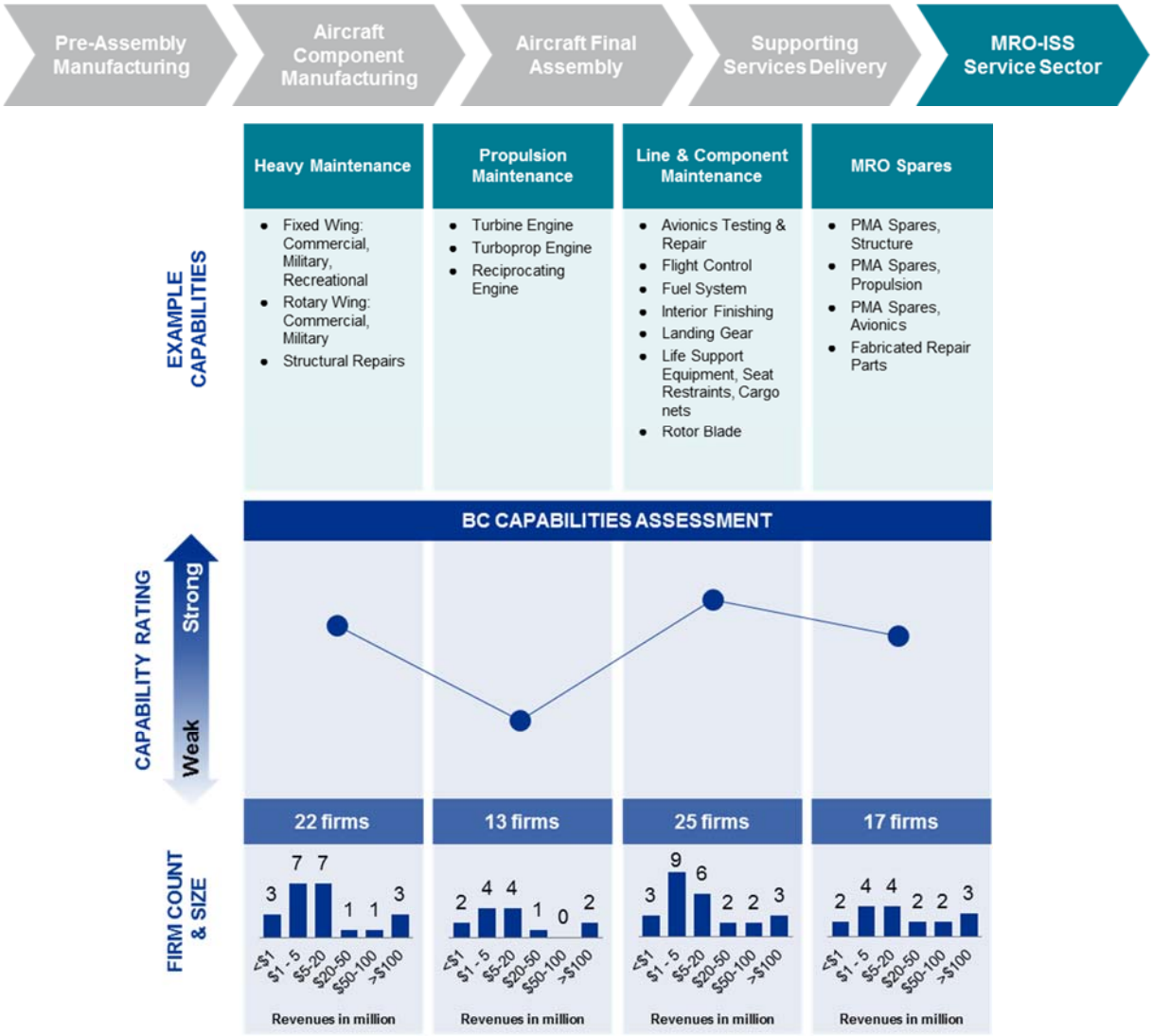
Compared to other segments of the value chain, BC's capabilities in supporting services delivery are relatively strong. There are 33 firms reporting capabilities in this area (likely more among non-respondents), 8 of which report revenues in excess of $20M per year. Within supporting services, education and training stand out as the strongest capability areas, with over 17 firms operating in this space, followed by business services with 14 firms and simulation with 9 firms. In each of these areas there are at least 4 companies reporting revenues in excess of $50M per year. Given the relatively niche nature of simulation services, BC firms represent a significant capability in the Canadian market.

While many of the companies in the supporting services sector are small, the size of firms in this category is not as detrimental as it is in the Aircraft Component Manufacturing category. Support services firms typically do not need scale to take on risk sharing type contracts making small firm size a less significant issue.

Detailed Mapping: Maintenance, Repair and Overhaul

Maintenance, Repair and Overhaul consists of firms that complete various forms of maintenance on in-service aircraft such as line maintenance, regular inspection and maintenance, overnight checks; propulsion maintenance, specialized work focused on the engine(s) of the aircraft; heavy maintenance, consisting of major overhauls and/or refits to aircraft and MRO spares, replacement parts and repair kits for aircraft maintenance.

Figure 53:
BC Aerospace MRO Capabilities Assessment



Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

	< $1 million	$1-$5 million	$5-$20 million	$20-$50 million	$50-$100 million	> $100 million
Airbus		6	1	2		2
Boeing		2			1	1
Bombardier		1			1	1
Lockheed Martin		1	2		1	1
Viking	1		1			2

Source: KPMG Analysis of KPMG BC Aerospace Industry Capabilities Survey

Maintenance, Repair and Overhaul Capabilities Observations

Consistent with the findings of our macro-economic analysis the MRO-ISS Service Sector stands out as a key strength within the BC aerospace ecosystem. There are 34 firms reporting capabilities in this category, 9 of which report revenues in excess of $20M, and 4 of which report revenues in excess of $100M. An area of particular capability strength is Line and Component maintenance, in which there are 25 firms reporting capabilities such as avionics testing and repair, flight control, fuel systems, interior finishing, landing gear, rotor blade, and life support equipment. Seven of these companies report revenues in excess of $20M per year.

There are also 22 firms reporting Heavy maintenance capabilities. While this is a significant number of firms, many of them are small (at least 10 with revenues less than $5M per year). As with Aircraft Component Manufacturing scale can be an important aspect of Heavy Maintenance MRO-ISS Service Sector, where firms often need to be of sufficient scale to take on risk-sharing type contacts.

Also of note is the relatively few firms participating in propulsion maintenance (approximately 13), about half of which report revenues of less than $5M per year.

Appendix II: Data Sources

Data Source and Age	Summary
Industry Canada 2011 data	A special dataset has been developed by Industry Canada, which has been extracted from tax files and business registry databases. Given the source of the data, this information is not publically available. The dataset has been created by using the business registry database to select firms within the aerospace industry. This dataset therefore includes firms which the Statistics Canada NAICS system does not include within the aerospace industry codes 336410 and 488190. With access to the revenues and expenditures of each firm within the aerospace industry in the country, Industry Canada is able to capture significant aerospace firms in the electronics, avionics and space sectors (such as MDA, CAE, and pure Avionics firms) which are missed by both 336410 and 488000. The information for these firms is often embedded in a diverse set of NAICS codes such as Telecommunications and Equipment, Machining, Industrial Electronics etc. which are not specific for the aerospace industry, thereby making it difficult to develop a complete statistical portrait of the aerospace industry. Further, this dataset presents a comprehensive, highly reliable portrait of the aerospace industry by province. The data on economic performance indicators such as revenues, GDP, employment, exports and R&D has been extracted from tax files at the establishment level, and therefore accurately attributes the output, employment etc. to the appropriate provinces. Statistics Canada NAICS industry data on the other hand, does not achieve this level of granularity, and would therefore attribute revenues from the BC operations of a firm headquartered in Ontario to Ontario rather than BC. For these reasons, this information is comprehensive and highly reliable, and was unavailable at the time of the national analysis conducted by AIAC in 2010. It is our belief that this data provides the most accurate picture of the aerospace industry in BC. Our analysis using Industry Canada data enables comparability to national analyses such as the annual State of the Aerospace Industry in Canada series by AIAC and Industry Canada.

Appendix III: Economic Impact Analysis Methodology

Economic Impact Definitions

We have quantified the economic impact of the Aerospace Industry in BC across two key dimensions: GDP and Employment. We present our working definition of these below.

Gross Domestic Product (GDP)

GDP is the "total unduplicated value of goods and services produced in the economic territory of a country or region during a given period"[29]. GDP includes household income from current productive activities (wages, salaries and unincorporated business income) as well as profits and other income earned by corporations. In the context of our study, GDP serves as a measure of the total value-added production in BC resulting from the operation of the aerospace industry in BC.

Employment

In our study we measure the employment impact in terms of full-year equivalent positions for ongoing employment (i.e. employment impact associated with annual expenditures). Full-year equivalent positions are counted according to their duration and not according to whether they were full-time or part-time. Accordingly, an individual who is permanently employed for the entire year in a part-time capacity (e.g., hotel service staff, seasonal labour) represents one full-year equivalent job or position.

Our economic impact estimates capture three main transmission mechanisms – direct impact, indirect impact and induced impact. We present our working definition of each type of impact below.

Direct Economic Impact

Direct economic impact is the total amount of additional expenditure within a defined geographical area (BC) that can be directly attributed to activity within the aerospace industry. Direct economic impact represents the deliveries by domestic industries and imports necessary to satisfy final demand expenditures on products and services. An example of a direct economic impact is the GDP and employment created directly by the operations of an aerospace firm in BC.

Indirect Economic Impact

Indirect economic impacts are the upstream activities associated with supplying intermediate inputs (the current expenditures on goods and services used up in the production process) to the aerospace industry. An example of an indirect economic impact is the purchase of goods and services (such as uniforms, utilities, office equipment etc.), that aerospace companies make to meet their plant's needs.

[29] (Statistics Canada - Industry Accounts Division, System of National Accounts, 2009)

Induced Economic Impact

Induced economic impacts are an estimation of the production and imports associated with the spending of wages on consumption. An example of an induced economic impact are the employees of an aerospace firm or its suppliers purchasing goods and services (at a household level) with their earnings. Induced economic impacts, while having a significant effect on the Canadian economy, are difficult to forecast accurately and are sometimes not considered when evaluating a specific activity's economic benefit.

Economic Impact Methodology

Economic Impact Analysis typically involves the use of industry impact multipliers developed from previous runs of a statistical input-output model of the economy. The input-output model maps the demand and supply relationships between the various sectors within the economy, and between the different labour requirements of each industry. Using this model, the direct, indirect and induced impacts of an industry can be estimated by simulating an output shock of that industry and estimating the value of the additional goods, services and labour that would be needed to meet the demand.

In the case of the aerospace industry, there is no single industry classification within the North American Industry Classification System (NAICS) that comprehensively captures all relevant sub-sectors. For this reason, there is no single set of economic impact multipliers that perfectly reflect the impact of the aerospace industry provincially or nationally. Due to this limitation, KPMG sourced two distinct sets of multipliers and developed a range of economic impact estimates for the aerospace industry in BC:

- **Statistics Canada Multipliers – BC-specific but not Aerospace Industry-specific**
  Statistics Canada has developed an input-output model of the economy using the NAICS standard industry classification system. Based on our consultations with Statistics Canada, Industry Canada, AIAC and Export Development Canada we identified two NAICS codes that together would account for the vast majority of firms in BC:
  - 336410 – Aerospace Products and Parts Manufacturing (represents firms in the Manufacturing Sector)
  - 488190 – Support Services for Air Transportation (represents firms in the MRO sector).

  Industry multipliers are not available at this 6-digit level of detail. This is particularly problematic for the MRO sector code, which is available only at the 3-digit level (488000 – Support Services for Transportation) and includes MRO firms in all forms of transportations such as rail, trucks etc. Therefore, these multipliers, although BC-specific, are not ideal since they are not aerospace industry-specific. They therefore serve as the lower bound in the majority of our analysis, since they are not based on a complete profile of the aerospace Industry.

- **Industry Canada Multipliers – Aerospace Industry-specific but not BC-specific**
  Using information contained in the business registry and tax file databases, Industry Canada has developed an input-output model that is specific for the aerospace industry in Canada. With access to the revenues and expenditures of each firm within the aerospace industry in the country, Industry Canada is able to capture the impact of not only those firms involved in aerospace manufacturing and MRO, but also, the impact of significant firms within the Space, Avionics and Simulation sectors (such as MDA) which are missed by both 336410 and 488000, and captured under a diverse set of

NAICS codes such as Telecommunications and Equipment, Machining, Industrial Electronics etc. which are not specific for the aerospace industry.

These multipliers, although aerospace industry-specific, are less than ideal since they are not BC-specific. These multipliers therefore serve as the upper bound in the majority of our analysis, as they capture the total impacts of the BC aerospace industry (both within BC and outside the province), whereas Stats Can multipliers capture only those impacts that occur within BC.

Appendix IV: Industry Capabilities Mapping Methodology

Identification of Aerospace Firms in BC

At the time of this analysis, no single source of data identified a comprehensive list of companies that operate within the aerospace sector in BC. KPMG leveraged local industry insights as well as national and provincial databases to identify 161 that are part of BC's aerospace ecosystem. Specifically, we consulted industry leaders within the AIAC Pacific Steering Committee, the BC Ministry of International Trade – Export Development, and Industry Canada to develop an initial list of aerospace companies in BC. Further, we used the Canadian Company Capabilities database managed by Industry Canada to identify additional firms reporting capabilities in aerospace, which were not captured during the initial consultative meetings with Industry. We cross-referenced our list against published reports and data from sources like Industry Canada, Export Development Canada, and AIAC, to ensure that we develop a comprehensive and inclusive list of firms to which the capabilities survey would be administered.

Breakdown of Capabilities

To assess the specific capabilities of firms, we developed a sector breakdown of the aerospace industry at three levels of detail, as described in **Section 1. BC Aerospace Capabilities Mapping**. To develop this breakdown, KPMG synthesized the industry breakdown methodologies that are currently in use by AIAC, Export Development Canada, and Industry Canada.

Survey Administration and Response Rate

Our capabilities survey – which assessed the specific capabilities of the firms within the BC aerospace value chain, was treated like a census, and administered to each of the 161 firms that were identified by KPMG. The list was classified into a priority list of 26 firms and a separate list of 131 firms. The priority list was built based on consultation with the AIAC steering committee, such that their operations represented the vast majority of the industry's revenues, GDP and employment in the province.

We achieved an overall response rate of 58%, with 100% response rate for the priority 26 firms, and 51% response rate for the remaining 131 firms.

Survey Data Analysis

We assessed the strengths and weaknesses across each of the aerospace sub-sectors based on the number of firms reporting specific capabilities, and their size as measured by annual revenues. Our analysis is designed to capture the BC aerospace industry's strengths by capability, rather than by firm. That is, if a firm reports capabilities in three distinct categories, that firm will be counted in the total number of firms reporting capabilities in each of those three categories. To develop an assessment of the strengths and weaknesses by capability, a weight was assigned for each revenue bucket, and this weight was used to aggregate the total number of firms reporting each capability.

Appendix V: Current IRB Obligations for Canadian Defence Procurement Contracts

Prime Contractor	Project	Total Value	Outstanding Obligation
Lockheed Martin	Airlift Capability Project - Tactical (ACP-T)	$2.4B	Acquisition: 10% ISS 10-15%
Cassidian	Area Surveillance Radar/ Secondary Surveillance Radar (ASR/SSR)	$65M	25 - 40%
Cascade	CC130 Primary Air Vehicle - Optimized Weapon System Support	$438M	>40%
TBD	CC130/CP140 Propulsion Group - Optimized Weapon System Management	TBD	TBD
Lockheed Martin	CF-18 AMIRS Acquisition—Advanced Multi-Role Infrared Sensor	$132M	<10%
Lockheed Martin	CF-18 AMIRS ISS—Advanced Multi-Role Infrared Sensor	$22M	25-40%
Raytheon	CF-18 Defensive Electronic Warfare	$80M	<10%
L-3 Mas	CF-18 Primary Air Vehicle (PAV) — Optimized Weapon System Support (OWSS)	$333M	<10%
Harris Canada	CF-18 Avionics — Optimized Weapon System Support (OWSS)	$300M	>40%
TBD	CF-18 Engines — Optimized Weapon System Support (OWSS)	TBD	TBD
TBD	Contracted Airborne Training Services (CATS)	TBD	TBD
Lockheed Martin	CP 140 ASLEP (Aurora Structural Life Extension Project)	$264M	33%
Thales Canada	CP 140—CMS—Communication Management System	$98M	0%
General Dynamics Canada	CP 140—DMS—Data Management System	$359M	0%
MDA	CP 140—IR (Imaging Radar)	$306M	30%
IMP Group Limited	CP 140 Aurora SSC—System Support Contract—Airframe	$345M	0%
L3 Communications Electronics Systems	CP 140 Aurora SSC—System Support Contract—Avionics	$240M	30%
TBD	FWSAR	TBD	TBD
MDA	Joint Space Support Project (JSSP)	Acquisition: $27M ISS: $10.8M	25-40%

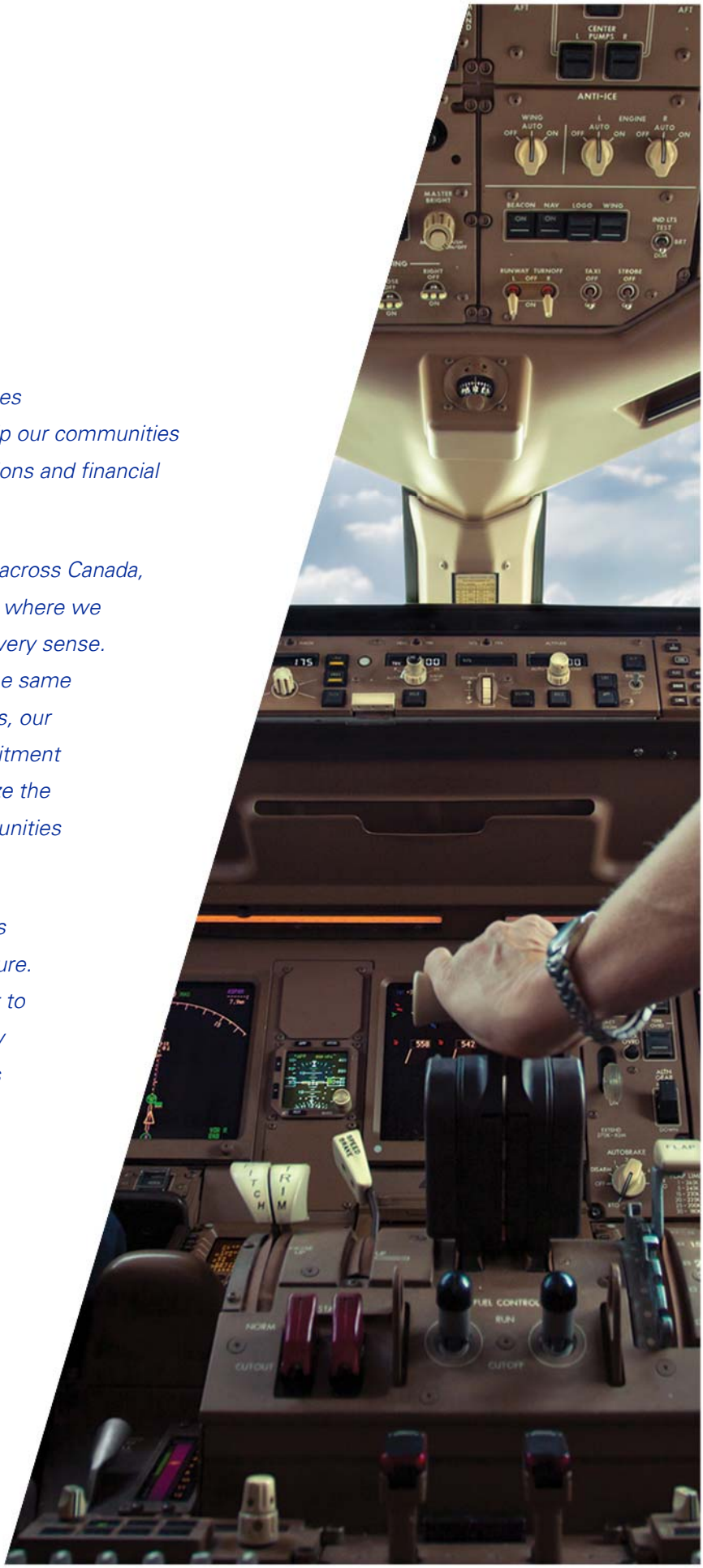
Prime Contractor	Project	Total Value	Outstanding Obligation
TBD	JUSTAS (Joint Uninhabited Surveillance and Target Acquisition System)	TBD	TBD
Sikorsky International Operations, Inc.	Maritime Helicopter Project (MHP)	Acquisition: $2B ISS: $2.7B	Acq: <10% ISS: <10%
Boeing	Medium-to Heavy-Lift Helicopter (MHLH)	$1.6B	10% to 25%
MDA	NOCTUA Project	$119.5M	10% to 25%
CAE Inc.	OTSP (Operational Training Systems Provider)	$580M	CC-130J tranche: Between 10% to 25% CH-147F tranche: Between 10% to 25%
Raytheon Canada	Protected Military Satellite Communication (PMSC)	$50M	< 10%
Boeing	Small Unmanned Aerial Vehicle Project (SUAV)	$106M	< 10%
Boeing	Strategic Airlift	Acquisition: $749M ISS: US$746M	Acquisition: < 10% ISS: > 40%
Pratt & Whitney	Strategic Airlift - Engines	$150M	10% to 25%
Thales Canada	Tactical Control Radar Modernization - TCR	$52.7M	10% to 25%
Bell Helicopters Textron Canada Ltd.	Utility Tactical Transport Helicopter (UTTH) Optimized Weapon System Management (OWSM)	$640M	25% to 40%

At KPMG Our Communities Matter

As one of Canada's leading professional services firms, we have an incredible opportunity to help our communities thrive by engaging our skills, knowledge, passions and financial resources to make a real difference.

As a firm with locations in more than 30 cities across Canada, we are actively connected to the communities where we operate – as a business, as an employer – in every sense. The issues that impact our communities are the same issues that impact our people and their families, our clients and our operations. So making a commitment to having a positive impact is how we recognize the significance of our relationship with the communities where we operate and live.

Being actively engaged in our communities has always been an important part of KPMG's culture. In 2009, we elevated our existing engagement to a whole new level by incorporating Community Leadership as one of the four key components of our overall business strategy.



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