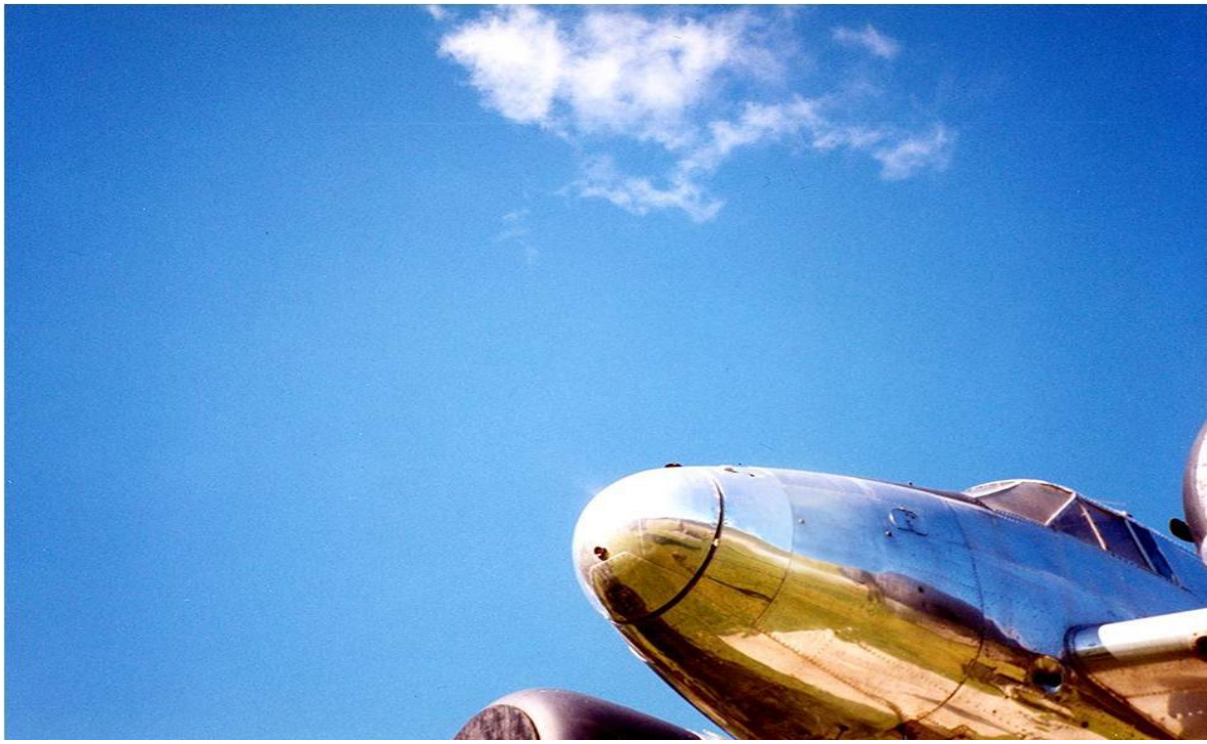
Deloitte.



Profile of the Canadian Aerospace Industry:

Analysis of the 2009 AIAC Annual Survey

October, 2010
AIAC Phase 1 Report

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1 Glossary of terms

Abbreviations	
A&AP	Aircraft & Aircraft Parts
A&ES	Avionics & Electro Systems
AIAC	Aerospace Industries Association of Canada
BE-LF	Break-Even Load Factor
BRIC countries	Brazil, Russia, India, and China
CAGR	Compound Annual Growth Rate
CAS	Civil Aerospace Sector
Category I members	The second largest (in terms of revenue per company) of the three strata of AIAC direct members analyzed as part of this study
Category II members	The smallest (in terms of revenue per company) of the three strata of AIAC direct members analyzed as part of this study
CDDP	Canadian Department of Defence Production
COMAC	Commercial Aircraft Corporation of China, Ltd.
CFI	Canadian Foundation for Innovation
CRIAQ	Consortium for Research and Innovation in Aerospace in Quebec
Deloitte	Deloitte & Touche LLP
DoD	US Department of Defense
E&EP	Aircraft Engines & Engine Parts
EDC	Export Development Canada
FTK	Revenue per Tonne of Freight
GARDN	Green Aviation Research & Development Network
GDP	Gross Domestic Product
GEO	Geosynchronous-Earth Orbit
IATA	International Air Transport Association
IMF	International Monetary Fund
ISS	International Space Station
ITAR	International Traffic in Arms Regulations
“large companies”	Respondents to the 2009 AIAC Annual Membership Survey with revenues greater than C$15 million
LCA	Large Commercial Aircraft
LCC	Low Cost Carriers
LEO	Low-Earth Orbit
M&A	Mergers & Acquisitions
MA&D	Military Aerospace & Defense
MAS	Military Aerospace Sector
MRO	Aircraft Maintenance, Repair & Overhaul

Abbreviations	
MTOW	Maximum Take-Off Weight
NRC-IRAP	National Research Council Industrial Research Assistance Program
NSERC	Natural Sciences & Engineering Research Council of Canada
Other AP&S	Other Industry Related Products & Services
PPE	Property, Plant, & Equipment
Provincial members	The fourth strata analyzed as part of this study, consisting of companies belonging to aerospace industry provincial associations
R&BA	Regional & Business Aircraft
R&D	Research & Development
RPK	Revenues per Passenger Kilometres
SADI	Strategic Aerospace & Defence Initiative
SIPRI	Stockholm International Peace Research Institute
“small companies”	Respondents to the 2009 AIAC Annual Membership Survey with revenues less than C$15 million
Special Category members	The largest (in terms of revenue per company) of the three strata of AIAC direct members analyzed as part of this study
SR&ED	Scientific Research & Experimental Development Program
“survey respondents”	Respondents to the 2009 AIAC Annual Membership Survey
SWOT	Analysis of Strengths, Weaknesses, Opportunity, & Threats
the AIAC Survey	the 2009 AIAC Annual Membership Survey
UAC	United Aircraft Corporation
UAV	Unmanned Aerial Vehicles
US	United States
YoY	Year-over-Year

2 Introduction

Deloitte & Touche LLP ("Deloitte") was retained by the Aerospace Industries Association of Canada ("AIAC") to assist in analyzing the contribution of the Canadian aerospace industry to the Canadian economy. This analysis consists of three related but distinct phases and corresponding reports:

- Phase 1: provides a synopsis of the Canadian aerospace industry based on a statistical analysis of the 2009 AIAC annual membership survey ("the AIAC Survey"). This report also includes a discussion of the membership's outlook for the sector.
- Phase 2: evaluates the contribution of the aerospace industry to the Canadian economy by quantifying the direct, indirect, and associated impacts of the aerospace industry on measures such as expenditure and investment, employment, and gross domestic product ("GDP"). This report uses macroeconomic and sectoral data, including the AIAC Survey results from Phase 1, to parameterize Deloitte's input-output model and generate numerical results. To further highlight the different ways in which the socioeconomic impacts of the aerospace industry can be felt in the broader economy, this report also presents four case studies drawn from specific development programs in the aerospace industry.
- Phase 3: provides a 10 year market growth forecast and competitive analysis for the global aerospace industry. This report includes a global market analysis, an analysis of external market drivers as well as an analysis of the trends in the Canadian and international markets which could positively and negatively affect the aerospace industry in the short term (1-2 years) and the long term (10 years). Also, a global report card is presented to highlight the strengths, weaknesses, opportunity and threats facing the Canadian aerospace industry. To highlight some of the opportunities and challenges faced by the aerospace industry, this report concludes by examining four scenarios that relate the long term aerospace forecast to policy-relevant issues facing the domestic aerospace industry.

Each phase is covered by a separate report. There are also a number of appendices that contain supplementary information.

For our analyses and reports, the Canadian aerospace industry is defined to include companies that perform the following activities: aircraft and aircraft parts design and manufacturing ("A&AP"); aircraft engines and engine parts ("E&EP"); avionics and electro systems ("A&ES"); maintenance, repair and overhaul ("MRO"); simulation and training and space related design and manufacturing.[1] The A&AP sector is the most diverse as a result of a wide range of aircraft types (i.e., business jets, regional aircraft, narrow-body commercial aircraft, wide-body commercial aircraft, freighters, military jets, etc.) and the associated range of components and technology used in each aircraft type. Furthermore, each sector within the industry has both military and civil end-users that often have unique requirements and objectives.

The purpose of this Phase 1 report is to analyze recent developments in the Canadian aerospace industry and to discuss the views on possible future trends as indicated by the 2009 respondents to the AIAC Survey ("survey respondents"). Given the nature of the industry, this report starts with a brief overview of the global aerospace industry.

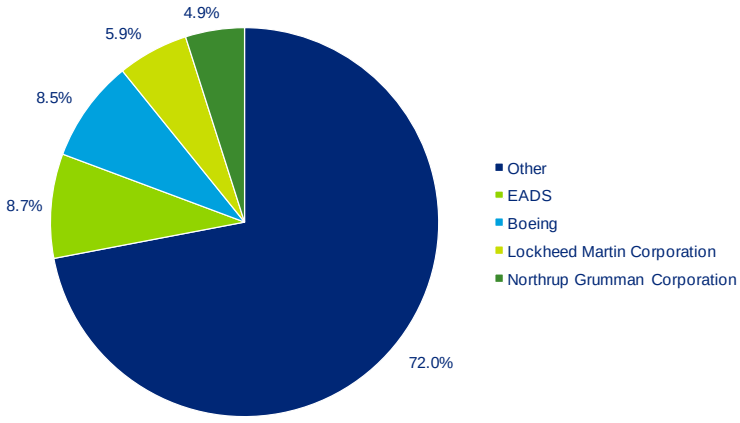
[1] Only selected companies and sub-sectors from the space sector are included in the membership survey and statistical analysis of the Canadian aerospace industry.

3 Current global environment

The size of the global aerospace industry, which includes both military and civil sectors, is estimated to be approximately US$382 billion in 2009. This includes all components of the value chain ranging from A&AP to MRO. The global civil aerospace sector ("CAS") is estimated to comprise 46% of aerospace industry revenue, while the military aerospace sector ("MAS") constitutes approximately 54% of total revenue in 2009.[2] The MAS is a subset of the military aerospace and defense ("MA&D") industry, which also includes many non-aerospace defense products and services. The CAS is beginning to see an improvement in passenger traffic as the developed countries begin to emerge from the recent financial crisis.[3] In contrast, with the continued focus on the rising threat of global terrorism, the MA&D industry is steadily growing and remains a lucrative market for existing players due to the high barriers to entry.

The following four major players dominate the global aerospace and defense market, as seen in Figure 1 below:

Figure 1: Global aerospace market shares for four major players[4]



3.1 Overview of the global civil aerospace market

The CAS is commonly defined to include the design and manufacturing of A&AP; E&EP; A&ES; MRO; simulation and training; and space related design and manufacturing. Excluded from the CAS are products or services used directly or in support of a military application (e.g., fighter jets, unmanned aerial vehicles ("UAVs"), military flight simulators). The CAS can be segmented most generally into A&AP manufacturers, E&EP manufacturers, MRO service providers, and space. Many of these segments can, and are, further subdivided. For example, aircraft can be subdivided into those designed for regional,

[2] DataMonitor, "Global – Aerospace and Defense." December 2009.
[3] Please note that this section is a summary of the Phase 3 analysis, and is reproduced herein for the purposes of assisting the reader with the contextual positioning of the survey analysis. For more details on the current environment of the global aerospace industry, please refer to the Phase 3 report.
[4] Source: DataMonitor, "Global – Aerospace and Defense." December 2009. Note the Datamonitor's industry definition differs from that used in the Phase 3 report.

business, and large commercial applications. CAS manufacturing is defined as encompassing all non-service, non-space, and non-MRO areas of the CAS.

There largest end-users for civil aerospace industry products are passenger airlines and logistics (freight) companies. Freight encompasses end-users who ship goods by aircraft. Other end-users include businesses, individuals, and non-military government sectors (e.g., government search and rescue aircraft).

The recent financial crisis, and the associated declines in both passenger and air freight volumes led to capacity cuts at major airlines (primarily through the retiring of aircrafts or deferring new aircraft deliveries). In 2010, airlines have seen a positive recovery in passenger traffic with a brief slowdown caused by the air space closures following the eruption of an Icelandic volcano in April 2010. The volcanic eruption resulted in over 100,000 flight cancellations spread over six days in European markets.[5]

The main drivers of the civil aerospace industry are:

- GDP;
- Aircraft deliveries and backlogs;
- Active fleet renewal and expansion;
- Emerging markets;
- Long term pilot and workforce shortages;
- Regulation changes; and
- Changes in technologies and the associated changes in research and development ("R&D") intensity.

The key indicators for the health of the civil aerospace industry are:

- Revenues per passenger kilometres ("RPK");
- Revenue per tonne of freight ("FTK"); and
- Passenger and freight load-factors.

3.1.1 Overall market: brief overview

The global CAS makes up approximately 46% of the total aerospace market in terms of revenue in 2009. Global revenue for the civil aerospace industry was approximately US$176 billion in fiscal year 2009. Manufacturing revenue decreased by 5.5% year-over-year ("YoY") in 2009; preliminary projections show global civil aerospace industry manufacturing revenue growing at 1.1% YoY in 2010. The top three civil aerospace manufacturing industry revenue producing countries in 2009 were the United States ("US"), France, and Canada.

The majority of the CAS manufacturing revenue is generated by primary aircraft manufacturers (59%) followed by E&EP manufactures (22.5%), and airplane part and equipment manufacturers (18.5%).[6] The average profit margin of CAS manufacturers remained high in 2009, at 9.5%, but down from double digit levels witnessed in the early part of 2000. In 2009, the primary costs for the CAS manufacturing were raw materials and wages. This cost structure is primarily due to the nature of the industry. CAS manufacturing is still concentrated in the developed world with North America controlling 48.5% of revenue and Europe controlling 43.0% of revenue. However, a shift in the industry is underway towards low-cost high-GDP areas including Asia-Pacific and Latin America. In 2009, CAS manufacturing revenue came

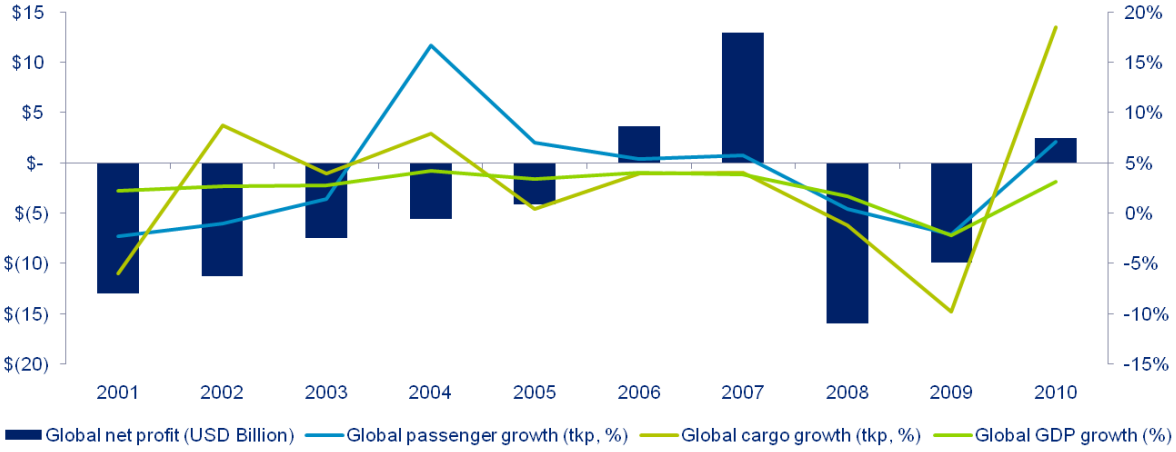
[5] The Financial, "IATA Expects Airlines to Post Profit in 2010", July 2, 2010.
[6] IBISWorld Global Civil Aerospace Products Manufacturing, February 2010.

predominantly from the world's 500 major airlines at 78.5%, followed by freight, at 10%, and other end-users at 11.5%.[7]

The major drivers of profitability in the CAS have shown signs of improvement. Airline revenues, RPKs, FTKs, and global GDP have begun to recover after a significant downturn during the global recession. This improvement was demonstrated by the recent report published by Scotiabank's Global Economic Research Group in April 2010 in which it stated that airline capacity had increased by 28%, passenger traffic by 6%, and freight traffic by 3% YoY. [8]

A third party research shows that confidence among airlines is beginning to increase with 80% and 71% of airlines surveyed stating they saw improvements in passenger and cargo demand respectively in the three months preceding April 2010.[9] A major challenge that the airlines continue to face is unprofitability – registering losses of US$11 billion in 2009 and US$10.4 billion in 2008.[10] In June 2010, the International Air Transport Association ("IATA") revised their profit projections for 2010 and estimated that the global airline sector will post a US$2.5 billion profit. This projection is an indication that if the cautious recovery continues airlines can resume network growth and fleet modernization.[11] A summary of the factors driving performance of the civil aerospace market is provided in Figure 2 below.

Figure 2: Factors Driving Performance of the Civil Aerospace Market



Two of the large commercial airline manufacturers, Boeing and Airbus, have a combined order back-log of 8,500 aircraft - representing seven years of production activity for each company. In 2009, Boeing and Airbus netted 142 and 271 new orders respectively; Airbus and Boeing reported increases in cancellation rates to just below 3% in 2009.[12] Boeing's historical net new orders data shows an average of 772 yearly net new orders between 2003 and 2008 (note that net new orders have been highly volatile during this time period with a yearly standard deviation of 465). It is also important to note that some new order reductions may be yet to come; historically, changes in large commercial aircraft production lag economic changes by 3 years.[13]

A positive trend for the CAS is the age of commercial airline fleets. The US commercial airline fleet is the world's oldest with an average age of 14.5 years compared to an average aircraft life-span of 20 years. This positive trend has been partially offset by a shift amongst the major airlines towards aircraft refurbishment, a sector that experienced a 10% jump in revenue in 2009.[14]

[7] IBISWorld Global Civil Aerospace Products Manufacturing, February 2010.
[8] Scotiabank Global Economic Research Industry Tends - Aerospace, April 20 2010.
[9] IATA Economics Briefing, April 2010.
[10] S&P Industry Surveys – Aerospace & Defense, February 11 2010.
[11] Aviation Week and Space Technology, "Airline Profitability on the Horizon." June 11, 2010.
[12] Scotiabank Global Economic Research Industry Tends - Aerospace, April 20 2010.
[13] S&P Industry Surveys – Aerospace & Defense, February 11 2010.
[14] *Ibid.*

3.1.2 Market segments

A&AP is the largest market segment at US$98 billion in 2009.[15] A&AP revenue is primarily split between manufacturers of large commercial aircraft ("LCA") with US$60.8 billion in revenue, and manufacturers of regional & business aircraft ("R&BA") with US$15.5 billion in revenue in 2009. In 2008, the world's commercial airline fleet had 18,800 aircrafts (83.7% of that fleet being LCA and 16.3% being regional aircraft).[16]

The LCA market is expected to grow due to the expected increase in air traffic as the global economy recovers. In response to the expected air traffic increase, both Airbus and Boeing see potential for new aircraft production and sales. Both Boeing and Airbus have planned new aircraft introductions within the next 10 years, with the 787 and A350 models, respectively.

Business jets experienced unprecedented growth prior to the economic crisis (in 2007) with manufacturers reporting historically high order volumes, especially for very light jets. However, the R&BA market segment was significantly impacted by the economic recession with order volumes for business aircraft dropping by 38%.[17] The impact of the recession on the R&BA market is further illustrated by Bombardier's April 2010 announcement that profits fell by 43% due to the decline in demand in this segment. In 2009, Bombardier had 53 more cancellations than new orders and delivered 54 business planes; Bombardier expects to deliver only 49 business planes in 2010.[18] However, the outlook for regional jets appears to be improving at least in the short-term with Bombardier receiving 40 new orders since late 2009 for their C-Series regional jets, nearly doubling their total number of orders to 90.[19] This spike in new orders goes against the trend of regional jets accounting for a declining share of the worldwide aircraft fleet. Economic and environmental efficiency requirements are pushing airlines to larger aircrafts, especially at the regional level, and congestion at major airports is driving demand away from the smallest planes. A trend is also seen in the business market towards fractional ownership arrangements.

Another major market segment is E&EP manufacturers, which reported revenues of US$28 billion in 2009. Like aircraft manufacturers, this market segment is dominated by an oligopoly consisting of General Electric's jet-engine division (US$19.2 billion in revenue in 2008), United Technologies' Pratt & Whitney division (US$13 billion in revenue in 2008), and Rolls-Royce plc jet-engine division (US$11.5 billion in revenue in 2008).[20]

The MRO segment reported global annual revenues of approximately US$36 billion in 2009.[21] In general, civil aerospace industry MRO accounts for 37% of total aerospace MRO revenues. Non-commercial MRO (including business aircraft MRO) currently makes up 10% of total MRO revenues, totalling approximately US$3 billion in 2009.

Globally, the MRO segment was hit harder than any other aerospace segment by the economic downturn, experiencing average declines of 15% to 20% in 2009 (compared to declines of only 4.1% for passenger air traffic). In particular, heavy maintenance MRO activity dropped by 50% in 2009. The primary driver of this drop in activity was airlines reducing their MRO costs by deferring non-essential repairs, grounding planes in need of heavy maintenance, and obtaining replacement parts from planes not currently in operation. Although there is a trend towards outsourcing to emerging markets, North America and Europe still remained key suppliers in 2009 reporting market shares of 35% and 26%, respectively. Asia-Pacific grew to a market share of 17% in 2009 and strong growth in this region (especially China and India) is projected to continue.

[15] Note that company revenues include sources not directly related to the final manufacturing of civil aircraft and therefore their sum may exceed this market size.
[16] S&P Industry Surveys – Aerospace & Defense, February 11 2010.
[17] *Ibid.*
[18] Bloomberg Business Week, "Bombardier Profit Falls on Lower Business-Jet Demand", April 1, 2010.
[19] Scotiabank Global Economic Research Industry Tends - Aerospace, April 20 2010.
[20] S&P Industry Surveys – Aerospace & Defense, February 11 2010.
[21] Oliver Wyman, MRO survey, 2009.

3.1.3 Market players

IBIS World reports that nine companies control over 95% of global civil aerospace industry manufacturing revenue. A summary of these companies is provided in Table 1 below.

Table 1: Top 9 global civil market leaders

Rank	Company	Country	Civil Manufacturing Revenues (US$ million)	Percentage of Total Civil Manufacturing Revenues
1	EADS	Netherlands	43,764	34.5%
2	Boeing	US	29,897	23.6%
3	United Technologies	US	11,195	8.8%
4	General Electric	US	9,414	7.4%
5	Bombardier	Canada	7,761	6.1%
6	Rolls-Royce	UK	6,997	5.5%
7	Embraer	Brazil	4,834	3.8%
8	Honeywell	US	4,325	3.4%
9	Textron	US	4,325	3.4%
10	Other	n/a	4,198	3.3%

Source: IBIS World, estimates based on market share value.

- **LCA:** The LCA market is controlled by the strong duopoly of The Boeing Company and EADS (maker of Airbus). From 2005 to 2008, Airbus held a slight advantage in market share based on order rates at 51% to Boeing's 49%. In 2008, EADS had revenue of US$40.4 billion versus US$28.3 billion for Boeing. EADS also experienced higher sales of 6.2%, over the five years preceding 2009, than Boeing, which experienced increased sales of 4.1%. Boeing and EADS control the majority of the civil aerospace market and therefore have a great deal of leverage over 90% of aircraft parts manufacturers globally.[22]
- **R&BA:** The R&BA market segment is controlled by a quasi-duopoly with Canada's Bombardier and Brazil's Embraer being the predominant market players. Unlike the LCA market, however, there are a number of other players of non-trivial market size (Textron, General Dynamics, Onex Corp., Dessault). Bombardier had annual revenues of US$10 billion in 2008 versus Embraer's annual revenues of US$6.3 billion. However, Bombardier had a much lower compound annual growth rate ("CAGR") than Embraer for the 5 years preceding 2008 (2.7% vs. 24.2%).The R&BA market is going to face significant pressure in the coming years as two new government-backed companies, one Russian and one Chinese, enter the regional aircraft market in Q3 2010.
- **E&EP Manufacturers:** This market segment is dominated by an oligopoly consisting of General Electric's jet-engine division, United Technologies' Pratt & Whitney division, and Rolls-Royce plc jet-engine division.[23]

[22] IBIS World Global Civil Aerospace Products Manufacturing, February 2010.
[23] S&P Industry Surveys – Aerospace & Defense, February 11 2010.

- **MRO:** The major players in the MRO market are the service arms of the major airlines. A number of smaller pure-play MRO companies exist, including: Triumph Group Inc. with 3.1% in market share; AAR Corp. with a market share of 3.1% and Heico Corp with a market share of 1.32%.[24]

3.2 Overview of the global military aerospace market

The global MAS is comprised of all aerospace products and services designed to address the needs of the military departments around the world. Governments control military spend through their respective departments of defense, and set military budgets based on strategic and policy considerations. The global MAS industry continues to steadily grow in revenues due to a stable commitment by the governments around the world to invest in military defense.

Global military spending by the 10 largest military spenders has increased by 15.9% over the last nine years. According to the Stockholm International Peace Research Institute ("SIPRI"), the US controls approximately 43.0% of the global military spend in 2009, followed by China with 6.6%, France with 4.2% and the UK with 3.8%.[25] Collectively the top five ranking countries constitute 57.6% of global military expenditure, which is estimated to be US$1.53 trillion in 2009.[26]

3.2.1 Overall market: brief overview

The global MAS makes up approximately 54% of the total aerospace market in terms of revenue in 2009. Global revenue for the military aerospace industry was approximately US$205 billion in fiscal year 2009. Despite the recent financial crisis, military spending has largely been exempt from government budget cuts. Two-thirds of the top MA&D spending countries in the world have increased military expenditures, largely to boost their economies. In the US, MA&D expenditures were not impacted by the Obama Administration's desire to counteract the recession despite playing a smaller role in the 'economic stimulus' package. The War on Terror, the Iraq War and a focus on Homeland Security have been the drivers behind the increase in overall military defense spending by the US Department of Defense ("DoD"). Over the last 10 years, the US MA&D spending increased by 67% from US$432 billion to US$730 billion.[27] However, as the US deficit deepens, MA&D spending is expected to be under increased public scrutiny. The Obama Administration has recently mandated a move in military spending to "70% solutions" that are cheaper and posses shorter development cycles.

Key customer groups are the various departments within the military establishments in each country. In the US, these are the US DoD, the US Air Force, the US Army, the US Navy and the US Marine Corps. In Europe and the US, current procurement trends show that governments give preference to multiple-award, indefinite-delivery, indefinite quantity omnibus contracts for integrated solutions, following rigorous bigger pre-qualification. Specific to US law, 50% of the content of US weapon systems must be made domestically. Through the Defense Development Sharing Program, the US DoD and the Canadian Department of Defence Production ("CDDP") collaborate to provide for the defense of both countries. The programs allow Canadian companies to perform R&D for the US armed forces and allow for increased interchangeability between Canadian and US defense equipment. Canada also enjoys certain exemptions with regard to US International Traffic in Arms Regulations ("ITAR").[28]

Emerging markets are becoming larger players in military defense spending as their economies grow. Over the last nine years, from 2000-2009, China has increased its military expenditure by 219%, Russia by 103% and India by 68%, while the US increased its military expenditure by 75% and the UK by 28% over the same period.[29] The major reason for the increase in spending by the US and UK was due to their involvement in the Afghanistan and Iraq wars.

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[24] Scotiabank Global Economic Research Industry Tends - Aerospace, April 20 2010. All figures are for 2009.
[25] SIPRI website. http://www.sipri.org/research/armaments/milex/resultoutput/trends
[26] *Ibid.*
[27] All figures are based on inflation adjusted dollars. Center for Arms Control and Non-Proliferation: US vs. Global Defense Spending. Numbers are based on 2001 and fiscal 2011 DoD published budgets.
[28] First Research, "Aerospace Products and Parts Manufacture." 2010.
[29] SIPRI database, Change in military expenditures from 2000-2009 for the top 10 largest military spenders, in constant (2008) US$, Accessed database June 2010.

3.2.2 Market segments

A&AP is the largest segment in the global MAS, and accounted for 50% of industry revenue in 2009, based on the Phase 3 analysis. This market segment consists of the production of bombers, attackers, fighters, tankers, cargo aircraft, trainers and rotary aircraft. Government investment in the military due to wars in Afghanistan and Iraq has increased the demand for aircrafts over the last five years, especially for UAV.

E&EP is the second largest segment with 11% of overall revenue and provides the engine and parts for aircrafts/spacecrafts. The segment continues to experience slight pressure from continued stability of maximum take-off weight ("MTOW") resulting from a move to more fuel-efficient engines and lighter airframe structures.

The aircraft parts segment contributes 17.0% to overall A&AP revenue. According to IBIS World, this segment has declined sharply since the Cold War due to a reduction in overall expenditure in the aerospace industry. The military aircraft parts industry is dominated by large aerospace and defense conglomerates in a small number of large industrialized countries such as the US, France and the UK. The increased competition from developing countries due to outsourcing has driven down margins and production costs, making for a challenging environment for part manufacturers in developed countries.

Guided missiles and space vehicles constitute US$7 billion or approximately 8% of industry revenues. This market segment includes whole vehicles and parts. In this definition, space includes modern defense systems such as satellites, early warning systems, intelligence gathering (image and signals), navigation and exo-atmospheric interceptors for ballistic missile defense. Major players in this segment are the US, Europe, Russia, China and Ukraine.[30]

3.2.3 Market players

The military defense market is dominated by large players based in the US. Statistics provided by *Defense News* - a leading publication tracking the global defense market – states that the top 100 contractors generated US$399 billion in revenue in 2009 from government military expenditures. This represents a 4% increase from 2008.[31]

The top 10 global defense market leaders make up US$239 billion or 60% of global military expenditure revenues, as shown in Table 2 below.

[30] IBISWorld Global Civil Aerospace Products Manufacturing, February 2010.
[31] Defense News, Top 100 for 2009. June 2010.
http://www.defensenews.com/static/features/top100/charts/rank_2009.php?c=FEA&s=T1C

Table 2: Top 10 global defence market leaders

Rank	Company	Country	Defense Revenues (US$ million)	Percentage of Total Defense Revenues
1	Lockheed Martin	US	42,026	10.5%
2	BAE Systems	UK	33,419	8.4%
3	Boeing	US	31,932	8.0%
4	Northrop Grumman	US	30,657	7.7%
5	General Dynamics	US	25,905	6.5%
6	Raytheon	US	23,139	5.8%
7	EADS	Netherlands	15,014	3.8%
8	L-3 Communications	US	13,332	3.3%
9	Finmeccanica	Italy	13,014	3.3%
10	United Technologies	US	11,100	2.8%

Source: Defense News, June 2010.

Canadian companies have relatively little presence on this list, with the exception of CAE, a simulation and training company. In 2009, CAE ranked 77th on the list, with military expenditure revenues of US$742 million.

4 About AIAC and the AIAC Survey

4.1 AIAC

AIAC is the national trade association which represents the interests of over 500 Canadian aerospace manufacturing and service companies. AIAC has 79 direct members, with most other aerospace-related companies belonging to aerospace industry provincial associations (herein, these companies are referred to as “Provincial members”). A brief summary of the membership of AIAC and the provincial associations is provided in Table 3 below.[32]

Table 3: Membership of Canadian Aerospace Industry Associations

	Province	Members
Aerospace Industries Association of Canada	All	79
Ontario Aerospace Council	Ontario	130
Aerospace Quebec Association	Quebec	135
Aerospace & Defence Industries Association of Nova Scotia	Nova Scotia	22
Aerospace & Defence Industries Association of Newfoundland and Labrador	Newfoundland & Labrador	14
SASK Aerospace & Defence Inc.	Saskatchewan	6
Aerospace Industry Association of B.C.	British Columbia	40
Aviation Alberta	Alberta	34
Manitoba Aerospace	Manitoba	29
New Brunswick Aerospace and Defence Association	New Brunswick	30
Aerospace Prince Edward Island	Prince Edward Island	8

Source: AIAC

AIAC’s primary functions can be classified into the following categories: issue identification and response, communications and advocacy, trade promotion and business development activities, and member engagement and networking. We have briefly outlined these functions below.

[32] It should be noted that several of the larger AIAC members in the Montreal region are also members of AéroMontréal. As such, the membership of AéroMontréal is substantially covered by the surveys issued to AIAC members and the Aerospace Quebec Association (AQA).

Issue identification and response

AIAC works to identify and resolve various issues facing the Canadian aerospace industry. Particular areas of focus include identifying issues regarding the Canadian government's policies as they relate to funding, procurement policies, export controls, and regulatory regimes.

Communications and advocacy

AIAC advocates on behalf of the Canadian aerospace industry through working to enhance the perception of the Canadian aerospace industry that is held by prominent figures in the government, media, and the public. In addition, AIAC works to maintain constructive dialogues on key issues with members of parliament, and participates in meetings with various advisory bodies of the federal and provincial governments to discuss issues important to the growth and global competitiveness of Canada's aerospace industry.

Trade promotion and business development

AIAC works to promote trade and business development through various means, such as providing a Canadian aerospace presence at important global trade shows, supporting events that bring Canadian aerospace companies into contact with other sectors of the global aerospace supply chain, and producing an annual guide of Canada's aerospace industry which is distributed to key customers, trade commissioners, associations, and governments worldwide.

Member engagement and networking

AIAC engages its members through the creation of various subcommittees to advise on the priorities of AIAC and the activities that are undertaken. In addition, AIAC connects industry leaders and government officials with AIAC's members through forums and AIAC's annual general meeting.

4.2 The AIAC Survey

In order to determine key industry statistics on the Canadian aerospace industry, AIAC has been conducting an annual survey of its direct and Provincial members since 2001. The AIAC Survey collects data on variables such as total output, total employment, costs and investment, as well as the composition of the Canadian firms providing aerospace products and services in Canada.

In 2009, the AIAC Survey was distributed by AIAC to its direct members and the provincial associations in March-2010. Deloitte was engaged by AIAC to provide support in the statistical analysis of the AIAC Survey responses. In 2009, the AIAC Survey also included qualitative questions regarding the impact of the recent economic crisis, the outlook of the Canadian aerospace industry, and factors which are expected to drive supply and demand within the Canadian aerospace industry over the next three years.[33]

In analyzing the 2009 results of the AIAC Survey, we classified the direct members into three strata (which can be further subdivided into twelve groups) based on self-assessed membership fees for the preceding year.[34] As membership fees are based on revenue bands, this classification effectively generates revenue-based strata for direct members. On the other hand, Provincial members, for whom sufficient data is not available for the derivation of a similar classification scheme, are examined as one separate stratum. For this sub-group, our analysis relies more on the advantages of a larger sample size, consistent with the working hypothesis that variation in firm size tends to be relatively smaller among Provincial members.

[33] The data reported by the direct and provincial members is treated as commercially sensitive and therefore strictly confidential. The results of the survey are used for purposes of statistical analysis and released in aggregate form only, with no insight provided into the operations and performance of individual companies, unless previously published in other public sources.
[34] The main benefits of using such classification schemes derive from enhanced efficiency of statistical analysis and the facilitation of subgroup analysis.

The first stratum of AIAC direct member companies which was analyzed consists of the14 largest companies (referred to herein as “Special Category members”), the second stratum consists of the AIAC direct members with the next highest revenues (referred to herein as “Category I members”), and the third stratum consists of the AIAC direct members with the lowest revenues (referred to herein as “Category II members”). Table 4 below illustrates the distribution of AIAC member companies within the three strata that AIAC direct members were segmented into.[35]

Table 4: Stratification of AIAC members by revenue

Stratum	AIAC Category	Revenue Bands (C$)	No. of Members	No. of Responses
1	Special Category I	$1 billion or more	3	3
1	Special Category II	$500 million - $1 billion	1	1
1	Special Category III	$225 million - $500 million	10	10
2	Category I: Group I	$100 million - $225 million	4	3
2	Category I: Group II	$50 million - $100 million	6	4
2	Category I: Group III	$20 million - $50 million	3	2
3	Category II: Group IV	$10 million - $20 million	4	4
3	Category II: Group V	$5 million - $10 million	7	4
3	Category II: Group VI	$2.5 million - $5 million	8	3
3	Category II: Group VII	$1 million - $2.5 million	8	5
3	Category II: Group VIII	$0.5 million - $1 million	4	0
3	Category II: Group IX	$0.5 million of less	21	6
	Total		**79**	**45**

Source: AIAC

In general, our analysis consisted of extrapolating the responses within each stratum, deriving industry-level estimates by summing the extrapolated data, and relying on statistical inference to derive a confidence interval around the industry-level estimates. Furthermore, we tested our reliance on the use of the normal distribution by the use of a bootstrapping technique, and we also tested the reliability of our computed confidence intervals by means of an Extreme Bound Analysis. For a detailed description of the statistical methodology utilized to analyze the AIAC Survey, including the calculation of confidence intervals, please refer to Appendix 1. For a detailed summary of the results of the statistical analysis please refer to Appendix 2. For a copy of the 2009 edition of the AIAC Survey please refer to Appendix 3.

[35] Each AIAC direct member strata is further classified into subgroups.

The response rate in 2009 was higher than in previous years. Overall, 13.1% of direct and Provincial members responded to the AIAC Survey, compared with 9.9% in 2008. As indicated in Table 4 above

- The response rate was higher among AIAC direct members, with, 45 of the 79 direct members responding. This response rate of 57.0% compares with a similar response rate of 39.2% in 2008.
- However, the response rate was significantly lower among the Provincial members, as only 24 members out of an estimated total of 448 responded (for a response rate of 5.4%). The response rate in 2008 for these Provincial members was only 4.7%. The provincial associations with the highest response rates were Manitoba (at 24%), Saskatchewan (at 17%), Ontario (at 9%), and British Columbia (at 5%),[36]
- Among AIAC direct members, there was a high response rate among the larger companies. Among the Special Category members the response rate was 100%; this group comprises approximately 73% of the estimated industry revenue. The Category I members attained a response rate of 69%; this group comprises approximately 10% of the estimated industry revenue.

[36] These figures refer only to companies which are members only of the provincial associations. These figures exclude AIAC direct members which reside in a particular province.

5 Canadian aerospace industry: profile and recent developments

The following section is based on Deloitte's statistical analysis of the 2009 responses to the AIAC Survey, and is intended to provide an overview of the size and composition of the Canadian aerospace industry.

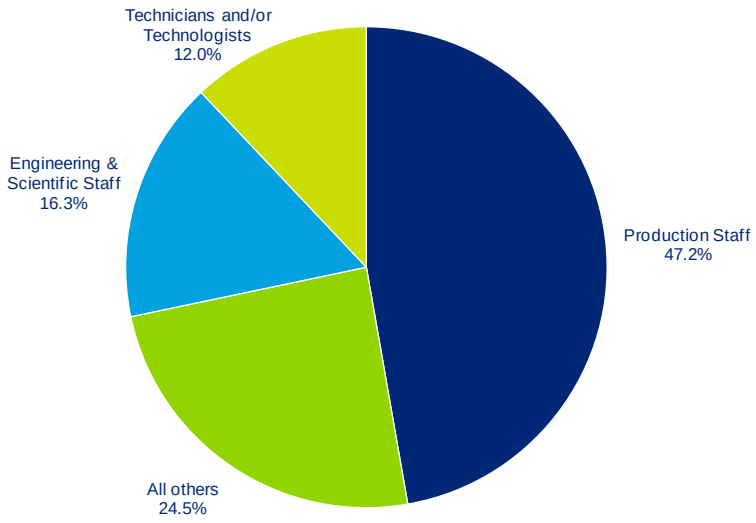
5.1 Size of the Canadian aerospace industry

In 2009, the Canadian aerospace industry was estimated to have generated C$22.2 billion in revenues. The Canadian aerospace industry is dominated by a small group of large companies; the 14 largest aerospace companies in Canada generated C$16.1 billion in revenues in 2009. This represents close to three-quarters of total Canadian aerospace revenues.

The aerospace industry is a significant source of employment within Canada; it employed an estimated 78,965 people in 2009, with a corresponding payroll cost of approximately C$4.6 billion. Again, the 14 largest aerospace companies in Canada generate the majority of aerospace jobs, totalling 40,738 jobs (51.6% of total aerospace employment) and C$3.0 billion in payroll (64.9% of total aerospace payroll).

The types of jobs generated by the Canadian aerospace industry can be broken up into four categories; engineering and scientific staff, production staff, technicians and/or technologists, and all others. Of these four groups, production staff is the largest category of employment (an estimated 47.2% of the Canadian aerospace workforce). Figure 3 below illustrates the relative proportions of each category of employment.

Figure 3: Canadian aerospace employment by category[37]



[37] Source: the AIAC Survey (2009)

5.1.1 Forecast 2010 revenues and employment

In the AIAC Survey, companies were asked to provide forecasts for their revenues and employment in the fiscal year 2010. The estimated forecast for aerospace revenues in 2010 is C$24.1 billion and the estimated forecast for employment is 82,956 jobs. The majority of the increases in revenue and employment are generated by forecasts from the Provincial members, with the 14 largest aerospace companies in Canada predicting a modest decrease in both aerospace revenues and employment (YoY decreases of 0.7% for both measures). The Provincial members constitute C$1.8 billion of the forecast C$2.0 billion increase in aerospace revenues and 2,954 of the forecast 5,316 increase in aerospace related employment.[38]

Of the survey respondents, 62.5% forecast higher revenues in 2010 than 2009, while 23.4% forecast lower revenues in 2010 than 2009, and 14.1% of survey respondents did not believe their revenues would either increase or decrease in 2010.[39]

5.1.2 Effects of the global economic downturn

When asked to forecast their revenue projections for 2010, 73.8% of survey respondents also indicated that their projections for 2010 had been impacted by the global downturn, with a corresponding 26.2% claiming their projections were not impacted by the global recession. Of the 14 largest aerospace companies in Canada, 11 indicated that their projections had been impacted by the global downturn.

Survey respondents were asked what actions their companies have taken or planned to take in order to offset the effects of the global economic downturn in 2010 and 2011. The most common actions having been already undertaken were reductions in the size of their workforce and deferrals in capital expenditures. Many survey respondents indicated their company had utilized the Government's "work-sharing" program, in which a company's employees work reduced hours, but are able to collect employment insurance benefits for the hours they did not work.[40] Other measures taken to cope with the economic downturn include increased marketing and sales efforts, restructuring business to focus on higher value activities, and controlling discretionary costs (such as travel expenses and office supplies).

5.2 Composition of the Canadian aerospace industry

This section examines the composition of the Canadian aerospace industry by product application (*i.e.,* civil or military), the final market of sales, the various functional sub-sectors of the aerospace industry, and the various geographic regions where Canadian aerospace companies operate.

5.2.1 Application of Canadian aerospace products and services

In contrast to the global aerospace industry (which as previously discussed is primarily dominated by the MAS), Canada's aerospace industry primarily operates within the CAS. In 2009 an estimated 83.4% of revenues generated by the Canadian aerospace industry were in the CAS, compared to only 16.6% of revenues generated within the MAS. This is not surprising as Canada's military spend relative to the rest of the world remains small. In 2009, Canada spent US$20.5 billion on military expenditures or 1.3% of GDP (0.03% of global GDP) versus 4.3% (1% of global GDP) in the US.[41]

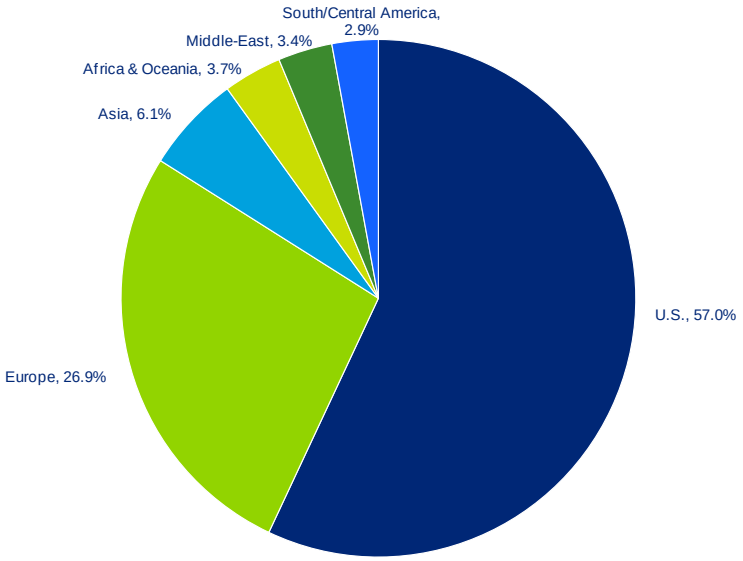
As you would expect from the above, the Canadian aerospace industry also employs a larger number of workers in the CAS as opposed to the MAS, with 80.4% of employees working in the CAS and 19.6% in the MAS.

[38] For more detail on the breakdown of forecast growth by stratum, please refer to Appendix 2.
[39] Companies that did not provide a forecast for revenues in 2010 were assigned their reported revenues for 2009.
[40] Service Canada, "Work-Sharing 2010." April 2010.
[41] SIPRI database, June 2010.

5.2.2 Final markets for Canadian aerospace products and services

The Canadian aerospace industry is largely export based, with an estimated C$17.3 billion in revenue (or 77.9% of total aerospace revenues) generated from sales to foreign markets in 2009. It appears that the percentage of sales to foreign markets vs. domestic sales differs by size of company. The largest 14 aerospace companies in Canada generate 86.6% of their revenues through sales to foreign markets vs. sales in the domestic market, while the rest of the industry generates an estimated 55.0% of their revenues through sales to foreign markets vs. domestic sales. Overall the largest foreign market for Canadian aerospace products and services is the US, accounting for an estimated C$9.9 billion in revenues (or 57.0% of total industry exports). The following graph illustrates the geographic composition of Canadian exports to foreign markets.

Figure 4: Distribution of 2009 Canadian aerospace exports by final market[42]



The foreign markets that constitute the majority of exports also appear to differ by size of company, as only 53.6% of exports from the 14 largest Canadian aerospace companies go to the US, compared to an estimated 71.0% of exports from the rest of the Canadian aerospace industry.

Given the importance of export markets for Canadian aerospace companies, Export Development Canada's ("EDC") role is of great significance. EDC is a governmental agency that provides extensive support to Canadian aerospace companies focusing on the export market, by providing financing, financing solutions, and accounts receivable insurance. In 2008, EDC was responsible for underwriting C$5 billion in total business volume related to Canadian aerospace exports, and had active relationships with 130 different aerospace companies.[43]

[42] Source: the AIAC Survey (2009)
[43] Export Development Canada, "EDC Support for the Aerospace Sector", 2010.

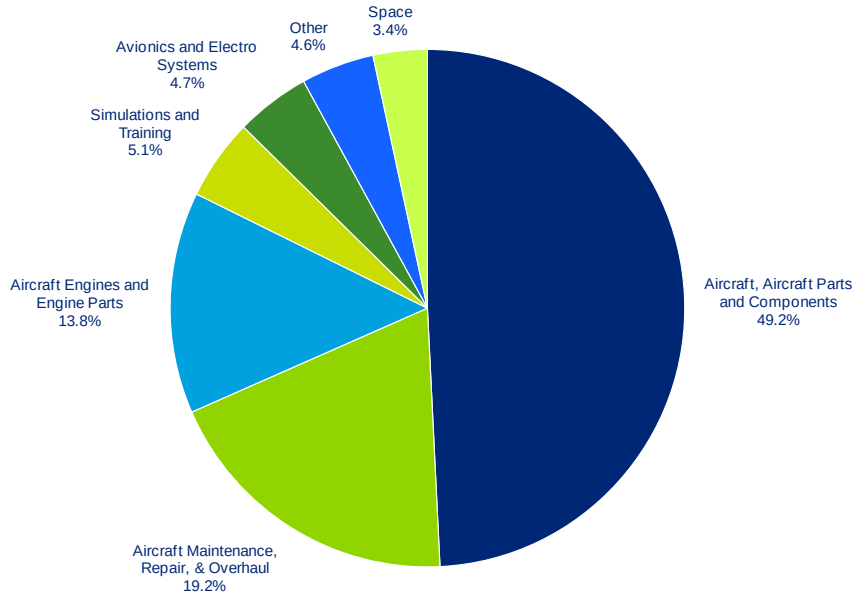
5.2.3 Size of sub-sectors of the Canadian aerospace industry

The Canadian aerospace industry can be broken into the following seven sub-sectors:

- Aircraft, Aircraft Parts & Components (or A&AP);
- Aircraft Engines & Engine Parts (or E&EP);
- Avionics & Electro Systems (or A&ES);
- Simulations & Training;
- Aircraft MRO (or MRO);
- Space; and
- Other Industry Related Products & Services ("Other AP&S").

The largest sub-sector of the Canadian aerospace industry is the manufacturing of A&AP, which generated revenues of approximately C$11.0 billion in 2009, this being 49.2% of estimated 2009 total aerospace revenues. The second largest sub-sector is MRO, which generated an estimated C$4.3 billion in 2009 (19.2% of estimated 2009 total aerospace revenues). The following graph shows the relative sizes of the various sub-sectors in the Canadian aerospace industry.[44]

Figure 5: Distribution of 2009 Canadian aerospace revenues by sub-sector[45]



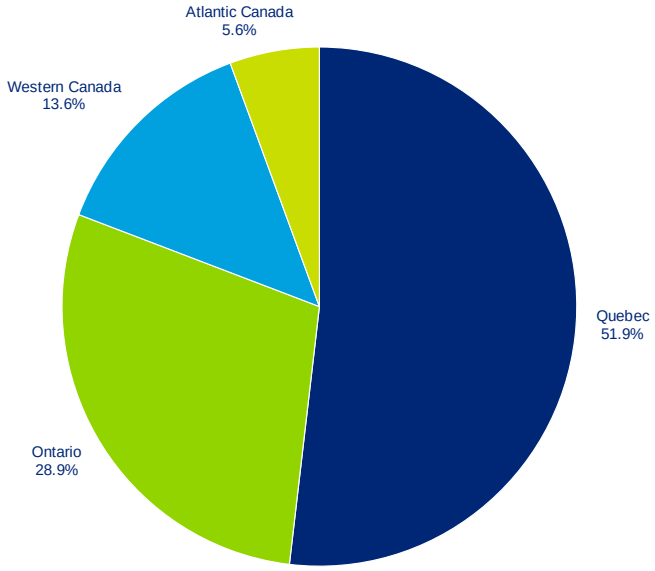
[44] Only selected companies and sub-sectors from the space industry are included in this analysis of the Canadian aerospace industry.
[45] Source: the AIAC Survey (2009)

5.2.4 Regional breakdown of the Canadian aerospace industry

Although analysis of data at a more disaggregated level tends to be statistically less reliable, it is still important to glean as much information as possible from regional data, particularly given the importance of regional clusters and associated spinoffs associated with the aerospace industry in Canada.[46] In this section, we provide estimates of revenue, employment, and payroll based on specified behavioural premises, and instead of statistical confidence intervals we provide a lower and upper bounds based on a type of extreme bound analysis (similar to the robustness check conducted for the aggregated data).[47] This is, the analysis in this section is not based on statistical inference, and additional care should be taken in the use of these estimates. The level of regional disaggregation presented herein is guided by the availability of a minimum number of available responses which are necessary to make the analysis meaningful and to ensure that company-specific data is not revealed.

The majority of 2009 aerospace revenues are reported in Quebec (an estimated C$11.5 billion or 51.9% of revenues) and Ontario (an estimated C$6.4 billion or 28.9% of revenues). The 14 largest aerospace companies in Canada produce 62.6% of their collective revenues in Quebec and 26.9% in Ontario. A summary of estimated aerospace revenues by region is provided in Figure 6 below.

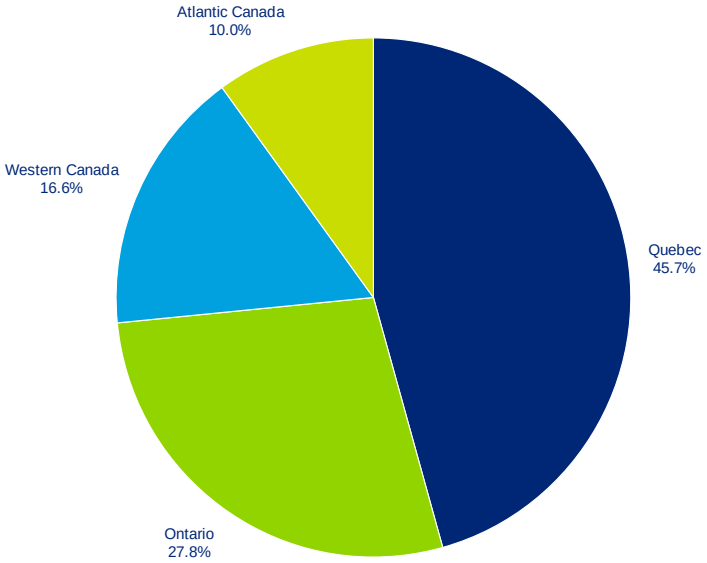
Figure 6: Canadian aerospace 2009 revenues by region[48]



Similarly to aerospace revenues, the majority of aerospace employment is reported in Quebec (an estimated 45.7% of employment) and Ontario (an estimated 27.8% of employment). The 14 largest aerospace companies in Canada employ 65.5% of their collective workforce in Quebec and 24.8% in Ontario. A summary of estimated aerospace employment by region is provided in Figure 7 below.

[46] The lower degree of reliability usually associated with more disaggregated statistical analysis arises primarily from reduced sample sizes and related concerns on the representativeness of the sub-sample. In the case of AIAC's 2009 annual survey, this means that confidence intervals for questions which ask for the breakdown of an aggregate measure (for example, breakdown of industry revenue into military and civil components) will have wider confidence intervals because not all respondents to the question on the aggregate measure provide a response to the sub-questions on the breakdown. In addition, some sub-questions end up with a sample size which is effectively too small for statistical inference; for example, the sub-questions on the breakdown of industry revenue by province sometimes produce a sample size which is as small as one (1) response for specific provinces.
[47] Please refer to Appendix 1 for a more detailed description of the robustness check conducted for the aggregated data.
[48] Source: the AIAC Survey (2009)

Figure 7: Canadian aerospace 2009 employment by region[49]



Consistent with these findings, the majority of aerospace payroll is received by employees in Quebec (C$2.3 billion or 49.0% of payroll), followed by Ontario (C$1.4 billion or 29.2% of payroll), Western Canada (C$0.6 billion or 13.0% of payroll), and Atlantic Canada (C$0.4 billion or 8.8% of payroll).

As a measure of the uncertainty associated with our reliance on sample data, we have calculated an upper and lower bound for the central estimates. Our lower (upper) bound assumes that non-respondents would all report a result which is equal to the lowest (highest) reported outcome. Our analysis was conducted by strata (of the classification scheme introduced earlier). For Provincial members, we have assumed that member companies do not differ (significantly) across regions. The central estimates for the regional data are presented in Table 5 below, please note that all figures are given in millions of dollars, except for employment which is in number of workers.[50]

[49] Source: the AIAC Survey (2009)
[50] For estimates of the extreme bounds by region and stratum, please refer to Appendix 4.

Table 5: Regional distribution of revenue, employment, and payroll

	Central Estimate (C$ million)
Revenue	
Industry (Total)	**22,196**
Atlantic Canada	1,251
Quebec	11,511
Ontario	6,415
Western Canada	3,019
Employment	
Industry (Total)	**78,965**
Atlantic Canada	7,902
Quebec	36,054
Ontario	21,935
Western Canada	13,073
Payroll	
Industry (Total)	**4,633**
Atlantic Canada	410
Quebec	2,269
Ontario	1,355
Western Canada	600

Source: the AIAC Survey (2009). Regional numbers may not sun to industry totals due to rounding errors.

5.3 Investment in the Canadian aerospace industry

Investment in the Canadian aerospace industry is geared towards R&D and investments in physical capital or property, plant, and equipment ("PPE"). In 2009 the Canadian aerospace industry invested an estimated total of C$1.9 billion in R&D and PPE, of which R&D comprised 72.7% (C$1.4 billion) and PPE comprised 27.3% (C$0.5 billion). The Government of Canada has various programs or initiatives which Canadian aerospace companies utilize in order to help fund these investments, especially in regards to R&D, including *inter alia:*

- Strategic Aerospace & Defence Initiative ("SADI") – specific to the aerospace sector;
- Green Aviation Research & Development Network ("GARDN") – specific to the aerospace sector;
- National Research Council Industrial Research Assistance Program ("NRC-IRAP"); and
- Scientific Research & Experimental Development Program ("SR&ED").

In 2009, government programs such as these provided an estimated C$0.5 billion in funding for R&D activities by Canadian aerospace companies. This represents an estimated 33.8% of these companies' total R&D spend. However, the sector's largest source of financing for R&D projects comes from internal company financing, which funded an estimated 66.2% of R&D spend.

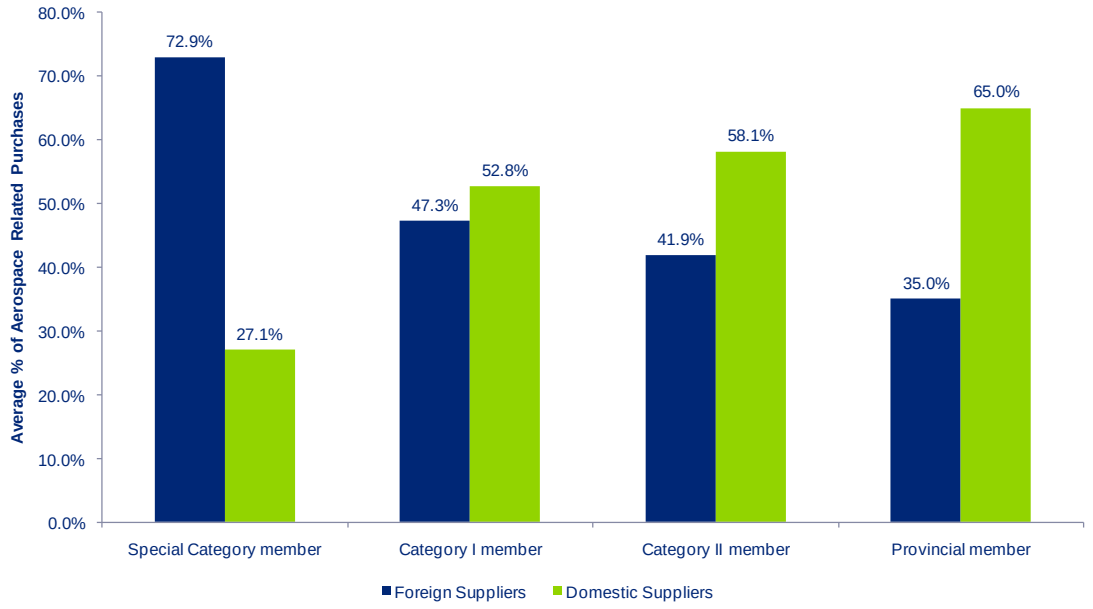
It should be noted that a key determinant of growth and innovation within the aerospace industry is the amount of research that is undertaken. Key aerospace research bodies within Canada include *inter alia:*

- Natural Sciences & Engineering Research Council of Canada ("NSERC");
- Canadian Foundation for Innovation ("CFI"); and
- Consortium for Research and Innovation in Aerospace in Quebec ("CRIAQ").

5.4 Suppliers to the Canadian aerospace industry

In order to stay competitive and minimize the costs of various inputs, Canadian aerospace companies access global supply chains. Based on responses received from the AIAC Survey, it appears that larger Canadian aerospace firms rely more heavily on foreign supply chains than do smaller Canadian aerospace firms. For example, the average Special Category member (AIAC members with revenues over C$225 million) makes 72.9% of their aerospace related purchases from foreign suppliers, compared to 47.3% for the average Category I member (AIAC members with revenues between C$20 million and C$225 million). As firm size becomes smaller, the use of foreign suppliers becomes progressively smaller. Thus, the average Category II member (AIAC members with revenues below C$20million) makes 41.9% of their aerospace related purchases from foreign suppliers, and the average provincial member (companies that are only members of a provincial aerospace association, which are typically smaller in size) makes only 35.0% of their aerospace related purchases from foreign suppliers.[51] Figure 8 below illustrates the composition of purchases made for each stratum.

Figure 8: Average percentage of aerospace related purchases from foreign and domestic suppliers[52]



5.5 Impact of foreign exchange rates on the Canadian aerospace industry

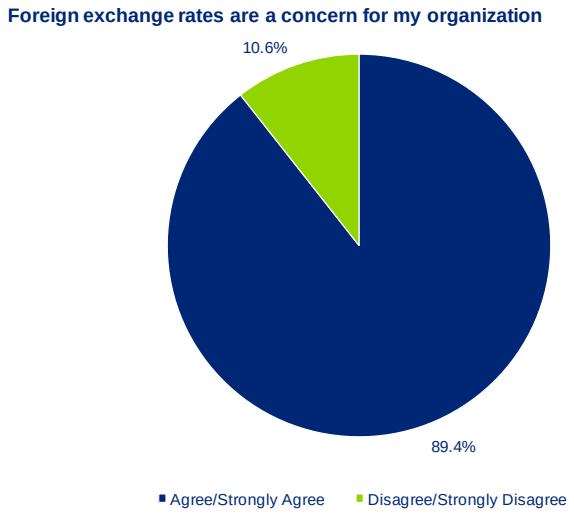
As the Canadian aerospace industry is predominantly export based, one would expect foreign exchange rates to be a major concern for Canadian aerospace companies.[53] Therefore, it is not surprising that, 89.4% of survey respondents believed foreign exchange rates to be a major concern for their company. See Figure 9 below.

[51] These numbers are based on the raw data from respondents to the survey (it is the average of the reported percentages of purchases from foreign and domestic suppliers for each stratum) and do not include any type of extrapolation or statistical inference. This is because survey respondents only indicated the percentage of purchases made from foreign and domestic suppliers, they did not indicate what their total purchases were. As such, we are unable to provide any insight on the total amount of purchases in the aerospace industry.

[52] Source: the AIAC Survey (2009)

[53] Foreign exchange risk is the risk that a firm's profitability will be affected due to changes in foreign exchange rates. Typically, this occurs where the firm earns revenues and incurs expenses in different currencies.

Figure 9[54]



However, 73.6% of survey respondents indicated that they actively manage their foreign exchange risk. This result varied quite dramatically by size of the respondent, with 96.3% of companies with aerospace revenues over C$15 million in 2009 reporting that they actively managed their foreign exchange risk, compared to only 45.8% of survey respondents with aerospace revenues below C$15 million.

The survey respondents who actively managed their foreign exchange risk did so through natural hedging (43.6%), financial instruments (17.9%), or a combination of both (38.5%). Natural hedging occurs when a company attempts to reduce the difference between its revenues and costs in a given foreign currency.[55] Alternatively, companies also manage foreign exchange risk through financial instruments such as purchasing currency options, which gives a company the right to purchase (or sell) a given amount of foreign currency at a pre-determined exchange rate in the future.[56]

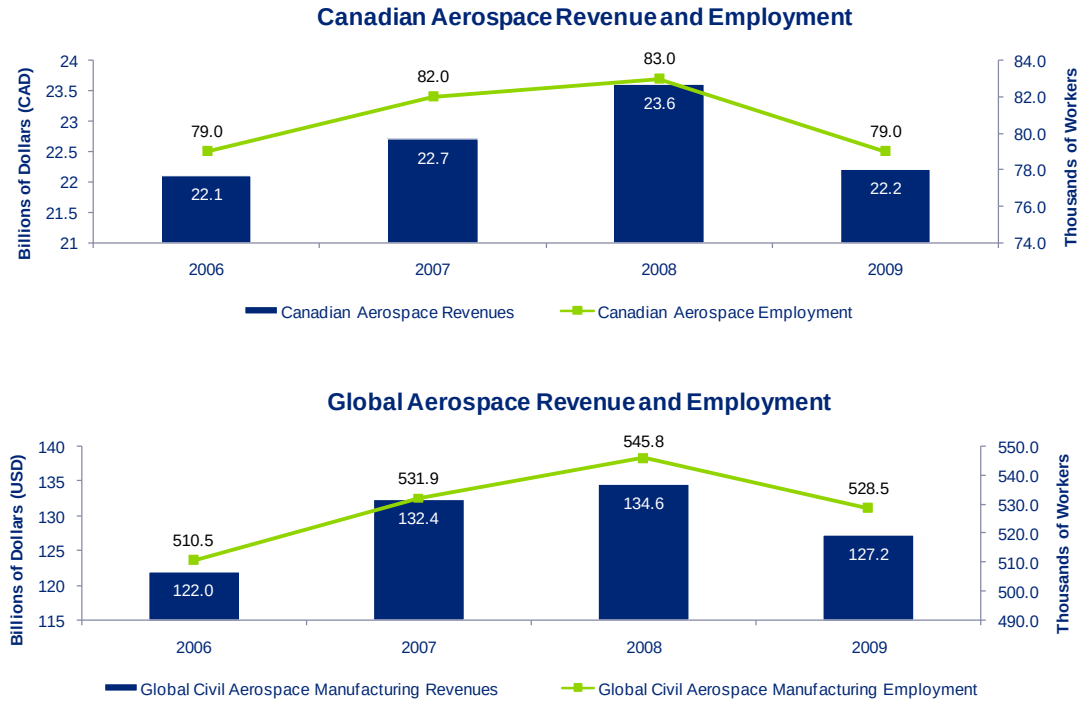
5.6 Comparison of 2009 to previous years' results

Based on the results reported by AIAC for 2008, 2009 registered a drop in industry revenue of approximately 6% (from the C$23.6 billion in 2008 to the C$22.2 billion in 2009). A similar decline was apparent in exports and employment, which dropped by approximately 10% and 5%, respectively.

These trends are broadly consistent with recent macroeconomic conditions in Canada and recent developments at the level of the global aerospace industry. This is described above in the Current Environment section and illustrated by Figure 10 below.[57].

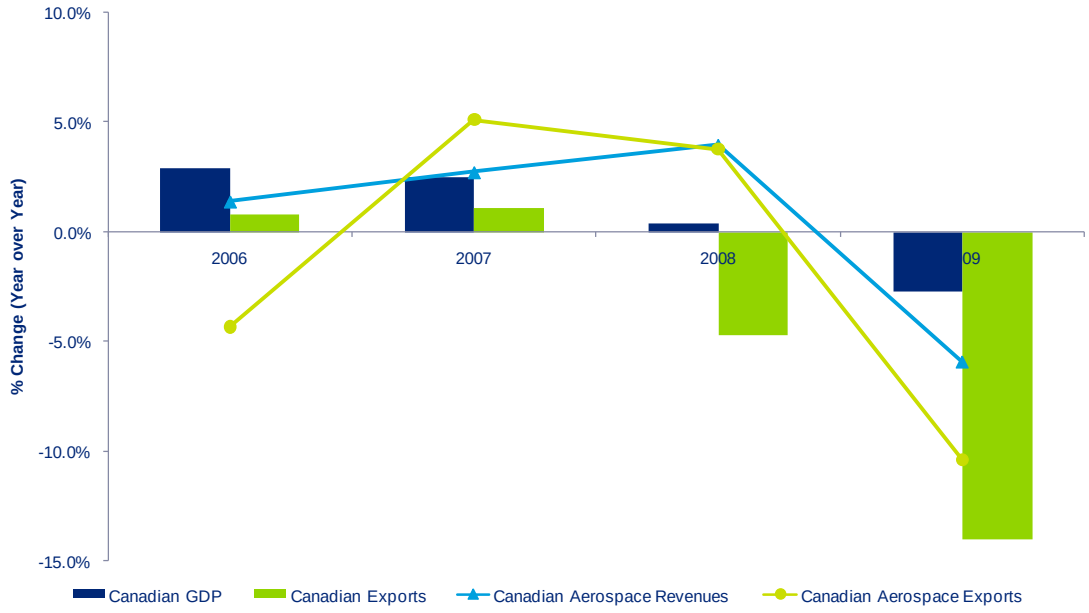
[54] Source: the AIAC Survey (2009)
[55] Export Development Canada, "Managing Foreign Exchange Risk", 2010. An example of natural hedging would be when a company that generates revenues in Canadian dollars adjusts its production process so to incur costs in Canadian dollars, in order to minimize its foreign exchange risk.
[56] *Ibid.*
[57] It should also be noted that there was a change in methodology in producing industry level statistics from the 2008 to the 2009 survey. Although we have not attempted to isolate this effect on the reported results, the fact that the observed pattern from 2008 to 2009 is broadly consistent with underlying macroeconomic trends confirms that the data are reasonably comparable.

Figure 10: Comparison of Canadian aerospace industry to global aerospace industry[58]



In addition, the YoY change in Canadian aerospace revenue and exports is broadly consistent with the YoY changes in the broader Canadian economy, with a clear (and expected) lag in the transmission mechanism from Canadian GDP to Canadian aerospace revenues. This is shown by the data portrayed in Figure 11 below.

Figure 11: Comparison of Canadian aerospace industry to broader Canadian economy[59]



[58] Source: IBIS World Report on Civil Aerospace Manufacturing; the AIAC Survey (2009).
[59] Source: OECD Economic Outlook No. 87; the AIAC Survey (2009).

According to the Conference Board of Canada, healthy recovery is not expected until 2011, and it will be until 2013 before the Canadian aerospace industry fully recovers from the effects of the recession.[60]

[60] Conference Board of Canada: Canada's Aerospace Product Manufacturing Industry Outlook, Spring 2010.

6 Future industry trends

6.1 Outlook of the global aerospace industry

6.1.1 Introduction

In comparison to other sectors impacted by the financial crisis, the global aerospace sector emerged from the financial crisis relatively unscathed.

However, after five years of strong growth, the aerospace industry encountered some headwinds in 2008 with the onset of the global financial crisis. In 2009, the global aerospace and defense industry's operating earnings were down 15.3%.[61] The negative impact on earnings in the industry was primarily due to accounting write-offs related to large programs, asset impairments, or regulatory fines (at a few largest firms).

Given their differing characteristics, the CAS and the MAS within the global aerospace industry will be examined separately.[62]

The following are key trends facing the CAS:

- Positive long term growth is expected as economies emerge from the recent financial crisis;
- Airline profitability is expected to recover moving forward;
- Active fleet renewal and expansion;
- Increased use of more green technologies;
- MRO activity increases as companies shifts to new geographies;
- Emerging markets are becoming serious competitors;
- Long term pilot and workforce shortages;
- Regulatory shifts as economies emerge from the financial crisis; and
- Increased demand in the private sector for satellite and launch services.

There are three key trends that face the MAS:

- Governments' are focused on deficit reduction;
- Growth focus is on Indian and Chinese markets; and
- Aging military equipment.

In addition, with respect to the space sector for both CAS and MAS, a key trend is the increase in demand for satellites and launch services.

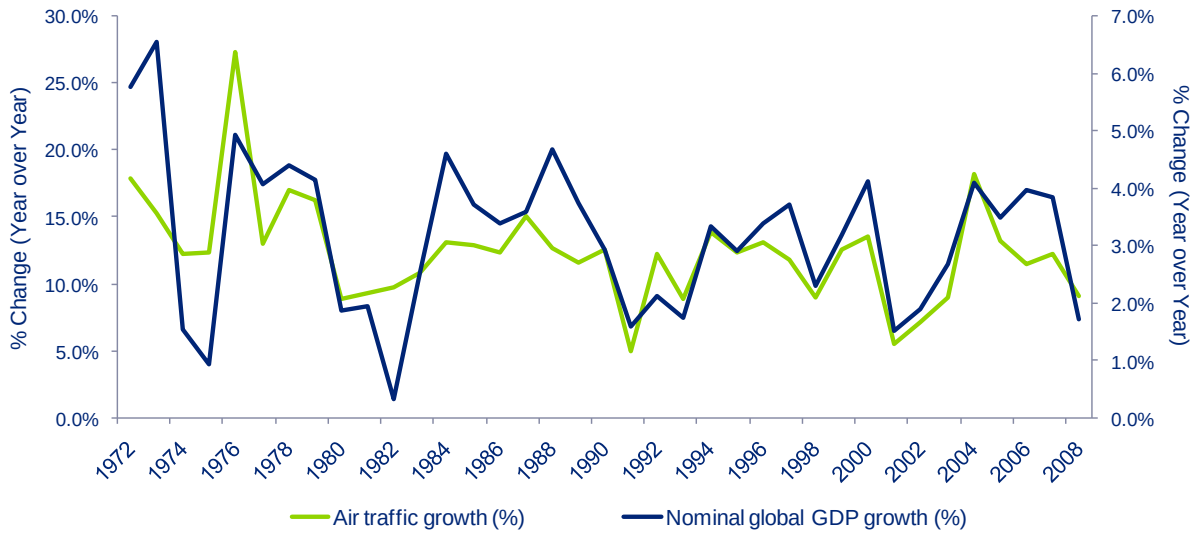
[61] Deloitte Development LLC., "2009 Global Aerospace and Defense Industry Performance Wrap Up", May 11, 2010.
[62] Please note that this section is a summary of the Phase 3 analysis, and is reproduced herein for the purposes of assisting the reader with the contextual positioning of the survey analysis. For more details on the future trends affecting the global aerospace industry, please refer to the Phase 3 report.

6.1.2 Global civil aerospace overview: key trends

Positive long term growth is expected as economies emerge from the recent financial crisis

Passenger air travel is highly correlated with GDP. As shown in Figure 12, the correlation between world GDP and passenger air travel means that a 1% rise in a country's GDP translates into an increase in air travel demand of 1% in developed countries and 2.5% in developing countries.[63] Despite the slow recovery of economies from the financial crisis, the long term forecast for the civil aerospace industry is positive due to increasing air travel and expected long term growth in global GDP. The International Monetary Fund ("IMF") expects global GDP to increase by 4.6% in 2010 and 4.3% in 2011. Furthermore, the OECD feels that advanced economies will remain relatively flat from 2010 to 2015[64], while developing Asian economies are expected to rebound with growth of 9.2% in 2010 and 8.5% in 2011.[65]

Figure 12: Correlation between air traffic growth and GDP growth[66]



As with the MAS, China and India are driving the majority of growth in the CAS. Bombardier has determined that from 2008-2028, China's economy will continue to lead growth in the Asia-Pacific markets and globally at a growth rate of 7.5%, while India is expected to be second in line in terms of growth rates at 6.3%.[67]

The IATA reports that international air passenger and cargo traffic is now approaching pre-recession levels, and that 2010 will be a year of positive growth for air traffic during the recovery.[68] RPK is an important measure of air traffic because of its high correlation with commercial aircraft deliveries and GDP. Global RPK increased in 2010 along with the uptick in global GDP. While RPK has consistently increased at 5% per year for the last 10 years, the stable forecasts of future 5% global growth mask significant disparities. A number of regions are forecast to have declines in RPK growth rates for both inter-region and intra-region travel. The largest increase in growth between 2008 and 2028 is expected to be between North America and North-East Asia for inter-region travel, and North-East Asia for intra-region travel, respectively.[69]

[63] Airbus, "2009-2028 Global Forecast", 2009.
[64] IMF, "World Economic Outlook Update: Restoring Confidence without Harming Recovery", July 2010.
[65] *Ibid*.
[66] Source: IATA; World Bank.
[67] Bombardier, "2009-2028 Market Forecast", 2009.
[68] IATA, "Economics Briefing", April 2010.
[69] Boeing, "Current Market Outlook 2010-2029", 2009.

Airline profitability

The overall revenue of the civil aerospace industry is tied to the financial performance of the primary buyers – major airlines. In the past three IATA's quarterly surveys, airline CFOs have said they were much more confident about financial performance improving over the next year.[70] Also, top-line airline revenue had been growing since 2001 before incurring a 15% decline in 2009. In 2010, aircraft revenues have rebounded by 13%, but profits have fared worse and that trend is expected to continue.[71]

Datamonitor projects that global airline revenue will grow at a 10% CAGR between 2010 and 2013.72 Much of this growth will be driven by China and India with airline revenues expected to exceed CAGRs of 15% between 2010 and 2013, while Canada's CAGR is expected to be at 8%.73 Revenue growth alone will not lead to increased industry profitability because airline costs are growing at a rapid rate. For example, both fuel and non-fuel costs have increased steadily over the last decade, and it is difficult to forecast future movements in non-fuel costs; however, fuel prices are projected to increase well into the future.74 This will force airlines to move towards more efficient operations and aircrafts.[75]

A positive sign that airlines may be becoming more efficient going forward is the trend in airline industry's break-even load factor ("BE-LF").[76] In particular, the BE-LF is growing at a slower pace than achieved load-factors; this is a positive trend because airline profitability increases as the spread between break-even and achieved LFs increases. One source of the strong trend in BE-LF could be the continuing rise of low cost carriers ("LCC"). Of the total air routes flown, 41% are expected to be flown by LCCs in 2028, compared to 19% in 2008.[77]

Active fleet renewal and expansion

Since the recession in 2001, the poor financial results of airlines imply limited capital expenditure budgets. Those airlines that were able to restructure through the recent financial crisis have been able to reinvest a portion of realized profits into fleet renewal. Consequently, Boeing estimates that the total of 18,890 planes in service is expected to grow by 3.5% over the next 20 years through the delivery of 30,900 new airplanes valued at US$3.6 trillion to meet the increased growth in traffic.[78] Beyond Boeing, all of the major aircraft and engine OEMs provide forecasts that include a significant increase in aircraft deliveries with varying seat capacities.

Similar to the defense industry, there will be an increased pickup in aircraft retirement rates. The average life of an aircraft is 20-30 years;[79] but, according to Rolls Royce, the average age that an aircraft is retired at has increased continuously since 1980.[80] This increase in average fleet age is not sustainable.

Increased use of more green technologies

A growing environmental awareness is forcing the aerospace industry to design more environmentally friendly aircrafts. Bombardier stated in their 2009 market forecast that by 2020, aircraft emission and noise levels will be reduced by 80% and 50% respectively.[81] Further, projections by third parties confirm that the long term trend in aircraft design is towards a greener aircraft. However, the rate of increase in fuel efficiency has been steadily declining as technologies mature, Shifts in technology have occurred among engine manufacturers through R&D spending innovations such as the turbofan technology

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[70] IATA, "Back to profits in 2010 but not in all regions: Risks Remain", June 2010.
[71] *Ibid.*
[72] Datamonitor, "Global Aerospace & Defense Industry Profile", December 2009.
[73] *Ibid*.
[74] EIA, "Annual Energy Outlook 2010", May 2010.
[75] IATA, "Fact Sheet: Industrial Statistics", 2009.
[76] A load factor is the amount of weight carried by an aircraft divided by the aircraft's weight. A break-even load factor in this context is the load factor that is required, on average, for the airline industry to net out at zero profit.
[77] Airbus, "2009-2028 Global Forecast", 2010.
[78] Boeing, "Current Market Outlook 2010-2029", 2009.
[79] S&P, "Aerospace Industry Analysis", 2010.
[80] Rolls-Royce, "Market Outlook", 2009.
[81] KTH Engineering Sciences, "Cost/Weight Optimization of Aircraft Structures", 2008

developed by Pratt & Whitney which will improve fuel efficiency and noise reduction.[82] To achieve such technological advantages cost effectively, many companies have begun to outsource R&D functions to India.[83]

MRO activity increases as companies shift to new geographies

MRO activity is likely to increase in the short to medium-term. Data on the US MRO market shows industry revenue increasing at a CAGR of 5% between 2010 and 2015.[84] Over 50% of airlines say that they have under-invested in MRO activity and expect significant investment increases in the future.[85] Oliver Wyman has performed significant research on the MRO market, and their findings include an expectation for a universal increase in MRO spending at just over 6% annually over the next five years, a shift of MRO work towards low-cost labour regions, and an airline expectation to achieve the next level of savings through lean and improved technology programs.[86]

Other trends within MRO include the following:

- Airlines refusing to maintain parts inventory or opting for part pooling agreements;[87]
- Longer-term service agreements: Boeing's GoldCare offering for 787 life-cycle management;[88] and
- Outsourcing of MRO to major network hubs developing in Asia-Pacific and Latin America.[89]

Emerging markets are becoming serious competitors

One significant development is the maturing of state-sponsored aircraft OEMs, especially at the regional and narrow-body product categories, which raises questions regarding Canadian OEMs. The Chinese government launched the Commercial Aircraft Corporation of China, Ltd. ("COMAC") in May 2008 with the express purpose of producing a commercial aircraft for delivery no later than 2016. The United Aircraft Corporation ("UAC") of Russia has stated that they want to achieve a 10% share of the world civil aviation market and more than a 50% share in the domestic Russian market by 2025.[90]

Long term pilot and workforce shortages

One of the largest issues that the commercial aerospace industry faces is pilot and workforce shortages. The following are among the factors that have contributed to the labour shortage:

- The growing demand for pilots due to increased passenger activity in emerging markets;
- The "stop-loss" programs instituted by the US military to prevent pilot departure; and
- The financial crisis led to a temporary short-lived softening of labour demand.

The pilot population is aging; the average age of a pilot for commercial US planes in 2009-2010 was approximately 44 years old, and the average age of a pilot in airline transport was approximately 49 years old.[91] It is estimated that the demand for pilots will reach approximately 125,411 by 2028, while the supply is forecast to be only 80,983.[92] Interestingly, this forecast assumes that there will be no major changes to the training standards. In practice, carrier training standards are being questioned because of a reduction

[82] Pratt & Whiney, "Pure Power 100G – Overview", from corporate webpage, 2010.
[83] Deloitte subject matter expertise, internal communication, 2010.
[84] Datamonitor, "Global Aerospace & Defense Industry Profile", December 2009.
[85] Oliver Wyman, MRO survey, 2009.
[86] *Ibid.*
[87] WedBush, "Industrial Growth: Aerospace", April 26, 2010.
[88] *Ibid.*
[89] *Ibid.*
[90] United Aircraft Corporation, "Strategy/Plans for Development", corporate webpage, July 2010.
[91] IATA, "Average Age by Active Pilots by Category", 2009.
[92] Journal of Aviation Management and Education. "International supply and demand for US trained commercial airline pilots", 2009.

in required flight-hours for prospective pilots.[93] To address the pilot shortage, the US Congress introduced a bill in 2009 for new training regulations and how to deal with safety concerns.

A labour shortage at other parts of the value chain is also an issue that must be considered by the global aerospace industry. The aging and skilled baby boomer generation means an increased number of the industry's workforce will be eligible for retirement in the coming years. According to Aviation Week, retirement eligibility will increase from 13% in 2009 to more than 20% in 2013 in the US.[94] As a result, aerospace firms will require long-term strategies which target developing countries or create specific programs to entice students. The short term strategy that the majority of aerospace companies are taking is to improve employee retention. This is particularly important because the airlines have to add thousands of new aircrafts to their fleet, which means they need to ensure they have the necessary labour force in place.[95]

Aerospace companies were careful in managing their workforces through the financial crisis by using salary freezes, furloughs, temporary shutdowns and other cost cutting measures to avoid mass layoffs.[96] The industry can move their focus to post-secondary students, interns, contract workers or reduce work hours to replace the retiring baby boomers.

Regulatory shifts as economies emerge from the financial crisis

Notable changes in airline policy and ownership include the developed countries that have retrenched into a protectionist mindset as the world economy struggles to recover in the short term from the global financial crisis. The protectionist mindset is expected to affect the EU-US Open Aviation Agreement Negotiations, which is expected to be ratified in November 2010. If the talks break down, it is feared that the UK will not permit foreign investment into Heathrow.[97]

Airline deregulation continues to gain momentum through the liberalization of air service rights to increase foreign ownership levels and eventually remove cabotage restrictions between economies. Boeing has outlined that the largest impacts in airline deregulation have been Central Europe's rapid increase in available seat kilometres and Chinese deregulation since 1990. China has reduced tariffs on business jets and approvals of flight plans have been reduced from three to four weeks to a few hours.[98] Among the agreements and prospective agreements to promote international trade in aerospace include the ASEAN Multilateral Agreement on Air Services or the ASEAN-China Free Trade Agreement.[99]

6.1.3 Global military aerospace overview: key trends

Governments are focused on deficit reduction

Governments are focused on deficit reduction. Defense budgets, particularly in the US and Europe have been and will continue to experience pressure to cut back as spending shifts to other domestic government priorities. It is expected that defense spending levels will continue to fall as countries, particularly G7 countries, stabilize their economies through fiscal and monetary policies post financial crisis.

Based on the current account spending during the period 2009-2011F[100], OECD countries, with the exception of Japan and Germany, will be focused on deficit reductions which can most easily be brought about by spending cuts and/or tax increases.[101] Both the US and the UK are incurring deficits that exceed

[93] Journal of Aviation Management and Education. "International supply and demand for US trained commercial airline pilots", 2009.
[94] Aviation Week, *Aviation Week 2009 Workforce Study*, July 20, 2009
[95] ICAO, "ICAO addresses shortage of skilled aviation professionals", March 2010.
[96] Aviation Week, *Aviation Week 2009 Workforce Study*, July 20, 2009.
[97] Boeing. "Global Geopolitical Trends and Commercial Aviation", 2009.
[98] S&P, "Aerospace Industry Analysis", 2010.
[99] Boeing. "Global Geopolitical Trends and Commercial Aviation", 2009.
[100] OECD. "Economic Outlook No. 87", May 2010.
[101] Conference Board of Canada. "Canada's Aerospace Product Manufacturing Industry", Spring 2010.

10% of GDP; but, following the new US packages of spending and tax breaks of November 2009 and May 2010 respectively, there does not appear to be any sign of government stimulus slowing down.[102]

The US government is a major customer for the industry, accounting for approximately 43.0% of the global military spend in 2009, according to SIPRI.[103] According to the Conference Board of Canada, the deficits of the developed countries will negatively impact the global military and defense aerospace market.[104] In addition, Deloitte believes that, "an ever-increasing amount of the US government's budget in the last three years has gone to increased military salaries, increases in operations and maintenance accounts, medical care for the wounded warrior programs, and inflationary pressures. This leaves a small slice of the budget for the R&D and procurement accounts."

The Canadian aerospace industry does not rely heavily on military spending, but the industry is still impacted by the US government's spending habits in military and defense since Canada, at present, has limited or no access to emerging markets.

Growth focus is on India and Chinese markets

As growth in developed countries becomes increasingly challenging, the MAS manufacturers will continue to search for new and emerging markets to grow top-line revenue. According to Deloitte estimates, India's MA&D spending is growing at an unprecedented rate whereby over the next five years, expenditures are expected to grow by US$80 billion.[105] US and European aerospace companies are beginning to recognize India as one of the largest military spenders in the world and as a country growing in strategic importance as an untapped market. It is estimated that Indian defense procurement will rise to an estimated US$42 billion by 2015, including US$19.2 billion for capital acquisitions, which makes it one of the most attractive defense markets in the world.[106]

China is one of the fastest growing economies in the world. During the period of 2007-2009, the Chinese military budget increased by an average of 16.8% YoY. According to the watchdog organization GlobalSecurity.org, 2010 military expenditures in China are expected to increase by 7.5%, reflecting the impact of the financial crisis.[107] RAND, a not-for profit-think tank, believes that Chinese military spending is likely to rise to US$185 Billion (5% of GDP) by 2025.[108]

Aging military equipment

Governments are facing an emerging problem of aging military equipment. The average age of global air force fighters, tankers and reconnaissance, and patrol aircraft inventories are increasing, and the equipment is increasingly expensive to maintain and operate. Many transport aircraft and aerial refuelling tankers are more than 40 years old – and under current US plans, some may be 70-80 years old before being retired.[109] Defense modernization spending, which includes research, development and construction of equipment and platforms, comprises about one-third of US defense spending. Modernization spending was 44% of the US defense budget in 1985.[110]

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[102] New York Times, "Economic Stimulus (Jobs Bill)", online article: http://topics.nytimes.com/top/reference/timestopics/subjects/u/united_states_economy/economic_stimulus/index.html accessed on July 20, 2010.
[103] SIPRI website. http://www.sipri.org/research/armaments/milex/resultoutput/trends
[104] Conference Board of Canada. "Canada's Aerospace Product Manufacturing Industry", Spring 2010.
[105] Indian Thirteenth Finance Commission Report, December 2009; Union Budgets and Economic Survey 2003-2011; Deloitte Global Manufacturing Industry Group analysis by service division.
[106] "Prospects for Global Defense Export Industry in Indian Defense Market," Deloitte Touche Tohmatsu India Private Limited. June 16, 2010.
[107] Global Security, "Chinas Defense Budget", online article: http://www.globalsecurity.org/military/world/china/budget-table.htm accessed on July 20, 2010.
[108] RAND, "Modernizing China's Military: Opportunities and Constraints", online article: http://www.rand.org/pubs/monographs/2005/RAND_MG260-1.sum.pdf accessed on July 20, 2010.
[109] Defense Industry Daily, "Aging Array of American Aircraft Attracting Attention", online article: http://www.defenseindustrydaily.com/aging-array-of-american-aircraft-attracting-attention-0901/ accessed on July 22, 2010.
[110] Heritage Foundation, "State of the US Military", January 2010.

6.1.4 Space

Increasing demand for satellites and launch services

The space sector is relatively small and evolving compared to the rest of the Aerospace industry, accounting for approximately 5% of total aerospace revenues in 2009. Over the next 20 years, the space sector is expected to become dominated by civilian customers; current projections indicate that civil payloads will make up 77% of proposed payloads through 2028.[111] The industry is trending toward launching more profitable micro- and nano-satellites. In addition, the service market for the International Space Station ("ISS") is expected to account for one quarter of new launches through 2020 because of the cancelation of the space shuttle program.[112]

The civil space market will be driven by the growing need for bandwidth. In particular, geosynchronous-earth orbit ("GEO") and low-earth orbit ("LEO") satellite activity will be pushed by the increase in: HD and 3D video, internet video, global file sharing, mobile broadband usage, and global positioning. By 2014, the sum of all forms of video (TV, VoD, Internet video, and peer-to-peer) will continue to exceed 91 percent of global consumer traffic; while global file sharing traffic is projected to reach 11 Exabyte per month in 2014, this is a 22% CAGR from 2009-2014.[113] The Teal Group has highlighted two other future major sources of growth: the replacement of Globalstar and Orbcomm LEO mobile communications constellations before 2015, and Iridium LEO satellites before 2020.[114]

6.2 Outlook of the Canadian aerospace industry

6.2.1 Qualitative questions from the AIAC Survey

The AIAC Survey also sought to gather the views of members on the industry outlook. Thus, a set of qualitative questions focused on key industry trends such as the state of global competition, the role of the Canadian government in the industry, challenges facing the Canadian industry, and the general business conditions within the Canadian industry.

We have analyzed the results to these qualitative questions in aggregate, as well as by segments[115] (i.e., by revenue bands and by the various provinces and subsectors in which Canadian aerospace companies operate).[116]

6.2.2 Analysis of results

Foreign competition and implications for the Canadian aerospace industry

Industry experts believe that, going forward, the global aerospace industry will continue to expand in developing countries such as China and India, which are expected to grow both as suppliers within the global aerospace supply chain and as consumer markets.[117] On the public policy side, there is a clear drive by these countries to expand their position in the civil aerospace industry, primarily in response to the belief that Asia-pacific will be the largest market for air transport aircraft in the next 10 years.[118] To

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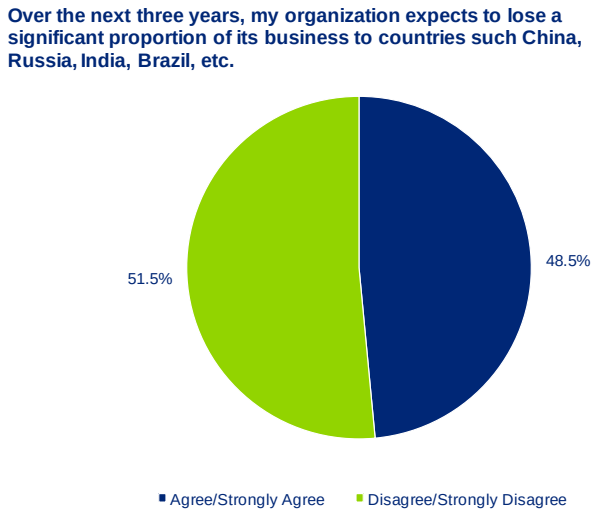
[111] Teal Group, Teal Mission Model Counts 2,033 Space Payloads through 2028", online article: https://www.tealgroup.com/index.php?option=com_content&view=article&id=41:teal-mission-model-counts-2033-space-payloads-through-2028&catid=3&Itemid=16 published on March 25, 2009.
[112] Ibid.
[113] Cisco, "Internet Traffic to Grow Fourfold by 2014", online article: http://newsroom.cisco.com/dlls/2010/prod_060210.html published June 16, 2010.
[114] Teal Group, Teal Mission Model Counts 2,033 Space Payloads through 2028", online article: https://www.tealgroup.com/index.php?option=com_content&view=article&id=41:teal-mission-model-counts-2033-space-payloads-through-2028&catid=3&Itemid=16 published on March 25, 2009.
[115] Reporting of results by segment are limited to those segments (geographic or industry sector) with at least five responses. This ensures that commercial information which is commercially sensitive is not revealed. Thus, we are not generally able to provide results for each province in the country.
[116] Please refer to Appendix 5 for the calculation of confidence intervals for these qualitative questions at the aggregate level.
[117] See previous discussion and also: Deloitte Touche Tohmatsu (DTT) Global Manufacturing Industry, "Compass 2010: Global Aerospace and Defense Outlook", 2010.
[118] AeroStrategy, "Aerospace Globalization 2.0: Implications for Canada's Aerospace Industry", November 2009.

assess the impact the growing eminence of developing countries like Brazil, Russia, India, and China (the "BRIC countries") might have on the Canadian aerospace industry, AIAC asked the survey respondents whether they expected to lose a significant proportion of their business to firms operating in countries such as the BRIC countries over the next three years. In response to this, 48.5% of the survey respondents acknowledged that they expect to lose a significant proportion of their business to other countries. This is illustrated in Figure 13 below. The survey respondents also indicate that Mexico is an additional competitor for Canadian companies.

Figure 13[119]

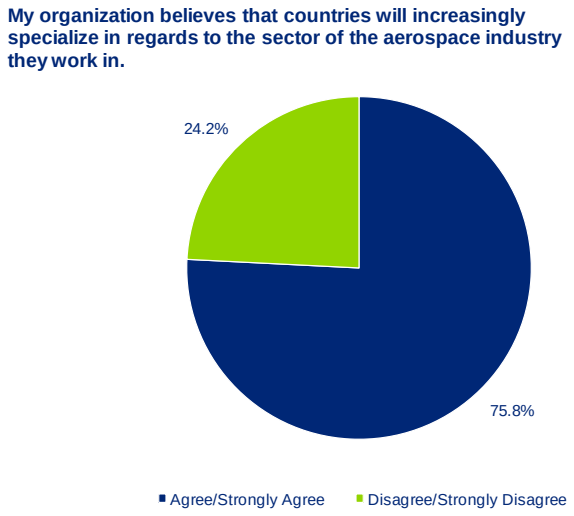


This trend appears to be of greater concern for companies operating within Ontario, where 54.5% of survey respondents believe that they will lose a significant portion of their business overseas over the next three years. Conversely, this concern is not as evident in Quebec, where 36.8% share the above concern.

The expected drive towards new markets is likely to induce global specialization, in which production functions are spread across a global supply chain, in order to efficiently utilize resources; the outcome is likely to be an increase in global productivity within the aerospace industry.[120] Thus, survey respondents were asked if they believe that countries will become increasingly specialized in those industry subsectors in which they operate. By and large, survey respondents fully expect global specialization to take hold, with over three quarters (75.8%) agreeing with this prediction. This is illustrated in Figure 14 below.

[119] Source: the AIAC Survey (2009).
[120] AeroStrategy, "Aerospace Globalization 2.0: Implications for Canada's Aerospace Industry", November 2009.

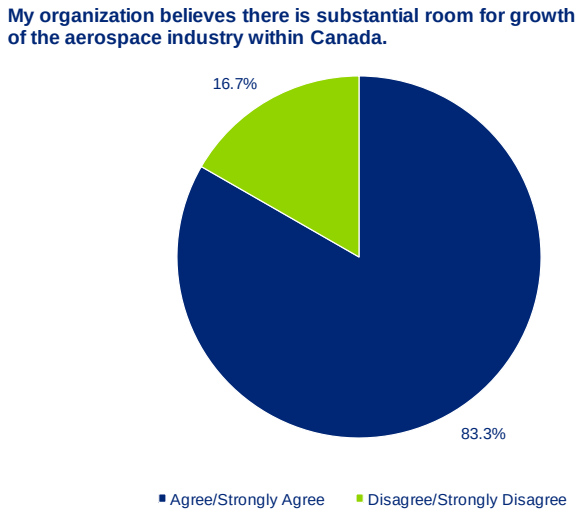
Figure 14[121]



Responses to this question did not vary significantly by revenue band of survey respondents, but did vary significantly by province. Of survey respondents whose operations are primarily in B.C., 88.9% recognized a rise in specialization by countries with regards to the subsector of the aerospace industry in which they operate, compared to 81.8% in Ontario, 68.4% in Quebec, and 57.1% in Manitoba. This may imply that companies located in B.C. and Ontario might be more likely to specialize in specific subsectors of the aerospace industry.

Given the predictions of faster growth in emerging markets, the AIAC Survey aimed to evaluate whether there remains substantial room for growth for the aerospace industry within Canada, and a significant majority of survey respondents agree that there is. Overall, 83.3% of survey respondents believe this was the case, as illustrated in Figure 15 below.

Figure 15[122]



The responses to this question vary significantly by size of survey respondent. Overall smaller companies believe their prospects for growth within the Canadian market are greater than that of larger companies. Of the survey respondents with revenues over C$15 million a year ("large companies"), 77.4% believed

[121] Source: the AIAC Survey (2009).
[122] *Ibid.*

there was still substantial room for growth in the Canadian aerospace industry, compared to 92.9% of companies with revenues under C$15 million a year ("small companies").[123]

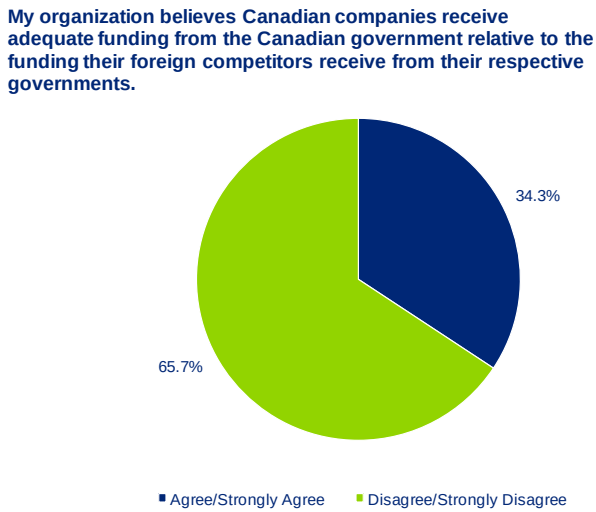
The responses also vary depending on the industry subsector in which survey respondents operate. Overall, the prospects for growth of the industry in Canada are more favourably assessed by companies operating in the MRO, A&ES, and Other AP&S sub-sectors. For instance, 100% of companies engaged primarily in MRO, A&ES, and Other AP&S believe that there was still substantial room for growth, compared to only 80% of companies engaged primarily in Space, 73.1% of companies engaged primarily in A&AP, and 66.7% of companies engaged primarily in E&EP.

Government funding and policy considerations in the Canadian aerospace industry

The role of government in the aerospace industry is widely recognized as being of strategic importance. A 2009 study by aerospace consultant, AeroStrategy LLC, suggests that another developing trend globally, and one with implications for Canada, is the growing collaboration between aerospace companies and foreign governments to create high value aerospace clusters within their respective countries.[124] This means that global competition faced by the Canadian aerospace industry will continue to increase due to foreign competitors' collaboration with their own domestic governments, such as the Mexican government's investment in a National Public Aero Trade School.[125] To assess the role played by the Canadian government in the key area of financing, the AIAC Survey asked whether Canadian aerospace companies believe that the Canadian government provides adequate financing to the aerospace industry relative to that received by foreign competitors from their governments.

The majority of survey respondents do not believe that the Canadian government is doing enough in providing funding, with close to two-thirds (65.7%) indicating that governmental funding is not adequate when compared to other countries. This is illustrated in Figure 16 below.

Figure 16[126]



Findings vary significantly by geographic location. In Ontario, 50.0% of survey respondents believe that they do not receive adequate funding, compared to 77.8% in B.C., and 84.2% in Quebec. The responses also vary significantly by size of survey respondent. Among large companies, 80.6% believe Canadian

[123] C$15 million was chosen as a cutoff as this divided the survey respondents into two equal groups, with a clear separation in the size of revenues between the two groups. Please note that if a different cut off was chosen, such as C$20million (which is the cutoff between Category I members and Category II members), the qualitative conclusions of our analysis would not change.
[124] AeroStrategy, "Aerospace Globalization 2.0: Implications for Canada's Aerospace Industry", November 2009.
[125] *Ibid.*
[126] Source: the AIAC Survey (2009).

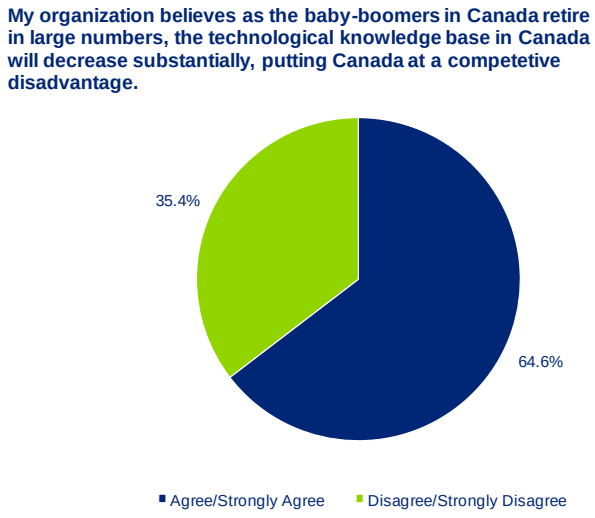
firms do not receive adequate funding from the government, compared to only 51.7% of the small companies.

Crucially, the AIAC Survey shows that 89.2% of survey respondents believe that increased funding from the Canadian government would result in a greater number of jobs within the Canadian aerospace industry. This result was consistent across all geographic locations. However, a significantly higher number of large companies indicate that additional funding would generate more jobs than small companies (96.7% versus 79.3%, respectively).

Government policies on education and training programs, as well as environmental regulations are also important factors for the Canadian aerospace industry. The work force employed in the aerospace industry is highly skilled and requires specific training within the sciences and engineering professions. As such, for the industry's success, it is important to maintain an evolving skilled workforce with a strong technological knowledge base. Studies indicate that the average age of the US aerospace industry workforce is over 45 years old, and as the US workforce ages and retires in large numbers, due in large part to the aging of the baby boomers, American aerospace companies will face a shortage of qualified workers.[127] To assess whether this trend is also a concern in the Canadian aerospace industry, AIAC inquired whether members believe that increased retirement resulting from aging baby boomers would deteriorate the Canadian technological knowledge base sufficiently to put Canada at a competitive disadvantage within the global aerospace industry.

In general, a majority of survey respondents (64.6%) agree that demographics present a particular challenge. This is illustrated in Figure 17 below.

Figure 17[128]



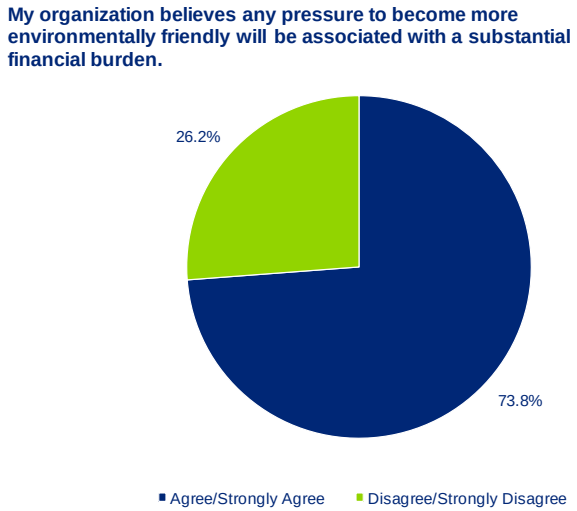
Opinions vary significantly by province. Of the survey respondents which operate primarily in Manitoba, 85.7% believe the retirement of baby boomers would disadvantage them, compared to 77.8% in B.C., 57.9% in Quebec, and 52.4% in Ontario. The results also vary by functional subsector, as 44.0% of those companies engaged primarily in A&AP believed the retirement of the aging baby boomers would disadvantage them, compared to 60.0% of companies primarily engaged in MRO, 84.6% of companies primarily engaged in Other AP&S, and 100.0% of companies primarily engaged in either A&ES or Space.

Supply and demand within the global aerospace industry is also impacted by environmental regulations and related efforts to fight climate change.[129] Thus, the AIAC Survey aimed to assess whether the Canadian aerospace industry is trending towards making a "green shift".

[127] Congressional Research Service, "U.S. Aerospace Manufacturing: Industry Overview and Prospects", December 3, 2009.
[128] Source: the AIAC Survey (2009).

Overall, 93.9% of survey respondents feel substantial pressure to become more environmentally responsible over the next three years, and almost three quarters of survey respondents (73.8%) believe that this shift will result in a material financial burden. This is illustrated in Figure 18 below.

Figure 18[130]



The responses to this question vary by functional subsector; for instance, 84.6% of survey respondents that operate primarily in A&AP believe pressure to become environmentally friendly would be associated with a substantial financial burden, compared to 69.2% of survey respondents engaged primarily in Other AP&S, and 60% in MRO or A&ES. In terms of geographic results, survey respondents within Ontario may be the most adversely affected by the drive to become more environmentally friendly as 85.7% of survey respondents within Ontario believe this "green shift" to be associated with substantial operating costs, compared to 68.4% of survey respondents in Quebec, 66.7% in B.C., and 57.1% in Manitoba.

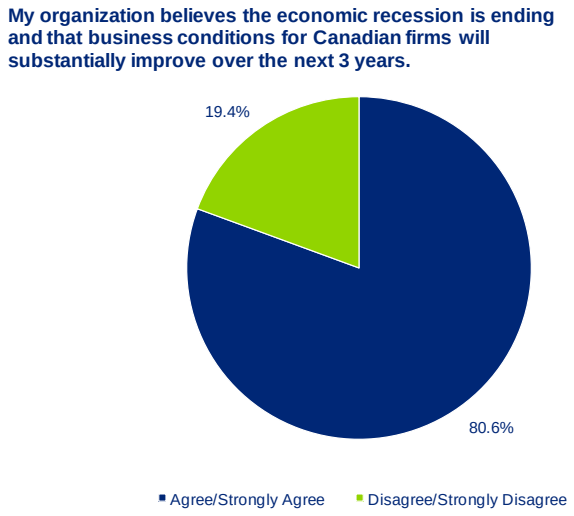
Business conditions for Canadian aerospace companies and international airlines

In 2009, net of cancellations, only 413 airplanes were ordered, which is rather low by historical standards. These cancellations are in large part a result of the global economic downturn. Despite this depressed number of orders, the global aerospace industry still produced 979 aircraft in 2009, a consequence of an existing six-year backlog.[131] As is apparent from the relatively low level of net aircraft orders in 2009, the global economic downturn has created business conditions that have negatively impacted the global aerospace industry.

However, the AIAC Survey found that 80.6% of survey respondents believe that the global economic downturn was coming to an end and that, over the next three years, there will be a significant improvement of business conditions. This is illustrated in Figure 19 below.

[129] Standard & Poor's Industry Surveys, "Aerospace & Defense", February 11, 2010.
[130] Source: the AIAC Survey (2009).
[131] Deloitte Touche Tohmatsu (DTT) Global Manufacturing Industry, "Compass 2010: Global Aerospace and Defense Outlook", 2010.

Figure 19[132]



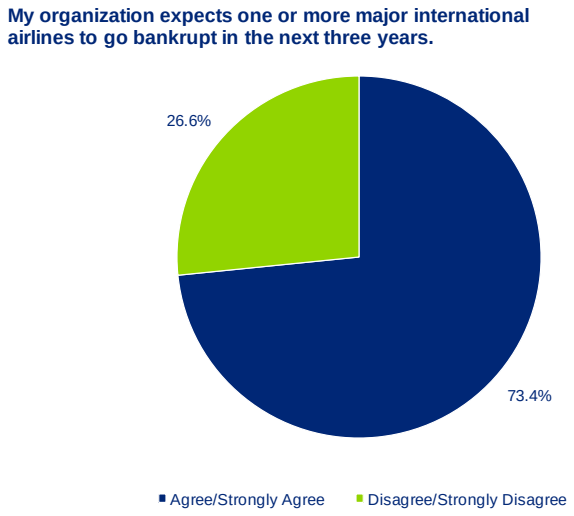
The outlook varies depending on the geographic location of the survey respondents, and the industry subsector in which the survey respondents operated. Thus, 85.2% of companies engaged primarily in A&AP believe an improvement in business conditions is evident over the next three years, compared to only 76.9% of companies engaged primarily in Other AP&S, and 60% engaged primarily in MRO. Geographically, 100% of survey respondents which operate primarily in B.C. believe business conditions will improve substantially, compared to 77.3% in Ontario, 75% in Manitoba, and 68.4% in Quebec.

Generally, the overall profitability of airlines is a key driver of demand within the global aerospace industry. The overall health and profitability of airlines helps determine whether airlines increase their fleet size or upgrade their fleet, which in turn helps drive demand within the global aerospace industry.[133] Given this strong positive correlation, AIAC asked the survey respondents if they believe that one or more major international airlines would go bankrupt over the next three years.

Although most companies believe that the economic recession is ending, almost three-quarters of survey respondents (73.4%) still expect that one or more of the major airlines will file for bankruptcy. This is illustrated in Figure 20 below.

[132] Source: the AIAC Survey (2009).
[133] Standard & Poor's Industry Surveys, "Aerospace & Defense", February 11, 2010.

Figure 20[134]



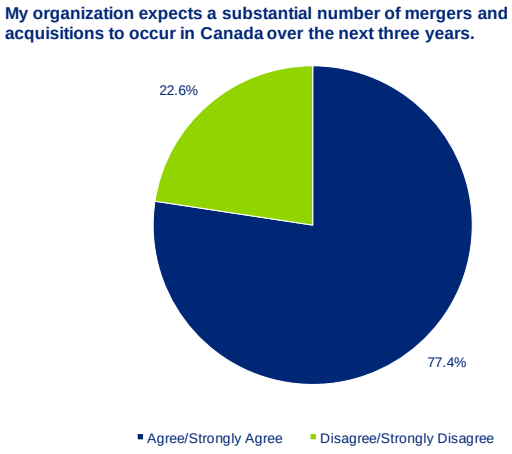
This expectation was stronger in B.C. and Manitoba, where 88.9% and 87.5% of survey respondents, respectively, believe a major airline will go bankrupt in the upcoming three years, compared to 76.2% in Ontario, and 64.7% in Quebec.

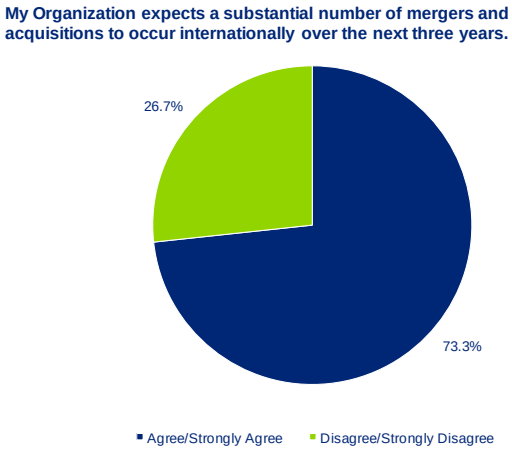
Mergers and acquisition activity

In general, mergers and acquisitions ("M&A") occur within tier-1 and tier-2 suppliers in the aerospace industry in order to gain economies of scale and to increase asset utilization within the industry. It is widely believed that M&A activity will increase as the global economic downturn ends and global aerospace companies hold the financial capacity to carry out these activities.[135]

The AIAC Survey reveals that more than three quarters (77.4%) of survey respondents expect substantial M&A activity in Canada to take place over the next three years, and a similar percentage (73.3%) expect a comparable trend at the international level. This is illustrated in Figure 21 below.

Figure 21[136]





[134] Source: the AIAC Survey (2009).
[135] Deloitte Touche Tohmatsu (DTT) Global Manufacturing Industry, "Compass 2010: Global Aerospace and Defense Outlook", 2010.
[136] Source: the AIAC Survey (2009).

The expectations on M&A vary significantly by revenue band. For instance, 82.1% and 79.3% of large companies believe that there would be substantial M&A activity within Canada and internationally, respectively, over the next three years. In contrast, among small companies, only 77.8% believe this would be the case in Canada, and only 72.0% believe this would be the case internationally. Realistically, it should be noted that it is less likely that the largest international aerospace companies will merge, due primarily to anti-competition laws and related anti-trust matters; however, this trend could become more prevalent amongst mid-tier suppliers.[137]

6.2.3 Future drivers of demand

The AIAC Survey also aimed to identify the future drivers of demand within the Canadian aerospace industry over the next three years.

A key factor determining demand in the aerospace industry is believed to be the general economic recovery following the recent global economic downturn. Survey respondents see the growth in emerging markets, in particular the rising middle class of countries like China, as a key future contributor to aerospace related demand. Many survey respondents believe that over the next three years, the global economy will grow and, on average, business profits will increase. The expected effect of a growing economy and rising business profits is to be an increase in the level of business and commercial air traffic. This would suggest that the overall financial health of airlines should improve over the coming years. This prediction is in line with S&P's estimate that the 10 largest US airlines will only lose US$1.4 billion in 2010 as compared to US$4.7 billion in 2009.[138] As previously discussed, and as described by the survey respondents, the health of airlines is a key driver of demand, as airlines represent major end consumers of the aerospace industry's output.

Survey respondents indicated that other important factors driving demand are the price of fuel and technological innovations. As the price of fuel increases, the costs associated with manufacturing aerospace products increases. However, technical innovation within the aerospace industry will lead to the production of more fuel efficient aircraft and equipment, causing a rise in demand for new aerospace products. Many consumers, such as airlines, wish to upgrade their fleets to more efficient technology in order to lower their operating costs in the long run. The same is true for consumers who prefer more fuel efficient aircraft and equipment due to environmental concerns, and governments who are more focused on substantial reductions in emissions.

Another key factor believed to drive aerospace demand over the next three years is the overall level of military activity and the defence budgets that are set by governments, in particular that of the US. For reference, the US defense spending bill for 2010 of US$636.3 billion was US$18.7 billion less than the defense spending bill for 2009.[139]

Survey respondents also believe that factors such as growth in developing countries, increased globalization and trade liberalization, the availability of government programs and incentives (particularly related to long-term R&D), global political stability, and the threat of terrorism (which affects passenger confidence) would impact demand in the aerospace industry over the next three years.

6.2.4 Future drivers of supply

Similarly, AIAC attempted to forecast the future drivers of supply in the Canadian aerospace industry over the next three years.

The most common drivers of supply for Canadian companies, as indicated by survey respondents, is access to a cost efficient supply chain. It is imperative for Canadian companies to access supply chains that are cost efficient, but which also provide inputs that meet Canadian quality standards. Survey respondents highlight the importance of the continued maturation of the supply chain in low cost,

[137] Deloitte Touche Tohmatsu (DTT) Global Manufacturing Industry, "Compass 2010: Global Aerospace and Defense Outlook", 2010.
[138] Standard & Poor's Industry Surveys, "Aerospace & Defense", February 11, 2010.
[139] Standard & Poor's Industry Surveys, "Aerospace & Defense", February 11, 2010.

developing countries. The access of reliable global supply chains in low cost countries by Canadian suppliers over the next three years may increase the level of supply within the Canadian aerospace industry. It is pointed out by survey respondents that for Canadian companies to maintain their competitive advantage against emerging economies, they need to specialize and move up at least one level of complexity in the global supply chain.

While the access to lower cost inputs from developing nations is beneficial to Canadian aerospace companies, the growth of the aerospace industry within countries such as Mexico and the BRIC countries puts Canadian aerospace companies under increased pressure. Many survey respondents highlighted that increased global competition would be a key factor determining the level of activity within the Canadian aerospace industry over the next three years. This is not surprising as 48.5% of survey respondents believe they will lose a significant portion of their business overseas, as discussed previously.

Another key driver of supply in the Canadian aerospace industry relates to the availability of two key inputs of production: a qualified workforce and access to capital. Many survey respondents highlighted the need for a suitably trained, skilled, and experienced workforce. They also indicated that, as discussed previously, the aging of the Canadian workforce is a critical issue impacting the level of supply within the industry, as it will decrease companies' access to a qualified workforce.

Given that the aerospace industry is very capital intensive in nature, the ability of aerospace companies to access capital, through financial institutions or government funding, will be a major determinant of the level of industry activity in the coming years, As the economy continues to recover and the credit crunch lessens, general access to capital for aerospace companies should increase, thus increasing the level of supply over the next three years.

Survey respondents also emphasize the importance of factors such as government funding, (especially for R&D initiatives), the need and availability of sustainable and green procurement, global economic recovery, the continuing strengthening of the Canadian dollar vs. the US dollar, and industry consolidation such as M&A activity would drive supply in the aerospace industry over the next three years.

7 Conclusion

This Phase 1 report provides an overview of the current environment of the global aerospace industry, as well as provides a profile of the Canadian aerospace industry and the future trends predicted by Canadian aerospace companies. A brief summary of the key statistics and trends illustrated by the AIAC Survey is provided below.

The Canadian aerospace industry was estimated to have generated C$22.2 billion in revenues in 2009. This is approximately a 6% drop from the C$23.6 billion reported in 2008. The bulk of aerospace production occurs in Quebec and Ontario, which generate 51.9% and 28.9% of total revenues, respectively. After five years of strong growth, the aerospace industry encountered some headwinds in 2008 with the onset of the financial crisis. In 2009, the global aerospace and defense industry's operating earnings were down 15.3%.[140] The negative impact on earnings in the industry was primarily due to accounting write-offs related to large programs, asset impairments, or regulatory fines (at a few largest firms). However, 80.6% of survey respondents believe the global economic downturn is ending and business conditions for Canadian firms will substantially improve over the next three years. Survey respondents based in Quebec, the largest aerospace region in Canada, are less optimistic, with only 68.4% of them believing that business conditions will improve over the next three years, which is substantially less than in Manitoba (75.0%), Ontario (77.3%), or B.C. (100.0%). In addition, the majority of survey respondents forecast higher revenues in 2010 than in 2009. Forecast aerospace revenues for 2010 are an estimated C$24.1 billion, with these forecasts being primarily driven by Provincial members.

The most common actions reported as having been already undertaken in order to offset the effects of the global economic downturn in 2010 and 2011 were reductions in the size of their workforce and deferrals in capital expenditures. Many survey respondents indicate their company had utilized the Government of Canada's "work-sharing" program, in which a company's employees work reduced hours, but are able to collect employment insurance benefits for the hours they did not work. Other measures taken to cope with the economic downturn include increased marketing and sales efforts, restructuring business to focus on higher value activities, and controlling discretionary costs (such as travel expenses and office supplies)

The Canadian aerospace industry employed an estimated total of 78,965 workers, with the largest proportion of the workforce working as production staff. The majority of survey respondents indicate that increased retirement, due to the aging of the baby boomers, will put pressure on the Canadian aerospace industry's workforce and deteriorate the Canadian technological knowledge base, likely putting Canada at a competitive disadvantage. This finding is especially pronounced among survey respondents based in B.C. and Manitoba, and less so from survey respondents based in Ontario and Quebec. Government policies on education and training programs, as well as environmental regulations are important factors for the Canadian aerospace industry. The work force employed in the aerospace industry is highly skilled and requires specific training within the sciences and engineering professions. As such, for the industry's success, it is important to maintain an evolving skilled workforce with a strong technological knowledge base.

Unlike the global aerospace industry, the Canadian industry was dominated by the CAS in 2009, which comprised an estimated 83.4% of the industry's revenues. The largest sector in the Canadian aerospace industry is the A&AP sector, which generated an estimated 49.2% of all aerospace revenues in 2009. The next largest sector is MRO, which generated an estimated 19.2% of all aerospace revenues in 2009. The

[140] Deloitte Development LLC., "2009 Global Aerospace and Defense Industry Performance Wrap Up", May 11, 2010.

majority of survey respondents indicate that they expect countries will increasingly specialize in which sub-sector of the aerospace industry they operate within over the next three years.

Although most survey respondents indicate that there was still substantial room for growth in the Canadian aerospace industry, the Canadian aerospace industry is largely export based, with an estimated 77.9% of revenues being generated by sales to foreign markets. The largest markets for Canadian aerospace exports are the US (57.0% of total exports) and Europe (26.9% of exports). Canadian exports may come under increased competition over the next three years, as 48.5% of survey respondents indicate that they expected to lose a substantial part of their business to developing countries such as the BRIC countries and Mexico. Survey respondents based in Ontario are less optimistic, with 54.5% of them believing that they will lose a substantial portion of their business to foreign competitors, compared to substantially fewer survey respondents based in Manitoba (37.5%), Quebec (36.8%), and B.C. (33.3%). Industry experts believe that, going forward, the global aerospace industry will continue to expand in developing countries such as China and India, which are expected to grow both as suppliers within the global aerospace supply chain and as consumer markets.[141] On the public policy side, there is a clear drive by these countries to expand their position in the civil aerospace industry, primarily in response to the belief that Asia-pacific will be the largest market for air transport aircraft in the next 10 years.

The aerospace industry is very capital intensive, and requires substantial research and development ("R&D") activities. In 2009 aerospace companies invested an estimated total of C$1.9 billion. The R&D component is the largest type of investment, constituting 72.7% of total investment, with the remaining 27.3% being spent on property, plant, and equipment ("PPE"). The Government of Canada has various programs designed to fund aerospace R&D activities, providing funding for an estimated 33.8% of the total aerospace R&D spend in Canada in 2009. The majority of survey respondents indicate that this level of governmental funding is not sufficient when compared to the funding provided to aerospace companies from foreign governments. This finding is especially pronounced among survey respondents based in Quebec and B.C., and less so from survey respondents based in Ontario and Manitoba. The role of government in the aerospace industry is widely recognized as being of strategic importance. A 2009 study by aerospace consultant, AeroStrategy LLC, suggests that another developing trend globally, and one with implications for Canada, is the growing collaboration between aerospace companies and foreign governments to create high value aerospace clusters within their respective countries.[142] This means that global competition faced by the Canadian aerospace industry will continue to increase due to foreign competitors' collaboration with their own domestic governments.

In addition, survey respondents also indicate that they expect factors such as the general economic recovery, the health of airlines, the price of fuel and technological innovations, and the level of military activity worldwide, to drive demand for Canadian aerospace products and services over the next three years.

Similarly, survey respondents note that factors such as access to low cost global supply chains, access to qualified labour and capital, increased foreign competition, and government funding will drive the supply of Canadian aerospace products and services over the next three years.

[141] See previous discussion and also: Deloitte Touche Tohmatsu (DTT) Global Manufacturing Industry, "Compass 2010: Global Aerospace and Defense Outlook", 2010.
[142] AeroStrategy, "Aerospace Globalization 2.0: Implications for Canada's Aerospace Industry", November 2009.

Appendix I - statistical methodology

Sampling strategy

Due to the relatively small size of the total population of Canadian aerospace companies (approximately 500 companies), it was determined that the 2009 AIAC annual survey ("the AIAC Survey") should be conducted as a census instead of a random sample. Therefore, the AIAC Survey was sent to all Canadian aerospace companies registered with either AIAC or a provincial association.[143]

Response rate

In total, there were 69 responses to the 2009 edition of the AIAC Survey. The response rate was substantially higher for AIAC direct members (57.0%) than it was from companies that are only members of provincial aerospace associations (5.4%). The breakdown of responses is as follows:

- 45 responses from AIAC direct members (out of a total membership of 79); and
- 24 responses from provincial-only members (out of a total membership of 448).

The geographical distribution of the results is outlined in Table 6 below.

Table 6: Geographic distribution of Provincial members' responses

	Members	No. of Responses	Response Rate
New Brunswick Aerospace and Defence Association	30	1	3.3%
Quebec Aerospace Association	135	1	0.7%
Ontario Aerospace Council	130	12	9.2%
Manitoba Aerospace Association	29	7	24.1%
Enterprise Saskatchewan	6	1	16.7%
Aerospace Industries Association of BC	40	2	5.0%
Other Provincial Bodies	78	0	0.0%
Total	**448**	**24**	**5.4%**

Source: AIAC
Note: Numbers may not add up due to rounding

We have conducted our analysis under the assumption that the provincial-only members that did respond are representative of the total population of provincial-only members. The basis of this assumption is that among provincial-only members the variation in size tends to be smaller than that of AIAC members as a whole.

[143] The provincial associations were responsible for issuing the questionnaire to their members and for any follow-up, while AIAC was similarly responsible with respect to its direct members.

Extrapolation of survey data

To derive estimates of industry-level statistics based on the 2009 responses to the AIAC Survey ("survey data"), we extrapolated the survey data using statistical inference. Extrapolation accounts for the non-responding members, and statistical inference allows us to derive a confidence interval for the industry-level estimates. Extrapolation to the industry level is only possible when the total population of the industry is known. Based on our discussions with AIAC, it was determined that the 79 direct members of AIAC and the 448 provincial-only members effectively comprise the entire population of the Canadian aerospace industry.

Stratification of survey data

Accuracy in extrapolation is enhanced with a higher degree of homogeneity in the sample (that is, when the sample is more likely to be representative of the underlying population). In this case, we determined that stratifying the survey data would result in a more efficient analysis.[144] Thus, we divided the Canadian aerospace industry into strata based on size (as measured by sectoral revenue of previous years). The working hypothesis is that firms that are closer in size (as measured by revenue) are more likely to behave in a similar fashion. In developing the strata, we utilized membership categories (or revenue bands) previously developed by AIAC (for AIAC members). These bands categorized each company based on their membership fees, which AIAC calculated based on self reported 2008 aerospace revenues. The resulting strata are shown in Table 7 below.

Table 7: Stratification of AIAC members by revenue

Stratum	AIAC Category	Revenue Bands (C$)	No. of members
1	Special Category I	$1 billion or more	3
1	Special Category II	$500 million - $1 billion	1
1	Special Category III	$225 million - $500 million	10
2	Category I: Group I	$100 million - $225 million	4
2	Category I: Group II	$50 million - $100 million	6
2	Category I: Group III	$20 million - $50 million	3
3	Category II: Group IV	$10 million - $20 million	4
3	Category II: Group V	$5 million - $10 million	7
3	Category II: Group VI	$2.5 million - $5 million	8
3	Category II: Group VII	$1 million - $2.5 million	8
3	Category II: Group VIII	$0.5 million - $1 million	4
3	Category II: Group IX	$0.5 million of less	21
	Total		**79**

Source: AIAC

[144] With surveys, it is common to use a stratified approach to improve the representativeness of sampling. Stratification refers to the process of dividing the population into homogenous, mutually exclusive groups called strata.

This level of detail is not available for the provincial-only members, and as such we created a fourth stratum which consists of all the provincial-only members. As the revenue variance among provincial-only members is relatively small, no categorization was used for this sub-component.

Extrapolation analysis

The extrapolation exercise was carried out by calculating the mean for each stratum and grossing up the mean to reflect the number of companies within the total population of each stratum. By calculating the sum of the grossed up figures for each stratum, we are able to derive total industry level figures for the Canadian aerospace industry. There was a 100% response rate from Special Category members, and as such no extrapolation for this stratum was required. This is, the survey data captured the total population value for this stratum.[145]

Confidence intervals

In order to calculate confidence intervals for our statistical inference analysis, which provide an indication of the level of accuracy possible given the sample data, we relied on the central limit theorem to use the normal distribution.

Calculation of confidence intervals

We calculated confidence intervals for the average value (or measure of central tendency) for each question analyzed from the 2009 edition of the AIAC Survey. The confidence intervals were calculated at the 90% confidence level (based on the observed sample variance). As we do not know the population variance for each stratum (due to the fact that the entire population did not respond to the AIAC Survey), we utilized t-statistics in our calculation of confidence intervals, which have a larger dispersion than the normal distribution. This results in the confidence intervals having a wider variance.[146]

The calculations were carried out for each stratum using the following equation:

$$CI = N \cdot [\mu \mp t(\alpha/2, n-1) \cdot \frac{\sigma}{\sqrt{n}}]$$

Where:

- $t(\alpha/2, n-1)$ is the relevant t-statistic with the corresponding significance level (α) and degrees of freedom ($n-1$). In this case the significance level is 10%, which corresponds to a 90% confidence level;
- N is the population size of a strata;
- n is the sample size from the strata;
- μ is the average (or measure of central tendency) of the strata for a given question; and
- σ is the standard deviation of the strata for a given question.

Using this methodology we have calculated the confidence intervals for each stratum, which effectively gives us the 90% lower bound (upper bound) for a given question. When the lower bounds (upper bounds) of each strata are summed, because the strata are assumed to be independent and mutually exclusive of each other, this gives us the lower bound (upper bound) at the industry level.

Example of confidence interval calculation

Below we have demonstrated the calculation for AIAC category I aerospace employment. For this calculation, the relevant inputs from the AIAC category I strata are:

[145] There are some questions where at least one respondent from the stratum of Special Category members chose not to answer; as such the statistical extrapolation methodology had to be used for these questions. These questions were in reference to the breakdown of aerospace employment and revenue by product application, payroll, and information on investments.
[146] Newbold, Paul *et al.* "Statistics for Business & Economics". Pearson Custom Publishing, 2003.

- $t(\alpha/2, n-1)$ is equal to $t(0.05,8)$ or 1.860;
- N is equal to 13;
- n is equal to 9;
- μ is equal to 835; and
- σ is equal to 385.

As such the following formula:

$$CI = N \cdot [\mu \mp t(\alpha/2, n-1) \cdot \frac{\sigma}{\sqrt{n}}]$$

Can be rewritten as:

$$CI = 13 \cdot [835 \mp 1.860 \cdot \frac{385}{\sqrt{9}}]$$

This simplifies to:

$$CI = 10{,}852 \mp 3{,}103$$

As such, the confidence interval for AIAC category I aerospace employment at the 90% confidence level is 7,750 employees to 13,955 employees. The correct interpretation of this confidence interval is that if you took 10 random samples of Category I members and calculated confidence intervals for each sample in the manner described above, then 9 out of 10 of those calculated confidence intervals would encompass the true population size for aerospace employment within Category I members.

Note on confidence intervals for disaggregated data

The analysis of data at a more disaggregated level tends to be less reliable than at an aggregate level, primarily due to reduced sample sizes. In the case of the AIAC Survey, this means that confidence intervals for questions which ask for the breakdown of an aggregate measure (for example, breakdown of industry revenue into military and civil components) will have wider confidence intervals because not all respondents to the question on the aggregate measure provide a response to the sub-questions on the breakdown.

In addition, some sub-questions end up with a sample size which is too small for meaningful statistical analysis; for example, the sub-questions on the breakdown of industry revenue by province sometimes produce a sample size which is as small as one response. For these cases, we have not presented the statistical analysis.

Testing the assumption of symmetry

To test for possible departures from distributional symmetry (a key assumption for our inference analysis), we tested for skewness in the data. This may arise, for example, in the presence of substantial economies of scale to firm size. In this case, significant skewness within each stratum would lead to a conclusion that the assumption of a normal distribution is not supported by the data.

Skewness can be defined with respect to the third moment about the mean:

$$\gamma_1 = \frac{\sum (X-\mu)^3}{n\sigma^3}$$

Which is simply the expected value of the distribution of cubed z-scores. When the deviations from the mean are greater in one direction than in the other direction, this statistic will deviate from zero in the direction of the larger deviations. From sample data, this measure of skewness is most often estimated by:

$$g_1 = \frac{n\sum z^3}{(n-1)(n-2)}$$

This is the estimate implemented by the "SKEW" function in Microsoft Excel. To test the significance of this statistic, we can divide the estimate by its standard error to obtain a z-test of the null hypothesis that the parameter is zero, as would be expected in a normal population. Where this test reveals the possibility of significant skewness, we augment it by a bootstrapping test of the skewness statistic.

Bootstrapping test of skewness

Bootstrapping is a general approach to statistical inference based on building a sampling distribution for a statistic by resampling from the data at hand. Thus, we can gather many alternative versions of the single statistic estimated from the original sample, which allows us to estimate properties of an estimator, such as its variance. With bootstrapping, we randomly extract a new sub-sample of the sampled data, typically with replacement (meaning that each observation can be selected multiple times). By doing this several times (say, 10,000 times), we create a large number of datasets that we might have drawn from the population. By computing the statistic of interest for each of these datasets, we get an estimate of the distribution of the statistic. In contrast, the traditional approach to statistical inference involves an assumption about the structure of the population (typically, an assumption of normality), and along with the stipulation of random sampling, using this assumption to derive the sampling distribution for the statistic of interest (say, the variance).

Bootstrapping is often used as an alternative to classical inference when the underlying parametric assumptions are in doubt, or where parametric inference is impossible or requires very complicated formulas for the calculation of standard errors. The key to the strategy is to create representative alternative versions of samples that could have been drawn from the population.

In this case, we used bootstrapping (involving 10,000 replications of each data set) to test for skewness by estimating the distribution of the skewness indicator. Where a zero skewness indicator was included in the bootstrapped distribution of skewness indicators, we concluded that the potential deviation from normality is not large enough to cause problems with the test statistic which assumes normality.

Corroborative analysis

As a test of the robustness of our results, we completed an extreme bounds analysis on aerospace revenues. In this test we calculated an extreme lower bound and an extreme upper bound utilizing the categorization of AIAC members based on 2008 membership fees, as provided by AIAC.

To calculate the extreme lower bound, all non-respondents were assigned a value equal to the minimum of:

a) The low point of the revenue band to which they belong; or

b) The lowest response from any respondent in the same revenue band.

To calculate the extreme upper bound, all non-respondents were assigned a value equal to the maximum of:

a) The high point of the revenue band to which they belong; or

b) The highest response from any respondent in the same revenue band.

As the Provincial members were not categorized into revenue bands, the lower bound for provincial-only members was calculated by assigning the lower quartile to all non-respondents, while the upper bound was calculated by assigning the upper quartile to all non-respondents. The results of the extreme bounds analysis are shown in the table below.

Table 8: Results of extreme bound analysis - revenue

Membership Category	Lower Bound (C$ millions)	Upper Bound (C$ millions)
AIAC: Special Categories I-III	16,106	16,106
AIAC: Category I	1,638	2,373
AIAC: Category II	522	1,391
Provincial-only members	490	2,663
Industry (Total)	**18,756**	**22,534**

Note: Numbers may not sum due to rounding error.

The range implied by this extreme bound analysis is broadly consistent with the range calculated using statistical inference. This provides additional comfort regarding the robustness of our analysis.

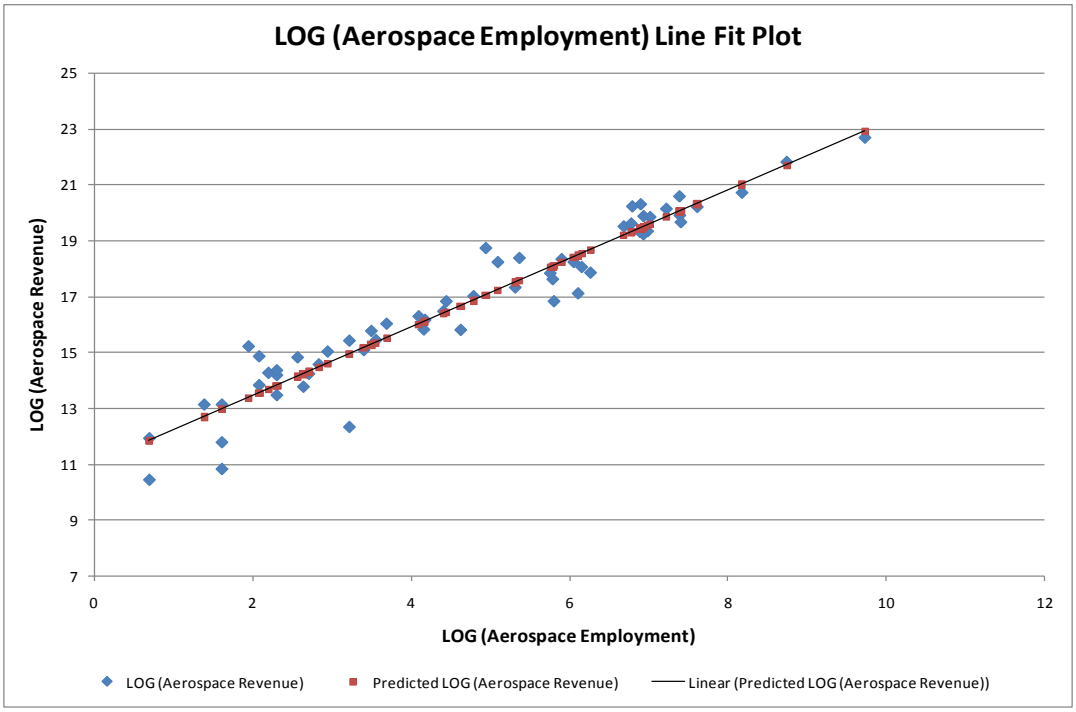
Test of relationship between revenue and employment

As a test of our working hypothesis that firms that are closer in size (as measured by revenue) are more likely to behave in a similar fashion, we have performed a regression analysis of revenue against employment, to determine if companies with similar revenues do indeed employ similar numbers of workers.

The statistical relationship between aerospace revenue and aerospace employment is non-linear; as such we performed an analysis of the logarithms of both revenue and employment. Taking logarithms of both revenue and employment yields a statistically significant relationship, which implies a constant employment elasticity of 1.22.[147] The interpretation is that for every 1% increase in employment, revenue tends to increase by 1.22%, with the ratio holding across the industry.

This relationship is statistically robust, as the R-squared value indicates that changes in employment "explain" approximately 93% of changes in revenue. In addition, the estimate for elasticity is (statistically) constant across firm size (no difference between smaller and larger members) and degree of export orientation. The following graph illustrates the relationship between the log of aerospace employment and the log of aerospace revenues.

[147] The 95% confidence interval for employment elasticity = (1.14, 1.31).



The apparent relationship between revenues and employment corroborate that our working hypothesis, and consequently the methodology used to stratify the data, appears reasonable.

Appendix II - results of statistical analysis

The following table summarizes the measures of central tendency and confidence intervals for the 2009 edition of the AIAC Survey. As discussed in Appendix 2, confidence intervals for each stratum are calculated at the 90% confidence level using t-statistics. Please note that all figures are given in millions of dollars, except for employment which is in number of workers. Also note that the central estimate represents the expected value for the industry level statistics based on the responses received to the AIAC Survey.

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Revenue			
Special Category members	16,106	16,106	16,106
Category I members	1,301	2,095	2,889
Category II members	434	1,048	1,663
Provincial members	757	2,947	5,136
Industry (Total)	**18,598**	**22,196**	**25,793**
Employment			
Special Category members	40,738	40,738	40,738
Category I members	7,750	10,852	13,955
Category II members	2,099	4,196	6,293
Provincial members	9,043	23,179	37,315
Industry (Total)	**59,630**	**78,965**	**98,301**
Payroll			
Special Category members	2,823	3,009	3,195
Category I members	446	683	921
Category II members	95	225	355
Provincial members	353	1,075	1,796
Industry (Total)	**3,665**	**4,633**	**5,602**
2010 Revenue			
Special Category members	15,993	15,993	15,993

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Category I members	1,499	2,281	3,063
Category II members	455	1,105	1,755
Provincial members	1,294	4,730	8,166
Industry (Total)	**19,091**	**24,109**	**28,977**
2010 Employment			
Special Category members	40,442	40,442	40,442
Category I members	7,706	11,015	14,325
Category II members	3,251	5,366	7,480
Provincial members	11,770	26,133	40,496
Industry (Total)	**63,169**	**82,956**	**102,744**
Revenue by Product Application			
Military	1,279	3,706	6,133
Civil	14,302	18,573	22,845
Industry (Total)	**15,581**	**22,279**	**28,978**
Employment by Product Application			
Military	5,278	15,553	25,827
Civil	44,386	63,681	82,976
Industry (Total)	**49,664**	**79,234**	**108,803**
Revenues by Market			
Domestic	3,317	4,899	6,481
Foreign	14,381	17,297	20,213
Industry (Total)	**17,698**	**22,196**	**26,694**
Exports by Region			
United States	7,711	9,859	12,007
South/Central America	420	502	584
Europe	3,733	4,657	5,581
Middle East	562	590	618
Asia	938	1,053	1,168
Africa and Oceania	549	636	723
Industry (Total)	**13,912**	**17,297**	**20,681**

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Revenue by Sub-Sector			
Aircraft, Aircraft Parts & Components	7,798	10,925	14,052
Aircraft Engines & Engine Parts	2,753	3,074	3,394
Avionics & Electro Systems	923	1,038	1,154
Simulations & Training	933	1,124	1,316
Aircraft MRO	3,173	4,262	5,351
Space[148]	69	754	1,438
Other Industry Related Products & Services	515	1,019	1,522
Industry (Total)	**17,289**	**22,196**	**28,227**
Employment by Category			
Engineering & Scientific Staff	8,928	12,770	16,612
Production Staff	19,271	37,102	52,509
Technicians and/or Technologists	3,862	8,559	14,477
All others	11,220	19,201	24,154
Industry (Total)	**47,785**	**78,529**	**109,273**
Investments			
Investments in R&D	962	1,412	1,862
Investments in PPE	141	529	917
Total Investments	**1,104**	**1,941**	**2,779**
Government Funding of R&D	**322**	**477**	**633**

[148] Only selected companies and sub-sectors from the space industry are included in this analysis of the Canadian aerospace industry.

Appendix III – the 2009 AIAC annual membership survey

The following document is the 2009 AIAC annual membership survey. It was distributed by AIAC to its direct members and the provincial associations in March-2010.

Aerospace Industries Association of Canada | L'Association des industries aérospatiales du Canada

PART I: 2009 ANNUAL SURVEY OF THE AEROSPACE INDUSTRY

The purpose of this survey: AIAC is conducting a survey to produce statistical information on the revenue, employment, costs, and investment of the Canadian firms providing aerospace products and services in Canada. This data will be used to determine the competitive position of the sector and its needs in terms of federal government policies and programs.

The data you report are confidential: The data reported by your company will be treated as commercially confidential. The results will be used for statistical purposes and released in aggregate form only with no insight into the operations and performance of individual companies.

Please print, complete and return the survey by:

Email: survey@aiac.ca

Fax: (613) 232-1142

Deadline: FRIDAY, APRIL 16th, 2010

Contact Information:

Vlada Shilina, Director, Supplier & International Market Development
Tel.: (613) 760-4554
Email: vlada.shilina@aiac.ca

SECTION 1: COMPANY INFORMATION

Name of Company			
Completed by		Job Title	
Telephone		Fax	
Email		Website	
Head Office Location (City, Province)			

If this company has other establishments (i.e. plants) involved in Aerospace production in Canada, please list Canadian city of other locations:

City:	City:
City:	City:
City:	City:

Primary Industry NAICS Code:

SECTION 2: COMPANY REVENUES

2.1 In 2009, what was the size of your company in terms of **overall revenue (including non-aerospace)** generated by facilities in Canada?

2.2 For year 2009, what was the total dollar value of your company's **aerospace-related revenues** (civil, military, space) generated by facilities in Canada?

2.3 What percentage of your organization's **aerospace revenues** is obtained from each of the following **aerospace sub-sectors**?

Sub-Sectors:	**Percentage:**
Aircraft, Aircraft Parts and Components	%
Aircraft Engines and Engine Parts	%
Avionics and Electro Systems	%
Simulations and Training	%
Aircraft Maintainance, Repair, & Overhaul	%
Space	%
Other Aerospace Industry Related Products and Service (please specify)	%

2.4 For year 2009, show the breakdown of **aerospace-related revenues** (civil, military, space) generated by company facilities in provinces. If there are multiple sites in province, please specify.

Provinces/Location:	**Revenue:**
Newfoundland	$
Prince Edward Island	$
Nova Scotia	$
New Brunswick	$
Quebec	$
Ontario	$
Manitoba	$
Saskatchewan	$
Alberta	$
British Columbia	$
NWT & Yukon	$
Nunavut	$
TOTAL 2009 Aerospace-Related Revenues:	

2.5 For year 2009, show percentage breakdown of **aerospace-related revenues** (civil, military) by **Product Application.**

Civil	%
Military	%
TOTAL	100 %

2.6 For year 2009, show percentage breakdown of **aerospace-related revenues** (civil, military, space) by **Domestic Sales** and **Export Sales**.

Domestic Sales	%
Export Sales	%
TOTAL	100 %

2.7 What percentage of your total **aerospace-related export sales** (civil, military, space) were to:

U.S.	%	South America/Central America	%
Western Europe	%	Eastern Europe	%
Asia	%	Africa & Oceania	%
Middle-East	%		

Please specify countries:

2.8 For 2010, provide your aerospace (civil, military, space) **revenue projection?**

2.8.1. Please provide **percentage breakdown** by geographical locations of your **projected sales**:

U.S.	%	South America/Central America	%
Western Europe	%	Eastern Europe	%
Asia	%	Africa & Oceania	%
Middle-East	%		

Please specify countries:

2.9 Has your projection been impacted by the economic downturn? (please mark the box)

YES ☐

NO ☐

SECTION 3: COMPANY EMPLOYMENT

3.1 In 2009, what was your company's **total employment (including non-aerospace)** in Canada?
(Please include Full-Time, Part-Time, and contract (persons working more than 30 hours) workers).

3.2 In 2009, what was your company's **total aerospace-related employment** in Canada?
Please show the distribution of Canada aerospace-related employees by category.

Total Aerospace Only Staff	
i. Engineering & Scientific Staff	
ii. Technicians and/or Technologist	
iii. Production Staff	
iii. All Other Employees (including Management, Administration, Marketing, etc.)	

3.3 For 2009, show the **distribution** of aerospace related employees (civil, military, space) by **provinces** and total **payroll costs**.
If there are multiple sites, please specify.

Provinces	Number of Employees	Total Payroll (in $CDN)
Newfoundland		$
Prince Edward Island		$
Nova Scotia		$
New Brunswick		$
Quebec		$
Ontario		$
Manitoba		$
Saskatchewan		$
Alberta		$
British Columbia		$
NWT & Yukon		$
Nunavut		$
Canada Total		$

3.4 For 2009, show the percentage distribution of **aerospace-related employees** (civil, military) by **Product Application**.

Civil	%
Military	%

TOTAL 100 %

3.5 What is your **projection** of your company's **aerospace-related employment** for 2010?

3.6 Has your projection been impacted by the economic downturn? (please mark the box)

YES

NO

SECTION 4: AEROSPACE RESEARCH & DEVELOPMENT (R&D)

4.1 For 2009, what was the **total value of expenditures** on aerospace (civil, military, space) R & D in Canada?

4.2. What was the **source of financing for R&D**?

4.2.1 **Government** **Total** $

Strategic Aerospace & Defence Initiative (SADI)	$
National Research Council Industrial Research Assistance Program (NRC-IRAP)	$
Scientific Research & Experimental Development Program (SR&ED)	$
Green Aviation Research & Development Network (GARDN)	$
Other Federal or Provincial Funding (please specify)	$

4.2.2 **Internal Company Financing** **Total** $

4.3. Has your company established one or more formal contractual agreements (i.e., service agreements, collaboration agreements, etc.) with the National Research Council Institute for Aerospace Research (NRC-IAR) before 2004? Please mark the appropriate box.

YES **NO**

4.4. Has your company established one or more formal contractual agreements the National Research Council Institute for Aerospace Research (NRC-IAR) between 2004 and 2009? Please mark the appropriate box.

YES **NO**

SECTION 5: AEROSPACE CAPITAL INVESTMENTS

5.1 For 2009, what was the **total dollar value** of aerospace related investment in **Capital Improvements** (Plant & Equipment) in Canada?

$

5.2. Please specify the **source of financing** for **Capital Improvements** (for example: retained earnings, debt, or new equity)?

Please specify:

SECTION 6: AEROSPACE RELATED PURCHASES

6.1 For 2009, in terms of your aerospace-related **purchases** (civil, military, space), what was the **percentage** coming from?

Domestic Suppliers	%
Foreign Suppliers	%
Total	100 %

SECTION 7: GENERAL SOURCES OFCOMPANY FINANCING

7.1 For 2009, please specify other sources of Financing for your company (for operations, exports, production, etc.)?

Please mark the appropriate box:

Government Programs and Grants:

EDC Programs:	
BDC Programs:	
Commercial Banks:	
Private Equity:	
Stock Issuance:	
Bond Issuance:	
Cash from Operations:	

SECTION 8: IMPACT OF FINANCIAL CRISIS

8.1 For 2010-2011, which actions and/or measures has your company taken or is considering to take as a result of the economic downturn?

Please list:

COMMENTS

If you have any comments, please note them below.

Comments:

THANK YOU FOR YOUR PARTICIPATION!

PLEASE RETURN YOUR SURVEY BY FRIDAY, APRIL 16th, 2010!

Aerospace Industries Association of Canada | L'Association des industries aérospatiales du Canada

PART II: 2009 ANNUAL SURVEY OF THE AEROSPACE INDUSTRY

SECTION 1: *Please indicate whether you strongly agree/agree or disagree/strongly disagree with the following statements*

STATEMENTS	Strongly Agree	Agree	Strong Disagree	Disagree
1. Over the next 3 years my organization expects Canada to lose a significant proportion of its business to countries such as China, Russia, and India, Brazil, etc. **If agree/strongly agree, please specify countries:**				
2. My organization believes Canadian companies receive adequate funding from the Canadian government relative to the funding their foreign competitors receive from their respective governments.				
3. My organization believes there will be substantial pressure to become more environmentally friendly in the next 3 years.				
4. My organization believes any pressure to become more environmentally friendly will be associated with a substantial financial burden.				
5. My organization expects one or more major international airlines to go bankrupt in the next 3 years.				
6. My organization believes the economic recession is ending and business conditions for Canadian firms will improve substantially over the next 3 years.				
7. My organization believes there is substantial room for growth of the aerospace industry within Canada.				
8. My organization believes as the baby-boomers in Canada retire in large numbers, the technological knowledge base in Canada will decrease substantially, putting Canada at a competitive disadvantage.				
9. My organization believes that additional funding from the Canadian government would result in a greater number of jobs within the aerospace industry.				
10. My organization believes that countries will increasingly specialize in regards to the sector of the aerospace industry they work in.				
11. My company expects a substantial number of mergers and acquisition to occur in Canada over the next 3 years.				
12. My company expects a substantial number of mergers and acquisition to occur internationally over the next 3 years. **If agree/strongly agree, please specify countries:**				
13. Are Foreign Exchange Rates a concern for your business?				
14. If Foreign Exchange is a concern to your business, how are you managing your Foreign Exchange exposure? **Please highlight the appropriate answer:** A) Natural Hedging B) Bank Instruments C) Not Actively Managing				

SECTION 2: *Please provide a brief point-form response to the following questions:*

1. What does your organization believe will be the most important factors driving demand for the aerospace industry over the next 3 years?
Response:

2. What does your organization believe will be the most important factors driving supply for the aerospace industry over the next 3 years?
Response:

Appendix IV - results of analysis of regional data

The following table summarizes the estimates of industry level revenue, employment, and payroll at the regional level by stratum. Please note that all figures are given in millions of dollars, except for employment which is in number of workers. As above, the level of regional disaggregation presented herein is guided by the availability of a minimum number of available responses which are necessary to make the analysis meaningful and to ensure that company-specific data is not revealed.

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Revenue			
Atlantic Canada			
Special Category members	167	167	167
Category I members	362	523	890
Category II members	53	74	604
Provincial members	125	487	848
Atlantic Canada (Total)	**707**	**1,251**	**2,509**
Quebec			
Special Category members	10,084	10,084	10,084
Category I members	171	247	674
Category II members	196	292	747
Provincial members	228	888	1,548
Quebec (Total)	**10,680**	**11,511**	**13,053**
Ontario			
Special Category members	4,328	4,328	4,328
Category I members	452	652	1,096
Category II members	198	580	749
Provincial members	220	855	1,490
Ontario (Total)	**5,198**	**6,415**	**7,664**

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Western Canada			
Special Category members	1,527	1,527	1,527
Category I members	466	673	1,110
Category II members	51	103	602
Provincial members	184	717	1,250
Western Canada (Total)	**2,227**	**3,019**	**4,488**
Industry (Total)	***18,811***	***22,196***	***27,714***
Employment			
Atlantic Canada			
Special Category members	656	656	656
Category I members	2,014	2,909	5,136
Category II members	379	509	2,729
Provincial members	1,494	3,829	6,164
Atlantic Canada (Total)	**4,542**	**7,902**	**14,685**
Quebec			
Special Category members	26,679	26,679	26,679
Category I members	861	1,244	3,659
Category II members	511	1,147	2,861
Provincial members	2,725	6,985	11,245
Quebec (Total)	**30,776**	**36,054**	**44,444**
Ontario			
Special Category members	10,117	10,117	10,117
Category I members	1,993	2,879	5,332
Category II members	765	2,213	3,115
Provincial members	2,624	6,726	10,828
Ontario (Total)	**15,499**	**21,935**	**29,393**
Western Canada			
Special Category members	3,286	3,286	3,286
Category I members	2,645	3,820	5,984
Category II members	191	327	2,541
Provincial members	2,200	5,640	9,079

	Lower Bound (C$ million)	Central Estimate (C$ million)	Upper Bound (C$ million)
Western Canada (Total)	**8,322**	**13,073**	**20,890**
Industry (Total)	***59,140***	***78,965***	***109,411***
Payroll			
Atlantic Canada			
Special Category members	44	47	58
Category I members	104	192	404
Category II members	14	52	178
Provincial members	50	118	187
Atlantic Canada (Total)	**211**	**410**	**827**
Quebec			
Special Category members	1,784	1,831	1,980
Category I members	62	115	323
Category II members	29	106	193
Provincial members	91	216	341
Quebec (Total)	**1,966**	**2,269**	**2,837**
Ontario			
Special Category members	771	872	969
Category I members	118	219	434
Category II members	15	55	179
Provincial members	88	208	328
Ontario (Total)	**991**	**1,355**	**1,910**
Western Canada			
Special Category members	212	258	409
Category I members	84	157	400
Category II members	3	12	168
Provincial members	73	174	275
Western Canada (Total)	**373**	**600**	**1,251**
Industry (Total)	***3,541***	***4,633***	***6,825***

Appendix V – confidence intervals for qualitative questions

The AIAC Survey also sought to gather the views of members on the industry outlook. Thus, a set of qualitative questions focused on key industry drivers such as the state of global competition, the role of the Canadian government in the industry, challenges facing the Canadian industry, and the general business conditions within the Canadian industry. These qualitative questions had two possible responses: (i) agree/strongly agree ("agree/SA") or (ii) disagree/strongly disagree ("disagree/SD"); in statistical terms, the answers are considered to be a binomially-distributed variable. To provide an estimate of the sampling error associated with the survey data, we have calculated 90% confidence intervals around the central point estimate (or the proportion estimated in a statistical sample)..

Calculation of confidence intervals

In order to calculate the binomial proportion confidence interval, we relied on the central limit theorem and used the normal distribution as an approximation of the binomial distribution. A general rule of thumb is that the normal distribution provides a good approximation of the binomial distribution when:[149]

$$n \cdot \pi \cdot (1 - \pi) > 9$$

Where:

- n is equal to the number of responses; and
- π is the probability that a survey member will agree/SA.

For our analysis, this general rule of thumb holds for 10 of the 13 questions. The formula for the confidence interval is as follows:[150]

$$CI = \pi \mp z(\alpha/2) \cdot \sqrt{\frac{\pi \cdot (1 - \pi)}{n}}$$

Where:

- $z(\alpha/2)$ is the relevant z-statistic with the corresponding significance level (α). We have set the significance level at 10%, which corresponds to a 90% level of confidence.

Example of confidence interval calculation

Below we have demonstrated the calculation of the confidence intervals for the response to the following question:

> "My organization believes the economic recession is ending and business conditions for Canadian firms will improve substantially over the next 3 years."

[149] Newbold, Paul *et al.* "Statistics for Business & Economics". Pearson Custom Publishing, 2003.
[150] Agresti, Alan and Coull, Brent. "Approximate is Better than Exact for Interval Estimation of Binomial Proportions". *The American Statistician*, Vol. 52 No. 2. May 1998.

For this question:

- $z(\alpha/2)$ is equal to $z(0.05)$ or 1.645;
- n is equal to 67; and
- π is equal to 80.6% (*i.e.* 80.6% of respondents agree/SA with this statement);

As such the confidence interval is calculated as follows:

$$CI = 80.6\% \mp 1.645 \cdot \sqrt{\frac{80.6\% \cdot (1 - 80.6\%)}{67}}$$

Which yields the following confidence interval:

$$CI = 80.6\% \mp 7.9\%$$

In words, the 90% confidence interval for the percentage of aerospace companies that agree/SA with the given question is 72.6% to 88.5%.

The following table summarizes the results of the statistical analysis for the 13 qualitative questions included in the AIAC Survey.

No. of responses	Actual Responses (% Agree/SA)	Lower bound (% Agree/SA)	Upper bound (% Agree/SA)	$n \cdot \pi \cdot (1 - \pi)$
1. Over the next 3 years my organization expects Canada to lose a significant proportion of its business to countries such as China, Russia, India, and Brazil, etc.				
66	48.5%	38.4%	58.6%	16.5
2. My organization believes Canadian companies receive adequate funding from the Canadian government relative to the funding their foreign competitors receive from their respective governments.				
67	34.3%	24.8%	43.9%	15.1
3. My organization believes there will be substantial pressure to become more environmentally friendly in the next 3 years.				
66	93.9%	89.1%	98.8%	3.8
4. My organization believes any pressure to become more environmentally friendly will be associated with a substantial financial burden.				
65	73.8%	64.9%	82.8%	12.6
5. My organization expects one or more major international airlines to go bankrupt in the next 3 years.				
64	73.4%	64.4%	82.5%	12.5
6. My organization believes the economic recession is ending and business conditions for Canadian firms will improve substantially over the next 3 years.				
67	80.6%	72.6%	88.5%	10.5
7. My organization believes there is substantial room for growth of the aerospace industry within Canada.				
66	83.3%	75.8%	90.9%	9.2
8. My organization believes as the baby-boomers in Canada retire in large numbers, the technological knowledge base in Canada will decrease substantially, putting Canada at a competitive disadvantage.				

No. of responses	Actual Responses (% Agree/SA)	Lower bound (% Agree/SA)	Upper bound (% Agree/SA)	$n \cdot \pi \cdot (1 - \pi)$
65	64.6%	54.9%	74.4%	14.9
9. My organization believes that additional funding from the Canadian government would result in a greater number of jobs within the aerospace industry.				
65	89.2%	82.9%	95.6%	6.2
10. My organization believes that countries will increasingly specialize in regards to the sector of the aerospace industry they work in.				
66	75.8%	67.1%	84.4%	12.1
11. My company expects a substantial number of mergers and acquisition to occur in Canada over the next 3 years.				
62	77.4%	68.7%	86.2%	10.8
12. My company expects a substantial number of mergers and acquisition to occur internationally over the next 3 years. If agree/strongly agree, please specify countries:				
60	73.3%	63.9%	82.7%	11.7
13. Are Foreign Exchange Rates a concern for your business?				
66	89.4%	83.2%	95.6%	6.3

Statement of responsibility

Deloitte prepared this report for the Aerospace Industries Association of Canada (“AIAC”) to provide an economic analysis of and outlook for the Canadian aerospace industry. Our report is general in nature and is not intended to be applied to address or reflect specific matters or circumstances as they may apply to a particular company or organization.

In preparing our report we have relied on the accuracy and completeness of information provided to us by AIAC and from publicly available sources. Deloitte has not audited or otherwise verified the accuracy or completeness of the information supplied to us. Events may have occurred since we prepared this report which may impact on the information therein and our conclusions.

While we discussed our draft report with AIAC the content of the final report, including any opinions, assessments and conclusions, is ours.