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

Future Major Platforms Report

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I. Executive Summary

The Aerospace Industries Association of Canada (AIAC) identified the Future Major Platforms (FMP) Initiative as one of its top priority in 2007. Under the FMP Initiative, the AIAC and representatives of Canadian aerospace companies conducted a detailed review of the market opportunities, technologies requirements, industry capabilities, and government support mechanisms that form the foundation for future growth in Canada's aerospace industry.

The following is the first report of the FMP Initiative. The objective of this report is to identify key priority technology areas, provide recommendations to align current support mechanisms, and propose initiatives to help industry and government to secure work packages on upcoming major aircraft platforms.

Canada's contribution to the aerospace industry has been leading-edge and iconic -- and its strength is recognized world-wide. From the de Havilland Beaver to Bombardier's Canadair Regional Jets, from Pratt & Whitney Canada's PT6 to the world's largest aircraft landing gear test facility in Oakville, Ontario, and CAE, the premier supplier of aviation simulation and training solutions, the industry achieved its success by developing capabilities in specific market niches, resulting in world product mandates as well as world leading products.

Aerospace is an innovation- and technology-intensive industry. The industry's need to improve efficiency, reduce its environmental foot print, and address safety concerns will drive new technologies and processes at an ever faster pace, including a greater use of lightweight materials, modeling and simulation, more fuel-efficient engines with lower emissions and less noise, and the move from hydraulic to all-electric aircraft.

Canada's aerospace industry is facing an enormous challenge. Its future growth and success rests with its ability to offer innovative solutions as original equipment manufacturers (OEMs) configure their next generation major aircraft platforms. The Boeing 737 and Airbus A320 replacement programs will seek to provide customers with game-changing products, which together will provide opportunities in excess of $500 billion. The Airbus A350 program, Embraer's business jets, and Bombardier's proposed CSeries aircraft and future business and regional jets will also provide substantial, long-term business opportunities for suppliers. It is imperative that the Canadian aerospace industry position itself to play a significant role in these future platforms.

The reserves of innovative technology developed in the 1960s and 1970s that fed the dramatic growth of the aerospace sector in the 1980s and 1990s are now substantially depleted. The current level of industry investment in research and development is inadequate to support future growth.

Not surprisingly, Canadian industry participation on the Boeing 787 declined substantially compared to the 757 and 767 that it replaces. There is no substantial Canadian presence on the Airbus A350 despite significant efforts by Canadian industry with support from Industry Canada. Similarly, a recent initiative to assist Canadian industry to bid on major work packages for the Embraer family of business aircraft was relatively unsuccessful. Finally, Canadian content on Bombardier's CSeries aircraft may be far less than the Dash 8 or Canadair Regional Jet (CRJ) aircraft.

To secure its current world ranking and foster future growth, productivity, and innovation, the Canadian aerospace industry will require significantly different strategies than those of the past.

The FMP Initiative highlighted three key areas of weakness that will hinder the future growth potential of the Canadian aerospace industry. These key areas were identified as part of the market requirements analysis of the key major platforms.

First, OEMs are no longer willing to bear the main financial burden of developing new products. OEMs now deal primarily with a relatively small group of systems integrators able to bear a substantial share of the development cost. Canada has very few tier 1 system integrators that are able to fund large work packages. This may explain why few Canadian aerospace suppliers were selected on the B787 and A350 programs and the lack of an integrator capacity is also a concern for their participation on the CSeries as well.

The second key issue is the lack of development of tier 1 suppliers that are required to manage and integrate the efforts of tier 2 and tier 3 suppliers. This weakness at the tier 1 level is directly linked to the lack of investment in technology demonstrators, which provide the key mechanism for the development of system integration capabilities.

The third key issue arises from the new technology requirements for the next generation of aircraft. Currently, the majority of Canadian industry participation in the existing programs of Boeing, Airbus, and Bombardier relies on traditional machining, metal fabrication and assembly technologies, which will be substantially diminished in the new generation of aircraft. Major investments in technology generation and advanced manufacturing processes will be required in order to meet the demands of the market.

It is critical therefore, that we, the Canadian aerospace industry and government, work with the OEMs to identify the key products and systems, leading-edge niche technologies, and work packages where Canadian industry can excel. We must identify and respond to the gaps within research and development (R&D) support mechanisms by aligning current R&D instruments to maximize their impact. We must accept and foster collaborative approaches to R&D activities and to the identification and capturing of market opportunities.

It is equally essential that the collaborative effort between industry, academia, and government should continue well into the future. The markets and technologies that drive the global aerospace industry will mature and evolve, creating an ongoing need for the Canadian aerospace industry to continually assess potential opportunities. The FMP initiative has successfully demonstrated the value of this collaborative approach.

Canada's aerospace industry must more fully participate in the early concept definition and validation phases of new programs and invest in order to transform its traditional manufacturing base and to leverage its technology discriminators to deliver more value-added products and services to higher tier suppliers. The 'supply pool' of Canadian-based OEMs can also be more fully capitalized on to induce higher levels of collaborative technology development and demonstration and domestic supply chain interaction including product/solution integration.

In concluding its detailed review, the AIAC offers specific recommendations which could lead to an increase in the level of pre-competitive collaborative R&D investment so critical to the continued growth of the aerospace Industry. They are focussed on aligning the support mechanisms with industry needs and achieving market-driven technology development through certain existing resources e.g. Natural Sciences and Engineering Research Council of Canada (NSERC), Industrial and Regional Benefits Policy leverage.

II. Setting the Context

Trends in the Global Aerospace Industry

The global aerospace industry is in the midst of an extended upswing. Having suffered significant losses after the events of September 11, 2001, airlines are experiencing strong, sustained demand for air travel. The strong economic cycle in recent years has supported robust business and tourist travel.

Growth is also being driven by new and emerging markets for air travel, such as the Middle East and Asia Pacific. These new and emerging markets will soon challenge the United States (U.S.) and Europe as the destination for new aircraft and aircraft services.

Despite this growth in demand, civil aviation remains highly competitive. Airlines are seeking new aircraft with reduced operating costs, less environmental impact, including reduced carbon dioxide emissions, noise emissions, and greater safety and comfort.

Challenges to Canada's Competitive Position

Canada is a world-leader in the global aerospace industry. The Canadian industry ranks fourth in sales and employment, after the United States, United Kingdom, and France. Although Canada is one of a few select countries producing complete aircraft, it has only a small number of tier 1 systems integrators, with the majority of the industry comprised of smaller tier 2 and tier 3 suppliers.

There are several emerging trends that will challenge the Canadian aerospace industry today and in the future:

- *New and emerging competitors*. Non-traditional aerospace competitors, such as China, Japan, Russia and India are emerging as centres for low cost engineering, production, and materials. These countries will increasingly challenge Canada in the areas of traditional parts and component production and engineering. China and Russia also represent large potential future markets. Both countries, as well as Japan, are seeking to fulfill their domestic markets with their own indigenous aircraft.

- *Changing nature of global supply chains*. Over the past decade, OEMs have altered their approach to new aircraft design by shifting responsibility for R&D and financial risk to suppliers. More and more, aircraft manufacturers deal with a relatively small group of tier 1 system integrators that are able to bear a substantial share of the development cost and program risks while at the same time manage their own supply chain. As a result, traditional tier 2 and tier 3 supplier relationships with OEMs will no longer provide a means of entry into their programs. Another trend in the industry is for OEMs to move from having specific project partners to having strategic partners, i.e., partners that engage the OEM very early in the technology development phase. European Tier 1 suppliers will be developed to become Airbus suppliers to the detriment of non-European suppliers.

Growing technology intensity. The global aerospace industry is characterized as technology intensive with significant investment in research and development (R&D), resulting in rapid technological advancement, critical to success. R&D is high-cost, high-risk, and the time to achieve a return on investment is long, typically fifteen years.

The governments of major global aerospace players recognize the need to share in the risk/reward nature of the aerospace industry and work closely with their industries to position them for success. For example, the U.S. government provides about $122 billion annually in non-repayable support for aerospace and defence R&D. European Union member governments have provided billions in repayable launch aid for specific aircraft since the 1970s and non-repayable technology support of approximately $1 billion per year for aerospace and defence projects. We understand that Canada does not have the level of financial resources of other leading aerospace countries, but nevertheless programs such as the Strategic Aerospace and Defence Initiative (SADI) should take into consideration the support other countries give to their industry, particularly where companies can elect to do R&D in many other countries around the world.

In Canada, the aerospace industry's investment in R&D has remained relatively constant over the past ten to fifteen years, at approximately $1 billion per annum. However, as global sales grew through the late 1990s and early 2000, Canada's R&D intensity (R&D expenditures / sales) declined dramatically from 12% to 6%, and has not rebounded since.

European OEMs are fully engaged in national technology demonstrator programs through their national suppliers, thereby actively promoting their competitive abilities. The EU Member States have earmarked under the 7th Framework, a total of €1.6 billion for funding such collaborative activities over the next 7 years. Activities are envisaged to address emission reduction, alternative fuels, air traffic management, air transport safety and environmentally efficient aviation – many of the same technology threads identified by the FMP project.

In the U.S., through Department of Defense and NASA Aeronautics Technology Programs, the OEMs are likewise strategically engaged with US suppliers. Other countries like Russia, Japan, and China have also defined their national technology development programs around home-grown OEM offerings. It should be understood that these strong national programs give these suppliers the ability to compete globally, as well as preferred entry on national programs.

Despite the return to growth of both the global and Canadian aerospace industry in the past two years following the downturn experienced in the post-2001 period, a number of significant challenges currently confront Canadian aerospace companies. These include the high value of the Canadian dollar, a decline in the Canadian content of domestic production and exports, and scarce capital for investing in new manufacturing equipment and technology development.

Several innovative aircraft programs have already been launched, including the Airbus A350 and A380, and Boeing's 787 Dreamliner. Not surprisingly, participation by the Canadian industry in the Boeing 787 declined substantially compared to the 757 and 767 aircraft that it replaces. There is no substantial Canadian presence on the Airbus A350 despite significant efforts by Canadian industry with support from Industry Canada. Many of the successful Canadian participants to these programs are corporations that have participated in recent years in substantial technology development, often in association with those OEMs.

Similarly, a recent initiative to assist Canadian industry to bid on major work packages for the Embraer family of business aircraft was relatively unsuccessful. This was due in large part to the inability of the industry to respond to the scope of the offered work packages. One exception to this is CAE, who has entered into a partnership program with Embraer to deliver training for the new light, and very light jets.

Opportunities for Growth

The trends driving the aviation industry cannot be met by the current fleet of commercial aircraft. To satisfy market demands, aircraft manufacturers will need to introduce new, innovative aircraft platforms. These new programs represent considerable opportunity for suppliers. Companies who capture work packages on new aircraft programs will likely have a guarantee of work for the duration of the program – 20 to 30 years.

For example, in the next decade both Boeing and Airbus are expected to replace their single aisle aircraft, the 737 and A320 respectively. These two aircraft alone represent over $1 billion per year in sales for

Canadian suppliers. However, timing is critical. Companies wanting to supply the replacement programs of these OEMs need to act now. Similarly, to maintain its leadership position in the business and regional market, Bombardier will be offering new products to meet changing customer requirements which will offer excellent opportunities for Canadian suppliers.

To secure its current world ranking, and foster future growth, productivity, and innovation, the Canadian aerospace industry will require significantly different strategies than those of the past. In particular, the Canadian industry should transform itself to foster tier 1 systems integrators and high technology content suppliers of products and services. Companies must be competitive even compared to non-traditional, emerging competitor nations.

III. The Future Major Platforms Initiative

It is within the context of these challenges and an evolving global aerospace industry that the Aerospace Industries Association of Canada (AIAC) and its stakeholders embarked on the Future Major Platforms (FMP) Initiative. The objective of the FMP Initiative is to ensure that Canada retains a strong competitive aerospace industry and maintains, or preferably increases, its participation rate in upcoming commercial aerospace programs.

The AIAC and industry representatives with input from federal government officials agreed to work together through the FMP Initiative to better position Canadian aerospace companies to supply the next generation of commercial aircraft programs by:

- Identifying the major commercial platforms that offer the best opportunities for Canadian firms
- Identifying priority technologies necessary to participate on the identified future major platforms;
- Providing recommendations to align existing support mechanisms to facilitate technological development, with the understanding that no new funding is available; and,
- Developing and implementing “capture plans” to assist Canadian companies in becoming suppliers to these platforms.

To achieve these objectives, the FMP Initiative identified a work plan and established a Steering Committee and three working groups:

1. Target Capture Working Group
2. Technology Definition Working Group
3. Tools Assessment Working Group

This report provides an integrated summary of the more comprehensive reports by each of the working groups. The detailed reports include the analysis and documentation which support the recommendations.

Identifying the Future Major Platforms

Of the entire aerospace industry, the commercial aerospace sub-sector offers the largest opportunity for Canadian suppliers with the fewest impediments to entry. It represents, by far, the largest portion of revenue (81% in 2007) for the Canadian aerospace industry. The majority of the opportunities are concentrated in a handful of platforms and each platform can fly for well over 20 years so there are very limited opportunities to bid.

It is for these reasons that the FMP Initiative, as its first step, decided to examine the commercial aerospace sector. Lessons learned from the FMP process can then be applied to other segments of the industry such as: Maintenance Repair and Overhaul; Military; Helicopter; Space and Unmanned Aerial Vehicles.

In April 2007, senior marketing executives from leading Canadian companies identified the top five future commercial aircraft platforms according to their potential, accessibility, and Canadian capacity to compete for work. The five major platforms selected are:

- Boeing 737 Replacement
- Airbus A320 Replacement
- Embraer Business Jets
- Airbus A350
- Bombardier CSeries

The selected future major platforms fall into two different categories, each requiring a slightly different approach for Canadian companies to adopt in order to capture opportunities:

1. The Boeing 737 and Airbus A320 replacement programs are expected to be launched in the mid to latter half of the next decade. Technological development to meet the technology needs of these aircraft will drive Canada's ability to participate.

2. The Embraer business jets, A350, and CSeries are under development now with most, if not all, of the tier 1 suppliers selected. Gaining opportunities on these programs will require concerted efforts to integrate and market today's technology and industrial capabilities.

Having identified these five future major platforms, and understanding that technological advancement is the key factor to ensure success, the FMP Initiative will continue to identify and prioritize the technologies that will maximize the Canadian industry's ability to supply these aircraft. Following the European and American examples, the development of new technology is best done by capitalizing on the presence of major OEMs in Canada, OEMs that can frame and structure substantial technology demonstration programs, with the appropriate participation of Tier 1, 2 and 3 suppliers.

It is understood that these technology developments will also position the Canadian supplier base favourably for potential upcoming business and regional aircraft programs which will ensure further growth of the Canadian aerospace industry.

IV. Identifying Priority Technologies

The aerospace industry's need to improve efficiency, reduce its environmental footprint, and address safety concerns will drive new technologies and processes at an ever faster pace. This includes a greater use of lightweight materials, modelling and simulation, more fuel-efficient engines with lower emissions and less noise, and a move from hydraulic to all-electric aircraft.

Currently, the majority of Canadian industry participation in the existing programs of Boeing, Airbus, and Bombardier rely on current generation technologies, which will be substantially diminished in the new generation of aircraft.

To better position Canadian aerospace companies to supply the next generation of commercial aircraft programs, it is imperative that the Canadian aerospace industry, government, and academia develop a comprehensive understanding of emerging technology requirements. To that end, the FMP Initiative sought to identify and prioritize the technologies that will maximize the Canadian industry's ability to meet market demands.

Through an intensive process of intelligence gathering, information was collected from Canadian OEMs, targeted OEMs, and their current Canadian supplier base concerning the technologies and processes that will satisfy the performance goals of the future major platforms.

A priority technology matrix was developed (Figure 1.) which identifies the technologies that are critical to both Canadian aerospace OEMs, and suppliers attempting to capture work on future major platforms. The matrix also evaluates the current level of proficiency of the Canadian industry.

The ongoing FMP Initiative will further refine the priority technology list with input from target OEMs.

Figure 1.

	Future Major Platforms - Priority Technologies							
Attributes	**Product Development**	**Manufacturing**	**Environment**	**Advanced Materials**	**Avionics**	**More Intelligent Systems**	**More Electric Systems**	**Human Performance Augmentation**
	Future configuration development	Lean	Noxious emissions reductions	Low cost manufacturing	In flight entertainment	Sensors	Electric power generation & distribution	Synthetic training environments
	Multi-disciplinary design optimization	Agile	Noise emissions reduction	High temperature composites	In flight business	Network centric	Actuation	Advanced diagnostics
	Integrated design and manufacturing	Special processes	Fuel burn	Thermosets	Systems integration	Morphing systems	Power management	Human machine interface
	Quality systems and processes	Automated fibre placement	Materials of Concern	Liquid composite moulding	Open platforms	Adaptive systems	Environmental control systems	Remote operators
	Lean engineering	Machining	Alternative fuels	High temperature alloys	Landing aids	Autonomous systems	Engine technologies	Integrated Electronic Tech Manuals
	Virtual prototyping, testing and integration	Joining		Metallics	Augmented/synthetic vision systems	Air transport system optimization		Environmental databases
	Advanced product development strategy	Advanced assembly processes		Advanced metallic alloys	Display systems			
	Logistics system integration	Robotics		Hybrids	Adaptive over life cycle			
	Life analysis	Inspection and Repair		Ceramic Matrix Composites	Fly by wire/light			
	Prognostics and health management	Near net shape manufacturing		Metal Matrix Composites	Diagnostics			
		Intelligent manufacturing		Thermoplastics				
		RFID		Multi-functional				
				Nano materials				
				Coatings				

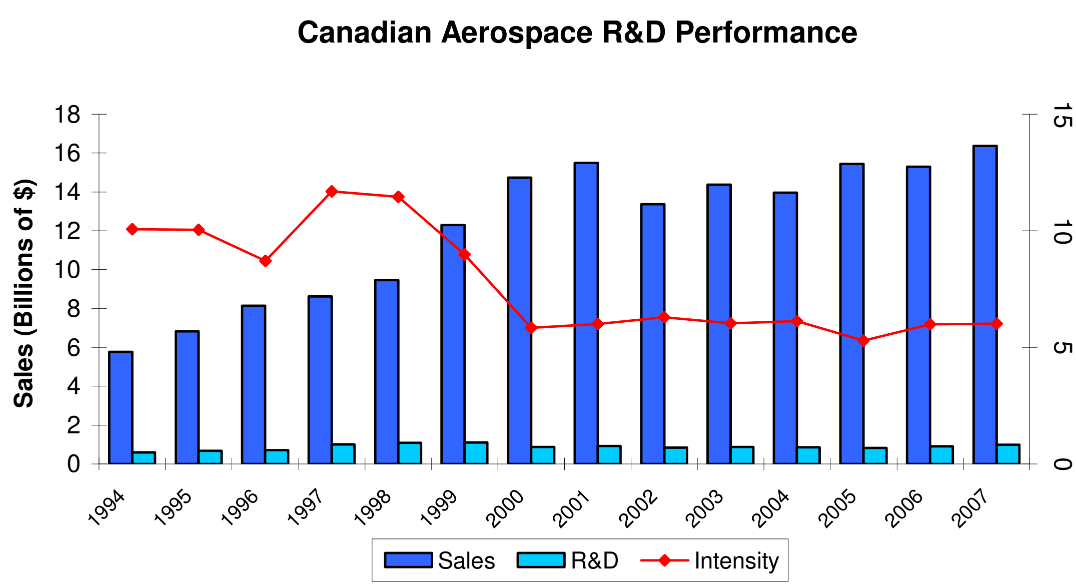
V. Accelerating Technology Advancement

Given the opportunities that are presented by future major aircraft platforms, and considering the timelines for the development of these platforms, Canada needs to be strategic in its decisions to ensure that limited resources are used to the best advantage of the industry. The priority technologies identified should provide focus for industry and government decision-makers and help to maximize the impact of industry and government investments. Also key to ensuring success for the industry is the need for strong collaboration among stakeholders, particularly in R&D. The strategic focus provided by the priority technologies will also help foster cooperative approaches to technology advancement, including collaborative research and technology development projects.

Investing in Research and Development

For some years, the Canadian aerospace industry, with the support of the federal government, has invested in R&D in order to secure its position as a major player in the global aerospace industry. Over the past 10 to 15 years, however, Canada's product base has matured and R&D intensity has declined. The Canadian aerospace industry's investment in R&D, however, has remained relatively constant at approximately $1 billion per annum. As reflected in Figure 2, R&D intensity (R&D expenditures/sales) declined dramatically in the year 2000 and has not rebounded since. The current level of industry investment in research and development, approximately 6 percent of sales, is inadequate to support future growth.

Figure 2.



By contrast, Canada's competitors in the aerospace industry are investing 10-15 percent of sales to develop industry-leading technologies and manufacturing capabilities.

As stated in Section 1, the governments of major global aerospace players recognize the need to share in the risk/reward nature of the aerospace industry and contribute significantly higher amounts on a non-repayable basis to their domestic aerospace industries.

Current Research and Development Support Instruments

In Canada, federal government support for the aerospace industry is offered through a number of mechanisms and covers a broad spectrum from basic research to product development. Within the Industry Portfolio, there are several instruments that support innovation in the Canadian aerospace sector:

- Natural Sciences and Engineering Research Council of Canada (NSERC)
- National Research Council (NRC)
- Industrial and Regional Benefits (IRB)
- Strategic Aerospace and Defence Initiative (SADI)

Natural Sciences and Engineering Research Council of Canada

Until recently, the Canadian aerospace industry has not made use of NSERC's programs to any great degree. The reasons for this are unclear but may be due to concerns regarding intellectual property and/or a lack of awareness about NSERC and the opportunities for joint funding of R&D through its partnership programs. With the emergence of the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), the take-up of NSERC programs has increased significantly. NSERC has invested almost $4 million in additional funding for this sector through CRIAQ-sponsored university-industry collaborative projects

National Research Council

The NRC's Institute for Aerospace Research (NRC-IAR) employs close to 370 researchers and technicians and has managed to leverage $28 million of A-base funding into a program that has been highly relevant to industry. This relevance is best illustrated by the fact that the revenues are close to 40 per cent of NRC-IAR's total expenditure. It is recognized that NRC-IAR's A-base alone is not sufficient to pay for facilities maintenance and staff salaries. This shortfall severely limits NRC-IAR's ability to collaborate with industry, particularly lower-tier companies. Funding of technology demonstrators is well beyond NRC-IAR's budgetary means and is primarily the domain of NRC-IAR's industrial partners. NRC has recently teamed-up with industry to launch the Canadian Technology Roadmap for Aviation and the Environment Roadmap. NRC has also conducted an exercise with Bombardier Aerospace to study ways of developing technology jointly in a manner that allows smaller and medium-sized enterprises access to new technology and growth in the supply chain.

Industrial and Regional Benefits

The Industrial and Regional Benefits (IRB) Policy provides the framework for using federal (defence) procurement as a lever to promote industrial and regional development objectives of the federal government. Under the Policy, the chosen prime contractors must undertake quality economic activities in advanced technology sectors of the Canadian economy. These activities must be an amount equal to one hundred percent of the contract value. While the traditional approach to leveraging IRB has resulted in significant economic benefits to Canada, the Policy can be made stronger with regard to fostering more rapid technological advancements by the industry, which in turn would result in higher productivity and enhanced competitiveness. The FMP initiative is a key opportunity to consider changes to Canada's IRB policy as it coincides with a time of significant government procurement. These procurements could be leveraged in such a manner to provide Canadian companies with a competitive advantage in securing work packages on FMP aircraft platforms.

The IRBs of the primes should be strategically leveraged in such a way that induces foreign OEMs to build long-term business relationships with Canada's aerospace companies. Industrial outcomes sought could include:

- Technology Transfer or Co-Development (with industry, with research organizations, with centres of excellence)
- Long Term Supply Arrangements (LTSA) (on existing platforms or those in development)
- Bestowing of Platforms/Product/Marketing Mandates & Licenses

To motivate (reward) primes to place priority on providing IRBs of high value, appropriate multipliers could be applied to the types of activities that directly target priority industrial outcomes. For example, multipliers could be applied when:

1. transferred technology does not currently reside within the domestic industry;
2. when the Canadian recipient has full and exclusive use of the IP;
3. when the technology is transferred to a multiparty consortia with diffusion to all participants;
4. when the prime co-develops technology with the Canadian recipient.

While there is a need to put a 'time gate' on the primes in respect to discharging their IRB obligations to Canada, sufficient recognition must be given to the time required for primes to identify high quality IRB opportunities with Canadian companies and then work through development of formal business undertakings e.g. negotiating LTSAs, technology transfer or collaborative technology development projects of strategic importance to a Canadian industry. To incentivize prime contractors to focus on these types of activities, there must be greater IRB credit given to the long-term economic benefits that accrue to Canadian industry from such activity.

Canada's re-equipping of the Canadian Forces provides significant opportunities to secure high value, lasting industrial benefits for Canada's aerospace industry -- announced procurements to-date amount to $18 billion and more programs are expected to soon be initiated. Specific procurements underway or those expected have been or may be awarded to OEMs of the 'target programs' set out in this report e.g. Boeing.

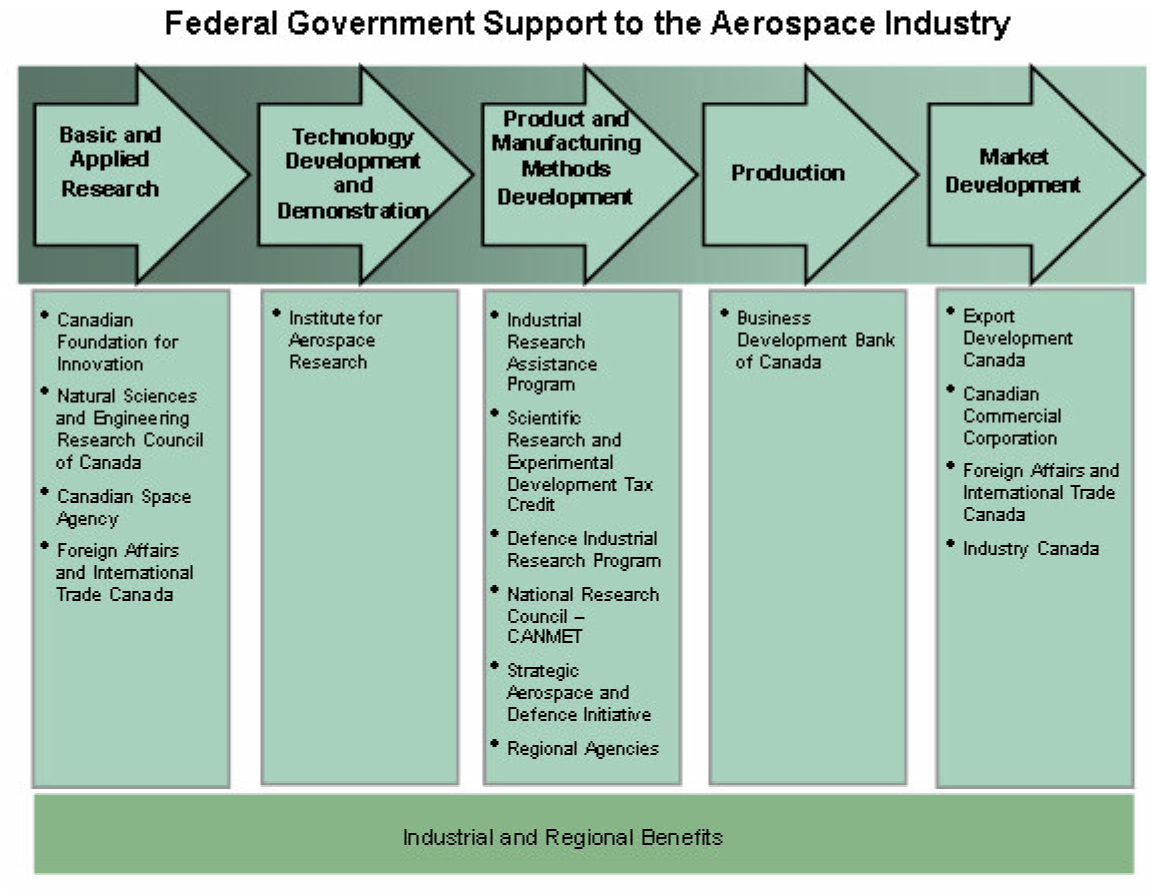
Strategic Aerospace and Defence Initiative

SADI provides important support to the aerospace industry. It is clearly sharing risks and rewards (through repayable contributions), as a means of assisting Canadian firms with the challenge of strategic industrial research and pre-competitive development. The continuation of SADI until 2018-2020 is vital if the Canadian industry is to be able to plan its resources in the key timeframes before each target platform enters into service. The investment required by Canadian industry in development costs and new industrial capabilities, could exceed $2 billion in order to capture approximately 10% of the opportunity presented by the 737R and A320R alone.

Gaps in Research and Development Support

As illustrated below (Figure 3), federal government support, while intended to encourage investment across the entire R&D spectrum, tends to be concentrated in the areas of basic and applied research and product and manufacturing methods development. This results in a lack of private and public investment in technology demonstration.

Figure 3.



Technology demonstration is defined as a project that demonstrates how technology may be operationally integrated and exploited for a specific end-use application, or range of applications. Technology demonstration programs aim to accelerate the maturation of advanced technologies and enable development of the next generation products. Demonstrated technologies are an essential entry gate for industry to be considered for participation in new development programs. Many promising technologies are ultimately unsuccessful in this resource-intensive stage and are never commercialized. The lack of investment in this inherently risky, but critical phase is a key to understanding why continued investment in basic and applied research is unlikely to lead to commercialisation. Furthermore, the limited capacity of the Canadian industry at the critical tier 1 system integrator level is directly linked to the lack of investment in technology demonstration. In order for SMEs to increase their capabilities, or to encourage multinational firms to increase their investment in Canada, it is vital that this issue be addressed. A potential vehicle for encouraging technology demonstration is a coherent collaborative framework that brings together Canadian OEMs and system suppliers.

The best avenue for Canadian suppliers to acquire Tier 1 integrator capabilities is to participate in new technology demonstration programs in close association with major Canadian OEMs and with strong technology support from the National Research Council. This approach was clearly demonstrated by the European countries and has resulted in many of their corporations now having Tier 1 capabilities on major aircraft programs. Another clear example of this, can be seen in the current collaborative technology demonstrator program being conducted by Bombardier, Bell Helicopter and the National Research Council, through which a SME is acquiring the ability to offer integrated solutions on future platforms.

If Canadian firms are unable to accumulate more support for technology demonstration, Canada will not be able to offer the next-generation of products and technologies expected of FMP participants. Canada will lose out on the most important global aerospace opportunities of the next twenty years which could severely limit the country's ability to remain a competitive force in the aerospace industry. Canada should continue to support R&D in all aspects of aerospace, particularly where companies are considered world leaders.

Two important and currently under-utilized routes can be more fully capitalized on to both induce a broader and higher pace of innovation across Canada's aerospace industry. First, induce greater technology collaboration and demonstration involving the R&D-intense Canadian-based OEMs and companies in the lower tiers of the supplier base. The outputs will allow Canadian aerospace suppliers to become more technologically savvy suppliers to both Canadian and foreign OEMs and will assist the Canadian OEMs to meet customer demands for technology-driven, 'game changing' solutions. Second, strengthen the Industrial and Regional Benefits Policy as means to induce foreign OEMs to transfer technology to Canadian companies and for them to participate/invest in collaborative technology development and demonstration projects.

VI. Capturing Opportunities

The changing nature of global supply chains is impacting the traditional supplier relationships that Canadian companies have had with OEMs. In addition to accelerating technology development, the Canadian aerospace industry requires a concerted approach to promote the Canadian supply chain and secure work packages on the future platforms.

Canada has very few tier 1 system integrators and the Canadian industry, in general, is unable to respond to the demand of OEMs to fund and manage large work packages. As previously mentioned, a recent initiative to assist the Canadian industry with bids on major work packages for the Embraer family of business aircraft was not as successful as anticipated, due in large part to the industry's inability to respond to the scope of the work offered. Integrators with world class capabilities still need to be nurtured and incentivized to develop in Canada through SADI. This applies to the complete development cycle – from product development to production and full training capacity. A collaborative effort, involving government and industry, is required to capture increasingly complex and comprehensive work packages.

Furthermore, the Canadian aerospace industry must continually engage with OEMs in the early stages of aircraft development to maintain up-to-date intelligence on the key technologies to be introduced, the commercial terms expected of participants, and to identify work packages where the Canadian industry can excel.

VII. Summary and Recommendations

In summary:

- The Canadian aerospace industry is at a critical juncture
- The five future major platforms, identified through the FMP Initiative, offer significant opportunities for the Canadian aerospace industry
- Canadian suppliers benefit from strong and competitive OEMs residing in Canada. A strategic association with these OEMs on technology development will place these suppliers in a stronger position to compete globally

- Success will require significant technology advancement and a concerted marketing approach to capture opportunities

- Investment in R&D should focus on strategic technologies

- Increased investment in technology demonstration is critical

- Given that no new funds are available, it will be necessary to identify funding from existing sources, excepting SADI, that can be marshaled in a more strategic manner to support pre-competitive collaborative development and demonstration of the key technologies identified in this report

- Collaborative approaches, through shared knowledge, risks, and costs, will contribute to success

Long-term commitment to the FMP Initiative will provide focus

Therefore, we offer the following recommendations:

Provide strategic focus

1. The industry and federal government should commit to extensive, long-term collaboration through the FMP Initiative to ensure ongoing review of market opportunities, technology requirements, and industry support mechanisms.

2. The federal government and industry should be guided by the priority technologies associated with the targeted future major platforms to maximize the impact of investments in R&D.

Accelerate technology advancement

3. The federal government, led by the Minister of Industry, should make available funding, on a non-repayable basis, for collaborative projects, particularly for technology demonstration. Existing programs should be targeted as the source of funding. As an immediate measure, Industry Canada should, on a pilot basis, fund collaborative technology demonstration projects in partnership with industry, post-secondary educational institutions, and the NRC. The projects should be funded on a 50/50 cost share basis between industry and the federal government, on a non-repayable basis, to a maximum of $100 million over three years. The initial pilot projects would focus on the identified priority technologies: environmental systems; composites; and, more intelligent and electrical systems.

4. The Minister of Industry should renew SADI to ensure sufficient funding to support Canadian participation on the identified future major platforms as well as support for the platforms and technologies which will be identified through the ongoing FMP process. It is important that its current mandate and funding base continue to support later-stage technology development and that it not be re-allocated towards earlier-stage pre-competitive collaborative technology development and demonstration. The government should ensure that SADI is aligned to how aerospace R&D is conducted and also ensure that it is competitive in comparison to similar programs of other nations.

5. Industry should promote the adoption of the CRIAQ model at the national level by engaging with other provincial governments and NSERC to increase the level of university-industry collaborative research in the aerospace sector. Industry should continue to use NSERC's partnership programs to jointly share the costs of research, and establish an Advisory Board to facilitate collaboration across the various provincial bodies.

6. The Minister of Industry should increase the Institute for Aerospace Research's (IAR) A-base allocations by a minimum of $15M per year in order to expand support for technology demonstration, particularly for SMEs. It is not proposed that this additional A-base funding supplant the revenues generated by the IAR but rather that it re-balance the ratio of government funding to industry revenues generated.

7. The Minister of Industry should strengthen the IRB policy to better position it to secure high value, lasting industrial benefits for Canadian aerospace companies. It should initiate and complete on an urgent basis a full review of the Policy in consultation with leaders of Canada's aerospace industry. The IRB Policy should place priority on incentivizing prime contractors to participate/invest with Canadian companies in collaborative technology development and demonstration projects. A more strategic approach should be applied to large procurements currently in the latter stages of planning.

8. Industry Canada should further utilize the IRB policy by allowing banking in very limited circumstances, which would permit the prime contractors to place work in Canada in anticipation of a selling opportunity to the Department of National Defence. Banking would be allowed for transactions involving new facilities or the expansion of existing facilities performing work related to FMP.

Support Small and Medium-sized Enterprises

9. Industry Canada should set aside a portion of SADI support (estimated amount of $10 million/year with repayment over ten years) for SMEs to fund manufacturing processes/productivity improvements, similar to the former Supplier Development Initiative under Technology Partnerships Canada. The funding would come from existing SADI resources.

10. In order to facilitate the development of system integration capabilities, the National Research Council should expand IRAP's reach to companies larger that 500 employees. At present, IRAP does not typically support firms larger than 500 employees. The IRAP program should be encouraged to focus on firms with a critical mass of employees to ensure that innovative research and technology development occurs within this segment of the industry. In addition, the funding limitation of $500,000 should be raised to $1 million.

11. The National Research Council should expand the IRAP National Aerospace Sector Team. The current network of over 200 professionals operating in 100 communities provides both technical and business advisory services and, in addition, should be used more effectively for outreach to the SME community. In this regard, Industry Canada should develop a communications plan to raise awareness of all Industry Portfolio instruments available to support R&D in the Canadian aerospace industry. Awareness-raising could be conducted through IRAP's Industrial Technology Advisors networks, the AIAC, Industry Canada regional offices and Regional Development Agencies.

Promote Canadian Capabilities

12. The federal government and the AIAC should develop and implement a plan to align efforts to establish ongoing relationships with targeted OEMs to: remain knowledgeable of critical technologies and market demands; promote Canadian companies as suppliers to FMP; and, secure work packages.

13. The federal government should schedule meetings with senior executives of targeted OEMs and their tier 1 suppliers at significant international Airshows such as the Farnborough International Air Show in July 2008 and the Paris Airshow in June 2009. The objectives of these meetings would be to deliver the message that the Canadian industry wants to work with the target OEMs, to communicate the Canadian government's support of the industry's goals, and to seek the commitment of target OEMs to participate in

follow-up activities. The intention of the latter being to ensure that Canadian investments in technology and production capacity meet the future needs of such OEMs.

14. The AIAC Supplier Development Council will adopt as its top priority the development of alliances and partnerships between the tier 2/3 SMEs and the tier 1 System integrators. Similarly, opportunities for collaboration between Canadian suppliers will be explored in order to enhance the scope of potential offers.

IX. Conclusion

The Canadian aerospace industry believes that the imperative for action is clear.

The decisions concerning suppliers to future major aircraft platforms are being made today. Canada's aerospace industry can position itself to be a major supplier of cutting-edge, innovative technologies and processes. While it is understood that no new federal funding is available to support R&D, industry and government agree to seek collaborative approaches.

A long-term, concerted effort is required by both industry and government to:

- Focus on the niche technology areas where Canada can excel
- Accelerate technology development by investing in technology demonstration, supporting SMEs, and promoting consortium-based activities;
- Capitalize on the presence of Canadian OEMs to lead national technology demonstrator programs important to the development of Canadian Tier 1, 2 and 3 suppliers; and,
- Foster collaborative approaches to identify and capture emerging market opportunities

The recommendations provided in this report are a significant step in the continuing success, growth and development of Canada's aerospace industry, and can be achieved only through vision, partnership, and determination.

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